300 The Fenway
Boston, MA 02115

HEARING CONSERVATION PROGRAM

Original Date: May 2017

HEARING CONSERVATION PROGRAM
REVIEW SUMMARY

Revision(s)	*By*	*Affiliation*	*Date*	*Changes*

Table of Contents

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

Every year, approximately 30 million people in the United States are occupationally exposed to hazardous noise. Noise-related hearing loss has been listed as one of the most prevalent occupational health concerns in the United States (U.S.) for more than 25 years. Thousands of workers every year suffer from preventable hearing loss due to high workplace noise levels.

The objective of the Simmons College (Simmons) Hearing Conservation Program is to minimize occupational hearing loss by providing hearing protection, training, and annual hearing tests to all persons working in areas or with equipment that have noise levels equal to or exceeding an eight-hour time-weighted average (TWA) sound limit of 85 dBA (decibels measured on the A scale of a sound level meter). A copy of the U.S. Occupational Safety and Health Administration (OSHA) Hearing Conservation Standard, 29 Code of Federal Regulations (CFR) 1910.95, is available on OSHA's webpage for Noise and Hearing Conservation.

Appendix A provides the definitions associated with this program.

2.0 ROLES AND RESPONSIBILITIES

Below outlines specific responsibilities for certain individuals within Simmons.

2.1 Employees

Employees will:

1. Assist their supervisor in identifying potentially hazardous noise locations or operations.
2. Report to supervisor changes in the workplace or noisy conditions.
3. Schedule and complete annual audiometric testing or exposure assessment as instructed by the Director of Environmental Health and Safety (EH&S).
4. Use safe work practices.
5. Use hearing protection as required and in accordance with training on how to use them. Do not use hearing protection unless training on how to use it.
6. Request new hearing protection, when needed.
7. Follow the proper care instructions for hearing protection to ensure proper use.
8. Attend annual training on noise and hearing protection.
9. Comply with this Hearing Conservation Program.

2.2 Department Directors, Managers, and Supervisors

Each department is responsible for ensuring employees are provided the support and means to adequately implement this program. Department Directors, Managers, and Supervisors will:

1. Identify to EH&S equipment and locations where high noise levels are suspected.
2. Identify to EH&S employees who may be exposed to excessive noise levels.
3. Ensure employees enroll in medical surveillance program, if applicable.

4. Use engineering and administrative controls to limit employee exposure.
5. Provide adequate hearing protection for employees.
6. Provide cleaning supplies for hearing protection, if required.

2.3 Director of Environmental Health and Safety

The responsibilities of the Director of EH&S are to:

1. Develop, implement, and administer this program and this written document.
2. Provide technical expertise and equipment necessary to identify work areas and equipment where noise levels equal or exceed 85 dBA.
3. Conduct noise monitoring, when it is determined to be necessary.
4. Periodically re-monitor identified at-risk employees.
5. Resurvey work areas and equipment when notified that noise levels may have changed due to facility or equipment modifications.
6. Identify potential high noise areas or equipment during routine building activities and measure sound levels to determine need for additional monitoring or protective equipment.
7. Recommend appropriate type(s) of hearing protection devices necessary to protect employees' hearing.
8. Train employees on mandatory elements of this program.
9. Provide recommendations concerning noise control measures including engineering controls and administrative controls.
10. Maintain records of noise measurement.

The Director of EH&S may use a contractor to complete or to assist with these responsibilities.

2.4 Talent and Human Capital Strategy

Talent and Human Capital Strategy (THCS), which is Simmons' Human Resource Department, will maintain training records and medical surveillance records. In addition, THCS will assist the Director of EH&S, as needed.

3.0 HAZARDS

Exposure to high levels of noise can cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss. Short term exposure to loud noise can also cause a temporary change in hearing (your ears may feel stuffed up) or a ringing in your ears (tinnitus). These short-term problems may go away within a few minutes or hours after leaving the noisy area. However, repeated exposures to loud noise can lead to permanent tinnitus and/or hearing loss.

Loud noise can also create physical and psychological stress, reduce productivity, interfere with communication and concentration, and contribute to workplace accidents and injuries by making it difficult to hear warning signals. Noise-induced hearing loss limits your ability to hear high frequency sounds, understand speech, and seriously impairs your ability to communicate.

