Great Western Painting

Noise Exposure / Hearing Conservation

OSHA Standards:

29 CFR 1910.95, *Occupational Noise Exposure*
29 CFR 1926.52, *Occupational Noise Exposure*
29 CFR 1926.101, *Hearing Protection*

OVERVIEW

This Hearing Conservation Program is designed for one purpose -- to prevent hearing damage caused by occupational noise exposure.

Most forms of personal protective equipment (PPE) are a response to an obvious hazard and are easy to understand. A hard hat will protect your head from falling objects, for example.

Hearing protection is different from most other types of PPE because loss of hearing generally occurs painlessly over a period of time and, when finally realized, the damage is permanent.

Because of the above, it is vital that cooperation between all affected employees and management be established to prevent occupational hearing loss. To achieve this goal, our Hearing Conservation Program focuses on the effects of noise on hearing as well as the selection and use of hearing protectors. Information is provided on how sound is transmitted to your brain, and lastly, the actual application of our Hearing Conservation Program.

While our Hearing Conservation Program has all the elements required of a complete safety program, it is not necessary to understand all the technical formulas and procedures that are required of licensed monitors, doctors, and hygienists. Individual employees are required to wear appropriate hearing protection when so directed and to understand the importance of protecting their hearing from damage. If job site noise bothers you and those noises are below the threshold for required ear protection, you should bring this to the attention of the Hearing Conservation Program Administrator for resolution.

Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, below, ear protective devices shall be provided and used.

Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.

Plain cotton is not an acceptable protective device.

TABLE D-2 - PERMISSIBLE NOISE EXPOSURES

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Hearing damage is caused by noise level and duration of exposure to the noise. If, after using the formula below, the equivalent noise exposure exceeds unity (1), then a Hearing Conservation Program will be initiated.

F(e)=(T(1)divided by L(1))+(T(2)divided by L(2))+ ... + (T(n) divided by L(n)) where:

F(e) = The equivalent noise exposure factor.
T = The period of noise exposure at any essentially constant level.
L = The duration of the permissible noise exposure at the constant level (from Table D-2).

If the value of F(e) exceeds unity (1) the exposure exceeds permissible levels.

A sample computation showing an application of the formula in paragraph (d)(2)(ii) of this section is as follows. An employee is exposed at these levels for these periods:

110 db A 1/4 hour.
100 db A 1/2 hour.
90 db A 1 1/2 hours.

F(e) = (1/4 divided by 1/2)+(1/2 divided by 2)+(1 1/2 divided by 8)
F(e) = 0.500+0.25+0.188
F(e) = 0.938

Since the value of F(e) does not exceed unity, the exposure is within permissible limits.

Hearing protection is different from most other types of PPE because loss of hearing generally occurs painlessly over a period of time and, when finally realized, the damage is permanent.

As one would reasonably expect, acoustic trauma to your hearing can cause instant and permanent damage.

The initial determination of excessive noise levels is generally subjective. Indications of excessive noise would include: actual information pertaining to specific machines; personal observation; complaints from employees; and noticed indications of hearing loss. It is requested that employees

draw attention to work situations where there is an apparent loudness that possibly requires hearing protection.

At no cost, and replaced as necessary, hearing protectors will be provided when employees are exposed to sound levels above 85 dba on an 8 hour time-weighted average.

Appropriate hearing protectors will be available in a variety of styles from which to choose from to provide a comfortable fit; employees will be made aware of the proper use and care of the protectors selected.

In selecting appropriate hearing protectors, the Program Administrator will consider the below factors:

a. the hearing protector's noise reduction rating (Subject Fit) [NRR(SF)].

NOTE: The NRR(SF), measured in dB and found as a number on the hearing protector, can be used by subtracting that number from an A-weighted sound level or a time-weighted average noise exposure to determine the level of protection for most (84%) of the users.

NOTE: The NRR(SF) is based on tests of continuous noise and may not be an appropriate indicator for protection against impulse or impact noise.

b. the user's daily equivalent noise exposure.

c. variations in noise levels.

d. user preference.

e. communication needs.

f. hearing ability.

g. compatibility with other safety equipment.

h. user's physical limitations.

i. climate and other working conditions.

j. replacement, care, and use requirements.

DUTIES OF THE PROGRAM ADMINISTRATOR

The duties of the Hearing Conservation Program Administrator include identifying work areas where the equivalent noise exposure factor exceeds unity (see next section); determining what types of noise level monitoring may be necessary; and ensuring that all personnel who are directed to wear hearing protection are trained in its proper use, cleaning, and storage.

