

PPPL	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES		
	ES&HD 5008 SECTION 8, CHAPTER 8 Noise Control and Hearing Conservation		
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CHAPTER 8 NOISE CONTROL AND HEARING CONSERVATION

8.1 INTRODUCTION

Noise at high levels can cause hearing loss, interference with communication, and annoyance. The policy of the Laboratory is to prevent permanent loss of auditory acuity (hearing ability) by avoiding prolonged exposure to injurious noise levels, to reduce noise levels wherever practicable, and to comply with all current Occupational Safety and Health Administration (OSHA) Standards, American Conference of Governmental Industrial Hygienists (ACGIH) recommendations, and U.S. Department of Energy (DOE) Orders.

8.2 DEFINITIONS

Acoustic - Containing, producing, arising from, actuated by, related to, or associated with sound.

Ambient noise - All-encompassing noise associated with a given environment, usually a composite of sounds from many sources near and far.

Attenuation - The reduction, expressed in decibels, of the sound intensity.

Audiogram - A record of auditory (hearing) acuity.

Continuous noise - Noise level maxima which occur at intervals of one second or less.

dBA - Sound level in decibels read on the A-scale of a sound level meter. The A-scale discriminates against very low frequencies; therefore, it most closely approximates the hearing spectrum of the human ear. For this reason it is best suited for measuring general sound levels.

dBC - Sound level in decibels read on the C-scale of a sound level meter. The C-scale discriminates very little against very low frequencies.

Decibel (dB) - A unit used to express sound power level. Sound power is the total acoustic output of a sound source. A decibel is a logarithmic function. The reference for sound pressure levels is commonly 0.00002 Newtons/m².

Frequency - Rate at which pressure oscillations are produced. Measured in hertz (Hz) where one hertz is equivalent to one cycle per second. A subjective characteristic of sound related to frequency is pitch (higher frequencies have higher pitch).

Hearing conservation - The prevention or minimizing of noise-induced deafness through the use of hearing protection devices, the control of noise through engineering methods, annual audiometric tests, workplace environmental noise level monitoring, administrative controls, and employee training.

Hearing loss - The amount, in decibels, by which the threshold of audibility of an ear at a given frequency exceeds a standard audiometric threshold.

Impact noise - A sharp burst of sound less than one-half second duration which does not repeat more often than once per second.

Intermittent noise - "Continuous noise" which occurs at periodic intervals.

Noise - Any unwanted sound.

Noise-induced hearing loss - The terminology used to refer to the slowly progressive inner ear hearing loss that results from exposure to continuous noise over a long period of time as contrasted to acoustic trauma or physical injury to the ear.

Octave - The interval between two sounds having a basic frequency ratio of two.

Sound - The sensation produced through the organs of hearing, usually by vibrations transmitted in a material medium, commonly air.

Sound level - A weighted sound pressure level, obtained with a standard sound level meter with the weighting A, B, or C as specified in the American National Standards Institute (ANSI) Standard "Sound Level Meters for Measurement of Noise and Other Sounds," Z24.3. The particular weighting employed must always be stated. Reference pressure is 0.00002 N/m².

Sound level meter and octave-band analyzer - Instruments for measuring sound pressure levels in decibels referenced to 0.00002 N/m².

Speech interference level - The average, in decibels, of the sound pressure levels of the noise in the three-octave bands of frequency 600-1,200, 1,200-2,400, and 2,400-4,800 Hz.

Threshold Limit Values for Noise - Sound levels that represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech.

8.3 RESPONSIBILITIES

8.3.1 Department Heads/Project Managers are responsible for:

- A. Assuring that noise from equipment and in facilities under their jurisdiction is reduced to the greatest extent practicable.
- B. Assuring that personnel do not receive noise exposure in excess of the established limits listed in this section.
- C. Following up on non-compliant conditions and coordinating with PPPL Industrial Hygiene to assure that satisfactory noise control actions are accomplished.

- D. Submitting the names of personnel working in areas shown by measurement to have noise levels exceeding maximum levels specified in this section to Industrial Hygiene for inclusion in the hearing conservation program.
- E. Reporting any areas or equipment suspected of having high noise levels to Industrial Hygiene.

8.3.2 Supervisors and Line Management are responsible for:

- A. Assuring that equipment and facilities for which they are responsible are maintained in a manner that minimizes noise, and the steps that must be taken to reduce noise levels to the practical minimum.
- B. Assuring that personnel are familiar with this section and that they utilize protective measures as recommended by Industrial Hygiene as appropriate for the conditions in their areas of work.
- C. Referring areas or equipment having high noise levels to Industrial Hygiene for a noise level survey with calibrated noise measuring equipment, for evaluation of the area, and for recommendations of needed corrective actions.

