National Institutes of Health

Hearing Conservation Program

Division of Occupational Health & Safety

April 2018

In compliance with 29CFR1910.95, this document provides information and services for the effective prevention of occupational hearing loss.

Table of Contents

National Institutes of Health

Division of Occupational Health & Safety

Occupational Noise Exposure and the Hearing Conservation Program

1 Revision History

Version	Author	Date	Changes	Purpose
2013	LCDR Matt Deptola	05/2013	N/A	Annual Review
2014	LT Brian Czarnecki	12/2014	Added "revision history" section. Added "abbreviation" section. Clarified that OMS conducts, evaluates, and stores the audiometric monitoring and records in Paragraph 8.	Update/Annual Review
2015	LT Brian Czarnecki	03/2015	Added footer with version history Update Appendices	Update/Annual Review
2016	LT Brian Czarnecki	05/2016	5.2.1 and 5.2.10 Modified 8-hour shift to full shift to include longer shifts 5.2.6 Required Dual Hearing Protection 6.2.2 Implemented a minimum NRR 6.2.4 Implemented attenuation equation (single) 6.2.5 Implemented attenuation equation (double) APPENDIX J – Provided example signage for High Noise Area APPENDIX K – Provided Dosimeter Settings for Monitoring Purposes	Update/Annual Review
2016	LT Brian Czarnecki	12/2016	5.1.1 Implemented "Peak" noise levels 5.2.6 Modified dual hearing requirement to 98 dB 5.2.10 Modified personal monitoring verbiage to "full-shift"	Update/Annual Review
2016	LCDR Matt Deptola	12/2016	Revised table of contents and extended TLV table Added "Caution-High Noise Area Signage" in Appendix	Update/Annual Review
2017	LT Brian Czarnecki	12/2017	NA	Annual Review
2018	LCDR Brian Czarnecki	04/2018	QA/QC of Appendices	Annual Review

2 PURPOSE

The Hearing Conservation Program (HCP) is intended to prevent occupational hearing loss. The program ensures compliance with the Occupational Safety and Health Administration's (OSHA) Standard 29 CFR 1910.95 titled Occupational Noise Exposure.

3 SCOPE

The Hearing Conservation Program applies to all National Institutes of Health (NIH) employees, contractors, and students.

4 RESPONSIBILITIES

NIH Manual Issuance 1340, *NIH Occupational Safety and Health Management*, outlines the scope, objectives, and responsibilities of NIH staff in implementing the NIH Occupational Safety and Health Management Program.

4.1 The Division of Occupational Health and Safety (DOHS), Office of Research Services:

4.1.1 Provides executive leadership in the development, promulgation, and implementation of the NIH HCP.
4.1.2 The Technical Assistance Branch is the functional group within DOHS that manages the HCP, staffed by Industrial Hygienists with intrinsic knowledge of noise and hearing as it relates to occupational health. The HCP Program Manager may be reached through the DOHS secretary at (301)-496-3353.
4.1.3 Conduct area noise monitoring and personal noise dosimetry.
4.1.4 Ensures that the HCP is evaluated annually (Appendix H).
4.1.5 Notifies employees of noise exposure at or above an 8-hour time-weighted average (TWA) of 85 decibels and their rights and responsibilities for inclusion into the HCP.

4.2 Occupational Medical Services (OMS) (301) 496-4411:

4.2.1 Enhances the health and safety of the NIH workforce through the provision of work- related medical and counseling services.
4.2.2 Completes periodic audiometric evaluations necessary to characterize hearing related issues, overseeing auditory monitoring protocols for employees enrolled in the HCP.
4.2.3 Communicates abnormal audiometric results to the employee, their supervisor, and DOHS.
4.2.4 May establish work restrictions necessary to prevent additional hearing loss.

4.3 Department Heads, Managers, Supervisors, and Principal Investigators (PI):

4.3.1 Assist in identifying locations on NIH owned or leased properties where a potential high noise environment may exist.
4.3.2 Request that DOHS evaluate employee noise exposures and noisy operations.
4.3.3 Assist DOHS in identifying employees who may be at risk of over-exposure to high noise areas for enrollment into the HCP.
4.3.4 Provide work environments that minimize noise to the greatest extent reasonable through the use of engineering controls, preventative maintenance, and administrative controls.

4.3.5 Provide adequate hearing protection devices (HPDs) for employees who are exposed to noise levels that meet or exceed levels established by the NIH HCP. HPDs may also be provided in situations where noise levels create a nuisance, but do not exceed program limits.

4.3.6 Supervise employees' proper use of HPDs in posted high noise areas or when using noisy equipment. The supervisor shall ensure that employees are appropriately trained and if enrolled

in the HCP, attend audiometric exams (baseline, annual, follow-up, and final).

4.3.7 Ensure employees are trained on HCP and effects of noise exposure.

4.3.8 Maintain copies of OSHA and NIH HCP policies in the workplace.

4.4 Employees:

4.4.1 Properly wear appropriate HPDs in posted high noise areas or when performing tasks which require the use of HPDs.

4.4.2 Report noise hazards and HPD problems to the appropriate supervisor, department representative, or DOHS.

4.4.3 Report to OMS for any work-related injuries/illnesses and health concerns.

4.4.4 Shall be provided a copy of the NIH HCP policy and the OSHA 1910.95 *Occupational Noise Exposure* standard upon request.

