



## HEARING CONSERVATION

### INTRODUCTION

Fermilab has a variety of high noise sources such as compressors, pumps, and machine tools. Exposure to high noise levels is typically brief and sporadic. Occasionally, however, exposure can be above an 8-hour time weighted average of 85 decibels using the A-weighted scale (dBA). To prevent occupationally related noise induced hearing loss from such exposures and comply with American Conference of Government Industrial Hygienists (ACGIH®), "Threshold Limit Values (TLVs®) for Chemical Substances and Physical Agents and Biological Exposure Indices, 2005, the hearing conservation program has been established.

### APPLICABLE STANDARDS

ACGIH® Noise Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, 2005.

### DEFINITIONS

Administrative control - those means of minimizing employee noise dose by controlling the duration of exposure.

Audiometric technician - an individual who has satisfactorily demonstrated competence in performing audiometric examinations, obtaining valid audiograms and properly using, maintaining, and calibrating audiometers, under the supervision of a physician.

Engineering controls - those means of minimizing employee noise dose with engineering methods such as enclosure of the noise source, redesign of noise producing equipment, application of noise dampening technology, etc.

Noise dosimeter - an instrument that integrates sound levels over a period of time to determine a noise dose. The noise dosimeters must meet the American National Standards Institute (ANSI): Specification for Personal Noise Dosimeters. ANSI S1.25-1991, ANSI, New York (1991).

Threshold Limit Value (TLV®) - Noise exposure that shall not exceed those levels listed in ACGIH®, Noise Standard (Table 1, TLVs® for Noise). The TLV® is exceeded when the dose is more than 100% as indicated on a dosimeter set with a 3 dB exchange rate

and an 8-hour criteria level of 85 dBA. Also, no exposure to continuous, intermittent, or impact noise in excess of a peak C-weighted level of 140 dB.

Representative sampling - measurements of an employee's average sound level that is representative of exposures of other employees performing that job on the same shift.

Standard threshold shift - an average change in hearing threshold of 10 dB or more, relative to the baseline audiogram, at 2000, 3000, and 4000 Hz in either ear, adjusted for age using the methods specified in Occupational Safety and Health Administration (OSHA) Regulation on Hearing Loss Recordkeeping, Code of Federal Regulation (CFR) 1904.10.

## RESPONSIBILITIES

1. Division/Section (D/S) Senior Safety Officer (SSO) or designee - Primary responsibilities are: to conduct noise monitoring to identify both high noise areas and employees for inclusion in the Hearing Conservation Program (HCP), to input monitoring results into the industrial hygiene sampling database, to maintain D/S noise monitoring equipment (if applicable), to notify each employee of their measured exposure or their representative exposure that is attributed to the employee, to distribute sampling results to the Medical Department, to identify and post areas where the ambient noise level is equal to or exceeds the limiting values in Table 1, to provide employee training, to evaluate hearing protection, and to recommend engineering and/or administrative controls.
2. Supervisor - Notify D/S SSO of any changes in personnel enrolled in the program through the Individual Training Needs Assessment (ITNA) process and any changes in working conditions that may change workers' exposure to noise, and to assure that Hearing Protection Devices are used properly.
3. ES&H Section - Primary responsibilities are: to provide guidance and technical information on the Hearing Conservation Program, to provide and maintain noise monitoring equipment, to maintain noise level readings for the Lab via industrial hygiene sampling database, and develop the HCP class.

In addition, the ES&H Section will be available, upon request, to assist the SSO with his/her duties.

4. Medical Department - To administer the audiometric testing program, to retain audiometric test records, and to notify the appropriate D/S ES&H Group when a standard threshold shift in an employee's hearing level has been detected.

5. Employee - To notify their SSO of unidentified and potentially hazardous noise exposure situations, and to wear hearing protection when required.

## PROCEDURES

1. Hearing Conservation Program

A continuing, effective hearing conservation program shall be administered whenever representative employee noise exposure equals or exceeds the limiting values in Table 1.

2. Monitoring

- a. Area Samples

Area sampling may be used to identify areas or equipment that exceeds the limiting values in Table 1. Sound level meters shall meet the Type II requirements of American National Standards Institute (ANSI) S1.4 (1983) and set to use the A-weighted network with slow meter response. Whenever possible, an octave band analysis should be done.

Area sampling should be repeated whenever there is a change in the area or equipment which could significantly change the noise exposure level.

- b. Personal Samples

When, in the judgment of the D/S SSO or designee, an employee's noise exposure may equal or exceed 85 dBA, representative sampling shall be performed. Noise dosimeters shall meet Class 2A-85/80-3 requirements of ANSI S1.25-1991, and shall be set at a 3-dB exchange rate.

The employee(s) selected for monitoring shall be representative of the exposure of all employees performing the same task. The initial exposure determination shall be done based on "worst case" scenarios. The rationale for the sampling strategy shall be documented on the Noise Sampling Field Notes Form.

Personal noise monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures. Monitoring frequency shall be based on the judgment of the industrial hygienist, safety engineer or SSO.

c. Employee Notification

The D/S SSO group conducting noise monitoring shall promptly notify each employee, in writing, of their measured exposure or the representative exposure that is attributed to the employee via the Industrial Hygiene Sampling Database. The medical department has been given access to the Industrial Hygiene Sampling Database for future reference.

d. Observation of Monitoring

Affected employees or their representative shall be provided an opportunity to observe any measurements of noise exposure.

3. Posting of High Noise Areas

Each D/S should post each area where the sound pressure level is equal to or exceeds 85 dBA. The sign shall say, "HIGH NOISE AREA HEARING PROTECTION REQUIRED".

