

	<h2 style="margin: 0;">Hearing Conservation Program</h2>	Document Number:
		Effective Date: 2/2012
		Revision Date: 4/2013

1.0 Purpose and Applicability

1.1 The purpose of this Hearing Conservation Program is to provide for the protection of University employees from long term hearing loss associated with **noise** levels in the workplace following the Occupational Noise Exposure Revised Criteria 1998 specified by the National Institute for Occupational Safety and Health (NIOSH) which exceeds standards and ensures compliance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.95.

NOTE: Words in ***bold italics*** throughout this Hearing Conservation Program indicate terms that are defined in **2.0 Definitions**.

Occupational **Noise** Exposure

1.2 It is the policy of the UMass Amherst to provide its employees with a safe and healthful work environment. Hearing conservation is an important aspect of the overall health and safety program. Workplace **noise** can cause hearing loss, create physical and psychological stress, and contribute to accidents by making it difficult to communicate.

1.3 An estimated 14 million employees throughout the United States are exposed to hazardous **noise**. Although UMA attempts to control **noise** exposures on campus, certain operations and workstations may expose faculty and staff to significant **noise** levels. All personnel who are regularly exposed to occupational **noise** levels at or exceeding an 8-hour time-weighted average of 85 dBA are included in the Hearing Conservation Program (HCP).

1.4 The Hearing Conservation Program applies to all University of Massachusetts Amherst (UMass Amherst) employees whose **noise** exposures equal or exceed an 8-hour time weighted average (TWA) of 85 **decibels** on the A-weighted scale (i.e., dBA). This is referred to as the "**action level**." Exposures at or above this level for this duration are considered hazardous. All such persons shall be enrolled in a Hearing Conservation Program that includes:

- **Noise** monitoring
- **Audiometric testing**
- Engineering and administrative **noise** exposure controls
- **Hearing protection devices**
- Employee training and education
- Recordkeeping

2.0 Definitions

2.1 Action Level: The level of **noise** exposure at which:

- An employee must be enrolled in the Hearing Conservation Program and provided audiometric testing
 - Representative **noise** exposure monitoring is required by EH&S
 - Hearing protectors and training on **noise** hazards must be provided to the employee
- *OSHA has set the current **action level** at 85 A-weighted **decibels**, or **dBA**, over an eight-hour period.
- 2.2 Audiometric Testing: Exams that measure the sensitivity of a person's hearing threshold in **decibels**. The testing also establishes a baseline hearing threshold that is compared to later exams to determine if hearing loss has occurred.
- 2.3 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.
- 2.4 A-Weighted Decibels (dBA): The A weighting, expressed as dBA, is the scale used for most occupational **noise** measurements. The A weighting approximates the range of human hearing as it filters out lower **frequency noises**, which are not as damaging as the higher frequencies.
- 2.5 Baseline Audiogram: The audiogram against which future audiograms are compared.
- 2.6 Continuous Noise: **Noise** levels that vary with intervals of one second or less.
- 2.7 C-Weighted: Expressed as dBC. The C **weighting filters** include both high and low **frequency noise** and are used for impact **noise** and in the selection of hearing protection.
- 2.8 Decibels (dB): A measure of the **sound** level (loudness). The decibel scale is a logarithmic scale; as an example, a 90 dB **noise** is ten times louder than an 80 dB **noise**.
- 2.9 Exchange Rate: The increase in decibels over which the permissible exposure duration is reduced by half. NIOSH and ACGIH ascribe to a 3 dB exchange rate. Therefore if an exposure of 85 dBA is permitted for 8 hours, then 88 dBA is permitted for only 4 hours.
- 2.10 Frequency: A sound's **pitch** measured in **hertz** (hz); high pitches are high **frequency** sounds.
- 2.11 Hearing Protection Devices (HPD's): Personal protective equipment that is designed to be worn in the ear canal or over the ear to reduce the **sound** level reaching the ear drum. Examples include ear muffs or plugs.
- 2.12 Hearing Threshold Level (HTL): The lowest threshold that the employee can hear the test tone during an audiometric test. The HTL's are recorded on the employee's audiogram.