4.5 Contractors:

4.5.1 Must adhere to their respective company policy that ensures compliance in a manner equal to the safety factor provided by the NIH HCP while working on NIH owned or leased spaces. The contracting agency may be required to submit periodic reports and any other requested documentation on the effectiveness of its HCP to the DOHS.

4.5.2 Properly wear appropriate HPDs in posted high noise areas or when performing tasks which require the use of HPDs.

4.5.3 Assist in identifying locations on NIH owned or leased properties where a potential high noise environment may exist due to facility infrastructure or local equipment.

4.5.4 Immediately notify a supervisor and/or Project Officer of any hazards encountered.

4.5.5 Report to OMS for any work-related injuries/illnesses and health concerns.

5 NOISE MONITORING

The two primary objectives of the NIH HCP are to identify and monitor areas where high noise levels exist (at or above 85 decibels dBA, measured on the A scale, slow response) and subsequently identify employees whose job duties may expose them to noise levels exceeding the 8-hour time weighted average (TWA), defined in Table 1. The NIH has established threshold limit values (TLVs) based on the American Conference of Governmental Industrial Hygienists (ACGIH) recommendations, which are more protective than standards currently required by OSHA (29 CFR 1910.95).

Table 1. Threshold Limit Values for Employee Noise Exposure

Duration Per Day	Continuous Sound Level
16 Hours	82 dBA
8 Hours	85 dBA
4 Hours	88 dBA
2 Hours	91 dBA
1 Hours	94 dBA
30 Minutes	97 dBA
15 Minutes	100 dBA
7.5 Minutes	103 dBA
3.75 Minutes	106 dBA
1.88 Minutes	109 dBA
0.94 Minutes	112 dBA
28.12 Seconds	115 dBA

5.1 High Noise Area Identification and Monitoring:

DOHS shall 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 (Appendix A) conducted and on record.

5.1.1 If peak 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.

5.1.2 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

HCP and are not required to wear HPD, though it may be provided if the noise causes a nuisance or distraction.

5.1.3 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.

5.1.4 More frequent surveys should be completed if substantial equipment, structural, or process changes occur, which could impact noise in the area.

5.1.5 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).

5.1.6 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 the HCP.

5.1.7 The Institute or Center (IC) Occupational Safety and Health Specialist shall be informed of any area within their respective IC where the posting of signs is required. It is the responsibility of the area supervisor, assisted by the IC Occupational Safety and Health Specialist, to ensure that these precautions are maintained.

5.1.8 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 SLM manufacturer and the difference between the before and after calibration shall be within plus or minus 1 dB.

5.1.9 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 identified work locations. Additional measurements should be recorded at all entrances. Diagrams and SLM measurements should be recorded on Appendix A: Noise Survey Form.

5.1.10 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.

5.2 Employee Monitoring:

5.2.1 Supervisors/managers/PIs who oversee the work of an employee in a high noise area must submit the name of the employee to the HCP Program Manager. All employees assigned to work in a high noise area, regardless of duration, must submit to an initial full-shift personal noise dosimetry evaluation within six months of assignment.

5.2.2 Any employee may request a personal noise dosimetry evaluation by the HCP Program Manager.

5.2.3 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 (Appendix G).

5.2.4 Any employee found to be exposed to a single 8-hr TWA of 85 dBA or greater must be enrolled in the HCP.

5.2.5 All employees in a High-Noise Area shall wear Hearing Protection.

5.2.6 All employees exposed to noise greater than 98 dBA, for an 8 hour shift, shall wear dual hearing protection.

5.2.7 No employee shall be exposed unprotected to continuous noise greater than 115 dBA.

5.2.8 No employee shall be exposed to intermittent/impact noise greater than peak C-weighted level of 140 dB.

5.2.9 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 Appendix B: Dosimetry Noise Survey Form.

5.2.10 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 full-shift 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 full-shift, the

dosimeter will be returned to the HCP Program Manager or a representative for analysis.

5.2.11 On occasions 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 AIHA formulas.

5.2.12 Within 30-working days, the employee will be notified in writing of the dosimetry results. Notification will also be sent to the employee's supervisor and the OMS representative if measurements meet or exceed the action level.

5.2.13 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.

6 NOISE CONTROL

Engineering controls (any mechanism/design that limits exposure at the source) should be the first line of defense in reducing high noise levels, as this approach provides a long-term or permanent solution. Specialists in the field of sound physics and with appropriate equipment should be consulted for an assessment before any controls are implemented. Equipment should be properly maintained and when scheduled for replacement, quieter alternatives should be sought for purchase. All assessments and actions taken should be documented and copied to the HCP Program Manager for recordkeeping. Upon implementation of engineering controls, new area monitoring must be conducted.

6.1 HEARING PROTECTION DEVICES

A hearing protection device is a personal safety product that is worn to reduce the harmful auditory and/or annoying effects of noise. HPDs should be viewed as a last resort, when other means such as engineering and administrative controls are not practical or economical. Personnel who work in high noise areas shall have several HPD options available to them at no cost by their supervisor. Issued HPDs should not be shared with anyone and be periodically replaced as necessary. Employees shall be instructed in the proper use and maintenance of HPDs by their supervisor, DOHS or OMS staff. Personal/portable stereo headphones shall not be used as HPDs.