The Program Administrator will also be responsible for recordkeeping, testing, and training. Lastly, the Program Administrator will keep abreast on developments in the hearing conservation field and he is encouraged to seek outside professional help when needed.

WHEN A HEARING CONSERVATION PROGRAM IS NEEDED

The two construction standards that deal with occupational noise exposure, 29 CFR 1926.101, *Hearing Protection*, and 29 CFR 1926.52, *Occupational Noise Exposure*, both reference the industry standard 29 CFR 1910.95, *Occupational Noise Exposure*, on which this program is based.

Hearing protection will be provided at 85 dbA or greater **or** when it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2 below, ear protective devices shall be provided and used.

TABLE D-2 - PERMISSIBLE NOISE EXPOSURES

Duration per day, hours	Sound level dbA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.

Plain cotton is not an acceptable protective device.

A continuing, effective hearing conservation program will be administered when employees are exposed to sound levels greater than 85 dbA on an 8 hour time-weighted average basis, see below.

This Hearing Conservation Program must be implemented when the equivalent noise exposure exceeds unity (the number 1) using the below formula and example:

F(e)=(T(1)divided by L(1))+(T(2)divided by L(2))+ ... + (T(n) divided by L(n)) where:

F(e) = The equivalent noise exposure factor.
T = The period of noise exposure at any essentially constant level.
L = The duration of the permissible noise exposure at the constant level (from Table D-2).

If the value of F(e) exceeds unity (1) the exposure exceeds permissible levels.

Because the action level is an 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, we will implement a monitoring program when this level is reached.

A sample computation showing an application of the formula is as follows. An employee is exposed at these levels for these periods:

110 db A	1/4 hour
100 db A	1/2 hour
90 db A	11/2 hours

F(e) = (1/4 divided by 1/2)+(1/2 divided by 2)+(1 1/2 divided by 8)
F(e) = 0.500+0.25+0.188
F(e) = 0.938

Since the value of F(e) does not exceed unity, the exposure is within permissible limits.

DEFINITIONS

There are certain words in our Hearing Conservation Program which are not used in everyday life. So that all may have a clearer understanding of this program, the below definitions are presented:

ACTION LEVEL	An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of fifty percent.
ATTENUATE	To lessen the intensity.
AUDIOGRAM	A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.
AUDIOLOGIST	A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.
BASELINE AUDIOGRAM	The audiogram against which future audiograms are compared.
CRITERION SOUND LEVEL	A sound level of 90 decibels.
DECIBEL (dB)	Unit of measurement of sound level.
DOSIMETER	An instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose.

HERTZ (HZ)	Unit of measurement of frequency, numerically equal to cycles per second.
MEDICAL PATHOLOGY	A disorder or disease which should be treated by a physician specialist.
NIHL	Noise Induced Hearing Loss.
NOISE DOSE	The ratio, expressed as a percentage, of: (1) the time integral, over a stated time or event, of the 0.6 power of the measured SLOW exponential time-averaged, squared A-weighted sound pressure and (2) the product of the criterion duration (8 hours) and the 0.6 power of the squared sound pressure corresponding to the criterion sound level (90 dB).
OTOLARYNGOLOGIST	A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.
REPRESENTATIVE EXPOSURE	Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employers deem to be representative of the exposures of other employees in the workplace.
SOUND LEVEL	Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals. Unit: decibels (dB). For use with OSHA standard 29 CFR 1910.95, SLOW time response is required.
SOUND LEVEL METER	An instrument for the measurement of sound level.
TIME-WEIGHTED AVERAGE	That sound level, which if constant over an SOUND LEVEL8-hour exposure, would result in the same noise dose as is measured.

NOISE MONITORING PROCEDURES

Initially, the implementation of a noise monitoring program is the result of subjective reasoning by the Program Administrator. Indications of excessive noise would include: actual information pertaining to specific machines; personal observation; complaints from employees; and noticed indications of hearing loss. It is requested that employees draw attention to work situations where there is an apparent loudness that possibly requires hearing protection.

The measure of a sound's strength is referred to as "sound level" and it is measured in units called "decibels" (dB).

To provide some idea of the loudness of 85 dB, the following comparisons are provided:

Sound of:	Approximate Decibels:
Softest sound heard with normal hearing	0 dB
Ordinary speech at conversational distance	65 dB to 70 dB
Telephone dial tone	80 dB
Train whistle at 500 feet	90 dB
Power mower	107 dB
Jet engine at 100 feet	140 dB
Gun Shot	140 dB

Sound levels above 80 dB may become uncomfortable; sound above 125 dB may be painful.

