PURDUE
UNIVERSITY

HEARING CONSERVATION PROGRAM

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I. PURPOSE

Exposure to excessive noise in the workplace can cause permanent hearing loss. Although Purdue University attempts to control noise exposures on campus, certain operations and workstations may expose faculty, staff, or students to significant noise levels. The Hearing Conservation Program has been established to help ensure that members of the campus community do not suffer health effects from exposure to excessive noise while at work.

II. REGULATIONS AND OTHER APPLICABLE STANDARDS

OSHA 29 CFR 1910.95, "Occupational noise exposure" and relevant appendices

OSHA 29 CFR 1904.5, “Determination of work-relatedness”.

OSHA 29 CFR 1904.10, “Recording Criteria for Cases Involving Occupational Hearing Loss”.

ANSI S1.11-1971 "Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets"

ANSI S1.25-1978 "Specification for Personal Noise Dosimeters"

ANSI S1.4-1971 "Specification for Sound Level Meters"

ANSI S3.6-1969 "Specifications for Audiometers"

III. SCOPE

The provisions of the Hearing Conservation Program apply to all personnel at Purdue University’s West Lafayette campus, regional campuses, University research farms and agriculture centers, and related facilities and operations.

IV. APPLICABILITY

This program shall apply to all operations either stationary or mobile where employees are expected to be exposed to noise levels of 85 dBA or above for 8 hours as a time weighted average.

V. DEFINITIONS

A. Action Level

An 8-hour time weighted average (TWA) of 85 decibels measured on the A-weighted scale, slow response, or equivalently a dose of 50%. This is the level of sound exposure at which employee participation in the Purdue Hearing Conservation Program is mandatory.

B. A-Weighted Sound Level (dBA)

The weighting of sound levels that represents the function of the human ear.

C. Audiometric Testing Program

The portion of the Hearing Conservation Program that consists of measuring an employee's hearing threshold to establish a baseline and for subsequent comparisons.

D. Decibel (dB)

Unit of measurement of sound level.

E. **Dose**

A ratio of noise exposure relative to the noise criterion level of 90 decibels, expressed as a percentage. Ninety decibels represents a dose of 100% over an 8-hour work shift. Eighty-five decibels represents a dose of 50% over an 8-hour work shift. Dose is based on the OSHA 5 dB exchange rate. Dose may be determined from the equation given in Table 1 for non-continuous noise or estimated from Table 2 based on the TWA.

F. **Hearing Conservation Program (HEACP)**

A written program that establishes procedures to ensure the protection of employees from high noise areas or operations in compliance with the OSHA Occupational Noise Regulation 29 CFR 1910.95.

G. **Hearing Protection Attenuation**

The estimated reduction in the noise level at the eardrum as a result of the use of hearing protection. Estimated using the formula: Attenuated TWA, dBA = TWA - (Noise Reduction Rating, NRR, – 7) for A – scale weighted sound levels. Attenuated TWA, dBC = TWA – NRR for C-scale weighted sound levels.

H. **Noise Induced Hearing Loss, NIHL**

The OSHA recordable occupationally related hearing loss, as defined by 29 CFR 1904.10 and 29 CFR 1904.5, and includes a Standard Threshold Shift (STS) of 10 db, with age correction, averaged over the 2K, 3K, and 4K frequencies from baseline in either ear and a 25 db shift from audiometric zero, in the same ear as the 10 dB STS at the same frequencies.

I. **Noise Reduction Rating (NRR)**

The theoretical maximum amount of noise reduction that can be achieved using a hearing protection device. This is a manufacturers' calculated value and must be displayed with the hearing protection device.

J. **Monitoring**

The sampling of noise levels using a sound level meter, octave band analyzer, or personal noise dosimeter.

K. **Permissible Noise Exposure**

The maximum daily noise exposure which may be experienced by employees not using hearing protectors from a continuous 8-hour exposure to a sound level of 90 dBA or equivalent dose of 100%.

L. **Standard Threshold Shift (STS)**

A change in hearing threshold, relative to the most recent audiogram for that employee, of an average of 10 decibels (dB) or more at 2000, 3000, and 4000 hertz in one or both ears and substantiated within 30 days with a follow-up audiogram.

M. **Time Weighted Average (TWA)**

The [equivalent] noise level, in dB, based on an 8-hour exposure time frame. If the noise is not constant over an 8-hour exposure, then a calculated 8-hour TWA must be made using the equation in Table 1. The TWA may also be estimated from the dose or percent noise exposure, based on noise exposure continuous over 8-hours, as given in Table 2.

