Occupational Safety Program

Hearing Conservation Program
Manual

Department of Environmental Health & Safety
Phone: (410) 704-2949
Fax: (410) 704-2993
Email: safety@towson.edu
Website: https://www.towson.edu/public-safety/environmental-health-safety/
Emergency: 911
TUPD: (410) 704-4444

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Purpose

The purpose of the program is to provide employees with a safe and healthful working environment through utilizing facilities and equipment that have all feasible safeguards incorporated into their design to prevent or reduce noise and vibration.

Scope

This program applies to all University employees and students who may work with, or adjacent to, equipment or machines that may pose a safety hazard with respect to noise and/or vibration. All employees subject to noise exposures equal to or exceeding an 8-hour time-weighted average (TWA) of 85 dBA and a peak exposure of 140 dBA, must be enrolled in the Hearing Conservation Program. Employees that work in shops that utilize loud, powered machinery and tools, or are most likely to be exposed to such sounds in their position through departmental duties (e.g. TUPD, EHS, and Facilities Management) are the most likely to be enrolled, with others employed in use of aforementioned machinery also required.

Definitions

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.

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.

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

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).

Noise 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.

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 this regulation, SLOW time response, in accordance with ANSI S1.4-1971 (R1976), is required.

Sound level meter: An instrument for the measurement of sound level.

Time-weighted average sound level: That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

Responsibilities

A. Environmental Health & Safety (EHS)

1. EHS will develop, implement, and administer the program (referred to as HCP).
2. EHS will provide consultation for hearing protection.
3. EHS will prepare and updating the written Hearing Conservation Program with periodic review and revisions as needed.
4. EHS will investigate and document all reported incidents related to noise and vibration.
5. EHS will coordinate training and retraining of those who may be involved in using machine guards.
6. EHS will coordinate and schedule health and safety training courses and seminars presented or sponsored by the SLH Clinic for University employees. EHS and the SLH Clinic maintain documentation of the training courses.
7. EHS will identify work areas and equipment within University facilities where noise levels equal or exceed an 8-hour time-weighted average of 85 decibels.
8. EHS will identify, through personal monitoring, University employees whose noise exposure levels equal or exceed an 8-hour time-weighted average of 85 decibels.
9. EHS will conduct periodic re-monitoring of identified at-risk employees.
10. EHS will resurvey of work areas and equipment where noise levels exceed an 8-hour time-weighted average of 85 decibels whenever a change in process, equipment or control occurs, or when requested by Supervisors or employees who have a concern about their noise exposure.

11. EHS will identify noise control measures (including engineering and administrative controls) and provide recommendations for these controls and personal hearing protective devices.
12. EHS will coordinate scheduling of audiograms for employees who are exposed to sound levels greater than or equal to 85 decibels with the Speech Language and Hearing Clinic on an annual basis.

B. Speech Language and Hearing Clinic (SLH)

1. SLH will conduct baseline and annual audiograms for new employees who may be assigned to tasks with potential exposure to elevated noise levels.
2. SLH will notify EHS, the individual, and the individual's Supervisor, of all employees who have experienced significant changes in hearing (standard threshold shifts) in order that follow-up investigations may be conducted.
3. SLH will notify EHS of any trends uncovered by the testing program or regarding preventative measures that should be taken.
4. SLH will issue hearing protective devices.
5. SLH will train employees in the need for, proper use, and care of hearing protective devices in compliance with the OSHA/MOSH standard and maintain documentation of such training.
6. SLH will provide specialized training for Supervisors once each year.
7. SLH will Identify noise control measures (including engineering and administrative controls) and recommendations.

C. Department of Facilities Management (FM)/Other Departments

1. Facilities Management and Departments will maintain facilities/engineering controls.
2. Facilities Management and Departments will follow appropriate procedures and signs related to hearing protection.
3. Departments will provide replacement personal hearing protective devices for issuance to employees.

D. Supervisors

1. Supervisors will ensure that employees follow all safety training requirements.
2. Supervisors will ensure that all of their employees exposed to noise levels equal to or greater than an 8-hour time-weighted average of 85 decibels have access to appropriate hearing protective devices (HPD) in the work area and are enrolled in the HCP.
3. Supervisors must ensure all employees enrolled in the HCP go to annual audiometric testing as required.
4. Supervisors are responsible for enforcing the use of HPDs, engineering and administrative controls in designated noise hazardous areas.
5. Supervisors must assist EHS in identification of University employees whose noise exposure levels may equal or exceed an 8-hour time-weighted average of 85 decibels and identification of work areas and equipment within University facilities where noise levels may equal or exceed an 8-hour time-weighted average of 85 decibels.