- 2.13 Hertz (Hz): A unit of measurement of **frequency**, expressed as cycles per second.
- 2.14 Impulse/Impact Noise: **Noise** that is a sharp burst of **sound**, generally less than one-half second in duration, that does not repeat itself more than once per second.
- 2.15 Noise: Unwanted **sound**.
- 2.16 Noise Dosimeter: An instrument worn by an individual that integrates the **sound** level exposure over a period of time.
- 2.17 Noise Reduction Rating (NRR): The **Noise Reduction Rating** of **hearing protection devices** (HPD) indicates the theoretical amount of reduction of **noise** levels that can be achieved if the HPD is worn correctly. This rating is shown on the HPD packaging.
- 2.18 Otolaryngologist: A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.
- 2.19 Pitch: Another term for **sound frequency**. Higher pitches are higher **frequency** sounds.
- 2.20 Recommended Exposure Limit (REL): 85 dBA. The NIOSH REL is 85 decibels, A-weighted scale, as an 8-hr time-weighted average (85 dBA as an 8hr TWA). Exposures at and above this level are considered hazardous.
- 2.21 Representative Exposure: Measurements of an employee's **noise** dose or 8-hour **time weighted average sound level** that is representative of the exposures of other employees in the workplace.
- 2.22 Sound: A vibration or pressure oscillation that is detectable by the ear drum.
- 2.23 Sound Level Meter: An instrument used for the measurement of **noise** in **sound** level surveys.
- 2.24 Speech Interference Levels (SILs): The frequencies most associated with speech, which are the 500-4000 hz (**frequency**) range. Vowels (a, e, i, o, u) are low **frequency** sounds (below 2000 hz) and consonants (b, c, d, etc) are high **frequency** sounds. The low frequencies are the least affected by **noise**. If the high frequencies are affected, t's and p's or s's and f's may be easily confused.
- 2.25 Standard Threshold Shift: An average shift from the baseline measurement in either ear of 10 dB or more at 2000, 3000 and 4000 Hz. These frequencies are the most important frequencies in communication and the most sensitive to damage by industrial **noise** exposure.
- 2.26 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.

- 2.27 Threshold limit Value (TLV) (ACGIH): 85 dBA Employees may be exposed to 85 dBA for an 8 hour time weighted average (TWA) exposure without experiencing serious hearing effects.
- 2.28 Threshold of Pain: A **noise** level of 120 dB causes pain.
- 2.29 Weighting Filters, Scales or Networks: **Sound** level meters and dosimeters use a selective weighting system (filters) to eliminate certain frequencies from the measurements that are unimportant in the **noise** exposure. The most common are A and C.

3.0 Roles and Responsibilities

3.1 UMass Amherst (Employer)

- 3.1.1 UMass Amherst is responsible for providing a hearing protection program and appropriate hearing protection equipment to employees when they are necessary for health protection. UMass Amherst will provide hearing protection equipment at no charge to affected employees. Any expense associated with hearing conservation training, medical evaluations, and hearing protection equipment will be borne by UMass Amherst.

3.2 Hearing Conservation Program Administrator (HCPA)

- 3.2.1 The *Hearing Conservation Program Administrator* for the UMass Amherst is the Lab Safety & IH Program Head, EH&S Department. The **HCPA** is responsible for administering the Hearing Conservation Program. Duties of the Program administrator include:
 - 3.2.2 Administer the UMass Amherst Hearing Conservation Program, and conduct required evaluations of its effectiveness.
 - 3.2.3 Conduct, and/or oversee noise measurements to identify areas or processes that require **noise** abatement and/or posting
 - 3.2.4 Install signs on doors to areas containing equipment or processes consistently generating **noise** levels in excess of 85 dBA
 - 3.2.5 Identify employees who are required to be enrolled in the UMA Hearing Conservation program.
 - 3.2.6 Select proper **hearing protection devices** and provide affected employees instruction on their use.
 - 3.2.7 Conduct and/or oversee annual Hearing Conservation Training on the health hazards of excessive **noise** exposure, and on the proper use and care of hearing protectors
 - 3.2.8 Maintain records of workplace **noise assessments**, employee **noise** exposure measurements, and training.