VI. RESPONSIBILITIES

A. Radiological and Environmental Management Shall:

1. Develop the written Hearing Conservation Program and revise the program as necessary.
2. Identify and establish a written agreement with an audiometric testing clinic for occupationally exposed employees. The written agreement is established with the Purdue University Audiology and Speech Sciences Department, M.D. Steer Audiology Clinic (AUS) for the West Lafayette campus. The written agreement with AUS is included as Appendix A. Regional campuses may have a different clinic agreement and shall include the written agreement in Appendix A.
3. Conduct monitoring to identify areas or operations requiring inclusion in a hearing conservation program.
4. Assist in noise control measures (i.e. hearing protection, noise control).
5. Identify approved hearing protection for use by Purdue employees requiring protection.
6. Oversee calibration and servicing of monitoring equipment (sound level meters, noise dosimeters, and other such equipment as necessary to protect the health of the employees) as manufacturers' guides instruct.

B. Audiometric Testing Clinic Shall:

1. Conduct hearing testing for University employees potentially exposed to noise levels at or above the OSHA Action Level of 85 dBA as an 8 hour TWA in accordance with 29 CFR 1910.95 including:
   a. Conduct audiograms.
   b. Provide training on effects of noise.
   c. Provide training in the use, care, and limitations of hearing protection devices.
2. Provide REM with written results for employees that have experienced a standard threshold shift of 10 dB or more following loss correction for age, regardless of a 25 dB shift from audiometric zero.
3. Retain audiometric testing results for the duration of an employee's employment. Audiometric testing record forms are included in this program as Appendix J.
4. Provide REM with written audiometric testing results for employees upon termination of employment from the University.
5. Maintain written calibration of audiometers and daily operational pre-testing checks. Conduct an exhaustive calibration, as specified in 29 CFR 1910.95(h)(5)(iii), of the audiometric measuring instruments at least every two years.

C. Departments, Supervisors, Directors, Managers Shall:

1. Identify potentially hazardous noise locations and operations and contact REM for evaluations.
2. Ensure that employees required to participate in the hearing conservation program complete their annual audiometric testing, at the clinic with which a written agreement has been established and all other requirements of the program.
3. Pay the costs of required hearing protection devices for employees. Departments shall also pay any fees assessed for scheduled audiometric testing appointments for which an employee does not appear and does not notify the clinic of the cancellation.

4. Cooperate with REM in implementing disciplinary steps for employees who fail to cooperate in a timely and reasonable manner with the requirements of the program, including but not limited to failure to schedule or attend audiometric testing at the specified service provider and failure to wear required hearing protection devices. Furthermore, departments will assume the expense of services provided by non-approved service providers.

D. **Employee Shall:**

1. Assist the supervisor in identifying potentially hazardous noise locations or operations to which they may be exposed.
2. Schedule and complete audiometric testing or exposure assessments as instructed.
3. Use hearing protection as required and in accordance with training received.

VII. GENERAL REQUIREMENTS

A. **Monitoring**

When information indicates that an employee's exposure may equal or exceed the action level of 85 dBA for an 8-hour TWA assessment, monitoring shall be conducted by REM. Affected employees shall be notified of the results of the monitoring where levels at or above the action level are identified. Monitoring activities may consist of:

1. Sound level measurements for locations where the noise level is stationary and expected to be continuous or
2. Personal noise dosimetry for work operations that are highly mobile or random in noise level.
3. Re-monitoring, if a change in equipment, process or controls increases the noise level to the extent that:
   a. Additional employees may be exposed at or above the action level or;
   b. The attenuation provided by the hearing protectors used by the employee(s) does not reduce the noise exposure level to 90 dBA for an 8 hour TWA or 85 dBA as 8 hour TWA for employees that have experienced a standard threshold shift.
   c. Follow-up monitoring if an STS has occurred.
4. The opportunity for affected employees to observe the noise measurements during collection.

B. **Audiometric Testing Program**

All employees exposed to noise at or above the Action Level are required to participate in the program. This program consists of:

1. A baseline test to be completed within 6 months of the employee's first exposure above the action level. This test must be preceded by at least 14 hours without exposure to workplace noise at or above 85 dBA or hearing protection devices must be used prior to testing.
2. Annual testing thereafter provided that exposure at or above the action level is expected.
3. Training of affected employees regarding the hazards of noise exposure, and where necessary the fitting of employees with appropriate hearing protection devices and training about their use, care and limitations.
4. A follow-up audiogram may be provided within 30 days if a standard threshold shift has been identified. The employee shall be informed in writing within 21 days of the determination.
5. Audiometric testing reviewed by an audiologist. The audiologist will determine if further evaluation or retraining is needed.

6. Maintenance of audiometric testing equipment in accordance with the requirements of the OSHA Occupational Noise Standard (29 CFR 1910.95 and its appendices).