E. Employees

1. Employees will complete all safety training requirements.
2. Employees will use appropriate safety and personal protective equipment, including hearing protection devices. Employees are responsible for wearing and maintaining hearing protective devices as instructed.
3. Employees exposed to excessive noise levels must also participate in annual training programs and audiometric testing. Prior to their annual audiometric testing, employees must have at least 14 hours of quiet time (both on the job and off the job).
4. In addition, if hearing protection is used in the course of their workday, employees must bring the protection with them to the audiometric testing. Employees are responsible to arrive ~15 minutes early for their appointment to complete the necessary paperwork.
5. Employees will report all workplace injuries and unsafe conditions to their Supervisor or the appropriate responsible individual.
6. New employees and those experiencing potential changes in hearing status will be evaluated for appropriateness of personal hearing protective devices by the Speech Language and Hearing Clinic who will be responsible for documenting issuance of new personal hearing protective devices. Any employee needing specialized protection may be referred to his or her own department for purchasing of a required device.

Introduction

Noise is your perception or reaction to sound wave pressure changes, which means it is subjective based on your views, desires, or preferences. Perceived loudness is a function of sound pressure, the frequency of the spectrum, and the variations of both these qualities over time. Loudness must take into consideration the physiological response to sound, and the persons reaction to the stimuli. There are four recognizable types of noise: continuous, typically from equipment that runs without interruption such as pumps or HVAC; intermittent, typically noise from traffic that passes by or machines that cycle off and on, periodically; impulsive, including loud bursts of sound from construction or equipment that creates loud booms or bangs; and low-frequency, which includes the humming from engines.

With respect to the human perception of noise, there are several factors in interpretation of the stimuli. First is the observer's health. One may be more irritable, if they are in pain or ill, specifically if they have a headache or a condition that makes hearing more sensitive than normal. Second are the characteristics of the sound, such as loudness, higher pitch, low hum, or heavier boom than one is used to. It may depend on the source (i.e. music vs. work equipment) or if it is under the observer's own control. Third is the observer's attitude toward the source of the stimuli. It may be that one is resting or focusing on an activity that requires full attention, so mood may be a factor in whether one is receptive to the sound. There are two components to the processing of any sense stimuli: the reception of the stimuli by the sense organ and the brain's perception or interpretation of the neurological transmission.

There are some universal effects of noise which are undesirable. Noise masks or distracts from hearing other desired sounds such as speech Annoyance from nuisance sounds can affect mood, causing unnecessary stress and affecting mental and physical health. Auditory fatigue can cause damage to hearing from an overexposure to longer duration of noise, loud noises, and heavy vibration.

Sound is a wave, which means noise is a wave, having all of the physical attributes or properties of a wave. Attributes include the following: the frequency (which is pitch), amplitude (which refers to loudness or softness), wave form (type of tone), and duration (length of time). Frequency is full wavelengths per unit time, typically in cycles per second or Hertz. The frequency determines the pitch of the sound. Human perception of pitch is 20 to 20,000 Hz. The amplitude is the pressure differential relative to atmospheric pressure, measured in pascals (Pa). It is the loudness of the sound or its vibration.

A decibel (dB) is a unit measuring sound pressure intensity and comparing it with a given level on a logarithmic scale used to describe a very large range in sound. Noise is the result of small rapid fluctuations in atmospheric pressure caused by vibrating objects. These pressure fluctuations are reported as sound pressure level in decibels for the sake of convenience. The pressure associated with the loudest known sound is more than ten billion times that associated with the faintest sound. Taking the logarithm compresses this scale to a more easily understood 0 decibels (the minimum point for human hearing) to 200 decibels as the maximum point. Every tenfold increase in pascals is equal to 20 decibels, which means ten times the power, ten times the pressure for every 20 decibels.

dBA means decibels on the A-scale or A-weighted decibels. The A-scale refers to A-weighting for frequencies for the noise measuring device used, so it is a type of filter for sound. It is the most common filter used, is mandated by OSHA, and is supposed to represent how humans typically hear sound as it focuses mostly on sounds between 500-4000 kHz. Similar to humans, it does not focus on very low or very high pitch sounds, though we can perceive sound above and below this range. Another scale that is occasional used is the C-scale (in dBC), which focuses on peak sound level noise, especially for machines and entertainment sound levels over 100 decibels. Its utility lies in focusing on bass tones (low pitch and frequency) and vibrations. There is also the Z-scale (in dBZ), which is considered unweighted and is used to gather information on noise as it actually appears in the environment, which can be used for other types of noise analysis.

Sound pressure doubles with every increase of 3 dB. For example, doubling the 90 dB noise level (or loudness) does not yield 180 dB, but 93 dB. Bear in mind that this measurement is not linear, but logarithmic. This means that for every 3 dB, the observer experiences double the pressure on their ears, considered to be twice as loud. This is called the exchange rate, the doubling rate for noise level. Depending on the government agency, the rate may be considered differently (i.e. DOD and EPA differ from OSHA, which regulates worker health in general industry).