6.1.1 Types

6.1.1.1 Aural inserts (ear plugs): fit directly into the ear canal, both formable and pre-molded versions are available in various sizes.

6.1.1.2 Circumaural protectors (ear muffs): Plastic domes that cover the ears and are connected with a spring band that fits on top of the head or attached to a hardhat.

6.1.1.3 Dual hearing protection is the use of both the aural inserts and circumaural simultaneously.

6.2 Noise Reduction Rating (NRR)

6.2.1 All hearing protection devices offered for use on NIH facilities must have the NRR listed on the packaging.

6.2.2 All hearing protection devices for use on NIH facilities must be a minimum NRR of 33dB.

6.2.3 Employees found to have a dose equal to or greater than TWA of 85 dBA for 8-hours must have their HPD evaluated for effectiveness: (1) Obtain the employee's A-weighted TWA exposure; (2) identify the NRR of the hearing protection and subtract 7 dB from the NRR; (3) divide that number by 2; (4) subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

Single Protection:

If C-weighted use: Estimated Exposure (dBA) = TWA (dBC) - [NRR x 50%], or

If A-weighted use: Estimated Exposure (dBA) = TWA (dBA) - [(NRR - 7) x 50%]

Example:

- Background noise (TWA) = 103 dBA
- Hearing protection of ear plugs = NRR 33
- Attenuation calculation =
    - 103 – [(33-7)/2] = 103-13 = **90 dBA**

Thus, the noise exposure is equivalent to 90 dBA

6.2.4 Dual Hearing Protection shall be calculated by the following means: (1) Obtain the employee's A-weighted TWA exposure; (2) identify the NRR of the hearing protection and subtract 7 dB from the NRR; (3) divide that number by 2; (4) subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

Dual Protection:

If C-weighted use: Estimated Exposure (dBA) = TWA (dBC) - [(NRRh x 50%) + 5], or

If A-weighted use: Estimated Exposure (dBA) = TWA (dBA) - {[(NRRh - 7) x 50%] + 5}

6.2.5 Dual Hearing Protection Example

- Background noise (TWA) = 103 dBA
- Hearing protection of ear plugs = NRR 33
- Protection from <u>all</u> dual hearing protection = 5
- Attenuation calculation =
    - 103 – {[(33-7)/2] + 5} = 103-18 = 85 dBA

      Thus, the noise exposure is equivalent to 85 dBA

7 HCP ENROLLMENT AND TERMINATION

7.1 **Eligibility** - All NIH employees whose single noise exposure equals or exceeds an 8-hour TWA of 85 dBA are eligible for participation in the program.

7.2 **Identification:** Supervisors are expected to identify work place hazards, including noise, as part of the pre-placement medical evaluation and through their annual review of the manifest of enrolled employees in their sections. Dosimetry will be conducted to confirm that the employee's TWA meets the criteria, as detailed in section 4.2.

7.3 **Removal from Program:** Employees who, through relocation, resignation, or termination of employment in their current position, are no longer exposed to high noise areas or a potential 85 dBA TWA may be removed from the HCP by either the HCP Program Manager or the lead OMS Physician. This shall occur immediately after 1 full year from the date of the last audiometric exam.

8 AUDIOMETRIC MONITORING

Conducted by OMS, the initial (baseline) evaluation shall occur either during the pre-placement medical examination or within 6-months of the employee's first exposure to workplace noise. Employees will be recalled annually for an evaluation in a manner consistent with OMS practices. The initial (baseline) evaluation, annual evaluation, and exit evaluation will be conducted, evaluated, documented, and stored by OMS.

8.1 Audiometric Monitoring Methodology:

Audiometric monitoring methodology consists of the individuals' otologic history, otoscopic examination, audiogram, a review of the evaluation by an OMS clinician, and periodic evaluations thereafter until removed from the HCP.

8.1.1 **Otologic history** (Appendix C) will be obtained to determine: (1) the history of past and current noise exposure; (2) the presence of audiological symptoms (e.g., tinnitus, pain, change in hearing, etc.); and (3) whether predisposing factors for hearing loss are present (e.g., family history of early hearing loss).

8.1.2 **Otoscopic examination** (Appendix C): performed to detect any abnormality in the external auditory canal or tympanic membrane. If an employee has cerumen impaction, an audiogram will be performed and the employee will be issued a letter stating that a retest should be done within 30 days and after cerumen has been removed.

8.1.3 **Audiogram:** performed utilizing a microprocessor audiometer according to the manufacturer's instructions for using the automatic mode (Appendix E). If it is not possible to establish valid hearing thresholds using the audiometer in the automatic mode, a manual audiogram is performed (Appendix D) by an OMS clinician certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC). The audiogram is documented on the Noise Exposure History Form (Appendix C). The audiogram results with the calculated average hearing threshold (AHT), lower frequency average hearing level (LAHL), and higher frequency average hearing level (HAHL) re-transcribed onto the Audiogram Flow Sheet and this baseline recording is highlighted.

