1.0 Introduction

Worker exposure to noise of sufficient intensity and duration can result in permanent hearing damage. Noise-induced hearing loss rarely results from a single exposure; it can progress unnoticed over a period of years. Early noise-induced hearing loss occurs at the higher frequencies where the consonant portion of speech occurs, making communication difficult.

The Occupational Safety and Health Administration (OSHA) requires employers to:

- Monitor facilities and employees to determine noise overexposure situations,
- Develop and implement a written hearing conservation program that identifies the methods used to comply with regulatory requirements,
- Implement an audiometric testing program for employees with high noise exposures to determine if exposure impacts hearing ability,
- Provide appropriate hearing protection to employees with high noise exposures if other methods of noise control are not feasible or during installation of such controls,
- Provide annual training for employees with high noise exposures, and
- Maintain medical and monitoring records pertaining to the hearing conservation program.

To meet these requirements, Radford University has established this Hearing Conservation Program with the goal to protect all faculty, staff, and students from hearing loss on campus. This Hearing Conservation Program was developed to assist the University in maintaining the safety of all persons working in high noise areas at Radford University. Furthermore, this program was designed to comply with 29 CFR 1910.95.

2.0 Scope

This program applies to all faculty, staff, and students of Radford University whose noise exposures equals or exceeds an 8-hour time weighted average (TWA) sound level of 85 decibels (dB), otherwise known as the action level, while performing their work activities. These employees must be enrolled into the hearing conservation program.

Excessive noise exposure can cause both temporary and permanent changes in hearing sensitivity. Repeated exposures over time can result in hearing loss, physical and psychological disorders, interfere with the detection of warning sounds, disruption of job performance, and more importantly, interfere with speech and communication.
3.0 Responsibilities

Department/Supervisor Responsibilities

Supervisors are responsible for ensuring that the Hearing Conservation Program is implemented in their particular areas. In addition to being knowledgeable about the program requirements for their own protection, supervisors must also ensure that the program is understood and followed by the employees under their charge. Supervisors will maintain surveillance of work conditions in all places where employees for whom they are directly responsible work, as well as employee exposures and stress, in order to determine if any additions to, or changes in, hearing protection use requirements are needed. The Supervisor shall promptly notify employees of changes whenever they are needed. Duties of the Supervisor include:

- Ensure that employees under their supervision (including new hires and transferred employees) have received appropriate training and medical surveillance;
- Determine appropriate type(s) of hearing-protective devices necessary to protect employees’ hearing;
- Ensure the availability of appropriate hearing-protective devices;
- Monitor and enforce the use of hearing protective devices when required and ensure those only properly trained and medically evaluated employees use the devices;
- Continually monitor work areas and operations to identify noise hazards; and
- Coordinate with Environmental Health and Safety (EHS) on how to address hearing hazards or other concerns regarding the program.

Employees exposed to TWA noise exposures at or over 85 dBA:

- Use safe work practices;
- Wear and maintain appropriate hearing protective devices as instructed while performing job functions;
- Attend annual training on noise and hearing protection;
- Participate in annual audiometric testing;
- Use only those brands/types of hearing protection devices which are appropriate for the noise exposure, and for which the employees have been trained and fitted;
- Report to their supervisor changes in the workplace or “noisy” conditions; and
- Comply with all provisions of the Hearing Conservation Program.

Employees with periodic exposure to high noise and whose TWA noise levels are below 85 dBA:

- Wear and maintain hearing protective devices as instructed; and
• Report to their supervisor any changing conditions that may impact personal noise exposures.

Environmental Health and Safety (EHS)

The overall responsibility to develop and implement occupational health and safety programs for the university falls with the Office of Environmental Health and Safety (EHS). Although it is the overall responsibility of EHS to develop these programs, it is ultimately up to each department or unit supervisor to ensure that employees are provided the vital support and means to adequately carry out the provisions of each program and achieve regulatory compliance with all OSHA requirements. Responsibilities of EHS related to the Radford University Hearing Conservation program include:

