Occupational Noise Exposure
29 CFR 1910.95

Purpose and Introduction
The Occupational Noise Exposure program is designed to protect employees from noise-induced neurosensory hearing loss that can occur from exposure to excessive sound pressure levels.

Scope and Application
Miami University shall protect its employees from occupational noise exposures that exceed the values listed in Table 1 through engineering or administrative controls. In areas where it has been determined that an employee may be exposed to sound pressure levels that exceed these values and cannot be controlled by engineering or administrative controls, Miami University shall provide personal hearing protection to prevent a noise-induced hearing loss. The employee shall be required to use the hearing protection offered by Miami University. All applicable policies, provisions, and procedures listed in this program are the responsibility of Miami University. Employees are required to comply with all aspects of this program.

Definitions

A-weighted: Electronic circuitry in a sound level meter that responds to frequency changes in the same way as the human ear.

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 weaken or reduce in force, intensity, effect, quantity, or value.

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 pressure level: A sound pressure level of 90 decibels.

Decibel (dB): Unit of measurement of sound pressure level.

Employee: A Miami University faculty member, staff member, student worker, or contract employee.

Hertz (Hz): Unit of measurement of frequency, numerically equal to cycles per second.

Impulse or impact noise: Sound of less than a second in duration, occurring less frequently than one sound per second.
Medical Pathology: A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.

Miami University: The Miami University main campus in Oxford, Ohio and all of its regional campuses.

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 pressure level (90 dB).

Noise Dosimeter: An instrument that integrates a function of sound pressure over time in such a manner that it directly indicates a noise dose.

Noise: Any unwanted sound.

Otolaryngologist: A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.

Permissible exposure limit (PEL): Exposure guidelines believed to represent conditions under which nearly all workers may be repeatedly exposed, day after day, without adverse effects.

Representative Personal Dosimetry: Measurements of an employee’s noise dose or 8-hour time-weighted average sound pressure level that Miami University deems to be representative of the exposures of other employees in the workplace.

Sound level Meter: An instrument for measuring sound pressure level.

Sound Pressure Level (SPL): The fundamental measure of sound pressure. 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).

Sound: The sensation produced through the organs of hearing—usually by vibrations transmitted in a material medium, commonly air.

Standard threshold shift: A standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

Temporary threshold shift: A temporary change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

Time-Weighted Average (TWA): Average concentration for a normal 8-hour workday on a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effects.
Permissible Exposure Limits

Protection against the effects of noise exposure shall be provided if the sound pressure levels exceed those shown in Table 1 when measured on the “A” scale of a Type 2 sound pressure level meter at slow response. When noise levels are determined by octave band analysis, the equivalent A-weighted sound pressure level may be determined as shown in Table G-9 (see 29 CFR 1910.95).

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Permissible Noise Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration per day, hours</td>
<td>Sound pressure level dBA Slow Response</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1.5</td>
<td>102</td>
</tr>
<tr>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>0.5</td>
<td>110</td>
</tr>
<tr>
<td>0.25 or less</td>
<td>115</td>
</tr>
</tbody>
</table>

Equivalent Sound pressure level Contours

1 Octave band sound pressure levels may be converted to the equivalent A-weighted sound pressure level by plotting them on a graph (as shown in 29 CFR 1910.95, Table G-9) and noting the A-weighted sound pressure level corresponding to the point of highest penetration into the sound pressure level contours. This equivalent A-weighted sound pressure level, which may differ from the actual A-weighted sound pressure level, is used to determine exposure limits from Table 1.

2 Sounds that occur less than one second in duration and occur more frequently than once per second is to be considered continuous.

3 When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions $C_1/T_1 + C_2/T_2 + \ldots + C_n/T_n$ exceeds unity, then the mixed exposure should be considered to exceed the limit value.

   - $C_n$ indicates the duration of exposure at a specified noise level.
   - $T_n$ indicates the duration of exposure permitted at that level.

4 Exposure to impulse or impact noise should not exceed 140 dB peak sound pressure level.
Hearing Conservation Program

Miami University shall administer a hearing conservation program, as described under the “Monitoring” section, whenever employee noise exposures equal or exceed the action level or, equivalently, a dose of fifty percent. For purposes of the hearing conservation program, employee noise exposures shall be computed according to the 29 CFR 1910.95 and Table 1, and without regard to any attenuation provided by personal protective equipment.

Monitoring

When information indicates that any employee’s exposure may equal or exceed the action level, Miami University shall develop and implement a monitoring program. The sampling strategy shall be designed to identify employees for inclusion in the hearing conservation program and to enable the proper selection of hearing protectors.