OSHA uses a 5-dB exchange rate for the workplace, so that for every 5 decibels increase in noise level, the loudness is considered to increase by double. That is, for a 90-db noise level, 95 dB is double the noise level). In proportion, the dose (employee exposure to sound) increases by double, which increases damage to the body, especially the ears. So, as one approaches 180 decibels, the intensity has increased by many multiples. The permissible noise level per OSHA for an 8-hour time-weighted average during the workday is 90 dBA, meaning the worker may not be exposed to more than 90 decibels on the A-weighted scale for 8 hours or its equivalent. An equivalent example is if the level is increased to 95 dBA, the worker may only be exposed to 4 hours of noise, meaning at double the rate, the time must be reduced by half for the same level of exposure (see Table 1 for other examples).

Evidence is well-established that worker exposure to noise of sufficient intensity and duration can result in hearing damage. Noise-induced hearing loss rarely results from just one exposure; it can progress unnoticed over a period of years. Initial noise-induced hearing loss occurs at the higher frequencies where the consonant portion of speech is found, making communications difficult. Other health effects may result from excessive noise exposure such as tinnitus, fatigue, stress, high blood pressure, digestive and hormonal disorders, and a loss of psychological well-being.

It is the policy of Towson University to provide employees with a safe and healthful working environment. This is accomplished by utilizing facilities and equipment that have all feasible safeguards incorporated into their design. When effective engineering controls are not feasible, or when they are being initiated, administrative controls will be used when and where possible followed by the use of personal protective equipment. The primary goal of the Towson University Hearing Conservation Program (HCP) is to reduce, and eventually eliminate hearing loss due to workplace noise exposures. The program includes the following elements:

- Work environments will be surveyed to identify potentially hazardous noise levels and personnel at risk.
- Environments that contain equipment that produces potentially hazardous noise should, wherever it is technologically and economically feasible, be modified to reduce the noise level to acceptable levels.
- Where engineering controls are not feasible, administrative controls and/or the use of hearing protective devices will be employed.
- Annual hearing testing will be conducted to monitor the effectiveness of the Hearing Conservation Program. Early detection of temporary threshold shifts will allow further protective action to be taken before permanent hearing loss occurs.
- Education is vital to the overall success of a hearing conservation program. An understanding by employees of the permanent nature of noise-induced hearing loss, the Towson University Hearing Conservation Program and the employee's responsibilities under the program are all essential for program effectiveness.

EHS has established the program in accordance with 29 CFR 1910.95, as it is aware that excessive noise exposure is a potential cause of hearing loss and other maladies.

Applicable Regulations

- 29 CFR 1910.95 – Occupational Noise Exposure

Procedure

A. Noise Evaluation and Surveillance Procedures

1. Identification of Hazardous Noise Areas
   a) EHS will identify work areas within campus facilities where noise levels equal or exceed an 8-hour time-weighted average of 85 decibels.
   b) EHS shall maintain and update records whenever a change in process, equipment or control occurs, or when requested by Supervisors or employees who have a concern about their nose exposure.
   c) Those areas where the noise levels are below 85 dBA will not be routinely monitored.
   d) EHS will identify hazardous noise areas and equipment for any subsequent noise monitoring.
   e) Signs will be posted at the entrance to any work area where noise levels exceed 85 dBA, requiring anyone entering the area to wear proper hearing protection.
   f) Anyone who works in these areas shall have hearing protection supplied to them, shall be instructed in its proper use, and be required to wear this equipment when in these identified areas. It is the responsibility of the area Supervisor to ensure that these precautions are maintained.
   g) Equipment that produces noise levels greater than 85 dBA or 140 dB peak sound pressure levels shall also be appropriately labeled.

2. Noise Measurements and Exposure Assessments
   a) In order to effectively control noise, it is necessary that the noise be accurately measured according to standard procedures and that the measurements be properly evaluated against accepted criteria. All noise monitoring will be conducted in accordance with the OSHA regulation.
   b) The monitoring of employees' noise exposure is made up of two parts: area monitoring and personal monitoring.
      i. Area measurements are generally obtained first.
      ii. If noise levels are at or above 85 dBA, personal monitoring may be performed using dosimeters.
      iii. EHS will maintain documentation of monitoring data for both area and personal noise monitoring results.
      iv. *Affected employees will be notified in writing of the survey results through the appropriate Supervisor/manager channels.*

   c) Area Measurements/Preliminary Sound Surveys
      i. In an area survey, measurements of environmental noise levels are recorded using a sound level meter to identify work areas where employees' exposures

may be above hazardous levels and where more thorough exposure monitoring may be needed.