3.1 How an Ear Works?

When sound waves enter the outer ear, the vibrations impact the ear drum and are transmitted to the

middle and inner ear. In the middle ear three small bones called the malleus (or hammer), the incus (or anvil), and the stapes (or stirrup) amplify and transmit the vibrations generated by the sound to the inner ear. The inner ear contains a snail-like structure called the cochlea which is filled with fluid and lined with cells with very fine hairs. These microscopic hairs move with the vibrations and convert the sound waves into nerve impulses–the result is the sound we hear. Figure 1 provides the diagram of the ear.

Exposure to loud noise can destroy these hair cells and cause hearing loss.

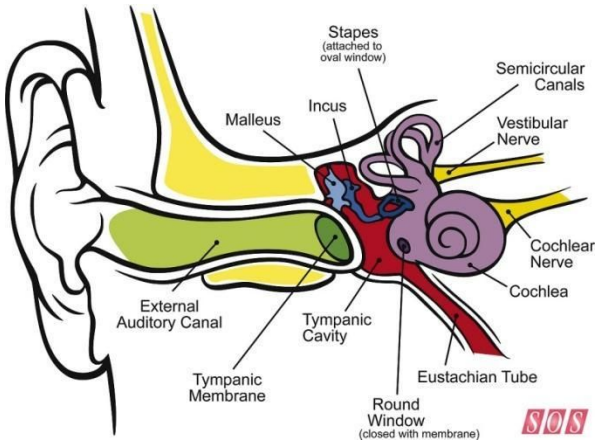

Figure 1 – Ear Diagram[1]

3.2 Warning Signs

Noise may be a problem in your workplace if:

- You hear ringing or humming in your ears when you leave work.
- You have to shout to be heard by a coworker an arm's length away.
- You experience temporary hearing loss when leaving work.

3.3 Loud

Noise is measured in units of sound pressure levels called decibels, named after Alexander Graham Bell, using A-weighted sound levels (dBA). The A-weighted sound levels closely match the perception of loudness by the human ear. Decibels are measured on a logarithmic scale which means that a small change in the number of decibels results in a huge change in the amount of noise and the potential damage to a person's hearing.

3.4 Occupational Exposure Limits

OSHA sets legal limits on noise exposure in the workplace. These limits are based on a worker's time weighted average over an 8 hour day. With noise, OSHA's permissible exposure limit (PEL) is 90 dBA for all workers for an 8 hour day. The OSHA standard uses a 5 dBA exchange rate. This means that when the noise level is increased by 5 dBA, the amount of time a person can be exposed to a certain noise level to receive the same dose is cut in half. Table 1 provides the permissible noise exposures based on duration.

[1] https://www.soundonsound.com/sos/mar11/articles/how-the-ear-works.htm, viewed February 1, 2016

Table 1 – Permissible Noise Exposures	
Duration per Day (hours)	**Sound Level (dBA slow response)**
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 dBA for eight hours to minimize occupational noise induced hearing loss. NIOSH has found that significant noise-induced hearing loss occurs at the exposure levels equivalent to the OSHA PEL based on updated information obtained from literature reviews. NIOSH also recommends a 3 dBA exchange rate so that every increase by 3 dBA doubles the amount of the noise and halves the recommended amount of exposure time.

4.0 NOISE MONITORING

Noise monitoring is broken down into two categories: Area Monitoring and Personal Monitoring. Area measurements are obtained first. If noise levels approach or exceed prescribed levels, personal monitoring using dosimeters is then performed. Employees should contact Director of EH&S to request a noise monitoring.

4.1 Area Monitoring

The Director of EH&S should be contacted for assessments regarding noise concerns in any area. Areas that are identified through a previous survey, with existing signage or posting, or which contain noisy equipment/machinery when in operation shall have a baseline sound level survey conducted and on record. If noise levels are found to be below 80 dBA in an area, no further monitoring is required provided there are no substantial process or equipment changes.

Areas identified to be at or above 80 dBA, but less than 85 dBA, shall be surveyed every three years but are not required to be posted. Employees working in such areas are not enrolled in the Hearing Conservation Program and are not required to wear hearing protection devices, though it may be provided if the noise causes a nuisance or distraction.

Areas identified to be at or above the action level of 85 dBA will be classified as “high noise areas” and shall be surveyed every two years. More frequent surveys should be completed if substantial equipment, structural, or process changes occur, which could impact noise in the area. As part of the identification of high noise areas, appropriate signage shall be posted on all entrances to the area or on the source

machinery/equipment if it is intermittently in use by an operator (e.g., a centrifuge unit). Anyone entering a posted high noise area must wear proper hearing protection, regardless of the duration spent in the area or whether the person is enrolled in this program. The Director of EH&S shall be informed of any area where the posting of signs is required. It is the responsibility of the area supervisor, assisted by the Director of EH&S, to ensure that these precautions are maintained.

