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## **Hearing Conservation Program**

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## 1.0 Introduction

### 1.1 Scope

Worker exposure to noise of sufficient intensity and duration can result in hearing damage. Noise-induced hearing loss rarely results from just one exposure. Generally, it will progress unnoticed over a period of years. Initial noise-induced hearing loss occurs at higher frequencies where speech is found, making communication difficult. Excessive noise exposure is a cause of hearing loss. OSHA exposure limits as cited in 29 CFR 1910.95 is as follows:

Duration per day (hours)	Sound level (dBA slow response)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115
Impact noise	140

When sound levels listed above are exceeded, feasible engineering or administrative controls shall be instituted. If the controls do not prove successful in reducing the levels to within those listed above or are not feasible, hearing protection shall be provided and used to reduce the sound levels to an acceptable level. In addition, OSHA requirements dictate that whenever employee noise exposures equal or exceed an 8-hour time-weighted average (TWA) of 85 dBA, slow response, a continuing effective hearing conservation program shall be incorporated.

The primary goal of the Hearing Conservation Program is to reduce noise exposure, and eliminate hearing loss in the workplace. The program includes the following elements:

- a) Sound level monitoring and workplace/employee evaluation
- b) Audiometric testing and medical surveillance
- c) Hearing protection devices and noise control methods
- d) Training
- e) Recordkeeping

## 2.0 Responsibilities

The following outlines the responsibilities, by OSU department, for the implementation and maintenance of an effective hearing conservation program.

### 2.1 The Office of Environmental Health and Safety (EH&S)

- Assist OSU departments to identify work areas and equipment where noise levels equal or exceed 85 dBA;
- Maintain a high-noise area database that includes areas where noise levels equal or exceed 85 dBA;
- Assist OSU departments to identify employees, whose noise exposure are equal or exceed an 8-hour TWA of 85 dBA.

- Provide employee exposure measurements to OSU Employee Health Services (when acquired) to be included in the employee's medical files;
- Maintain a database of OSU employees included in the Hearing Conservation Program;
- Resurvey areas and equipment that are included in the high-noise area database whenever changes are made that might affect noise levels (i.e., new equipment, relocation of existing equipment, etc.);
- Provide training to employees who are part of the university's Hearing Conservation Program that includes the effects of noise on hearing; hearing protection device use and care; and audiometric testing;
- Identify noise control measures (including engineering and administrative controls) and make recommendations.

## 2.2 Employee Health Services

- 2.2.1 Employee Health Services is responsible for conducting baseline and annual audiograms for new employees who may be assigned to tasks with potential exposure to elevated levels of noise and employees identified by EHS who are exposed to elevated noise levels. Employee Health notifies program participants of required audiograms; and schedules and conducts them on an annual basis for employees exposed to sound levels greater than or equal to 85 dBA. Employee Health Services will notify EHS of all employees who have experienced significant changes in hearing (standard threshold shifts) to ensure follow-up investigations are conducted.

## 2.3 Colleges, Departments, and Administrative Units

- 2.3.1 It is the responsibility of Colleges, Departments, and Administrative Units to ensure all of their employees exposed to noise levels equal to or greater than 85 dBA have access to appropriate hearing protective devices in the work area. Supervisors are also responsible for enforcing the proper use of hearing protective devices and engineering and administrative controls in the designated areas. Colleges, Departments, and Administrative Units shall notify EH&S of known high-noise areas.

## 2.4 Employees

- 2.4.1 Employees are responsible for wearing and maintaining hearing protective devices as instructed. Employees exposed to excessive levels of noise must also participate in annual training programs and the medical surveillance program, which includes audiometric testing. Employees shall notify their supervisor and/or EH&S if they suspect an area may be a high-noise area ( $\geq 85$  dBA).

### 3.0 Definitions

<i>Action Level:</i>	An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of 50%.
<i>Audiogram:</i>	A chart, graph or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.
<i>Audiologist:</i>	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.
<i>Baseline audiogram:</i>	The audiogram against which future audiograms are compared.
<i>Criterion sound level:</i>	A sound level of 90 decibels.
<i>Decibel (dB):</i>	Unit of measurement of sound level.
<i>Hertz (Hz):</i>	Unit of measurement of frequency, numerically equal to cycles per second.
<i>Medical pathology:</i>	A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.
<i>Noise dose:</i>	The ratio, expressed as a percentage, of the (1) 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 and the 0.6 power of the squared sound pressure corresponding to the criterion sound level of 90 dB.
<i>Noise dosimeter:</i>	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.
<i>Otolaryngologist:</i>	A physician specializing in the diagnosis and treatment of disorders of the ear, nose and throat.
<i>Representative exposure:</i>	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.
<i>Sound level:</i>	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).
<i>Sound level meter:</i>	An instrument for the measurement of sound levels.
<i>Time-weighted average (TWA):</i>	The sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