• Develop, implement and administer the University Hearing Conservation Program and written plan;
• Provide the technical expertise and equipment necessary to identify work areas and equipment within facilities where noise levels equal or exceed 85 dBA;
• Provide the technical expertise and equipment necessary to identify, through personnel monitoring, employees whose noise exposure levels equal or exceed an 8-hour Time-Weighted Average (TWA) of 85 dBA;
• Periodically re-monitor identified at-risk employees;
• Resurvey work areas and equipment when notified that noise levels may have changed due to facility or equipment modification;
• Identify potential high noise areas or equipment during routine building activities and measure sound levels to determine need for additional monitoring or protective equipment; Recommend appropriate type(s) of hearing-protective devices necessary to protect employees' hearing;
• Train employees on mandatory elements of the Hearing Conservation Program;
• Conducting an annual review of each department that conducts work within the scope of this program.
• Provide recommendations concerning noise control measures including engineering controls and administrative controls; and
• Maintain records of noise measurement and employee training.

4.0 Definitions

Action level – The noise level, measured over a full shift, at which an employee must be included in the hearing conservation program. This is 85 dBA for an 8-hour shift.
Attenuation – Reduction of noise level.

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. Conducted within the employee’s first 6 months after an exposure at or above the action level.

Decibel (dB) – Unit of measure for sound levels. Based on a logarithmic scale.

Decibel A-weighted (dBA) – Decibels weighted to provide a result that simulates the sensitivity of the human ear at moderate sound levels. The weighting reduces the level of low frequency sounds and increases high frequency sounds in the average.

Dose – A percentage of the maximum allowable noise that a worker can be exposed to per day. This is a computation that is based on the following variables: criterion level, lower threshold and exchange rate. Dose is expressed as a percentage.

Frequency – Pitch or the number of cycles that a sound wave completes per second. Measured in Hertz or cycles per second (CPS).

Hearing Protective Device – Any device that can be worn to reduce the level of sound entering the ear

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

Noise dosimeter – An instrument worn or used by an individual to measure the accumulation of their noise exposure over a work period. The dosimeter calculates the TWA exposure for the individual. Dosimeters have an accuracy of ± 2 dB.

Noise reduction rating (NRR) – Measure of the estimated attenuation capacity of a hearing protector. The manufacturer provided NRR is adjusted to account for differences in laboratory-derived and real world values. The following formula should be used: adjusted NRR= (NRR-7) x0.5. If custom molded ear plugs are used the formula is: adjusted NRR= (NRR-7). For double hearing protection 5 dBA is added to the higher adjusted NRR.
OSHA – Occupational Safety and Health Administration is responsible for the promulgation, modification, and enforcement of occupational safety and health standards.

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

Peak level – The absolute highest measurement taken. A peak level above 140 dB requires inclusion in the hearing conservation program.

Permissible Exposure Limit (PEL) – An eight-hour time-weighted average of 90 dBA is the exposure limit published and enforced by OSHA as a legal standard. The PEL is not adjusted for longer shift lengths.

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 – A sound-level meter is a handheld, direct-reading instrument with a microphone, an electronic-filter network and a visual display such as a meter or digital readout. Because sound-level meters provide a real-time indication of noise loudness, they are typically used to initial survey an area. Once high-noise areas are identified, more exhaustive monitoring can be with an audio dosimeter.

Standard Threshold Shift (STS) – An average shift in either ear of 10 dBA or more at 2,000, 3,000, and 4,000 hertz (Hz) when comparing the annual audiogram to the baseline.

Time-weighted average (TWA) sound level – That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.
5.0 Limits

<table>
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<th>Duration per Day, Hours</th>
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<tr>
<td>8</td>
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<tr>
<td>6</td>
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<td>110</td>
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If the sound levels listed above are exceeded, feasible administrative or engineering controls will be instituted. If these controls fail to reduce the sound levels to within those listed above, hearing protection will be provided and used to reduce the sound levels to an acceptable level. Effective hearing conservation measures will be instituted whenever employee noise exposures equal or exceed an 8-hour time weighted average (TWA) of 85 dBA, slow response.

6.0 Program Elements

6.1 Monitoring

In order to effectively control exposure to high level noise it is necessary that the noise be accurately measured according to standard procedures, and that the measurements be properly evaluated against accepted criteria.

The monitoring of employees for noise exposure is made up of two parts, area and personal monitoring. Area measurements are generally obtained first. If noise levels approach or exceed prescribed levels, personal monitoring using dosimeters is then performed. Affected employees or their representatives shall be provided with an opportunity to observe any noise monitoring conducted.