- 3.2.9 Notify appropriate department supervisors when persons enrolled in the Hearing Conservation Program are due for renewal medical evaluations (i.e., **audiometric testing**) and/or refresher training
- 3.3 Supervisors of Persons Enrolled in the UMA Hearing Conservation Program
 - 3.3.1 Ensure that the Hearing Conservation Program is implemented in their particular areas.
 - 3.3.2 Ensure that the Program is understood and followed by the employees under their charge.
 - 3.3.3 Notify **HCPA** of **noise** complaints or potential **noise** hazards.
 - 3.3.4 Ensure that employees are provided with hearing protectors when required.
 - 3.3.5 Ensure that employees properly use and care for hearing protectors.
 - 3.3.6 Implement administrative controls, and enforce the use of appropriate engineering controls when applicable.
 - 3.3.7 Ensure that **noise**-hazardous equipment / areas identified by the **HCPA** are properly labeled or posted.
 - 3.3.8 Notify the **HCPA** of processes, materials, or equipment changes that may alter **noise** exposures.
 - 3.3.9 Ensure that potentially overexposed employees are provided with a baseline audiometric hearing test prior to the initial work assignment and then annually thereafter.
 - 3.3.10 Ensure that potentially overexposed personnel attend EH&S HCP training and annual refresher training
- 3.4 Persons Enrolled in the UMass Amherst HCP
 - 3.4.1 Wear **hearing protection devices** as required in posted high **noise** areas (also applies to students, visitors and guests).
 - 3.4.2 Attend required training sessions on **noise** hazards
 - 3.4.3 Participate in annual **audiometric testing**.
 - 3.4.4 Report **noise** hazards and hearing protector problems to the appropriate supervisor
 - 3.4.5 Maintain hearing protectors in sanitary condition and proper working order
- 3.5 Audiological Services at the Center for Language, Speech, and Hearing Services

- 3.5.1 Perform **audiometric testing** according to established standards of the American Speech-Language-Hearing Association such as the Guidelines for Audiologic Screening
- 3.5.2 Interpret results of **audiometric testing**
- 3.5.3 Report hearing deficiencies (standard threshold shifts) to the *HCPA*.
- 3.5.4 Maintain all employee medical records pertaining to the UMA Hearing Conservation Program.
- 3.5.5 Provide information to employees, as requested, concerning the effects of **noise** on hearing and interpretation of **audiometric testing**.

4.0 Procedure

4.1 Noise Monitoring

- 4.1.1 **Noise** measurements (monitoring) shall be made at the employee's normal working location(s). This procedure allows an accurate estimation of the employee's daily exposure except in instances where an employee is required to move from one work location to another in his/her daily routine, or when an employee's instantaneous **noise** exposure levels vary markedly during the shift because of machine cycling. In these cases, **noise dosimetry** is performed.
- 4.1.2 The sound pressure level will be determined by a sound level meter or dosimeter conforming to the minimum requirements of the American National Standards Institute (ANSI) Specification for Sound Level Meters, S1.4-1983, Type S2A, or ANSI S1.25-1991 Specification for Personal Noise Dosimeters. The measurement device will be set to use the A-weighted network with slow meter response.
- 4.1.3 UMass Amherst shall provide affected employees or their representatives with an opportunity to observe **noise** monitoring procedures.
- 4.1.4 If **noise** levels are below 80 **dba** in the area, no further routine monitoring will be required for that area.
- 4.1.5 If there are indications that an employee's **noise** exposure may equal or exceed an 8-hour time-weighted average of 85 **decibels** ('**action level**'), the *HCPA* (EH&S) oversees and/or conducts a detailed **noise** survey using a **sound level meter** (A-scale, slow response) and/or **noise dosimeter** for evaluation of personal exposures.
- 4.1.6 All continuous, intermittent and impulsive sound levels from 80 to 140 **dba** will be integrated into the computation of a **time weighted average**. Therefore 80 **dba** is the lower threshold for including measurements in calculations of dose.

4.1.7 Determination of Noise Exposure: Continuous or Intermittent Noise (for steady sound levels of at least 3 seconds): When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered using the following calculations:

$$\text{Dose} = (C1/T1 + C2/T2 + \dots Cn/Tn) \times 100 \quad \text{where}$$

- C1 = the total duration of exposure at a specific noise level
- T1 = the total duration of exposure permitted at that level from Table 1 or from the following equation;

$$T_{(\text{min})} = \frac{480}{2^{(L-85)/3}} \quad \text{where L is the sound level in dB}$$

- If the total dose exceeds 100 then the NIOSH REL and ACGIH TLV-TWA has been exceeded.

Table 1. TLVs for Noise using the NIOSH & ACGIH criterion of 85 dBA for 8 hours at an **exchange rate** of 3 dB

Sound Level dBA	Permissible Exposure Duration (T)
80	24 hours
82	16 hours
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 min
100	15 min
103	7.5 min
106	3.75 min
109	1.88 min
112	0.94 min
115	28.12 sec
118	14.06 sec
121	7.03 sec
124	3.52 sec
127	1.76 sec
130	0.88 sec
133	0.44 sec
136	0.22 sec
139	0.11 sec

These values apply to total duration of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposures.