Area monitoring shall be conducted using a pre- and post-calibrated sound level meter (SLM), programmed for A-weighting, slow response, and meeting or exceeding the requirements for a Type 2 SLM per the American National Standards Institute (ANSI) S1.4, "Specification for Sound Level Meters". The calibrator must be recommended by the 4 SLM manufacturer and the difference between the before and after calibration shall be within plus or minus 1 dB.

Surveys of locations should include a diagram which characterizes the space (i.e. location of equipment and personnel work locations). Measurements should be taken at ear level at each of the indentified work locations. Additional measurements should be recorded at all entrances. Diagrams and SLM measurements should be recorded on a Noise Survey Form. On rare occasions, monitoring may be conducted in locations with a high magnetic field, which may damage or destroy the SLM. On such occasions, monitoring can be conducted using a manufacturer supplied extension cable and nonmagnetic microphone.

4.2 Personal Monitoring

Supervisors, who oversee the work of an employee in a high noise area, must submit the name of the employee to the Director of EH&S. All employees assigned to work in a high noise area, regardless of duration, must submit to an initial 8- hour personal noise dosimetry evaluation within six months of assignment. Any employee may request a personal noise dosimetry evaluation by the Hearing Conservation Program.

Employees working in high noise areas shall be monitored at least every two years to determine their noise exposure. In lieu of conducting noise dosimetry for all employees, "Similar Exposure Group" dosimetry sampling may be conducted utilizing representative exposure averages. Any employee found to be exposed to a single 8-hr TWA of 85 dBA or greater must be enrolled in this program. No employee shall be exposed unprotected to continuous noise greater than 115 dBA or to intermittent /impact noise greater than a peak C-weighted level of 140 dB.

Personal monitoring shall be conducted using a pre- and post-calibrated dosimeter, programmed for A-weighting, slow response, 80 dBA threshold, 85 dBA criterion level, 3 dBA Exchange Rate, and meeting or exceeding the requirements for a Type 2 dosimeter per the ANSI S1.25, "Specification for Personal Dosimeters". The calibrator must be recommended by the dosimeter manufacturer and the difference between the before and after calibration shall be within plus or minus 1 dB. All intermittent, continuous, and impulse sound level from 80-140 dB shall be integrated into the dosimetry measurement. Settings and results should be recorded on the Dosimetry Noise Survey Form.

The dosimeter should be placed in the "hearing zone" (at ear level) prior to the start of the employee's work shift and remain in place for the 8 hour duration. The dosimeter should be attached and detached

before and after it enters the recording mode so that noise artifacts are not introduced. Attachment will depend on the type of dosimeter used. At the completion of the 8-hour shift, the dosimeter will be returned to the Director of EH&S or a contractor for analysis.
When dosimeters cannot be used to obtain a TWA (e.g., areas with high magnetic fields or work that may expose the dosimeter to water or contaminants), the TWA may be derived by calculation using current American Industrial Hygiene Association (AIHA) formulas.

Within 30-working days, the employee will be notified in writing of the dosimetry results. Notification will also be sent to the Department's Director, Manager, or Supervisor if measurements meet or exceed the action level.

Repeat dosimetry monitoring shall occur when significant changes to employee work areas are determined to have altered the noise exposure potentials (e.g., change in process, equipment, facility, or controls) or when an employee has a clinically observed condition that warrants further evaluation.

5.0 CONTROLS

Noise controls are the first line of defense against excessive noise exposure. The use of these controls should aim to reduce the hazardous exposure to the point where the risk to hearing is eliminated or minimized. With the reduction of even a few decibels, the hazard to hearing is reduced, communication is improved, and noise-related annoyance is reduced. There are several ways to control and reduce worker exposure to noise in a workplace. Below are the three key points when determining how to reduce noise:

1. Less time
2. Further distance
3. Use shielding

5.1 Engineering Controls

Engineering controls that reduce sound exposure levels are available and technologically feasible for most noise sources. Engineering controls involve modifying or replacing equipment, or making related physical changes at the noise source or along the transmission path to reduce the noise level at the worker's ear. In some instances the application of a relatively simple engineering noise control solution reduces the noise hazard to the extent that further requirements of the OSHA Noise Standard and the required program elements are not necessary. Examples of inexpensive, effective engineering controls include some of the following:

- Choose low-noise tools and machinery (e.g., Buy Quiet Roadmap (NASA)).
- Maintain and lubricate machinery and equipment (e.g., oil bearings).
- Place a barrier between the noise source and employee (e.g., sound walls or curtains).
- Enclose or isolate the noise source.