4. Audiometric Testing Program

a. An audiometric testing program shall be administered and maintained for all employees whose representative noise exposure equals or exceeds 85 dBA for at least one shift in the preceding year.

b. The test shall be performed by certified audiometric technicians under the supervision of the Medical Department.

c. Baseline Audiograms

A baseline audiogram shall be obtained for all employees during the pre-employment medical exams.

Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. The use of hearing protectors during the 14 hour period meets this requirement.

An annual audiogram may be substituted for a baseline audiogram if in the opinion of the supervising physician, the standard threshold shift shown by the audiogram is persistent or the hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

d. Annual Audiograms

At least annually, a new audiogram shall be obtained for each employee in the Hearing Conservation Program.

e. Evaluation of Audiograms

Each employee's annual audiogram shall be compared to the baseline audiogram to determine if a standard threshold shift (STS) has occurred. Age adjustment of the audiogram will be done if indicated. Evaluation may be done by the certified technician.

If the annual audiogram shows a STS, the audiogram will be repeated within 30 days during which time the employee will be required to use hearing protection in areas that equal or exceed 85 dBA.

The physician reviews the follow-up audiogram to determine if there is further need for evaluation.

If the repeat test confirms STS, the employee will be promptly advised (must take place within 21 days). If the physician has determined a work relationship, the following action shall be taken:

The employee shall be re-trained on the use of available hearing protection. Different styles of hearing protection will be provided if necessary.

The employee will be referred for a clinical audiological or otological evaluation if additional testing is necessary or the physician suspects a medical pathology of the ear.

Standard threshold shift (STS), an average change in hearing threshold of 10 dB or more, relative to the baseline audiogram, at 2000, 3000, and 4000 Hz in either ear, adjusted for age using the methods specified by OSHA, will be reported to Department of Energy (DOE) via the Computerized Accident Injury Reporting System (CAIRS) report form by the D/S SSO or designee. If the STS is confirmed and the employee's overall hearing level is 25 dB or more averaged at 2000, 3000, and 4000Hz above audiometric zero in either ear and the hearing loss is determined to be work-related then the case will be recorded on the OSHA 300 log.

f. Audiometer Calibration

Audiometric tests shall be conducted with audiometers that meet the specifications of, and are maintained and used in accordance with ANSI Specification for Audiometers, S3.6-1969.

5. Noise Control

The use of engineering or administrative controls shall be investigated, documented and implemented where feasible to reduce employee exposure levels to below the limiting values in Table 1.

Changes in production, processes, or equipment shall be reviewed in advance to determine if these changes will expose employees at or above the ACGIH<sup>®</sup> Threshold Limit Value (TLV<sup>®</sup>). Engineering controls shall be considered if noise levels associated with the changes will equal or exceed the limiting values in Table 1.

The design of new facilities or operations shall be reviewed to determine the potential for noise exposure. Engineering controls shall be considered to keep noise levels associated with the new operation at or below the limiting values in Table 1.

6. Hearing Protection

- a. Hearing protection shall be required for all employees who work in areas where exposure may equal or exceed the limiting values in Table 1.
- b. Employees shall be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors.
- c. Employees must be trained in the proper use and care of hearing protection issued to them.
- d. Hearing protection must be evaluated by the D/S ES&H group to ensure that they attenuate noise levels to less than 85 dBA.
- e. Supervision shall assure that hearing protection is worn properly.

## 7. Training

Initial training must be provided upon assignment to a job that has been identified as having an exposure level at or above 85 dBA. Training must be provided annually thereafter.

The training shall address:

- the effects of noise on hearing;
- the basic elements of the noise reduction and hearing conservation program;
- the specific nature of operations that could result in over exposure to noise;
- the use of engineering controls to reduce noise exposure;
- the fitting, use, and maintenance of personal protective equipment associated with the employee's job assignment;
- the location of high noise areas, operations with potential of producing high noise levels, and special precautions to be taken in these areas;
- and the purpose and description of the audiometric testing program.

## 8. Record Retention

Noise measurements shall be entered by either the D/S SSO or the ES&H Section for IH Sampling database inclusion. Audiogram results are maintained by the Medical Department and entered into the Audiometric Testing Database.

## 9. References

- a. "Specification for Personal Noise Dosimeters," ANSI S1.25 - 1991.
- b. "Specification for Sound Level Meters," ANSI S1.4-1983 (R1997).
- c. "Specifications for Audiometers," ANSI S3.6-1996.

**TABLE 1**

The ACGIH®-TLV® for "continuous" noise is given in the table below. The "A" in "dBA" means that the sound pressure levels have been frequency weighted in a way which mimics the spectral effectiveness of noise to induce hearing loss.

**TLVs® for Noise<sup>A</sup>**

Duration per Day		Sound Level dBA <sup>B</sup>
Hours	24	80
	16	82
	8	85
	4	88
	2	91
	1	94
	Minutes	30
15		100
7.50 <sup>C</sup>		103
3.75 <sup>C</sup>		106
1.88 <sup>C</sup>		109
0.94 <sup>C</sup>		112
Seconds <sup>C</sup>	28.12	115
	14.06	118
	7.03	121
	3.52	124
	1.76	127
	0.88	130
	0.44	133
	0.22	136
	0.11	139

<sup>A</sup> No exposure to continuous, intermittent, or impact noise in excess of a peak C-weighted level of 140 dB.

<sup>B</sup> Sound level in decibels are measured on a sound level meter, conforming as a minimum to the requirements of the American National Standards Institute Specification for Sound Level Meters, S1.4 (1983) Type S2A, and set to use the A-weighted network with slow meter response.

<sup>C</sup> Limited by the noise source-not by administrative control. It is also recommended that a dosimeter or integrating sound level meter be used for sounds above 120 dB.