8.1.4 **Review of evaluation:** An appropriately trained OMS clinician will perform a documented review of each employee evaluation performed. Employees, enrolled in the HCP and thereby required to participate in annual evaluations, will have results interpreted to the baseline information. Items that must appear on clinical evaluations are: 1) employee name, 2) employee job classification, 3) clinical evaluation date, 4) examiner's name, 5) clinical instrumentation calibration date, and 6) date of employee's current dosimetry results.

8.1.5 Reminder/recall letters are sent to those employees who are due for annual exams. If an employee declines to attend an annual exam, they must sign a declination form, provided by OMS.

8.2 Abnormal Audiogram:

8.2.1 All abnormal audiograms are classified by severity and reviewed by a physician. An abnormal audiogram has occurred if:

8.2.1.1 any individual hearing threshold in either ear is greater than 25 dB;

8.2.1.2 a difference of greater than 15 dB in the baseline LAHL or 30 dB in the baseline HAHL between the two ears;

8.2.1.3 a difference of greater than 15 dB in the periodic LAHL or 20 dB in the periodic HAHL compared to the baseline test value for the same ear; or

8.2.1.4 a Standard Threshold Shift (STS) is documented.

8.2.2 Abnormal Audiogram Procedure

8.2.3 If an occupationally related audiometric test abnormality (e.g., an STS or a unilateral change in either the LAHL or HAHL with a logical occupational basis) is present, the following is to occur:

8.2.3.1 the employee is verbally notified of the abnormality, usually during the visit;

8.2.3.2 counseling is provided regarding the effects of noise on hearing and the role of hearing protective devices (Appendix F);

8.2.3.3 a formal written notification (TO WHOM) is also provided within 21 days, in compliance with OSHA requirements;

8.2.3.4 the supervisor is notified by letter that per routine, employees are required to wear hearing protective devices in areas of noise 85dB or greater; this employee's interval hearing exam was abnormal and will be retested within 30-days; and, if the abnormal finding persists, the hearing loss will be documented in accordance with the Federal Employee's Compensation Act and the HCP Program Manager will be asked to investigate the worksite practices and procedures;

8.2.3.5 a follow-up audiogram is performed within 30-days, following a mandatory 40-hour quiet period (without exposure to excessive work place and non-occupational or recreational noise) to determine if the audiometric abnormality persists.

8.2.4 If the audiometric abnormality is not present on repeat testing, no further action is indicated and the employee is returned to the routine testing cycle. If the employee fails to return for the follow-up audiometric exam, the initial audiogram abnormality results shall stand alone for reporting and evaluation purposes. If the audiometric abnormality persists on repeat testing, then:

8.2.4.1 the HCP Program Manager is notified in writing of the findings and a follow-up worksite evaluation is requested by OMS to DOHS;

8.2.4.2 Noise induced hearing loss is reported for the employee utilizing the OMS Accident Reporting System, and a Notice of Occupational Disease and Claim for Compensation form (CA-2) is issued to the employee (see OMS Compensation Procedures). The periodic audiogram is designated "revised baseline" and the employee is referred for further medical evaluation.

8.3 Medical Referral for Further Evaluation:

8.3.1 An employee with significant otologic complaints or findings on physical exam is referred immediately for further diagnostic evaluation and treatment.

8.3.2 An employee with a medical complaint suspected to be a result of noise or noise protection device exposure (e.g., persistent tinnitus or feeling of fullness or discomfort in one or both ears not due to cerumen accumulation) and not previously documented to be secondary to exposure to excessive noise is referred to an otolaryngologist for further evaluation.

8.3.3 An employee with a subjective complaint or objective otologic finding not believed to be noise related (e.g., otalgia, dizziness, drainage from ear, cerumen accumulation, or foreign body impaction) is referred to his/her personal physician for further evaluation.

8.3.4 An employee with an abnormal audiogram, unusual hearing loss curve, fluctuating or rapidly progressive hearing loss is referred to an otolaryngologist for appropriate evaluation following confirmation of the test findings. The repeat audiogram is performed within 30-days following a mandatory 40-hour quiet period.

8.3.5 Employees referred for further evaluation secondary to a work-related finding are provided:

8.3.5.1 Release of Medical Information form to sign;

8.3.5.2 a letter for otologic referral;

8.3.5.3 their baseline and most recent audiograms;

8.3.5.4 their audiogram flow sheet;

8.3.5.5 records of audiometer and audiometric test booth calibrations; and

8.3.5.6 authorization of Release of Information form to obtain a copy of the resulting consultation report.

8.4 The consultation report is incorporated into the employee's OMS medical record once it is reviewed by an OMS physician. If the consulting physician concludes that the findings are work related, the OMS physician reviews the record to confirm that:

8.4.1 the employee received appropriate counseling and was issued the applicable federal workers' compensation forms;

8.4.2 the HCP Program Manager has performed a worksite evaluation; and

8.4.3 the supervisor is aware of his/her responsibilities (through written communication between OMS and the supervisor).

9 EDUCATION AND MOTIVATION

All employees enrolled in the HCP must receive initial and annual hearing conservation training. Information provided in the training program shall be updated to be consistent with changes in work processes and protective equipment.