8.3.3 PPPL Industrial Hygiene is responsible for:

- A. Measuring and evaluating noise levels.
- B. Making periodic sound level surveys as needed or when requested to detect areas or equipment having noise levels that have the potential to exceed the Threshold Limit Values.
- C. Determining noise levels resulting from new work, construction, or other operations.
- D. Reporting findings, along with any recommendations for correction, to the responsible line supervisor, the division director or project manager concerned, and the Occupational Medicine Office (OMO).
- E. Determining the practicality of noise abatement or other recommended actions in coordination with those responsible for the noise source and the appropriate engineering consultants and tracking the implementation of any corrective actions.
- F. Including in the Hearing Conservation Program any individual who has been identified to have a time-weighted average exposure to noise levels exceeding those listed in 8.4.2.A.
- G. Removing any individual from the Hearing Conservation Program when his/her noise exposure no longer is expected to exceed the noise levels listed in 8.4.2.A.
- H. Notifying the OMO and Human Resources (HR) of any additions or removals of personnel from the Hearing Conservation Program.
- I. Providing written notice to the OMO indicating the reasons for the addition or removal of an individual from the program.
- J. Maintaining the master list of current participants in the PPPL Hearing Conservation Program and periodically reviewing the lists with HR and OMO for accuracy.
- K. Approving all personal protective equipment utilized for hearing protection.
- L. Investigating suspected cases of noise-induced hearing loss.

M. Conducting training courses with the cooperation of Human Resources.

8.3.4 Occupational Medicine Office is responsible for:

- A. Offering a "baseline" (reference) audiogram to any personnel determined to be included in the Hearing Conservation Program.
- B. Offering annual audiometric examinations to all personnel in the Hearing Conservation Program to detect hearing loss.
- C. Notifying Industrial Hygiene of any personnel who do not participate in the annual audiometric examinations.
- D. Reviewing and discussing audiogram changes with affected individuals if requested, and when indicated, having a specialist referral for further evaluation.
- E. Providing written reports of significant audiogram changes to the individual affected and to Industrial Hygiene within 21 days of the determination of the change.

8.3.5 Human Resources is responsible for:

- A. Coordinating and scheduling noise exposure training courses for PPPL personnel, students, term employees, and temporary employees.
- B. Maintaining documentation of the training courses presented.
- C. Notifying individuals when their training is due for renewal.
- D. Informing IH of individuals whose training has expired or who have requested removal from the Hearing Conservation Program.

8.3.6 The Maintenance and Operations Division is responsible for:

- A. Furnishing engineering services including information, technical assistance, and/or designs as required for new equipment or facilities construction.
- B. Providing engineering services for the modification of existing equipment or facilities to control noise and meet the criteria set in this section.
- C. Determining, in coordination with PPPL Industrial Hygiene and those responsible for the noise source, the practicality of recommended corrective actions.

8.3.7 The Stockroom is responsible for maintaining a stock of hearing protectors and other protective equipment as may be specified and approved by Industrial Hygiene for personnel working in areas having high noise levels. This equipment shall also be available for use by employees where exposures do not exceed levels listed in 8.4.2 A., at the employee's option.

8.3.8 All employees are responsible for:

- A. Reporting suspected high noise areas or equipment to their supervisors or to Industrial Hygiene.
- B. Reporting malfunctioning or new equipment that increases the noise level in their areas.

- C. Attending the Hearing Conservation Training or "challenging" the examination annually if a participant in the Hearing Conservation Program.
- D. Properly using all personal protective equipment in accordance with training given by Human Resources, Industrial Hygiene, and their supervisors.
- E. Reporting to the Occupational Medicine Office for an annual audiogram if a participant in the Hearing Conservation Program. If an employee wishes to refuse the annual or baseline audiograms, the employee shall sign a form indicating this refusal, and forward it to the Occupational Medicine Office.