ii. *Area monitoring is conducted using a calibrated sound level meter set to the A scale, slow response.*

iii. *Within the area of interest, several different locations will be measured. Typical measurement locations would include:*
   1) *In the hearing zone at the employee's normal work location.*
   2) *Next to the noise source(s).*
   3) *At the entrance(s) to the work area.*
   4) *At other locations within the area where the employee might spend time working.*

iv. *The results will include a rough sketch of the area showing the locations where the noise readings were obtained.*

v. *If the noise levels are below 85 dBA on a time-weighted average basis in the area, no further routine monitoring will be required for that area.*

vi. *Should any of the noise measurements equal or exceed 85 dBA, records shall be maintained as to the noise levels recorded, where they were taken, and the source(s) of the noise. See Table 1 to assist in determining worker exposure.*

vii. *These records shall be updated whenever a change in process, equipment or control occurs, or when requested by Supervisors or employees who have a concern about their nose exposure to determine if any changes have occurred that would warrant re-monitoring of exposed employees.*

viii. *If any of the measurements equal or exceed a noise level of 85 dBA, employees who work in or near the high noise area or equipment shall have their noise exposure determined through personnel monitoring using dosimeters.*

d) Personal Monitoring

i. *Determination of the noise exposure level will be accomplished using calibrated personal noise dosimeters.*

ii. *Each employee to be monitored will have a dosimeter placed on him/her at the beginning of his/her normal work shift with the microphone placed in the "hearing zone".*

iii. *The dosimeter will be worn for the full duration of the work shift while the employee performs his/her normal work routine.*

iv. *At the end of the work shift, the dosimeter will be removed, and information printed out as soon as possible.*

v. *Background information will be collected from each employee detailing job description, unusual job activities, etc., for the time period sampled.*

vi. *Those employees whose noise exposure equals or exceeds an 8-hour time-weighted average of 85 decibels will be included in the HCP. See Table 1 to assist in determining worker exposure.*

e) Engineering Sound Survey

i. The Engineering Sound Survey is a more detailed survey conducted to identify the major sound source(s) in an area and to provide technical information for noise abatement.

ii. This survey is usually performed using an octave band analyzer to separate the noise into its component frequencies, and determine at which frequencies the hazardous portions of noise exist. This information can be used to match those frequencies with the appropriate acoustical material to dampen the noise. See Figure 1.

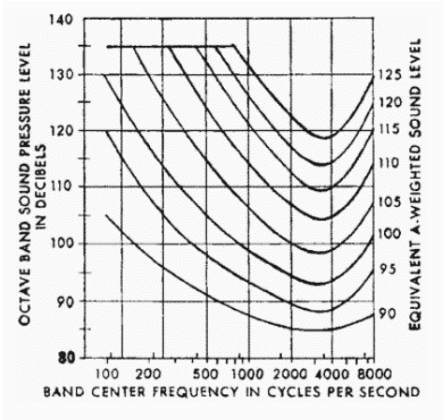

Figure 1. Equivalent Sound Level Contours. Octave band sound pressure levels (in decibels) may be converted to the equivalent A-weighted sound level (dBA) by plotting them on this graph and noting the A-weighted sound level corresponding to the point of highest penetration into the sound level contours. This equivalent A-weighted sound level, which may differ from the actual A-weighted sound level of the noise, is used to determine exposure limits from Table 1.

Table 1. Permissible Noise Exposures. When employees are subjected to sound exceeding those listed in the table, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of the table, HPDs shall be provided to reduce sound levels to within the levels of the table.

Duration Per Day (in 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

3. Re-monitoring of Hazardous Noise Areas

a) Any area with noise levels that equal or exceed 85 dBA shall also be re-monitored whenever a change in production process, equipment, or controls increase the noise exposure such that additional employees are exposed to noise levels at or above 85 dBA on a time-weighted average basis.

b) Areas where the noise levels have dropped below 85 dBA due to alterations in equipment, controls or process changes shall be eliminated from the monitoring program.
c) Employees who work for extended periods of time (>2 hours) in the high noise areas and where their 8-hour TWA equals or exceeds 85 dBA will be monitored as needed to determine their personal noise exposure.
d) Whenever an employee exhibits a standard threshold shift (STS), as determined by SLH, the employee's workplace shall be re-monitored to identify the cause and determine appropriate procedures to reduce the risk.

B. Noise Control Methods

1. Engineering and Administrative Controls

a) Engineering Controls
   i. The primary means of reducing or eliminating exposure to hazardous noise is through the application of engineering controls.
   ii. 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.
   iii. Engineering controls include redesigning the machinery, replacement with quieter equipment or materials, modifying the source, and modifying the path by enclosing the operation and adding barriers, mufflers, or room absorption.
   iv. Engineering controls such as mufflers on heavy equipment exhausts or on air release valves are required where possible.

b) Administrative Controls
   i. Administrative controls are defined as changes in behavior that reduce noise exposure (including scheduling for work or operational performance).
   ii. Administrative controls include reducing the duration of exposure time, limiting the time that a machine may operate, purchasing equipment that will reduce employees' noise exposure, use of policies/procedures on when and how to use equipment, use of hazard signs/signals to warn workers of high-noise or high-vibration areas, audiometric testing, training, and other similar actions.
   iii. If engineering solutions cannot reduce the noise, administrative controls such as those mentioned in Step B1b(ii), increasing the distance between the noise source and the worker, and/or rotation of jobs between workers in the high noise area will be used if possible.

c) The use of engineering and administrative controls should reduce noise exposure to the point where the hazard to hearing is eliminated or at least more manageable.