9.1 Training Components**:**

9.1.1 the effects of noise on hearing;

9.1.2 the purpose, advantages, disadvantages, and attenuation of various types of hearing protectors;

9.1.3 the selection, fitting, care, and use of HPDs;

9.1.4 the purpose and procedure of audiometric evaluations; and

9.1.5 the structure, components, and updates to the HCP.

10 DOCUMENTATION AND RECORD KEEPING

The OMS and DOHS are responsible for maintaining HCP records, to include: noise surveys (area monitoring), personal noise dosimetry evaluations, and clinical audiometric evaluations.

10.1 **Retention:** Non-clinical documents related to this program shall be kept for no less than 2-years. Employee audiometric evaluations must be kept for the duration of the employee's employment.

10.2 **Transfer of Documents:** If the NIH ceases to be a functional entity, all relevant documents pertaining to this program will be transferred to an agency of the employee's preference.

11 REFERENCES

A. American Conference of Governmental Industrial Hygienists: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
B. American National Standards Institute (ANSI) S1.25, "Specification for Personal Dosimeters".
C. American National Standards Institute (ANSI) S1.4, "Specification for Sound Level Meters".
D. DOHS_OMS_HCP_Chapter_IV_Section_4_Revision_November_2011
E. NIH Hearing Conservation Program (HCP): S:\Database\TAS-data\Noise Surveys & HCP Reports
F. NIH Manual Issuance 1340, *NIH Occupational Safety and Health Management*
G. NIOSH Publication No. 98-126: Criteria for a Recommended Standard: Occupational Noise Exposure
H. Occupational Safety and Health Act, OSHA 3704: *Hearing Conservation*
I. OMS Accident Reporting System, *Notice of Occupational Disease and Claim for Compensation* form (CA-2)
J. OSHA 29 CFR 1910.95, Occupational Noise Exposure
K. TED 01-00-015, OSHA Technical Manual, Chapter 5: *NOISE AND HEARING CONSERVATION*

12 DEFINITIONS

Action level: 85 dBA or greater, for an 8-hr period. The level of noise exposure at which: (1) An employee must be enrolled in the HCP and provided audiometric testing, hearing protection devices (HPD) and training; (2) the area is classified as a high noise area and posted, with monitoring required every two years; (3) HPD must be worn at all times, regardless of duration spent in the high noise area by the employee.

Administrative Controls: Methods that limit an employee's exposure time to noise. This includes assigning the employee to less noisy areas in the workplace for a certain length of time so the employee does not exceed the action level.

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.

- Baseline Audiometric Exam: ideally this should be done as soon as the employee is hired or prior to the employee's first work assignment in an area with high noise levels (85 dBA) (OSHA requires that baseline audiograms be preceded by 14 hours without any unprotected noise exposure)
- Annual Audiometric Exam: conducted as long as the employee is enrolled in the HCP.
- Follow-Up Audiometric Exam: follow-up exams are required within 30 days if a standard threshold shift or other problems are detected in the annual or baseline exam.
- Exit Audiometric Exam: conducted upon employee's relocation, resignation, or termination of employment

Audiometer: An instrument for measuring the threshold or sensitivity of hearing.

Audiologist: A professional specializing in the study and rehabilitation of hearing, who is certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC).

Average hearing threshold (AHT): The hearing threshold for each ear at 2000 Hz + 3000 Hz + 4000 Hz divided by 3.

Baseline AHT: The AHT for each ear at the time of enrollment in the HCP. **Baseline HAHL**: The HAHL for each ear at the time enrollment in the HCP. **Baseline LAHL:** The LAHL for each ear at the time of enrollment in the HCP. **Continuous Noise:** Noise levels that vary with intervals of one second or less.

Decibels (dB): A measure of the sound level (loudness). The decibel scale is a logarithmic scale; as an example, a 90 dB noise is two times louder than an 85 dB noise, on a 5-dB exchange.

Decibels, A-Weighted (dBA): The scale used for most occupational noise measurements. The A-weighting approximates the range of human hearing by reducing the effects of lower and higher frequency noises with respect to the medium frequencies.

Dosimeter Threshold: The level at which sound is recorded. All sound below the threshold is non-existing noise for averaging and integrating functions.

Engineering Controls: May include purchasing quieter equipment, using barriers, damping, isolating, muffling, installing noise adsorption material, mechanical isolation, variations in force, pressure or driving speed or any combination of methods to decrease noise levels.

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

Hearing Conservation Program (HCP): Program established when employees are exposed to noise exceeding the Action Level. Program must include noise surveys, audiometric testing, hearing protectors, training, and recordkeeping requirements.

Hearing Protection Devices (HPDs): Personal protective equipment 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 (1 cycle/ second = 1Hz).

Higher frequency average hearing level (HAHL): The hearing threshold at 3000 Hz + 4000 Hz + 6000 Hz divided by 3.

Lower frequency average hearing level (LAHL): The hearing threshold for either ear at 500 Hz + 1000 Hz + 2000 Hz divided by 3.

Noise: Unwanted sound.

Noise Dosimeter: An instrument worn by an individual that integrates the sound level exposure over a period of time. It is used to calculate a TWA for an employee.

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.