Calculation of Time Weighted Average (TWA) using the NIOSH & ACGIH criterion of 85 dBA for 8 hours at an **exchange rate** of 3 dB:

$$\text{TWA (dBA)} = 9.97 \log (\text{Dose}/100) + 85$$

- 4.1.8 Determination of Noise Exposure Impulsive or Impact Noise: For sounds with levels of less than 3 second duration, a dosimeter or an integrating sound level meter must be used. The TLV is exceeded when the dose is more than 100% as indicated on a dosimeter set with a 3dB exchange rate and an 8 hour criteria level of 85 dBA. The TLV is exceeded on an integrating sound level meter when the average sound level exceeds the values in Table 1.
- Sound levels between 80 and 140 dBA will be measured and the pulse range will be at least 63db
 - Hearing protection must be worn when there are exposures in excess of C-weighted peak of 140dB
- 4.1.9 The results of all measurements are recorded, and employees are notified of their individual exposure level by the **HCPA**.
- 4.1.10 Each employee found to be exposed at or above an 8-hour time-weighted average of 85 **dBA** is notified by the **HCPA** and included in the UMass Amherst Hearing Conservation Program.
- 4.1.11 Follow-up monitoring is conducted whenever a change in production, process, equipment or controls increases **noise** exposures to the extent that:
- Additional employees may be exposed at or above the **action level**, or
 - The attenuation provided by hearing protectors used by employees may be rendered inadequate to meet the OSHA requirements for the devices
- 4.1.12 Areas where the **noise** levels have dropped below 80 **dBA** due to alterations in equipment, controls or process changes shall be eliminated from the monitoring program.
- 4.2 Audiometric Testing
- 4.2.1 The objective of the hearing conservation program developed by UMass Amherst is the preservation of the hearing of its employees. In order to achieve this goal, an effective **audiometric testing** program has been implemented. This program includes an initial survey of the existing work force whose exposures equal or exceed a TWA of 85 **dBA** in order to establish baselines, and termination audiograms when possible. All employees exposed to levels equal to or exceeding a TWA of 85 **dBA** receive an annual audiometric test.
- 4.2.2 The success of the hearing conservation program with regard to each individual employee is evaluated by comparing annual audiograms to the **baseline audiogram**. Audiogram review is performed by an **audiologist** or physician, and recommendations regarding the audiometric results are followed. This procedure, among others, helps to determine the effectiveness of the hearing protection program, and, as a result, ensures the protection of employees' hearing.
- 4.2.3 Annual **audiometric testing** shall be performed by a licensed or certified **audiologist**. A **baseline audiogram** shall be obtained within six months of an employee's first exposure at or above the **action level**. The **baseline**

audiogram is established to compare against subsequent audiograms. Baseline audiograms will be preceded by at least 14 hours without exposure to workplace **noise**. This requirement may be met by wearing hearing protectors which will reduce the employee's exposure to a **sound** level of 80 dBA or below.

- 4.2.4 The results of the audiometric tests are reviewed by the Audiological Services at the Center for Language, Speech, and Hearing Services to determine whether problem audiograms require further evaluation.
- 4.2.5 Audiometric tests are to 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** are to be taken separately for each ear.
- 4.2.6 Employees will be informed in writing within 21 days when an audiogram indicates a **standard threshold shift** (STS) which is determined to be work related. In this case, the employee will also be referred for a follow-up clinical audiological evaluation. The employee's supervisor will also be notified of the STS and shall ensure that the employee has appropriate hearing protection, is trained in their use and care, and required to use them. Employees already using hearing protection shall be refitted (if necessary) and retrained in the use of hearing protection and provided hearing protection offering greater attenuation if necessary. Employees who have experienced a **standard threshold shift** will be retested by UHS within 30 days, and the results of the retest will be used as the annual audiogram.
- 4.2.7 Initial and annual **baseline audiograms** will be provided for employees whose job classification and **noise** exposure monitoring demonstrates that workplace **noise** levels continue to equal or exceed 85 **dBA**.

4.3 Engineering and Administrative Controls

- 4.3.1 When employees are subjected to **sound** levels exceeding 85 **dBA** TWA, UMass Amherst recognizes the desirability of controlling the existing **noise** levels by engineering and/or administrative controls. Therefore the feasibility of such controls shall be carefully considered.
- 4.3.2 Types of administrative controls are rotation of employees, limiting time of certain operations, or restricting areas or work operations.
- 4.3.3 Engineering controls may include maintenance, modifying equipment, substitution of equipment, isolation, and acoustic material.

4.4 Hearing Protective Devices

- 4.4.1 If feasible engineering or administrative controls cannot be accomplished, personal hearing protective devices must be provided at no cost to employees, and used to reduce **sound** levels in areas identified in paragraph 5.4.4.