2. Personal Protective Equipment/Hearing Protection
   a) Hearing protective devices (HPDs) shall be the permanent solution only when engineering or administrative controls are considered to be infeasible or cost prohibitive, and they are recommended to be used in combination with said other controls.
   b) Hearing protective devices are defined as any device that can be worn to reduce the level of sound entering the ear.
   c) Hearing protection will be made available to all employees exposed to any 8-hour time-weighted average of 85 dBA or greater. All persons must wear hearing protective devices when they enter or work in an area where the operations generate noise levels of:
      i. Greater than 85 dBA sound levels, or
      ii. 140 dB peak sound pressure level or greater.

   d) Dual protection (earmuffs and earplugs) must be used when noise is 104 dbA or greater.
   e) The enforcement of hearing protection usage is the responsibility of the employee's Supervisor.
   f) Types of Hearing Protective Devices
      i. Insert Type Earplugs
         1) Earplugs are devices designed to provide an airtight seal with the ear canal. There are three types of insert earplugs: premolded, formable, and custom earplugs.
         2) Premolded Earplugs
            A) Premolded earplugs are pliable devices of fixed proportions.
            B) Two standard styles, single flange and triple flange, come in various sizes, and will fit most people.
            C) If premolded earplugs are required, the SLH Clinic will be responsible for fitting and dispensing earplugs and will train users on proper insertion, wear, and care.
            D) While premolded earplugs are reusable, they may deteriorate and should be replaced periodically.

         3) Formable
            A) Formable earplugs come in just one size. Some are made of material which, after being compressed and inserted, expands to form a seal in the ear canal.
            B) When properly inserted, they provide noise attenuation values that are similar to those from correctly fitted premolded earplugs. This is the primary form of hearing protective devices used at Towson University. The employee's department will provide formable earplugs top workers.
            C) SLH and Supervisors will instruct users in the proper use of these earplugs.
            D) Each earplug must be held in place while it expands enough to remain firmly seated. A set of earplugs with a cord attached may be used. In some cases, these earplugs may be washed and therefore are reusable, but will have to be replaced after two or three weeks or when they no longer form an airtight seal when properly inserted.

4) *Custom Molded Earplugs*
   A) A small percentage of the population cannot be fitted with standard pre-molded or formable earplugs. Custom earplugs can be made to fit the exact size and shape of the individual's ear canal.
   B) Individuals needing custom earplugs will be referred to an audiologist at the SLH Clinic. The employee's department will be responsible for any custom molded earplugs.

ii. *Earmuffs*
   1) *Earmuffs are devices worn around the ear to reduce the level of noise that reaches the ear. Their effectiveness depends on an airtight seal between the cushion and the head.*
   2) *The SLH Clinic will advise if earmuffs are required and will instruct employees in their proper usage and maintenance.*

g) Selection of Hearing Protective Devices
   i. *Employees will be given the opportunity to select hearing protective devices.*
   ii. *In all cases, the chosen hearing protection devices shall have a Noise Reduction Ratio (NRR) high enough to reduce the noise at the eardrum to 85 dBA or lower.*

h) Issuance of Hearing Protective Devices
   i. *The issuance of hearing protective devices is handled through both the SLH Clinic and the employee's department.*
   ii. *The SLH Clinic will issue and fit the initial hearing protective devices as listed in Step B2f(i).*
   iii. *The SLH Clinic will provide instruction on the proper use and care of earplugs and earmuffs whenever HPDs are dispensed and maintain documentation of such training.*
   iv. *Employees requiring earmuffs in addition to earplugs (dual protection) will be informed of this requirement and educated on the importance of using proper hearing protection by SLH Clinic. Departments will dispense replacement HPDs when necessary and must maintain a supply of HPDs.*

i) Use of Hearing Protective Devices
   i. *The user shall always use and maintain HPDs as originally intended and in accordance with instructions provided.*
   ii. *Earmuff performance may be degraded by anything that compromises the cushion-to-circumaural flesh seal. This includes other pieces of personal protective equipment such as eyewear, masks, face shields, and helmets. The user shall ensure nothing compromises the cushion-to-circumaural flesh seal.*