Individual occupational sound exposures above 85 dB do not trigger the need for noise monitoring or a Hearing Conservation Program -- it is when the equivalent noise exposure factor exceeds unity. The two factors that cause occupational hearing loss are: 1) loudness and 2) the duration of time one is exposed to that loudness. **In spite of the above**, when information indicates employee exposure may equal/exceed the 8 hr time-weighted avg. of 85 decibels, the monitoring program will be implemented to identify employees to be included in the hearing conservation program.

Hearing loss generally occurs over a lengthy period of time. Of course, as one would reasonably expect, acoustic trauma to your hearing can cause instant and permanent damage.

Our monitoring program is designed to identify:

a. areas where feasible administrative controls may be implemented to reduce noise exposure. Example: shorter exposure times.

b. areas where feasible engineering controls may be implemented to reduce noise exposure. Example: soundproofing.

c. which employees should be included in our hearing conservation program.

d. the types of hearing protection to be used.

Noise monitoring equipment and procedures will be determined by employee mobility; variations in workplace sound levels; individual types of noise such as impact, impulse, or steady stream; and/or the noise type combinations.

NOISE LEVEL MONITORING

The monitoring equipment and procedures will be designed to determine the actual sound levels that reach the employee's ears and the length of time there is exposure to those levels.

Noise level monitoring is generally conducted by using either a dosimeter, a sound level meter, or both. Because a sound level meter takes one measurement at one point in time, it is useful when sound is fairly constant and the employee is not moving in and out of the noise area.

A dosimeter, on the other hand, stores sound level measurements and can produce an average noise exposure which can be calculated into an 8-hour time weighted average. When using a dosimeter in an area where employees are exposed to varying sound levels or they move in and out of the noise area, the dosimeter is actually worn and the sound pick-up is placed close to the employee's ear to get an accurate measurement of the sound level exposure. Generally, a dosimeter is the best choice for a job site.

Noise level monitoring results, as well as 29 CFR 1910.95, will be made available to affected employees and copies of these items be **posted** in the workplace.

MONITORING PLAN

All continuous, intermittent and impulsive sound levels from 80 dB to 130 dB will be integrated into the noise measurements.

All instruments to measure employee noise exposure will be calibrated to ensure measurement accuracy.

Representative personal sampling will be used, in lieu of area sampling, when there is high employee mobility, significant variations in sound levels, or a significant component of impulse noise.

Area sampling will be used when sound levels are relatively constant and employees have a constant exposure to them.

When there is a change in job site activity or equipment which would likely increase noise levels, additional monitoring will be undertaken.

a. All persons found to be exposed to sound levels at or above the action level will be notified.

b. Affected employees or their representatives will be allowed to observe the noise monitoring process.

NOISE LEVEL MONITORING RECORDS

All noise level monitoring records will be kept for a period of two (2) years.

AUDIOMETRIC TESTING PROGRAM

Audiometric testing will be made available at no cost to affected employees.

When noise exposures reach the action level **(8 hour time-weighted average of 85 dbA)**, the audiometric testing will be initiated.

Audiometric tests will be performed by a licensed or certified audiologist, otolaryngologist, physician, technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence in administering audiometric examinations, obtaining valid audiograms, and properly using, maintaining and checking calibration and proper functioning of the audiometers being used. A technician who operates microprocessor audiometers does not need to be certified. A technician who performs audiometric tests must be responsible to an audiologist, otolaryngologist or physician.

BASELINE AUDIOGRAM

Within 6 months of an employee's first exposure at or above the action level, a valid baseline audiogram will be established against which subsequent audiograms can be compared. Hearing loss can occur as a result of age, trauma, drug reaction, and exposures that are not work related. However, with a baseline audiogram -- which measures the frequency (125 or 250 Hz to 8000 Hz) and loudness (-10 or 0 dB to 110 dB) -- it is possible from subsequent audiograms to determine with accuracy if hearing loss is due to occupational noise exposure or some other cause.

For the purposes of this program, audiograms must measure, in each ear, at least the frequencies of 500, 1000, 2000, 3000, 4000, and 6000 Hz.

Occupational hearing loss occurs within the inner ear in the cochlea. By using a bone-conduction vibrator, sounds can be carried directly to the inner ear and bypass the outside and middle ear areas.