6.1.1 Area Measurements

In an area survey, measurements of noise levels are documented using a sound level meter to identify work areas where employees' exposures may be above the action level; thus requiring more thorough exposure monitoring. Area monitoring is conducted using a
calibrated sound level meter set to the A scale, slow response. Within the area of interest, several different locations are typically measured. Measurement locations might include:

- 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 work

If noise levels are below 85 dBA in the area, no further monitoring is required for that area. 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. These records shall be updated periodically to determine if any changes have occurred that would warrant re-monitoring of exposed personnel. If any of the measurements equal or exceed a noise level of 85 dBA and the duration of exposure each day is unknown, employees who work in or near the high noise area or equipment shall have their noise exposure determined through personal monitoring using dosimeters. If the measurements equal or exceed 85 dBA, but the time of exposure is sporadic and less than the permissible exposure level, personal monitoring will not be required. Recommendations will be made to wear hearing protection while operating in that area or with that piece of equipment.

Locations that exceed 90 dB will be posted as high noise areas and hearing protection shall be required.

6.1.2 Personal Monitoring

Determination of personal noise exposures will be accomplished using calibrated noise dosimeters. The dosimeter will calculate an eight-hour time-weighted average (TWA). Instruments used will be calibrated to ensure measurement accuracy. Employees monitored will have dosimeters placed on them at the beginning of their normal work shift with the microphone attached in the "hearing zone". The dosimeter will be worn for the full duration of the work shift while the employee performs a normal work routine. At the end of the work shift, the dosimeter will be removed and information analyzed. Background information will be collected from each employee detailing job description, unusual job activities, etc., for the sample period. Those employees whose noise exposures equal or exceed 85 dBA as an 8-hour TWA will be identified to supervisors for enrollment into the Hearing Conservation Medical Surveillance Program.
6.1.3 Re-monitoring of Hazardous Noise Areas

All areas where noise levels equal or exceed 85 dBA shall be re-monitored periodically. Representative employees who work in high noise areas and whose 8-hour TWA equals or exceeds 85 dBA will be monitored periodically to determine personal noise exposure for all similar employees.

6.1.4 Re-monitoring Due to Changes

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 increases the noise exposure such that additional employees are exposed to noise levels at or above 85 dBA on a time-weighted average basis. 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.

Environmental Health and Safety shall provide copies of personal exposure monitoring results to the supervisors of monitored employees in areas under their control. Supervisors will notify their employees of the results.

6.2 Medical Surveillance/Audiometric Testing Program

Upon identification of employees whose 8-hour TWA equals or exceeds 85 dBA, EHS shall contact a Professionally Licensed Healthcare Provider (PLHCP), either a qualified physician, otolaryngologist, audiologist or certified technician, to enroll these employees in the University Hearing Conservation Medical Surveillance Program. Information supplied to the PLHCP will include the employee's name, supervisor's name, work telephone number(s) and the noise levels recorded in the employee's work area. EHS will forward copies of dosimetry data to the PLHCP. It is the responsibility of supervisors to enroll their employees in the University Hearing Conservation Medical Surveillance Program.

EHS will be responsible for costs associated with the University Hearing Conservation Medical Surveillance Program.

In work locations where either through administrative or engineering controls, noise levels decrease such that the employees' 8-hour TWA's are below 85 dBA, EHS shall notify the PLHCP and the employees' supervisors, in writing, that the employees working in that area are no longer required to be enrolled in the University Hearing Conservation Program.
The supervisor is responsible for scheduling with EHS, employee audiometric testing with a PLHCP. Employees with exposure to TWA noise levels of 85 dBA or greater must have baseline audiometric testing performed within 6 months of initial noise exposure. The employee should not be exposed to workplace noise for at least 14 hours prior to the baseline audiogram. Hearing protection may be worn as a substitute for this requirement. The supervisor should also notify the employee to avoid high levels of non-occupational noise during this period.

The PLHCP has the responsibility for administering the Audiometric Testing Program portion of the University Hearing Conservation Program. A qualified physician, otolaryngologist, audiologist or certified technician will perform the audiogram examination. The testing must conform to OSHA’s requirements on audiometric testing, which are covered in Appendices C through F in the Occupational Noise Exposure Standard. The object of the audiometric testing program is to identify workers beginning to experience hearing loss to allow intervention before the hearing loss progresses. Audiometric testing will be provided to all employees with exposure to TWA noise levels of 85 dBA or greater. Annual retesting will be performed for all personnel enrolled in the University Hearing Conservation Medical Surveillance Program until separation from employment or upon transfer to duties with noise exposures below 85 dBA.