j) Maintenance of Hearing Protective Devices
   i. *The user will follow the procedures below to ensure proper maintenance of their HPDs.*
   ii. *Reusable earplugs*
      1) *Earplugs such as formable devices should be washed in lukewarm water using hand soap, rinsed in clean water, and dried thoroughly before use.*
      2) *Wet or damp earplugs should not be placed in their containers.*
      3) *Cleaning should be done as needed.*

   iii. *Earmuffs*
      1) *Earmuff cushions should be kept clean.*
      2) *The plastic or foam cushions may be cleaned in the same way as earplugs, but the inside of the muff should not get wet.*
      3) *When not in use, earmuffs should be placed in open air to allow moisture that may have been absorbed into the cups to evaporate.*

k) Hearing Protection Performance Information
   i. *The maximum sound attenuation one gets when wearing HPDs is limited by human body and bone conduction mechanisms.*
   ii. *Even though a particular device may provide outstanding values of noise attenuation, the actual noise reductions may be less because of the noise surrounding the head and body bypasses the hearing protector and is transmitted through tissue and bone pathways to the inner ear.*
   iii. *Attenuation shall be determined by the following method:*
      1) *Determine the actual exposure through personal dosimetry.*
      2) *Subtract 7 dB from the Noise Reduction Rating (NRR) listed for the hearing protective device chosen.*
      3) *It is recommended that a 50% derating value be added at this point in order to compensate for the differences between laboratory and real-world performance.*
      4) *Subtract this value from the value obtained through personal dosimetry for the actual noise exposure while wearing the hearing protective device.*
   iv. *The most common HPDs available are the foam-forming earplugs.*
      1) *The highest noise reduction rating afforded by such products is 35 decibels.*
      2) *Applying the above method to this NRR results in an actual protection rating of 14 dB (35 dB – 7 dB = 28 dB -> 28 dB X 50% (or 28/2) = 14 dB). Therefore, the maximum 8-hour time-weighted average exposure allowable when correctly wearing such devices is 104 decibels (90 dB + 14 dB = 104 dB).*
      3) *For noise exposure greater than 104 decibels, dual protection with earplugs and earmuffs is required as stated in Step B2d.*

v. *The terms “dual protection” or "double hearing protection" are misleading, as the attenuation provided from any combination earplug and earmuff is not equal to the sum of their individual attenuation values.*

vi. *If dual protection (e.g. earplugs and earmuffs) is worn, the attenuation value of the combined protection is calculated as follows:*

1) Add 5 dB to the NRR of the higher-rated protector.

2) Average the two NRRs.

3) Apply the protection factor of 2.

For example, if earplugs had a NRR of 35 dB and earmuffs had a NRR of 25 dB, when used together their combined NRR is 32.5 dB (35 dB > 25 dB; 35 dB + 5 dB = 40 dB -> 40 dB + 25 dB = 65 dB -> 65 dB/2 = 32.5).

C. Audiometric Testing

1. Notification

a) Upon identification of employees whose 8-hour TWA equals or exceeds 85 dBA, EHS will recommend to the SLH Clinic and the employee's Supervisor, in writing, to enroll certain employee(s) in the HCP. Information supplied to the SLH will include the employee(s) name, Supervisor's name, and telephone number. EHS will enroll the employee in the HCP.

b) In work locations where either through administrative or engineering controls, noise levels are found to have fallen such that the employee's 8-hour TWA is below 85 dBA, EHS shall notify the SLH Clinic and the employee's Supervisor, that the employees working in that area are no longer required to be enrolled in the HCP. The employee may remain in the program voluntarily at their discretion.

c) Any employee experiencing difficulty in wearing assigned hearing protection (i.e., irritation of the canals, pain) will be advised to immediately report this to their Supervisor and make arrangements to go to the SLH Clinic for evaluation as soon as possible.

2. Performance of Audiometric Testing

a) The SLH Clinic has the responsibility for administering the audiometric testing program portion of the HCP.

i. *The object of the audiometric testing program is to identify workers who are beginning to lose their hearing and to intervene before the hearing loss becomes worse.*

ii. *Audiometric testing will be provided to all employees with exposure to noise levels that equal or exceed an 8-hour time-weighted average of 85 dBA.*

iii. *Annual retesting will be performed for all employees enrolled in the HCP.*

b) All University employees who are exposed to potentially hazardous noise are required to participate in audiometric testing.

i. *The SLH Clinic conducts audiometric testing on campus.*

ii. *Each department will be responsible for ensuring their employees are schedule for and undergo annual audiograms.*

iii. EHS determines which employees are required to participate in audiometric testing.