## 4.0 Sound Level Monitoring and Employee/Workplace Evaluation

### 4.1 Workplace Evaluation

EH&S will actively identify work areas within university facilities where noise levels equal or exceed 85 dBA. Records shall be maintained by EHS and updated at least every two years to determine if any change in noise levels has occurred. This information will be forwarded to the respective maintenance or departmental leaders responsible for those areas. Requests for sound level monitoring made to EHS will be investigated and the affected areas monitored.

### 4.2 Noise Measurements and Exposure Assessments

In order to effectively control noise, the sound level must be accurately measured according to standard operating procedures and equipment specifications. The monitoring of employee noise exposure is composed of two parts, (1) area and (2) personal monitoring. Area measurements are generally obtained prior to personal monitoring. If noise levels are at or greater than 85 dBA, personal monitoring is performed utilizing a personal dosimeter as necessary.

#### 4.2.1 Area Measurements

To perform sound level area measurements, noise levels are recorded using a sound level meter to identify work areas where employee exposure may be above exposure limits, and where more thorough exposure monitoring may be needed. Area monitoring is conducted using a calibrated sound level meter set to the A scale, slow response. Within the affected area, several locations will be measured. Typical measurements could involve monitoring at the following locations:

- In the hearing zone at the employee's normal work location
- Next to the noise source(s)
- At the entrance(s) to the work area
- At other locations within the area where the employee might spend time working

When sound levels are below 85 dBA in the area, no further routine monitoring will be required. If any of the noise measurements equal or exceed 85 dBA, records shall be maintained indicating the noise levels recorded, where they were taken, and the source(s) of the noise. Employees working in or near these areas may have their noise exposure (dose) determined through personnel monitoring using dosimeters. Employees working in areas where excessive noise exists or using equipment generating excessive noise are required to take part in the Hearing Conservation Program.

Standard Operating Procedures for area measurements are provided in Appendix A.

#### 4.2.2 Personal Dosimetry

Calibrated noise dosimeters can be utilized to determine employee noise exposure levels. Each employee to be monitored will have a dosimeter placed on him/her for a minimum of two hours with the microphone placed in the hearing zone. Background information will be collected from each employee detailing the job description, unusual job activities, etc., for the time period sampled. For areas where multiple employees perform similar tasks under similar conditions, as related to noise exposure, EHS shall randomly sample the workers' noise exposure levels. The results shall then be generalized to all employees in the area. Those employees whose noise exposures equal or exceed 85 dBA on an 8-hour TWA will be referred to Employee Health Services for inclusion in the medical clearance portion of the Hearing Conservation Program.

Standard Operating Procedures for personal dosimetry are provided in Appendix B.

#### 4.3 Re-monitoring of Hazardous Noise Areas

All areas where noise levels equal or exceed 85 dBA shall be resurveyed whenever a change in production process, equipment, or controls takes place that may have altered the noise exposure levels. Any additional employees exposed to noise levels equal to or greater than 85 dBA on a time-weighted average shall be included in the Hearing Conservation Program. Areas where noise levels have dropped below 85 dBA, as a result of engineering or administrative controls, shall be eliminated from the monitoring program, after evaluation by sound level measurements. Employees whose noise exposure levels no longer exceed an 85 dBA time-weighted average may be removed from the Hearing Conservation Program.

#### 4.4 Noise Control Methods

The use of engineering and administrative controls to reduce noise levels in the workplace should be considered during design and construction phases of new projects. Existing areas where excessive sound levels are present should consider engineering or administrative controls as a method to control sound levels prior to utilizing personal protective equipment. Engineering and/or administrative controls should reduce employee noise exposure to levels below the acceptable threshold limit value (TLV), which should be verified through noise survey or personal dosimetry measurements.

#### 4.5 Engineering Controls

The primary means of reducing or eliminating personnel noise exposure shall be through the application of engineering controls. Engineering controls are defined as any modification or replacement of equipment, or related physical change at the noise source or along the transmission path that reduces the noise level at the employee's ear.