Audiometric testing not only monitors the sharpness or acuity of an employee's hearing over time, but also provides an opportunity for employers to educate employees about their hearing and the need to protect it. The important elements of the audiometric testing program include baseline audiograms, annual audiograms, training, and follow-up procedures. Audiometric testing is available at no cost to employees exposed to TWA noise levels of 85 dBA or greater. Annual audiograms must be conducted within 1 year of the baseline. Annual audiograms must be routinely compared to baseline audiograms to determine if the employee has lost hearing ability (i.e., if a standard threshold shift (STS) has occurred). STS is defined as an average hearing loss in either ear of 10 dB or more at frequencies of 2000, 3000, and 4000 hertz.

If a STS is indicated, the employee shall be informed of this fact in writing within 21 days of the determination. If a PLHCP determines the STS may be work-related or aggravated by occupational noise exposure, the employee may 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 may refuse audiometric testing and must fill out the Refusal of Hearing Test form located in Appendix A. The completed form should be placed in the employee’s personal file.
6.3 Hearing Protection

The primary means of reducing or eliminating personnel exposure to hazardous noise is 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. Engineering controls such as mufflers on heavy equipment exhausts or on air release valves are required where possible.

Administrative controls are defined as changes in the work schedule or operations which reduce noise exposure. If engineering solutions cannot reduce the noise, 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 used if possible.

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.

Hearing protective devices (ear plugs, muffs, etc.) shall be the permanent solution 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. Departments shall make hearing protection available at no cost to their employees who are exposed to TWA noise levels of 90 dBA or greater, the level at which hearing protection becomes mandatory. Hearing protection will also be provided and encouraged for employees with routine periodic noise exposures over 85 dBA.

Hearing protection devices must be approved by EHS. Several different types of hearing protection devices are available. The employee’s supervisor and/or EHS will instruct employees in the proper care and use of the devices.

**Types of Hearing Protective Devices**

**Ear Plugs**

Ear plugs are inserted into the outer portion of the ear canal and effectively seal the inner ear. They are made of rubber or plastic and may come with or without strings. Strings are useful to prevent loss and help keep the plugs clean. Some come in standard sizes that fit most ears and others are moldable to conform to the ear canal. Ear plugs are small, comfortable, and inexpensive. Because of their comfort, ear plugs are generally recommended in areas that require all day protection. However they can work loose, may not always fit properly, and protection may vary among individuals. Workers should always use clean hands to insert the plugs because they can introduce dirt into the ear...
canal possibly leading to infections. Disposable ear plugs should be thrown away after use. Reusable ear plugs should be cleaned each day with soap and water.

Canal Caps

Canal caps seal the entrance to the ear canal with soft pads connected to a headband. Workers who find ear plugs annoying may prefer canal caps. They are comfortable, more sanitary than ear plugs, and inexpensive but may not effectively seal the ear canal.

Ear Muffs

Ear muffs consist of ear cushions, head band, and ear cups. They fit over the outer ear and provide the greatest protection against high frequency sounds. Ear muffs seldom come loose, can be adjusted for comfort and are more sanitary than other hearing protective devices. Ear muffs are generally worn by workers who frequently move in and out of high noise areas. However, they may not be as comfortable as ear plugs and canal caps, especially in hot weather. They are more expensive and may be difficult to wear with other protective equipment. For noise levels above 105 dB ear muffs should be worn with ear plugs.

Employees shall be given an opportunity to select their hearing protection from a variety of suitable devices. EHS shall provide training in the use and care of all hearing protection devices provided to employees. The supervisor shall monitor the correct use of all hearing protection. EHS shall determine hearing protection attenuation necessary for the specific noise environments in which the hearing protection will be used. Only hearing protection with a suitable noise reduction ratio (NRR) will be used. The NRR used for calculating attenuated noise exposure levels will be calculated in the following manner, using a safety factor of 50%:

Reduction (dB) = (NRR - 7) ÷ 2

For example: If the NRR on a pair of earplugs is 21, subtract 7 from that number and divide that by 2, (21 – 7) ÷ 2 = 14 ÷ 2 = 7. Therefore, this pair of earplugs will reduce the TWA 7 decibels and the supervisor must determine if this will be enough protection for the employee.