c) Each individual should refrain from occupational- and recreational-related noises (e.g. concert, gunfire, lawnmower, etc.) for at least 14 hours prior to their audiogram.
d) If hearing protection is used in the course of their workday, employees must also bring their HPDs to annual audiometric testing for inspection by the SLH Clinic for condition and shape.
e) In addition, the SLH Clinic would like the employees to arrive approximately 15 minutes early for their appointment to complete the necessary paperwork.
f) If any employee is unable to keep their scheduled appointment, their department must notify EHS, so that EHS may contact the SLH Clinic. A 24-hour notification of cancellation is required; otherwise, the employee's department will be billed for a first missed appointment; 2X for a second missed appointment; 4X for a third missed appointment, and so on.
g) The SLH Clinic will send a copy of the completed hearing results to the employee.
h) Individuals with abnormal baseline audiometric test results or threshold changes will be referred to their private physician. If the individual's baseline examination or their annual retest is within normal limits, they will be filed for recall in one year.
i) If a threshold shift has been identified, the individual will be notified in writing within 21 days. The SLH Clinic will notify EHS of all cases noting a threshold shift. Individuals may be sent for repeat audiograms if it is felt that their most recent audiogram may not have been accurate. EHS will investigate all cases involving a Standard Threshold Shift (STS).
j) The baseline audiogram will be administered within the first six months of employment for individuals exposed to potentially hazardous noise.
k) Annual audiograms will be conducted in order to determine if a standard threshold shift has occurred.
l) Audiometric test requirements are for a pure tone air conduction hearing threshold examination, which test frequencies 500, 1000, 2000, 3000, 4000, and 6000 Hz.
m) If the annual audiogram shows that the employee has suffered a STS, the employee is required to obtain a retest within 30 days and consider the results of this retest as the annual audiogram.
n) A STS is defined as a change in the hearing threshold, relative to the baseline audiogram, of an average of 10 decibels or more for ranges 2000, 3000, and 4000 Hz in either ear.
o) Allowance will be made for the contribution of aging to the changed hearing level by correcting the annual audiogram.
p) When an STS is detected, the employee must be notified, and fitted or refitted with hearing protection as needed.

3. Recording a Hearing Loss
    a) If the SLH Clinic determines an employee has a STS, they will establish the significance of the loss by comparing the employee's total hearing level (in the ear(s) that suffered the loss) to "audiometric zero."
    b) Audiometric zero represents the statistical average hearing threshold of young adults with no history of aural pathology.
    c) If the employee's hearing level is determined to be 25 dB or more above audiometric zero, then his hearing level is considered significantly worse than normal.
    d) The SLH Clinic will immediately notify EHS and Human Resources (HR) of the employee's hearing loss and HR will record it in accordance with OSHA's Occupational Injury and Illness Recording and Reporting Rule (29 CFR 1904).

D. Recordkeeping

1. Health Conservation Program records will be maintained as listed in Table 2:

Table 2. Health Conservation Program Recordkeeping. The table includes records related to the Hearing Conservation Program, and their respective storage locations or departments responsible for their maintenance.

Record	Department/Location
Medical Evaluation and Audiograms	Speech Language & Hearing Clinic
Training Records	Environmental Health & Safety
Hearing Conservation Program	Environmental Health and Safety Speech Language & Hearing Clinic
Hazard Evaluations (Work Area Noise Surveys, Personnel Monitoring)	Environmental Health & Safety
Program Evaluations	Environmental Health & Safety
OSHA 300 Log	Human Resources

2. All non-medical records (ex. work area and equipment surveys) will be maintained for a period of at least five years. 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 the employee's record.
3. All employees who routinely work in designated hazardous noise areas shall be identified and a current roster of such employees shall be maintained by EHS and updated as needed.

E. Program Evaluation

1. Periodic program evaluations will be conducted to assess compliance with federal and state regulations.
2. Both the monitoring and audiometric testing portions of the HCP will be reviewed to assure its quality and effectiveness.

3. An evaluation of the HCP, including wearer acceptance, appraisal of protection afforded, and field audits of both hearing protection usage and recordkeeping will be conducted. Items to be considered include:
    a) Training records and course content for Supervisors and employees;
    b) Maintenance of HPDs;
    c) Field audits of HPD use; and
    d) Review of recorded threshold shifts.
4. The findings of the Towson University HCP evaluation will be documented, and this documentation will list plans to correct faults in the program and set target dates for the implementation of the plans.

F. Training

1. Training requirements apply to personnel who are within the scope of the Hearing Conservation Program (HCP). The training and education program will provide information about the adverse effects of noise and how to prevent noise-induced hearing loss. At a minimum, all training will cover the following topics:
    a) Noise-induced hearing loss;
    b) Recognizing hazardous noise;
    c) Symptoms of overexposure to hazardous noise;
    d) Hearing Protective Devices (HPDs) - advantages and limitations;
    e) Selection, fitting, use and maintenance of HPDs;
    f) Explanation of noise measurement procedures; and
    g) Hearing Conservation Program requirements.