Noise-induced hearing loss: Slow but progressive inner-ear hearing loss resulting from exposure to continuous noise over a long period of time, as opposed to acoustic trauma or physical injury to the ear.

Normal hearing threshold: Auditory acuity equal to or less than 25 dB in all frequencies.

Permissible Exposure Limit (PEL): The maximum legal noise exposure, established by OSHA. The current PEL is 90 dBA over an 8-hr period. NIH has established PEL at 85 dBA.

Presbycusis: Hearing loss attributed to the aging process.

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 (sound pressure levels in decibels) during area monitoring.

Sound Pressure Level: The level in decibels, of a sound is 20 times the logarithm to the base 10 of the ratio of the pressure of this sound to the reference pressure, which must be explicitly stated.

Speech Interference Levels (SILs): The frequencies most associated with speech: 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 (STS): An average shift from the baseline measurement in either ear of 10 dB or more at 2000, 3000 and 4000 Hz.

Tinnitus*:* A condition in which sounds are heard within the head in the absence of actual sounds in the environment. Tinnitus can be experienced in many forms, such as ringing, hissing, whistling, buzzing, or clicking.

Time-Weighted Average Sound Level (8-hr TWA): That sound level, which if constant over an 8- hour exposure, would result in the same noise dose measured in an environment where noise level varies.

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

13 ABBREVIATIONS

14 APPENDICES

Appendix A: Noise Level Survey Form
Appendix B: Dosimeter Noise Survey Form
Appendix C: Noise Exposure History Form
Appendix D: Guidelines for Performing a Manual Audiogram
Appendix E: Maintenance of Audiometer and Audiometric Test Booth
Appendix F: Individual Counseling and Available Hearing Protective Devices
Appendix G: Hearing Protection Device
Appendix H: Similar Exposure Group Dosimetry Sampling
Appendix I: Annual HCP Evaluation
Appendix J: "CAUTION – High Noise Area" signage
Appendix K: Dosimeter Settings

APPENDIX A

National Institutes of Health NOISE LEVEL SURVEY

Division of Occupational Health and Safety FORM

Location:_____IC:_____Date:_____Time: _____

Supervisor:_____Phone:_____Surveyor: _____

	Sound Meter	Sound Meter Calibrator
Manufacturer:	_____	_____
Model:	_____	_____
Serial Number:	_____	_____
Calibration Date:	_____	_____

	Before Survey	After Survey
Calibration Reading:	_____	_____

Location / Equipment / Descriptor	dBA	dBC	Noise Sources, Exposure Time, Comments
See Attached working diagram			

Noise sources in operations? Yes No Type:

(circle)

Area Workers:

Hearing Protection: (circle) Yes No Type:

Signage: (circle) Yes No Type:

Room Layout: (Use numbers from Table to display locations.) See Attached diagram

APPENDIX B
NOISE LEVEL SURVEY FORM

Location:_____ IC:_____ Date:_____Time:_____

Supervisor:_____Phone:_____ Surveyor:_____

	Sound Meter	Calibrator
Manufacturer:		
Model:		
Serial Number:		
Calibration Date:		

	Before Survey	After Survey
Calibration reading:		

Employee Name	Job Description	Location of Work / Task Performed	Time Period

Results

Date:_____Time Weighted Average:_____

Time Period:_____Dose:_____

APPENDIX C

Noise Exposure History

Previous employment (last 3 jobs)

Employer Phone Number Position Hearing Protection Required (Y/N)

_____

_____

_____

B. History of exposure to loud noise in the military? Y / N

C. Hobbies that expose you to loud noise? Y / N

D. Recent exposure to loud noise – (Required to shout to hold a conversation.)
   1. Hours per work day of loud CONSTANT noise: [ ]
   2. Hours per work day of loud INTERMITTENT noise: [ ]
   3. Minutes per work day of loud IMPULSE noise? [ ]

E. When in high noise areas, how often do you wear hearing protective devices (HPD)? Never / Rarely / Sometimes / Often / Always

F. What type of HPD do you use? Ear plugs Ear Muffs Other: _____

G. Medical History (baseline and/or since last exam) Comments

   1. Head injury with unconsciousness? Y / N
   2. Perforated eardrum? Y / N
   3. Tinnitus or buzzing in either ear? Y / N
   4. Either ear "blocked"? Y / N
   5. Hearing Loss in family (before age 50)? Y / N

H. Otologic Exam

   1. Perforation of Typanic Membrane Neither Left Right
   2. Drainage from the Ear Neither Left Right
   3. Cerumen Impaction Neither Left Right

H. Hearing Protection Issued Y / N

Type: _____

Manufacturer: _____

Quantity: _____

PA / Physician: _____ Name: _____ Signature: _____ Date: _____

APPENDIX D

Guidelines for Performing a Manual Audiogram

Background

The audiogram must be performed by a certified otologic technician or physician and in accordance with the manufacturer's guidelines. Certification is from the Council of Accreditation of in Occupational Hearing Conservation.

Performing the Audiogram

A. The examiner explains the test procedure to examinee.

B. The examinee is placed in a calibrated audiometric testing booth and the earphones are placed on the examinee by the examiner.