An annual audiogram may be substituted for the baseline audiogram if the audiologist, otolaryngologist or physician who is evaluating the audiogram determines:

a. the standard threshold shift revealed by the audiogram is persistent; or

b. the hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

PROCEDURE

To ensure an accurate test, employees must not be exposed to occupational noises for at least **14 hours prior to the establishment of a baseline audiogram.** To meet this requirement, if needed, hearing protectors may be worn during the preceding work shifts. This procedure is to factor out temporary hearing changes from the test.

ANNUAL AUDIOGRAM

At least annually, after obtaining the baseline audiogram, a new audiogram will be obtained for each employee exposed at or above an 8-hour time-weighted average of 85 decibels. Each employee's annual audiogram will be compared to that employee's baseline audiogram to determine if the audiogram is valid and if a standard threshold shift has occurred. If a standard threshold shift has occurred, the employee will be notified **in writing within 21 days** of this determination.

A standard threshold shift would be a change in hearing of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

While audiograms may be compared by a technician, problem audiograms will be referred to an audiologist, otolaryngologist, or physician for further evaluation.

The person performing this evaluation will be provided the following:

a. a copy of this program including all standards.

b. the baseline audiogram and most recent audiogram of the employee to be evaluated.

c. measurements of background sound pressure levels in the audiometric test room as required in Appendix D to 29 CFR 1910.95.

d. records of audiometer calibrations.

NOTE: If the annual audiogram shows that an employee has suffered a standard threshold shift, the employee will be re-tested within 30 days and these results will be considered the annual audiogram.

If the physician determines that a standard threshold shift has occurred, the following steps will take place:

1. those employees not using hearing protectors will wear them and be trained in their use and care.
2. those employees using hearing protectors will be **re-evaluated and refitted** and provided with hearing protectors that offer greater attenuation. They will also be retrained using this program with emphasis on the need for hearing protection.
3. the employee shall be referred for a clinical audiological evaluation or an otological examination if additional testing is necessary or if it is suspected that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.
4. the employee will be informed, **if necessary**, of the need for an **otological examination if a medical pathology of the ear** that is unrelated to the use of hearing protectors is suspected.

AUDIOMETRIC TESTS - RECORDKEEPING

Audiometric test records will be retained for the duration of the affected employees' employment.

These records will include:

a. the employee's name and job classification.

b. the date of the audiogram.

c. the examiner's name.

d. the date of the last acoustic or exhaustive calibration of the audiometer.

e. the employee's most recent noise exposure assessment.

f. accurate records of the measurements of the background sound pressure levels in audiometric test rooms.

Upon request, employees may have access to these records.

HEARING PROTECTORS

At no cost, and replaced as necessary, hearing protectors will be provided to all affected employees [those exposed to an 8-hr. time-weighted average of 85 decibels or more].

Appropriate hearing protectors will be available in a variety of styles from which to choose from to provide a comfortable fit; employees will be made aware of the proper use and care of the protectors selected.

In selecting appropriate hearing protectors, the Program Administrator will consider the below factors:

a. the hearing protector's noise reduction rating (Subject Fit) [NRR(SF)].

Note: The NRR(SF), measured in dB and found as a number on the hearing protector, can be used by subtracting that number from an A-weighted sound level or a time-weighted average noise exposure to determine the level of protection for most (84%) of the users.

Note: The NRR(SF) is based on tests of continuous noise and may not be an appropriate indicator for protection against impulse or impact noise.

b. the user's daily equivalent noise exposure.

c. variations in noise levels.

d. user preference.

e. communication needs.

f. hearing ability.

g. compatibility with other safety equipment.

h. user's physical limitations.

i. climate and other working conditions.

At no cost, **replacement ear protection will be provided** as needed.

Using one of the methods described in Appendix B to 29 CFR 1910.95, a competent person or an outside qualified professional will evaluate hearing protector attenuation for the environment in which the hearing protector will be used.

Specifically, hearing protectors must attenuate sound exposure at least to an 8-hour time-weighted average of 90 dB or, for those who have experienced a standard threshold shift, to an 8-hour time-weighted average of 85 dB or below.

Should noise levels increase, more effective hearing protectors will be provided to meet the above requirements.

TRAINING

Affected employees (those exposed to action level noise) will receive training in our Hearing Conservation Program and this training will be repeated annually. Training will be updated to be consistent with changes in the PPE and work processes. **An employee who is required to wear hearing protectors and fails to do so will be retrained** with emphasis on the needless and permanent damage to hearing caused by careless exposure to hazardous noises in the work environment.