2. Employees will also be advised of where the Occupational Noise Exposure Standard and advised of the availability of the HCP availability online.
3. University employees shall be encouraged to use HPDs when they are exposed to hazardous noise during activities at home (e.g. from lawn mowers, chain saws, concerts, gunfire, etc.).
4. All University employees identified for inclusion in the HCP will receive training by EHS (and the SLH Clinic during their annual audiogram) in the requirements of the program. Supervisors will receive a formal initial training by the SLH Clinic to reinforce the program's requirements so they can answer questions from their employees and enforce the requirements of the program.
5. Supervisors must notify EHS to schedule training for new employees assigned to work in noisy environments and for retraining of current employees.
6. Any employee found to have a STS will have additional training on the purpose of HPDs, how to wear HPDs and to answer any questions.
7. Training may be accessed virtually through Vector Solutions SafeColleges found at the following URL: https://towsonehs-md.safecolleges.com/training/home. Employees shall request training by emailing safety@towson.edu or by calling the Environmental Health & Safety (EHS) office at 410-704-2949.

Resources

A. OSHA

1. Hearing Conservation Program & Related Hearing Programs
2. OSHA Technical Manual, Section 3: Health Hazards, Chapter 5: Noise
3. OSHA Technical Manual, OSHA Instructions TED 1.15, Section II, Chapter 5: Noise Measurement

B. CDC-NIOSH

1. Noise-Induced Hearing Loss
2. A Practical Guide to Effective Hearing Conservation Programs in the Workplace, September 1990

C. ANSI

1. ANSI S1.4-1971 Specifications for Sound Level Meters
2. ANSI/ASA S12.6-2016 Hearing Protectors Real-Ear Attenuation

D. Berger, E. H., et.al., Ed., Noise & Hearing Conservation Manual, 4th ed., Akron, OH: American Industrial Hygiene Association, 1986.

E. Environmental Health & Safety

1. To request documents, reviews for procedures or equipment, or general inquiries, contact EHS by emailing safety@towson.edu or by calling the Environmental Health & Safety (EHS) office at 410-704-2949.

Appendix A: Hearing Conservation Standards & Regulations

29 CFR 1910.95: Occupational Noise Exposure
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95

Appendix B: Noise Awareness Information

A. Supervisors and exposed workers must become aware of and understand the adverse effects of noise and how to prevent noise-induced hearing loss. To prevent progressive permanent hearing loss, people exposed to hazardous noise must take positive action. Each exposed worker and Supervisor should know the following:
   1. Exposure Hazards & Results
      a) Noise exposure may result in permanent damage to the auditory system and there is no medical or surgical treatment for this type of hearing loss.
      b) Other health effects may result from excessive noise exposure such as tinnitus, fatigue, stress, high blood pressure, digestive and hormonal disorders, and a loss of psychological well-being.
      c) Though the use of a hearing aid may provide some benefit, normal hearing will not be restored.
      d) Many people do not realize loud sounds can cause hearing loss.
      e) Furthermore, in its initial stages, the person may not notice a problem since noise-induced hearing loss is invisible, painless, and occurs in the high frequencies.
      f) It is dangerous to ignore the temporary characteristics of noise-induced hearing loss (such as ringing or buzzing in the ears, excessive fatigue, etc.)

   2. Hazard Recognition
      a) Each person should know how to recognize hazardous noise even if a noise survey has not been conducted and/or warning signs posted.
      b) Recognizing and understanding the adverse effects of off-duty noise exposures is also important.
      c) The best rule to follow is: "If you have to shout at arms' length (approximately three feet) to talk face-to-face, you are probably being exposed to hazardous levels of noise."
      d) Each person must know how to tell if they have been overexposed to loud sound.
      e) Overexposure may occur even while wearing hearing protection.
      f) Earplugs and/or earmuffs alone may not be enough protection.
      g) Each overexposure results in a temporary threshold shift (TSS), a certain degree of permanent loss results.
      h) The recognizable symptoms of overexposure are described as "dullness in hearing or ringing in the ears."

   3. Hearing Loss Prevention Methods & Communication
      a) Preventing noise-induced hearing loss is accomplished by reducing both the time (duration) and intensity of exposure.
      b) Reducing exposure time is accomplished by avoiding any unnecessary exposure to loud sound.

c) Reducing intensity is usually accomplished by wearing personal hearing protection or use of engineering controls such as barriers and noise-cancelling devices.
d) Each person must be able to properly wear and care for the particular type of hearing protection selected.
e) Speech communication is difficult in high intensity noise. However, most people do not realize it is easier to understand speech if hearing protection is worn in a hazardous noise environment.
f) Hearing protection reduces the noise and the level of speech, resulting in a more favorable listening level.
g) Hearing protection reduces the intensity of frequencies above the speech range; thus, reducing the noise and accentuating speech.
h) People who claim wearing hearing protection makes it difficult to hear speech are probably in noise levels less than 85 dBA or have already developed a hearing loss.