8.4 REQUIREMENTS

8.4.1 Equipment and Facilities

- A. The engineering and design goal for equipment and facilities in all areas normally occupied by personnel shall be the practical, minimum emission of noise.
- B. Specifications for new facilities or equipment purchases shall include requirements for provisions to meet the criteria set in this section.
- C. Areas having noise levels such that the levels tabulated in Section 8.4.2.A are likely to be exceeded, and all areas having noise levels above 85 dBA shall be posted to provide administrative control instructions and to require specific personal protective measures as determined by Industrial Hygiene.
- D. When practical, portable equipment that produces noise levels capable of exceeding levels listed in Section 8.4.2.A should be marked indicating that personal protective equipment should be worn.
- E. Engineering studies to determine the practicability of, and subsequent methods for, abatement of the noise at its sources, and plans and schedules concerning such abatement shall then be initiated and followed through to completion.
- F. Industrial Hygiene shall evaluate adequacy of corrective measures taken.

8.4.2 Personnel Exposure

- A. The following levels and exposure times for noise shall prevail as maximum levels for continuous noise measured in the hearing zone of the individual:

Exposure Time (Hours per Day)	16	8	4	2	1	1/2	1/4	1/8
Noise Level (dBA)	82	85	88	91	94	97	100	103*

* Time exposure must be controlled by the noise source, not administratively.

- B. All employees exposed to 85 dBA or greater for an eight hour time-weighted average (TWA) (see A. above) must be entered into the Hearing Conservation Program (8.5.4).
- C. The noise dose to individuals shall be determined by audio noise dosimetry. The noise dosimeters will meet the minimum standards prescribed by OSHA and the American National Standards Institute (ANSI) A1.25.
- D. No exposures of an unprotected ear in excess of 140 dBA are permitted.

- E. Personnel subject to exposures meeting or exceeding the above criteria shall be required to use approved hearing-protective devices or equipment as specified by Industrial Hygiene to reduce noise exposure to the ear below the TWA of 85 dBA..

8.5 PRACTICES AND PROCEDURES

8.5.1 Any areas having high noise levels (e.g. a person must shout to be understood three feet away) shall be referred to PPPL Industrial Hygiene for measurement of noise levels.

8.5.2 Any complaints concerning noise levels shall be reported to Industrial Hygiene for evaluation.

8.5.3 Noise surveys, studies, corrective actions, non-compliance situations, and other practices shall be made a matter of record by written report to the responsible line supervisor with copies to the division head, department head, or project manager and the Occupational Medicine Office. Industrial Hygiene will also maintain a copy of the report along with any other data, notes, or results collected.

8.5.4 A Hearing Conservation Program will be implemented for personnel in areas or involved in tasks where the noise levels are above those shown in Section 8.4. The Hearing Conservation Program consists of:

- A. Voluntary baseline and annual audiometric testing on exposed employees. This testing will be directed by the Occupational Medicine Office and shall be conducted by a physician, certified audiologist or other personnel who are accredited by the Council for Accreditation in Occupational Hearing Conservation (CAOHC).
- B. The issuance and mandatory use of the proper hearing protection. A selection of proper hearing protection devices will be made by Industrial Hygiene.
- C. Annual training for personnel in the hazards of noise and in the care and use of the selected hearing protectors.

8.5.5 The complete Hearing Conservation Program Requirements are found in Appendix A of this section.

8.6 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values and Biological Exposure Indices," Cincinnati, OH, latest edition.

American Industrial Hygienists Association (AIHA) Noise Committee, Industrial Noise Manual, Akron, OH, latest edition.

National Institute for Occupational Safety and Health (NIOSH), "Occupational Noise Exposure," Rockville, MD.

American National Standards Institute (ANSI), S1.25, New York, N.Y., latest edition.

Occupational Safety and Health Administration (OSHA), 29 CFR 1910.95.

National Safety Council, "Fundamentals of Industrial Hygiene," Chicago, IL.

APPENDIX A

HEARING CONSERVATION PROGRAM

1. All personnel assigned to high noise areas will be offered an audiometric test annually. The test should be administered after a 14 to 16 hour period in a "noise free" environment.
2. New personnel assigned to a high noise area must be offered a hearing test within 90 days after starting date. This baseline test will be used to screen any predisposed condition.
3. Those employees showing significant hearing loss will be sent their test results. A retest will be scheduled.
4. Test results will be available to the employees at the Occupational Medicine Office.
5. All personnel in a high noise area must wear approved hearing protection while in the noisy area.
6. All personnel in high noise areas must attend annually the Hearing Conservation Training or "challenge" the exam administered by Human Resources.
7. Hearing protection will be available through the Stockroom in either disposable ear plug or ear muff forms.
8. People walking through a high noise area are exempt from wearing hearing protection as long as criterion set in this section for time/exposure levels are not exceeded.