C. **Noise Control**

Where noise levels for non-mobile sources are found to be in excess of 90 dBA or above the Permissible Noise Exposure as listed in Table 1 on a continuous basis and employees are required to work in such areas the following measures shall be taken:

1. Engineering controls will be reviewed for feasibility in noise reduction. Until they are implemented or if adequate controls are not feasible then;
2. Hearing protection devices shall be worn by employees whose exposure is at or above 90 dBA as an 8 hour TWA. Hearing protection devices will be made available to exposed employees at no cost. Hearing protection attenuation shall reduce the exposure below 90 dBA as an 8 hour TWA using the NRR of the rated device.
3. For employees exposed to noise levels at or above 85 dBA, but below 90 dBA as an 8 hour TWA the use of hearing protection devices shall be strongly encouraged.

D. **Record-keeping**

The audiometric testing clinic shall maintain audiometric exams for each tested employee for the duration of that employee's participation in the program. Upon leaving employment from the University or discontinuance in the Hearing Conservation program, all records will be transferred to REM. REM shall maintain all noise monitoring data.

TABLES

TABLE 1: 8- HOUR TWA SOUND LEVELS & ALLOWABLE EXPOSURE TIMES

Sound Level (dBA) (loudness)	**Allowable Exposure Duration** (Hours)
80	32
85	16
90	8
95	4
100	2
105	1
110	0.5
115	0.25
120	0.125
125	0.063
130	0.031

For brevity, only dBA values that are multiples of 5 are shown. Shaded areas represents OSHA defined exchange rate. The complete table G-16A at 29 CFR 1910.95 App A will be used. Allowable exposure duration is time in hours at a dBA level, which constitutes an exposure equivalent in energy and sound dose to 90 dBA for 8 hours.

Calculations/Definitions:
Allowable exposure time may be calculated using the following equation for sound levels not specified in this table:

$T = 8/2^{(L-90)/5}$

Where T = Allowable Exposure Duration and
L = measured A-weighted sound level.

Example: measured sound level = 75 dBA
$T = 8/2^{(75-90)/5}$ = 64 hours Allowable Exposure Duration

Sound levels below 80 dBA are not included in exposure calculations. A dose of 50% or more, or an 8h-TWA of 85 dBA or higher, triggers the Action Level requirements and mandates an employee's participation in the Purdue Hearing Conservation Program.

TABLE 2: PERCENT NOISE EXPOSURE (DOSE) AND EQUIVALENT 8-HOUR TWA

Dose (%)	**8-Hour TWA**
10	73.4
20	78.4
30	81.3
40	83.4
50	85.0
60	86.3
70	87.9
80	88.4
90	89.2
100	90.0
120	91.3
140	92.4
160	93.6
180	94.2
200	95.0
240	96.3
280	97.9
300	97.9
400	100.0
500	101.6

For brevity, a shorten selection of dose values are shown. The complete list is given in table A-1 of 29 CFR 1910.95, Appendix A.

The dose may be calculated using the following formula:
$Dose = 100 \times \{(C_{Level1})/(T_{Level1})+(C_{Level2})/(T_{Level2})+(C_{Level\ n})/(T_{Level\ n})\}$
Where C = time of exposure at any noise level and
T = allowable exposure time, in hours given by Table 1.

Example: 100 dBA for 1 hour, 95 dBA for half hour, and 80 dBA for 4h

Dose = 100x{1/2 + 0.5/4 + 4/32} = 100x(0.5 + 0.125 + 0.125} = 75%

For a dose greater than or less than the values printed in the chart use the following equation to calculate the TWA:

$$8h\text{-}TWA = 16.61 \log(10) (D/100) + 90$$

Where D = accumulated dose in percent exposure.

Example: Dose = 75%

8h-TWA = 16.61 log(.75) + 90 = 16.61(-.1249) + 90 = -2.07 + 90 = 87.93 dBA

APPENDICES

APPENDIX A: AUDIOMETRIC TESTING CLINIC AGREEMENT

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PHYSICAL FACILITIES
RADIOLOGICAL & ENVIRONMENTAL MANAGEMENT

Date:

Subject: Letter of Agreement between Radiological and Environmental Management (REM) and the Department of Audiology and Speech Sciences.

Purpose: To establish a letter of agreement between Radiological and Environmental Management (REM) and the Department of Audiology and Speech Sciences pertaining to each organization's duties and responsibilities in fulfilling Purdue University's Occupational Safety and Health Administration (OSHA) requirements for hearing conservation as outlined in the Occupational Noise Exposure Standard, 29 CFR 1910.95, the Recording Criteria for Cases Involving Occupational Hearing Loss, 29 CFR 1904.10, and Determination of Work-relatedness, 29 CFR 1910.5. Copies of these standards are included in the appendices of the written Hearing Conservation Program. (Bold type indicates the relevant standard and subsection.)