Interactive training will include, but not be limited to:

a. the effects of noise on hearing.

b. the purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, **fitting, use, and care.**

c. the purpose of audiometric testing and an explanation of the test procedures.

d. a review of the program including all appropriate standards.

PROCESS OF HEARING

Hearing involves, in its simplest terms, conducting sounds from outside your body to your brain. The ear is divided into three main sections:

a. EXTERNAL EAR	collects sounds and directs them to the tympanic membrane (ear drum).
Major Components:	
Pinna:	the visible part of the ear.
External auditory canal:	approximately 1¼ inch tube to direct sound to the eardrum.
Tympanic membrane:	vibrates as it is hit with incoming sounds.
b. MIDDLE EAR	air filled space that connects outer ear to inner ear.
Major Components:	
Ossicles:	three bones commonly called the “hammer”, the “anvil”, and the “stirrup”. These bones collect the sound, amplify it, and transfer it to the fluid in the inner ear.
Eustachian tube:	small tube connected to the throat that brings air into the middle ear allowing pressure equalization of both sides of the ear drum.
c. INNER EAR	transfers sound vibrations to nerve impulses and sends them to the brain.

Major Components:

Vestibule:	helps maintain balance.
Cochlea:	takes vibrations of the middle ear bones and transfers them into nerve impulses that go the brain. The stirrup, in the middle ear, vibrates through a small opening in the cochlea. This opening is connected to fluid filled canals. The pressure waves in the fluid cause small hair type cells to bend. As they bend, they release a nerve impulse which is sent to the brain. The brain perceives these impulses as sound. This is where noise induced hearing loss occurs.
Semicircular canals:	involved with equilibrium (balance)
Acoustic nerve:	a. cochlear nerve: connects the cochlea to the brain. b. vestibular nerve: connects the semicircular canals to the brain.

NOISE INDUCED HEARING LOSS (NIHL)

Moderate exposure to loud noise (over 90 dB for one or more hours) may cause **reversible** changes within the inner ear such as: subtle intracellular changes in the hair cells or swelling of the auditory nerve endings. These temporary changes present themselves as temporary threshold shifts (TTS) 10 dB or more at various frequencies in either ear. This temporary hearing loss will go away within hours -- 16 hours maximum.

How this loss may occur is as follows: continued sound may decrease the stiffness in the hair bundles at the top of the hair cells in the inner ear. This in turn would cause less vibration at a given sound level and an accompanying loss in hearing.

However, continued exposure to loud noise over time will result in permanent threshold shift (PTS) and the resultant permanent, **non-reversible** hearing loss.

Additionally, the most common cause of tinnitus (an annoying ringing in the ears) is damage to the ear from noise exposure resulting in hearing loss.

Because the loss of hearing is so gradual, so painless, so unnoticeable, there may be a tendency to not take hearing conservation seriously until it is too late and you have lost one of your major contacts with the world around you -- your hearing.

Why bother with a Hearing Conservation Program? Why not, instead, just require hearing protectors at all times, in all situations?"

This misses the point. Your hearing -- just as your sight, touch, and smell -- is your means of contact and placement in the world around you. By wearing hearing protectors when not needed, you lessen your ability to hear and be in touch with your environment.

You certainly wouldn't want to save your hearing and lose your life because you didn't hear the warning "Watch out!", "Stop!" or you missed the sound of approaching danger.

HEARING CONSERVATION PROGRAM RECORDKEEPING

The below records will be retained.

1. All noise level monitoring records.
2. All employee exposure measurements.
3. All employee audiometric test records which will include:
    a. The employee's name and job classification.
    b. The date of the audiogram.
    c. The examiner's name.
    d. The date of the last acoustic or exhaustive calibration of the audiometer.
    e. The employee's most recent noise exposure assessment.
    f. Accurate records of the measurements of the background sound pressure levels in audiometric test rooms.

<u>Record Retention:</u>

The below records will be retained at least for the period indicated:

Noise exposure measurement records will be retained for two years.

Audiometric test records will be retained for the duration of the affected employee's employment.

<u>Access to Records:</u>

All the above records will be provided upon request to employees, former employees, representatives designated by the individual employee, and the Assistant Secretary.

Transfer of Records:

If we cease to do business, we will transfer to the successor employer all above records and the successor employer will retain them for the remainder of the period noted above.