#### 4.6 Administrative Controls

Administrative controls are defined as changes in the work schedule or operations that reduce personnel noise exposure. If engineering solutions cannot reduce the noise level, administrative controls such as increasing the distance between the noise source and the worker or rotation of jobs between workers in the high noise area should be implemented if possible.

## 5.0 Audiometric Testing and Medical Surveillance

### 5.1 Medical surveillance

Employees, and their supervisor(s), whose 8-hour TWA equals or exceeds 85 dBA, as determined through monitoring and evaluation, will be notified in writing by EHS. EHS will contact OSU Employee Health Services of the need to enroll employee(s) in the Hearing Conservation Medical Surveillance Program. Information supplied to Employee Health Services will include the employee's name, department, supervisor's name, contact information, and his/her noise exposure level. It is the responsibility of the supervisor to ensure EH&S is notified of the need for noise measurements that will lead to an employee being enrolled in the Hearing Conservation Medical Surveillance Program.

In work locations where noise levels are found to have decreased, through engineering/administrative controls, such that the employee's 8-hour TWA is below 85 dBA, EH&S shall notify Employee Health Services and the employee's supervisor, in writing, that the affected employee(s) area are no longer required to be enrolled in the Hearing Conservation Program. The final decision for employee's enrollment status is the responsibility of the Employee Health Physician.

### 5.2 Audiometric Testing

Employee Health Services is responsible for administering the Audiometric Testing Program portion of The Ohio State University's Hearing Conservation Program at no charge to the employee. Within 6 months of being notified of an employee's initial exposure at or above the 85dBA noise level, a baseline audiogram must be completed through Employee Health Services. Employees receiving the audiogram should not be exposed to excessive workplace-related noise for at least 14 hours prior to the testing period.

Annual audiograms will be performed for all personnel enrolled in the Hearing Conservation Program. If a Standard Threshold Shift is discovered during the annual testing, as determined by a trained technician, the Employee Health Services Physician must review the employee's audiogram and historical records and make recommendations for changes in the work responsibilities or hearing protection in use by the employee. The object of the audiometric testing program is to ensure employees are not experiencing workplace-related hearing loss by comparing a baseline audiogram to each annual audiogram.

## 6.0 Hearing Protection Devices

### 6.1 Use of Hearing Protection Devices

Hearing protective devices (ear plugs, muffs, etc.) shall be the permanent solution to reduce exposure to excessive noise only when engineering or administrative controls are considered to be infeasible or cost prohibitive. Hearing protective devices are defined as any device that can be worn to reduce the level of sound entering the ear. Hearing protective devices shall be provided at no cost to the employee and worn by all personnel when they enter or work in an area where the operations generate noise levels greater than 85 dBA, or 120 dB peak sound pressure level or greater.

### 6.2 Types of Hearing Protection Devices

If required to be worn, EH&S will recommend various types of hearing protective devices for employee use. Supervisors and employees must choose from the available options. In all cases, the chosen hearing protectors shall have a Noise Reduction Ratio (NRR) high enough to reduce the noise at the eardrum to below 85 dBA. The following types of hearing protection devices will typically be offered to the employee.

6.2.1 Earplugs – A device designed to provide an airtight seal with the ear canal when inserted properly. There are three types of insert earplugs:

6.2.1.1 Pre-molded Earplugs – Pliable devices of fixed proportions available in various sizes

6.2.1.2 Formable Earplugs – Come in one size and after being compressed and inserted, expand to form a seal in the ear canal

6.2.1.3 Custom Molded Earplugs – Earplugs constructed to fit the exact size and shape of the individual's ear canal. Individuals needing custom earplugs will be referred to an audiologist

6.2.2 Earmuffs – 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.

6.2.2.1 In cases where noise levels are extreme, the use of earplugs and earmuffs may be recommended to reduce noise exposure below 85dBA.

### 6.3 Maintenance of Hearing Protection Devices

6.3.1 Reusable earplugs should be washed in lukewarm water using hand soap, rinsed in clean water, and dried thoroughly before use. Wet or damp earplugs should not be placed in their containers. Cleaning should be done as needed or as often as recommended by manufacturer instructions.

6.3.2 Earmuff cushions should be kept clean. The plastic or foam cushions may be cleaned in the same way as earplugs, 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.

6.3.3 Any personnel experiencing difficulty in wearing assigned hearing protection (i.e., irritation of the ear canals, pain) will be advised to immediately report this to his/her supervisor and make arrangements to go to Employee Health Services for evaluation as soon as possible.