C. The examiner establishes the hearing thresholds by:
   1. Selecting a frequency (500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz, and 8000 Hz) and present the tone at 10dB;
   2. Increasing the tone by 5dB increments until the subject responds;
   3. Reduce the level by 10dB increments until the subject no longer responds;
   4. Continue testing the frequency in this manner until the subject responds at one level at least 50% of the time (e.g., 2 out of 3 tries, 2 out of 4 tries, 3 out 5 tries etc.);
   5. Repeat the process with each frequency (in no particular order) for that ear; then
   6. Repeat the process for the other ear.

Analyzing the audiogram

A. The difference between 1kHz and 1kHz retest must be equal to or less than 5dB

B. All test frequencies must be valid; i.e., any test frequency identified with audiometer error message NR (no response), NC (no consistent response) or IV (invalid) must be repeated until a numerical response is recorded.

APPENDIX E

Maintenance of Audiometer and Audiometric Test Booth

I. Audiometer

A. Biological (Bio-Acoustic Simulator) Check

1. Objective: to detect any evidence of unwanted or distorted sounds in the output of the audiometer.
2. Frequency: once daily, at beginning of day
3. Methodology: perform an audiometric test on the Bio-Acoustic Simulator. In addition, the earphones should be placed on an individual at the time of the biological check to determine if there are any abnormal sounds heard.
4. Tolerances
    a. No unwanted or distorted sounds
    b. Audiogram results
        i. deviations less than 10dB allowable
        ii. deviations equal to or greater than 10dB require acoustic calibration of audiometer by the manufacturer. Audiometer is not to be used unless biological tolerances have been met.

B. Acoustic calibration

1. Objective: to check the sound pressure output and linearity of the audiometer.
2. Frequency: yearly or when audiometer fails to meet the tolerances of a biological check.
3. Methodology: to be performed in accordance with 29 CFR ch XVII by manufacturer of audiometer.
4. Tolerances: deviations equal to or greater than 15dB at any test frequency require exhaustive calibration.

C. Exhaustive calibration

1. Frequency: every two years or when the audiometer fails to meet the tolerances of an acoustic calibration.
2. Methodology: to be performed in accordance with OSHA regulation, the manufacturer of audiometer or the authorized vendor.

D. Documentation: results of all biological checks and calibrations are kept on file attached to the sound booth and audiometer.

II. Audiometric Test Booth

A. Objective: to ensure that background sound pressure levels meet the requirements set forth by OSHA regulation.

B. Frequency: yearly (arranged by OMS).

C. Methodology: to be performed in accordance with OSHA regulation by the manufacturer or authorized vendor.

APPENDIX F

Individual Counseling and Available Hearing Protective Devices

A. Review audiogram with patient

1. Describe a normal audiogram to the patient, the hearing threshold at any frequency should be less than or equal to 25dB.
2. Show present examination and compare it with the patient's baseline.

B. Effects of noise on hearing ability

1. Discuss the fact that individuals exposed to loud noise at the worksite without hearing protection progressively lose hearing.
2. Describe to the patient that hearing loss is irreversible, but with the use of protective devices further damage can be avoided.
3. Explain that without protection the auditory system is over loaded and it is difficult to differentiate speech from background noise. Protective devices will block background noise enabling the employee to hear normal speech tones.

C. Noise induced hearing loss

1. Inform the employee that noise induced hearing loss is a slow, insidious process. It is not usually associated with pain, bleeding, or a sensation of pressure.
2. Acute symptoms - ringing after noise exposure and pain with excessive noise.
3. Chronic symptoms - constant ringing/roaring; difficulty understanding speech with background noise; in severe cases, difficulty understanding speech without background noise; difficulty hearing high-pitched noises.

D. Prevention of harmful effects of noise

1. Reiterate that using protective devices will prevent further loss.
2. Explain reference pictures and graphs that show the difference between noise induced hearing loss and age induced loss.
3. Show pictures describing noise levels in daily life and how harmful levels may be avoided.
4. Encourage use of protective devices at home, during recreation, and at the worksite.

APPENDIX G (Hearing Protection Devices)

Hearing Protective Devices

A. Types of protection available

1. Ear plugs
2. Earmuffs

B. Availability of protective devices

1. Foam Ear plugs - at worksite
2. Rubber plugs - at OMS without an appointment
3. Earmuffs - contact supervisor or the Division of Occupational Health and Safety

C. When to use hearing protection

1. Use hearing protection on the job whenever in an area posted as "high noise area" by OSHB.
2. Encourage use of protective devices during non-occupational events (e.g., hunting, lawn mowing, music concerts, etc.),

D. Fit employee with hearing protection

1. Foam plugs - disposable
    a. Lift top of external ear with opposite hand (Right ear with left arm),
    b. Insert plug into canal with flap against posterior side of outer ear
2. Rubber plugs - measure ears with earscope device; demonstrate insertion to the employee:
    a. Lift top of external ear with opposite hand (Right ear with left arm),
    b. Insert plug into canal with flap against posterior side of outer ear
    c. May be washed and reused.
3. The type of protection device is the employee's choice; if an individual likes the item and feels comfortable with it, then he/she is more likely to use it.
4. Employees are instructed to examine hearing protection devices regularly for wear and defects and to replace immediately if needed.