5.2 Administrative Controls

Administrative controls are changes in the workplace that reduce or eliminate the worker exposure to

noise. Examples include:

- Operating noisy machines during shifts when fewer people are exposed.
- Limiting the amount of time a person spends at a noise source.
- Providing quiet areas where workers can gain relief from hazardous noise sources (e.g., construct a sound proof room where workers' hearing can recover – depending upon their individual noise level and duration of exposure, and time spent in the quiet area).
- Restricting worker presence to a suitable distance away from noisy equipment.
- Controlling noise exposure through distance is often an effective, yet simple and inexpensive administrative control. This control may be applicable when workers are present but are not actually working with a noise source or equipment. Increasing the distance between the noise source and the worker, reduces their exposure. In open space, for every doubling of the distance between the source of noise and the worker, the noise is decreased by 6 dBA.

5.3 Personal Protective Equipment

Hearing protection devices will be required when engineering and/or administrative controls are considered to be infeasible economically and/or technically. Departments shall make hearing protection available at no cost to their employees who are exposed to TWA noise levels of 85 dBA or greater. Hearing protection will also be provided to employees with routine periodic noise exposure over 85 dBA. Below are the types of hearing protection devices. The Director of EH&S or contractor will determine hearing protection attenuation necessary for the specific noise environments in which hearing protection is required to be worn.

The type of hearing protection provided to employees will be documented on the Record of Hearing Protection Needs form provided in Appendix B.

5.3.1 Types

Table 2 provides information regarding the different types of hearing protection devices.

Table 2 – Types of Hearing Protection Devices				
Type	**Description**	**Advantages**	**Disadvantages**	**Example**
Foam Earplugs	¼ to ½ inch foam to be inserted into ear	Small Inexpensive Portable More comfortable than others No interference from hair or glasses	Hard to fit May introduce dirt into ear canal Protection level varies based on ear canal, insertion method, and wax/hair in canals	
Molded or Pre-molded Earplugs	Small, flexible devices Seal against ear canal wall Re-usable	Variety of sizes Carrying case for convenience Washable Re-usable	May need different size for each ear	
Earmuffs	Ear cushions that seal against head and directly over ears	Easy to fit properly Fits “most” people Less time and effort applying and fitting Easily visible/monitored Not easy to lose	Uncomfortable in hot environments May restrict head motion Hair, facial hair, and glasses can alter protection Protection is less in low frequency Depends on an air tight seal between cushion and head	

5.3.2 Noise Reduction Ratio

Only hearing protection with suitable Noise Reduction Ratio (NRR) will be used at Simmons. The NRR used for calculating attenuated noise exposure levels will be calculated using the following equations. A safety factor of 50% will be used for these calculations.

A common method used for **single protection** (either muffs or plugs) is as follows:

1. Determine the laboratory-based noise attenuation provided by the hearing protection device. This is referred to as the NRR and is listed on the packaging.

2. Subtract the NRR from the C-weighted TWA workplace noise level, as follows:

Estimated Exposure (dBA) = TWA (dBC) - NRR

If C-weighted noise level data is not available, A-weighted data can be used by subtracting a 7 dB correction factor from the NRR, as follows:

Estimated Exposure (dBA) = TWA (dBA) - (NRR - 7)

Example:

TWA=100 dBA, muff NRR=19 dB

Estimated Exposure = 100 - (19-7) = 88 dBA

For **dual protection** (ear muffs and plugs are used simultaneously) use the following:

1. Determine the laboratory-based NRR for the **higher** rated protector (NRR_h).
2. Subtract 7 dB from NRR_h if using A-weighted sound level data.
3. Add 5 dB to the field-adjusted NRR to account for the use of the second hearing protector.
4. Subtract the remainder from the TWA as follows:

Estimated Exposure (dBA) = TWA (dBC) - (NRR_h + 5) , or

Estimated Exposure (dBA) = TWA (dBA) - [(NRR_h - 7) + 5]

Example:

TWA=110 dBA, plug NRR=29, and muff NRR=25 dB

Estimated Exposure = 110 - [(29 - 7) + 5] = 83 dBA

6.0 AUDIOGRAMS/HEARING TESTS

Employees subject to the Hearing Conservation Program who have TWA noise exposures of 85 dBA or greater for an eight (8) hour work shift will be required to have both a baseline and annual audiogram. The audiograms will be provided by THCS and conducted by an occupational health provider with no cost to the employee.