Guidelines

1. Where circumstances such as high worker mobility, significant variations in sound pressure level, or a significant component of impulse noise make area monitoring generally inappropriate, representative dosimetry shall be used to comply with the monitoring requirements of this program unless it can be shown that area sampling produces equivalent results.

2. All continuous, intermittent and impulse sound pressure levels from 80 decibels to 130 decibels shall be integrated into the noise measurements.

3. Instruments used to measure employee noise exposure shall be calibrated to ensure measurement accuracy.

4. Monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures if the attenuation provided by hearing protectors being used by employees may be rendered inadequate to meet the requirements of the “Hearing Protector Attenuation” section of this program.

5. Each employee exposed at or above the action level shall be notified of the monitoring results.

6. Affected employees or their representatives shall have an opportunity to observe any noise measurements conducted pursuant to this program.
Audiometric Testing Program

An audiometric testing program shall be established and maintained as described in this program by making audiometric testing available to all employees whose exposures equal or exceed the action level.

1. The program shall be provided at no cost to employees.

2. Audiometric tests shall be performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a 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.

   a. Within 6 months of an employee’s first exposure at or above the action level, a valid baseline audiogram shall be established against which subsequent audiograms can be compared.
   b. Mobile test van exception. Where mobile test vans are used to meet the audiometric testing obligation, a valid baseline audiogram shall be obtained within 1 year of an employee’s first exposure at or above the action level. Where baseline audiograms are obtained more than 6 months after the employee’s first exposure at or above the action level, employees shall wear hearing protectors for any period exceeding six months after first exposure until the baseline audiogram is obtained.
   c. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hours without exposure to workplace noise.
   d. Employees shall be notified of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination.

5. Annual audiogram. At least annually after obtaining the baseline audiogram, a new audiogram shall be obtained for each employee exposed at or above the action level.

6. Revised baseline. An annual audiogram may be substituted for the baseline audiogram when, in the judgment of the audiologist, otolaryngologist or physician who is evaluating the audiogram:
   a. The standard threshold shift revealed by the audiogram is persistent.
   b. The hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.
Monitoring/Audiometric Testing Program, continued...

**EVALUATION OF AUDIOGRAM**

1. Annual audiograms shall be compared to the baseline audiogram to determine if the audiogram is valid and if a standard threshold shift has occurred. The comparison may be done by a technician.
   - In determining whether a standard threshold shift has occurred, allowance may be made for the contribution of aging (presbycusis) to the change in hearing level by correcting the annual audiogram.

2. If the annual audiogram shows that an employee has suffered a standard threshold shift, Miami University may obtain a retest within 30 days and consider the results of the retest as the annual audiogram.

3. The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is a need for further evaluation. Miami University shall provide to the person performing this evaluation the following information:
   - A copy of the requirements for hearing conservation as set forth in this program.
   - The baseline audiogram and most recent audiogram of the employee to be evaluated.
   - Measurements of background sound pressure levels in the audiometric test room.
   - Records of audiometer calibrations required in the “Audiometric Test Requirements” section of this program.

**FOLLOW-UP PROCEDURES**

1. If a comparison of the annual audiogram to the baseline audiogram indicates a standard threshold shift has occurred, the employee shall be informed of this fact in writing within 21 days of the determination.

2. Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, Miami University shall ensure that the following steps are taken when a standard threshold shift occurs:
   - Employees not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.
   - Employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.
   - The employee shall be referred for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if Miami University suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.
   - The employee is informed 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.
3 If subsequent audiometric testing of an employee, whose exposure to noise is less than an 8-hour TWA of 90 decibels, indicates that a standard threshold shift is not persistent, Miami University:
   a. Shall inform the employee of the new audiometric interpretation.
   b. May discontinue the required use of hearing protectors for that employee.

**Audiometric Test Requirements**

1 Audiometric tests shall be pure tone, air conduction, hearing threshold examinations, with test frequencies including as a minimum 500, 1000, 2000, 3000, 4000, and 6000 Hz. Tests at each frequency shall be taken separately for each ear.

2 Audiometric tests shall be conducted with audiometers (including microprocessor audiometers) that meet the specifications of, and are maintained and used according to the American National Standard Specification for Audiometers, S3.6-1969.

3 Pulsed-tone and self-recording audiometers, if used, shall meet the requirements specified in the 29 CFR 1910.95 regulation.

4 Audiometric examinations shall be administered in a room meeting the requirements listed in the “Audiometric Test Rooms” section of this program.