APPENDIX H

Similar Exposure Group Dosimetry Sampling

Ideally, attempts should be made to obtain dosimetry results for all employees working in high noise areas, but this can be laborious and may not even be necessary for improving precision. When employees are engaged in essentially similar tasks and exposed to similar noise, statistical methods can be used to reduce the monitoring effort by considering employees as members of Similar Exposure Groups (SEGs). The groups could be composed of employees all working in the same room but doing different jobs; or conversely, engaged in the same trade, doing similar work but in different locations. The sample size required depends upon the number of employees in the group, the target precision (ideally ± 2dBA or less), the variability between the sample group's average exposure levels (Lave) values (the standard deviation), and the confidence in the results (generally 95%). Because of the inherent variability of workplace noise exposures, statistically guaranteeing that all exposures are below the action level is practically impossible; however, demonstrating statistically that no more than a given percentage of exposures are greater than the limit, with some given confidence, is possible. Surveyors should be aware of statistical assumptions and justify their reasons for conducting SEG dosimetry sampling rather than measuring all individual exposures.

The following procedure may be applied, based upon the assumption that Laves of the population follow a normal distribution. This may not be the case in practice:

1. Select at least 3 employees (at **random**) to represent the group, then conduct dosimetry monitoring to determine their individual Laves.
2. Compute the mean and standard deviation (SD) of the Laves.
3. Consult the table below to find how large the sample **should have been** to obtain the calculated SD and ± 2 dBA 95% confidence interval.
4. After sampling more employees (as needed), recalculate the mean and SD. Ideally, the SD should decrease, but extreme outliers may skew the results.
5. If the standard deviation is so large that a very large sample size is called for, consider subdividing the "group" into smaller, separate groups. Otherwise, it may be best to simply obtain dosimetry results from all employees in the group.

Table 1: Number of employees to sample for precision ± 2 dBA (95 % confidence)
A range of standard deviations of Lave values for a sample of employees is given at the top. The population of employees in a SEG to be sampled is given at the left. A sample of employees are drawn randomly from the population of N employees according to the desired precision and standard deviation.

Example: Noise exposure information is needed for a group of 12 employees.
Dosimetry results are obtained for 3 employees (chosen at random from the 12). The Lave values obtained by dosimetry are 95.5, 90 and 87.5 dBA. This yields a mean of 91.0 dBA and a standard deviation of 4.1 dBA. Consulting the table for a group size of 12 (in the range 9 to 16) and having a standard deviation of 4 dBA, determines that 7 employees should have been sampled. A further 4 employees are randomly sampled. The additional Lave values are 92, 85, 93 and 91 dBA.
The new mean is 90.6 dBA, with a standard deviation of 3.4 dB.
Conclusion: SEG's mean Lave = 90.6 ± 2 dBA at 95 % confidence interval.

Number of workers in group N	Standard Deviation of Sample L_{EXS}, dB					
	2	3	4	5	6	7
5 to 8	3	4	5	5	5	5
9 to 16	3	5	7	8	10	11
17 to 29	3	5	8	11	13	15
29 to 39	3	6	9	12	16	18
40 and more	3	6	9	13	17	20

Annual HCP Evaluation

The NIH Hearing Conservation Program (HCP) shall be evaluated annually. The evaluation can be done internally and/or externally. The primary purpose of the evaluation is to assess the program's effectiveness. Additionally, this assessment serves to advise management on the compliance status of the HCP.

Evaluation checklist:

1. Noise and dosimetry surveys:
   a. Are they audited for accuracy and frequency of recurrence, according to Sections 4.1 and 4.2 of the HCP policy?
   b. Are they retained on record for at least 2 years?

2. Noise controls:
   a. Have employees and supervisors been apprised of noise control measures and have noise control needs been prioritized?
   b. Have employees and supervisors been counseled on the operation and maintenance of noise control devices, if installed?

3. Hearing protection devices (HPDs):
   a. Have HPDs been made available to all employees working in high noise areas?
   b. Are employees given the opportunity to select from a variety of appropriate HPDs?
   c. Are employees thoroughly trained in the use and care of HPDs, initially and annually?
   d. Do employees wear HPDs in all posted high noise areas?

4. Audiometry (hearing testing):
   a. Is the purpose of audiometry testing understood by employees?
   b. What percentage of employees are attending annual tests?
   c. Are records retained for the employee’s term of employment?

5. Education and Motivation:
   a. Is the effectiveness of training evaluated?
   b. Are posters, regulations, handouts, employee newsletters, and supervisor support used as reinforcement supplements?
   c. Are managers and supervisors directly involved?
   d. Is the training content revised periodically?
   e. Is there any measurable disciplinary or enforcement measure?
   f. Have there been changes in federal regulations/policy, and are those changes reflected by the NIH HCP policy?

6. Is the program evaluation checklist updated periodically?

Posted “CAUTION – High Noise Area” signage

APPENDIX K

Dosimeter Settings

Dosimeter	ACGIH	OSHA (HCP)	OSHA (PEL)
Exchange Rate	3 dBA	5 dBA	5 dBA
Criterion Level	85 dBA	85 dBA	90 dBA
Threshold Level	80 dBA	80 dBA	90 dBA
Response Time	Slow	Slow	Slow
Frequency Weighting	A-Scale	A-Scale	A-Scale