The baseline audiogram will be given to an employee within one (1) month of employment with Simmons and before any exposure to high noise levels. Annual audiograms will be performed within one year from the date of the previous audiogram. It is the responsibility of the individual and THCS to schedule the annual audiogram.

If an annual audiogram shows that an employee has suffered a standard threshold shift, the employee will be retested within thirty (30) days of the annual audiogram. If the retest confirms the occurrence of a standard threshold shift, the employee will be notified in writing within twenty-one (21) days of the confirmation. Employees who do experience a standard threshold shift will be refitted with hearing

protection and provided more training on the effects of noise.

7.0 TRAINING

Affected employees will be required to attend training concerning the proper usage and wearing of hearing protection. The training will be conducted by Director of EH&S, or a contractor, within a month of hire and annually thereafter.

Training shall consist of the following components:

- How noise affects hearing and hearing loss;
- Review of the OSHA hearing protection standard;
- Explanation of audiometric testing;
- Rules and procedures;
- Locations within company property where hearing protection is required; and
- How to use and care for hearing protectors.

8.0 RECORD KEEPING

8.1 Annual Review

This Hearing Conservation Program will be reviewed at least annually by the Director of EH&S, a representative from the Buildings and Grounds Department, and one representative from the affected departments. It will be revised as necessary. Revisions will be documented in the table provided at the beginning of this document. The review will include at a minimum:

1. Review of hearing conservation policies and practices to determine compliance.
2. Review of OSHA and/or industry data to help improve the overall program.
3. Review accidents or incidents associated with noise.
4. Evaluate the efficacy of the procedures outlined in this program.

8.2 Training

THCS will document that the required training has been provided to the affected employees. Training sign-in sheets or an on-line program will be part of this documentation. A qualified instructor will be utilized for this training and training certificates will be provided by instructor or the on-line program.

9.0 STANDARDS, REFERENCES, AND REGULATIONS

The following standards, references, and regulations were reviewed or used to develop this Hearing Conservation Program:

- Arizona State University's *Hearing Conservation Program*, https://www.asu.edu/ehs/documents/asu-hearing-conservation-program.pdf, dated February 2010

- Centers for Disease Control and Prevention/National Institutes for Occupational Safety and Health, *Hearing Protection Devices Training Presentation,* http://www.cdc.gov/niosh/mining/UserFiles/workshops/hlp1/05-HudakHearingProtectors.pdf, dated June 2005
- National Institutes of Health, *Hearing Conservation Program,* http://www.ors.od.nih.gov/sr/dohs/Documents/NIH%20Hearing%20Conservation%20Program.pdf , dated May 2013
- OSHA's Noise and Hearing Conservation Webpage, https://www.osha.gov/SLTC/noisehearingconservation/index.html)

APPENDIX A

DEFINITIONS

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.

Audiogram 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.

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.

A-Weighted: 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.

Baseline Audiogram : The audiogram against which future audiograms are compared.

Continuous Noise : Noise levels that vary with intervals of one second or less.

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.

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 a 80 dB noise.

Frequency: A sound's pitch measured in hertz (hz); high pitches are high frequency sounds.

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.

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.

Hertz (Hz) : A unit of measurement of frequency, expressed as cycles per second.

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.

Noise: Unwanted sound.

Noise Dosimeter : An instrument worn by an individual that integrates the sound level exposure over a period of time.

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.

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

Permissible Exposure Limit (PEL) : 90 dBA TWA. Employees may be exposed to 90 dBA for an 8 hour time weighted average (TWA) exposure without experiencing serious hearing effects.

Pitch : Another term for sound frequency. Higher pitches are higher frequency sounds.

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.

Sound : A vibration or pressure oscillation that is detectable by the ear drum.

Sound Level Meter : An instrument used for the measurement of noise in sound level surveys.

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.

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.

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.

Threshold of Pain : A noise level of 120 dB causes pain.

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.

APPENDIX B – RECORD OF HEARING PROTECTION NEEDS

Simmons College Personnel in Hearing Conservation Program				
Hearing protection is required for and has been issued to the following personnel:				
Employee Name	Department	Job Description/ Equipment Being Used	Type of Hearing Protection Issued	Date Issued