- 4.4.2 The hearing protection used will depend on the operation, employee preference and attenuation required. The **HCPA** is to assist in supplying information on **noise** attenuation data and supervise the correct use of hearing protectors.
- 4.4.3 Employees are given the opportunity to select their hearing protectors from a variety of suitable hearing protectors. Personal protective devices should also be used during non-routine, infrequent operations, which do not warrant special engineering control.
- 4.4.4 The University strongly encourages the use of **hearing protection devices** while working around noisy equipment. The use of **hearing protection devices** is *required* when the exposure is 85 **dba**, or greater
- 4.4.5 Hearing protective devices must attenuate employee exposure to at least an 8-hour TWA of 85 **dba**.
- 4.4.6 The adequacy of hearing protector attenuation shall be re-evaluated whenever employee **noise** exposures increase to the extent that the hearing protectors provided may no longer provide adequate attenuation.
- 4.4.7 Hearing protectors shall be available to all employees exposed to **noise** levels at or above the **action level** of 85 **dba**, 8-hr TWA, at no cost to the employees.
- 4.4.8 Employees whose 8-hour TWA **noise** exposures do not meet or exceed 85 **dba** will be provided hearing protection if their duties require entry into **noise** hazard areas with **sound** levels measured over 85 dBA.
- 4.4.9 **Noise** hazard areas that are not designed for extended work operations (e.g., mechanical rooms) will be placarded with appropriate **noise** hazardous 'warning' signage advising entrants of the maximum **noise** levels measured in these spaces. Entrants are strongly encouraged to utilize hearing protection when entering these spaces.
- 4.4.10 Employees will be given the opportunity to select their hearing protectors from a variety of suitable types.
- 4.4.11 Proper initial fitting and supervision of the correct use of hearing protectors will be provided by the **HCPA**. The **HCPA** shall be trained by and under the supervision of an **audiologist** or physician.
- 4.4.12 Re-evaluation of hearing protectors will be done whenever a workplace **noise** level increase renders the hearing protector's attenuation inadequate.
- 4.4.13 Any person experiencing difficulty in wearing assigned hearing protection (i.e., irritation of the ear canals, pain) will be advised during training to immediately report this to their supervisor and to schedule an appointment with the Audiological Services for evaluation as soon as possible.
- 4.4.14 Until such time as engineering and/or administrative controls reduce the amount of **noise** exposure at or below the allowed limits, appropriate personal hearing protective devices are made available and issued to **noise**-exposed employees.

It is recognized that the use of these devices is considered a temporary solution to the problem of overexposure until feasible controls are provided.

4.5 Employee Training and Education

- 4.5.1 UMass Amherst recognizes the need for a strong educational program, and therefore properly educates its **noise**-exposed employees. An annual training program is provided for each employee included in the Hearing Conservation Program.
- 4.5.2 The training program includes:
- Effects of **noise** on hearing
 - The purpose, advantages, disadvantages, and attenuation of various types of hearing protectors, and instruction on their selection, fitting, use, and care.
 - The purpose of **audiometric testing** and an explanation of testing procedures.
- 4.5.3 All areas where hearing protection is required are posted with appropriate signs in order to alert employees to the need for wearing protective devices.
- 4.5.4 Training will be documented on forms provided by the **HCPA**.
- 4.5.5 The **HCPA** ensures that a copy of the UMass Hearing Conservation Program is made available to affected UMass Amherst employees or their representatives, and that a copy is posted in affected work areas.

4.6 Recordkeeping

- 4.6.1 Records of employee exposure measurements and assessments are maintained for 30 years by the UMass Amherst **HCPA**.
- 4.6.2 Employee audiometric test records are maintained by Audiological Services at the Center for Language, Speech, and Hearing Services for the duration of affected employees' employment plus 30 years.
- 4.6.3 Audiometric test records shall include:
- Name and job classification of the employee
 - Date of the audiogram
 - Examiner's name
 - Employee's most recent **noise** exposure measurement
 - Date of the last acoustic or exhaustive calibration of the audiometer
 - Background **sound** pressure levels in the audiometric test rooms.

5.0 Key References

- 5.1 OSHA Occupational **Noise** Exposure Standard, 29 Code of Federal Regulations 1910.95

- 5.2 OSHA Technical Manual, Section IV: What constitutes an effective hearing conservation program?
- 5.3 2012 TLV's and BEI's ACGIH
- 5.4 Criteria for a Recommended Standard: Occupational Noise Exposure Revised Criteria 1998. National Institute for Occupational Safety and Health. DHHS (NIOSH) publication No. 98-126. <http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf>
- 5.5 Guidelines for Audiologic Screening 1997, American Speech-Language-Hearing Association. <http://www.asha.org/policy/GL1997-00199.htm>