**AUDIOMETER CALIBRATION**

The functional operation of the audiometer shall be checked before each day’s use by testing a person with known, stable hearing thresholds, and by listening to the audiometer’s output to make sure that the output is free from distorted or unwanted sounds. Audiometer calibration shall be checked acoustically at least annually according to the “Acoustic Calibration of Audiometers” section of this program. An exhaustive calibration shall be performed at least every two years.
Hearing Protectors

1. Hearing protectors shall be made available to all employees exposed to the action level or greater at no cost to the employees. Hearing protectors shall be replaced as necessary.

2. Hearing protectors shall be worn:
   a. By an employee who is required by this program to wear personal protective equipment.
   b. By any employee who is exposed to the action level or greater, and who:
      (1) Has not yet had a baseline audiogram established pursuant to the Baseline Audiogram requirements of this program. [or]
      (2) Has experienced a standard threshold shift.

3. Employees shall be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors provided by Miami University.

4. Training shall be provided in the use and care of all hearing protectors provided to employees.

5. Miami University shall ensure proper initial fitting and supervise the correct use of all hearing protectors.

Hearing Protector Attenuation

1. Hearing protector attenuation shall be evaluated for the specific noise environments in which the protector will be used.

2. Hearing protectors must attenuate employee exposure at least to an 8-hour time-weighted average of 90 decibels as required in the Scope and Application section of this program.

3. For employees who have experienced a standard threshold shift, hearing protectors must attenuate employee exposure to the action level or below.

4. The adequacy of hearing protector attenuation shall be reevaluated whenever employee noise exposures increase if the hearing protectors provided may no longer provide adequate attenuation. More effective hearing protectors shall be provided where necessary.
Estimating the Adequacy of Hearing Protector Attenuation

For employees who have experienced a significant threshold shift, hearing protector attenuation must be sufficient to reduce employee exposure to the action level. The adequacy of hearing protector attenuation shall be estimated by using the most convenient method (Noise Reduction Rating, or NRR) developed by the Environmental Protection Agency (EPA). According to EPA regulation, the NRR must be shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector.

Audiometric Test Rooms

Rooms used for audiometric testing shall not have background sound pressure levels exceeding those in Table 4 when measured by equipment conforming at least to the Type 2 requirements of American National Standard Specification for Sound pressure level Meters, S1.4-1971 (R1976), and to the Class II requirements of American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets, S1.11-1971 (R1976).

| TABLE 4                                                                 |
| Maximum Allowable Octave-Band Sound Pressure Levels For Audiometric Test Rooms |

<table>
<thead>
<tr>
<th>Octave-band Center Frequency (Hz)</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Pressure Level (dB)</td>
<td>40</td>
<td>40</td>
<td>47</td>
<td>57</td>
<td>62</td>
</tr>
</tbody>
</table>

Acoustic Calibration of Audiometers

Audiometer calibration shall be checked acoustically, at least annually, according to the procedures described in this program. The equipment necessary to perform these measurements is a Type 2 sound pressure level meter, octave-band filter set, and a National Bureau of Standards 9A coupler. In making these measurements, the accuracy of the calibrating equipment shall be sufficient to determine that the audiometer is within the tolerances permitted by American Standard Specification for Audiometers, S3.6-1969.
Employee Information and Training

A training program shall be instituted for all employees who are exposed to noise at or above the action level. Affected employees are required to participate in this program. The training program shall be repeated annually for each employee included in the hearing conservation program. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes. Affected employees or their representatives shall have access to copies of this program and a copy shall be posted in the workplace. Affected employees shall be given any informational materials pertaining to this program that are supplied to Miami University.

Each employee shall be informed of:

1. The effects of noise on hearing.

2. The purpose of hearing protectors, including:
   a. Advantages and disadvantages.
   b. Attenuation of various types.
   c. Instruction on selection, fitting, use, and care.

3. The purpose of audiometric testing and an explanation of the test procedures.

Recordkeeping

Miami University shall maintain noise exposure measurement records for two years. Audiometric test records shall be retained for the duration of the affected employee's employment. All records required by this section shall be provided upon request to employees, former employees, representatives designated by the individual employee, and the proper state officials.

Miami University shall maintain records of the following:

1. Employee exposure measurements as listed in the “Hearing Conservation Program” section of this program.

2. All employee audiometric test records obtained pursuant to the “Audiometric Testing Program” section of this program.
   This record shall include:
   a. The employee’s name, job classification, Social Security Number, and date of birth.
   b. Date of the audiogram.
   c. The examiner’s name.
   d. Date of the last acoustic or exhaustive calibration of the audiometer.
   e. Employee’s most recent noise exposure assessment.

3. Measurements of the background sound pressure levels in audiometric test rooms.