## 7.0 Training

The Training and education program will be presented to employees in the Hearing Conservation Program on an annual basis. At a minimum, the training program will cover the following topics:

- The effects of noise on hearing
- The purpose, advantages and disadvantages, and attenuation of various types of hearing protectors
- Instructions on selection, fitting, use, and care of hearing protectors
- The purpose of audiometric testing and an explanation of the test procedures
- Employees must demonstrate their ability to properly use hearing protection devices during annual training

Employees will be provided copies of the OSHA Noise Standard (29 CFR 1910.95) upon request.

## 8.0 Recordkeeping

The Ohio State University Hearing Conservation Program will include the following records:

- Sound Level Surveys and Hazard Evaluations (work area noise surveys, personnel monitoring) – Located at EH&S
- Equipment Calibration and Maintenance – Located at EHS and Employee Health
- Medical Evaluation and Audiograms – Located at Employee Health Services
- Training Records (initial and annual) – Located at EHS
- Standard Operating Procedures – Located at EHS

All non-medical records (ex., work area and equipment surveys) will be maintained for a period of at least five years or longer if required by university record retention schedules. Results of hearing tests and medical evaluations performed for hearing conservation purposes as well as noise exposure documentation shall be recorded and shall be a permanent part of an employee's health record. All personnel who routinely work in designated hazardous noise areas shall be identified and a current database shall be maintained by EHS.

## Appendix A - Area Noise Monitoring - Standard Operating Procedure



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### Area Noise Monitoring Standard Operating Procedure

#### 1.0 Purpose

The location and magnitude of a noise problem can be determined by conducting a general noise survey and a frequency (octave band) analysis. Subsequent monitoring may be conducted to assess an individual's personal exposure (personal dosimetry), as well as the effectiveness of control measures.

#### 2.0 Responsibilities

It is the responsibility of Environmental Health and Safety, Occupational Health, Safety, and Education team members responsible for sound level monitoring to review and understand this procedure.

#### 3.0 Scope

The procedure outlines the steps to take to complete area noise monitoring to evaluate sound levels in a workplace.

#### 4.0 Procedures

##### 4.1 General Noise Survey

- 4.1.1 Calibrate sound level meters (SLM's) and related equipment (i.e. frequency analyzer, impact meter) before and after each survey to ensure that the instruments are working properly. The manufacturer's directions and EHS SOPs should be followed when these instruments are calibrated. The calibration results should be recorded on the basic sound-level survey form.
- 4.1.2 Conduct a walk-around inspection of the site to be surveyed to determine potential noise sources, work-site locations, and possible measurement points. If possible, make a simple sketch of the important features as previously described.
- 4.1.3 Use the microphone extension whenever possible to minimize the acoustic effects caused by the body. Measurements should be taken with the instrument in the slow response mode, A scale, and recorded as decibels (dB).
- 4.1.4 Take noise measurements at a hearing-zone height or within a two-foot diameter area surrounding an employee's head, if at an occupied

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workspace. It may be necessary to obtain measurements on either side of an employee to determine the highest noise level. Noise or sound level measurements should be recorded on the basic sound-level survey form.

- 4.1.5 Direct the microphone toward the noise source unless reverberant conditions exist. As a precaution, do not place one's body between the noise source and the microphone.
- 4.1.6 In drafty or outdoor environments, use a windscreen on the microphone to muffle the noise that would be produced as air passes over the microphone.
- 4.1.7 Make note of the environmental conditions (i.e. temperature, humidity, corrosive atmospheres, wind, electrical and magnetic fields, etc.), which may adversely affect measurements and record on the basic sound-level survey form.
- 4.1.8 If possible, conduct background measurements, without the noise source(s), for comparison purposes.
- 4.1.9 Prior to noise measurements, past reports should be checked for historical background on the noise environments, if applicable.

#### 4.2 Frequency Analysis

- 4.2.1 Conduct a frequency or octave band analysis at surveyed noise locations above 85 dB. This is necessary to characterize the noise for engineering controls and/or PPE selection purposes.
- 4.2.2 Take noise measurements in the same manner as described in the general noise-survey section.
- 4.2.3 Measure the noise or decibel (dB) level at full octave bands with settings appropriate with the equipment being used (manufacturer's recommendations). Record results on the basic sound-level survey form.
- 4.2.4 Set the weighting switch to LIN (linear) if you wish to know the overall non-weighted noise levels. The readings will be an all-pass flat response, which is the noise sum of all bands measured. These measurements are useful when determining the need and effectiveness of engineering controls.