Hearing protection must attenuate (lower) employee exposure at the ear to no more than a TWA noise level of 90 dBA. The adequacy of hearing protection shall be reevaluated whenever employee noise exposures increase to the extent that the hearing protection may no longer provide adequate attenuation.
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 or use of loud equipment where sound levels measure over 85 dBA. These areas or pieces of equipment should be placarded with signs advising employees that hearing protection should be worn.

Any personnel experiencing difficulty in wearing assigned hearing protection (i.e., irritation of the canals, pain) will be advised during training to immediately report this to their supervisor to schedule an appointment with the PLHCP for evaluation as soon as possible.

6.4 Hazard Communication

In areas with a sound level above 90 dBA warning signs should be posted at the entrance to the area. The signs should include the following language: “Warning”, “Noise Area”, “Hearing Hazard”, and “Use of Hearing Protectors Required”.

In areas with a sound level above 100 dBA warning signs should be posted at the entrance to the area. The signs should include the following language: “Warning”, “High Noise Area”, “Hearing Hazard”, and “Use of Double Hearing Protectors Required”.

7.0 Training

Before using earplugs/and or earmuffs, each employee who is exposed to noise levels at or above an eight-hour TWA of 85 dBA must receive training. This will be provided to employees upon initial work assignment to areas that are identified as excessively noisy, and annually thereafter or upon request.

When workers understand the reasons for the University Hearing Conservation Program requirements and the need to protect their hearing, they will be better motivated to participate actively in the program and to cooperate by wearing their hearing protection and taking audiometric tests. Environmental Health and Safety personnel knowledgeable of the requirements of the University Hearing Conservation Program may provide this training annually to employees exposed to 8-hour TWA noise exposures of 85 dB and above concerning:

- The University Hearing Conservation Program,
- The effects of noise on hearing,
- The purpose, advantages, and disadvantages and attenuation of various types of hearing protection,
- The selection, fit, use and care of hearing protection,
- The purpose of audiometric testing and an explanation of the test process, and
- Noise hazard areas.

Training will be documented on forms provided by EHS at the time of training. Information in the annual training program will be updated to be consistent with any changes in protective devices and work processes.

**8.0 Program Evaluation**

EHS will conduct periodic program evaluations to assess compliance with federal and state regulations and University Hearing Conservation Program requirements. Both the monitoring and audiometric testing portions of the University Hearing Conservation Program will be reviewed annually to assure its quality and effectiveness. An evaluation of the program, including training records and course content, maintenance of hearing protection devices and field audits of hearing protection use and record keeping will be conducted at least annually.

Problems identified will be noted in an inspection log and addressed by EHS. A report will be generated which will list plans to correct deficiencies in the program and target dates for the implementation of those corrections.

**9.0 Recordkeeping**

Audiometric test records must include the name and job classification of the employee, the date, the examiner's name, the date of the last acoustic or exhaustive calibration, measurements of the background sound pressure levels in audiometric test rooms, and the employee's most recent noise exposure measurement.

EHS shall maintain an accurate record of all employee exposure measurements. Noise exposure measurement records must be kept for 2 years and all employee audiometric testing records for the duration of employment. Employee records shall be provided upon request by the employee, former employee or designated representative.

**10.0 Document Revision History**

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**11.0 Document Author(s):** John Crocker, CSP and Nathan Tripp, EHS Specialist
Appendix A

Refusal of Hearing Test

I understand that in my employment with Radford University, I may have had an occupational exposure to high noise levels and may be at risk for hearing impairment. I acknowledge that I have received information about the occupational exposure to high noise levels, and I have had full opportunity to ask any questions I may have about the exposure and the risk it could present.

I also acknowledge that I have been given the opportunity to have my hearing tested as required by the University Hearing Conservation Program at no charge to myself. However, at this time I am declining the hearing test.

I also understand that although I have declined the hearing test, I may at any time during my employment at the University notify my supervisor to request and schedule such a hearing test, at no charge to myself.

Print Name _____________________________________________________

Job Classification/Department________________________________________

Print Supervisor Name: ____________________________________________

Supervisor Signature___________________________ Date_______________

Employee Signature___________________________ Date_______________

Cc: Facilities Management