#### 4.3 Report

- 4.3.1 When field investigations are performed, a written communication complete with analytical results; interpretation of these results; and

recommendations for corrective measures will be sent to the initiator of the complaint.

#### 4.4 Hazard Analysis

- 4.4.1 The appropriate personal protective equipment (PPE) should be worn when conducting noise measurements. This will generally consist of safety glasses and hearing protection (i.e. ear muffs and/or earplugs). It is important that all PPE is comfortable and fitted properly for maximum protection.

#### 4.5 Quality Assurance

- 4.5.1 The quality of the general noise survey and frequency analysis can be assured by adherence to the following:
  - 4.5.1.1 Servicing, maintenance, and calibration of sound level meters and frequency analyzers
  - 4.5.1.2 Training of individuals conducting surveys
  - 4.5.1.3 Provision of appropriate personal protective equipment (i.e. eye wear, ear muffs and/or earplugs)
  - 4.5.1.4 Noise monitoring requests have been responded to within five working days. Noise monitoring reports have been forwarded to involved parties within five days of a field visit
  - 4.5.1.5 Employees meeting the requirements for the Universities Hearing Conservation Program (HCP) have been notified within appropriate time constraints

## Appendix B - Personal Noise Dosimetry Monitoring - SOP



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### Noise Monitoring – Personal Dosimetry Standard Operating Procedure

#### 1.0 Purpose

Personal dosimetry is performed to document an individual's actual noise exposure following preliminary area noise monitoring, as deemed necessary.

#### 2.0 Responsibilities

It is the responsibility of Environmental Health and Safety, Occupational Health, Safety, and Education team members responsible for sound level monitoring to review and understand this procedure.

#### 3.0 Scope

The procedure outlines the steps to take to complete personal noise dosimetry monitoring to evaluate sound level exposure in a workplace.

#### 4.0 Procedures

##### 4.1 Personal Noise Dosimetry

- 4.1.1 Calibrate personal noise dosimeters before and after each survey to ensure the instruments are working properly. The manufacturer's calibration instructions should be followed.
- 4.1.2 Measure employee exposure levels in high noise areas. Persons should be selected with the highest expected exposure for each job classification.
- 4.1.3 Inform the individual that the dosimeter should not interfere with normal duties and the person should continue to work in a routine manner.
- 4.1.4 Instruct the individual being monitored not to remove the dosimeter unless necessary and not to cover the microphone with a coat or outer garment. Inform the employee when and where the dosimeter will be removed.
- 4.1.5 Emphasize the purpose of the dosimeter to the individual and explain it is not a tape recording device.
- 4.1.6 Position the dosimeter in the shirt pocket or attach at the waist. The microphone should be clipped to the individual's shirt collar at the top of the shoulder. The microphone should be positioned in a vertical

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direction. Placement should be according to the manufacturer's instructions.

- 4.1.7 Position and secure the microphone cable to avoid snagging or any inconvenience to the individual.
- 4.1.8 Check the dosimeter occasionally to ensure the microphone is oriented properly.
- 4.1.9 Observe the individuals work activities and record pertinent information.
- 4.1.10 Make note of the environmental conditions (i.e. temperature, humidity, corrosive atmospheres, wind, electrical and magnetic fields, etc.) that may adversely affect measurements.

#### 4.2 Hazard Analysis

- 4.2.1 The appropriate personal protective equipment (PPE) should be worn when conducting noise measurements. This will generally consist of safety glasses and hearing protection (i.e. ear muffs and/or earplugs). It is important that all PPE is comfortable and fitted properly for maximum protection.

#### 4.3 Quality Assurance

- 4.3.1 The quality of the personal-dosimetry noise survey can be assured by adherence to the following
  - 4.3.1.1 Servicing, maintenance, and calibration of dosimeters per manufacturers requirements
  - 4.3.1.2 Training of individuals conducting surveys
  - 4.3.1.3 Provision for use of appropriate personal protective equipment (i.e. eye wear, ear muffs and/or earplugs)
  - 4.3.1.4 Compliance with the appropriate OSHA regulations
  - 4.3.1.5 Requests for monitoring have been responded to within five working days. Reports showing dosimetry results have been forwarded to involved parties within two weeks of a field visit
  - 4.3.1.6 Employees meeting the requirements for the Universities Hearing Conservation Program (HCP) have been notified.
  - 4.3.1.7 All monitoring records must be maintained at EHS and forwarded to Employee Health as necessary.