The Audiology Clinic accepts the following duties and responsibilities:

I. Conduct sound level monitoring and noise surveys when requested by REM. **(29CFR1910.95(d))**

II. Conduct the audiometric testing program for all active employees identified by REM, whose time weighted average exceeds the action level (85dBA), thereby requiring audiometric testing.

   A. Schedule all baseline, annual and follow-up audiometric tests, send appointment notices to employee through their respective departments, review and evaluate the audiograms, notify employee when there is a new audiometric interpretation, establish a revised baseline audiogram, identify when a standard threshold shift (STS) has occurred **(29CFR1910.95(g))** after age correction specified in **(29CFR1910.95, Appendix F)** and identify recordable work related noise induced hearing losses **(29CFR1904.10 and 29CFR1904.5).**

   B. Administer audiometric tests by a certified and licensed audiologist or by a graduate audiologist under the supervision of an audiologist.

   C. Ensure the following requirements are met for audiometric testing:

      1. Audiometric Measuring Instruments **(29CFR1910.95, Appendix C)**
      2. Audiometric Test Rooms **(29CFR1910.95, Appendix D)**
      3. Audiometric Calibration **(29CFR1910.95, Appendix E)**
      4. Maintain calibration records for the testing equipment **(29CFR1910.95 (h)(5))**

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APPENDIX A: AUDIOMETRIC TESTING CLINIC AGREEMENT

III. Fit employees with appropriate hearing protection when requested. Inspect condition of hearing protection during annual audiometric evaluation visits and train employees on the proper use and care of their hearing personal protective equipment. **(29CFR1910.95 (i))**

A. Provide custom fit hearing protection when authorized by REM and the individual employee's department.

B. If noise data is provided by REM, determine the appropriateness of the employee's personal hearing protection and if necessary to attain an appropriate attenuation level, prescribe, fit and train the employee with new hearing protection.

IV. Provide training annually for all active employees identified by REM during the annual audiometric evaluation visit. **(29CFR1019.95(k))** This training may be done via video tape and will cover:

A. The effects of noise on hearing **(k)(3)(I)**

B. Purpose, selection, attenuation, fitting, use and care of hearing protection **(k)(3)(ii)**

C. Purpose of audiometric testing and explanation of procedures and results **(k)(3)(iii)**

V. Maintain audiometric test records for all active and newly identified employees as designated by REM for participation in the hearing conservation program. The audiometric tests records of non-active employees who are no longer required to receive annual testing will be returned to REM for appropriate action. **(29CFR1910.95(m))**

VI. Provide REM with a copy of all annual and follow-up disposition sheets for each employee tested and a weekly summary sheet of employee participation and status.

VII. The Audiology Clinic will charge for the actual services performed at its normally approved rates. REM or the requesting department will provide a University account number to the Clinic Business Office for billing purposes.

VIII. Contact REM with any problems or concerns regarding the fulfillment of any of these duties or responsibilities.

Lata Krishnan, M.S., CCC-A Audiology Clinic Director	Stephen Jurss, REM	Linda Swihart, REM

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(Continued)

APPENDIX B: NOISE DOSIMETRY DATA SHEET

Name: _____ Date: _____

Job Title: _____

Dosimeter Manufacturer: Quest Model & Serial #: 300 SN: QCB110098

Work Location Description: _____

Threshold: 80 dBA Criterion Level: 90 dBA Exchange Rate: 5 dBA

Microphone Location: _____

Monitoring Conducted: ☐ Personal ☐ Area

Are Hearing Protectors Used? ☐ Yes ☐ No

If yes, what percent of the workday? 5%

Exposure Description

Calibration Check

Date	Initial Reading	Time	Final Reading	Time

Calibrator QC-10 @ 1000 Hz @ 114 dB, Serial # -QE5120112

Dosimetry Data

Date	115 dBA Exceeded	Start Time	Stop Time	Display Reading %	L eq(t)

Noise Dosimetry Additional Information

1. Reason for monitoring?

   a. Random selection in area above the action level.
   b. Because of mobility or intermittent exposure.
   c. Has experienced TTS.
   d. Other Explanation:_____

2. Indicate the degree of reliability in the data collection.

   Check: Very Unreliable Very Reliable

	1	2	3	4	5	6	7	8	9	10	

3. Were there any adverse environmental conditions that might have affected the readings during the wearing period? If yes, explain.

4. Did you suspect any tampering with the dosimeter during the time period it was worn?

5. Was an audiogram taken during the monitoring? If so, what were the results?

6. Does this individual currently use any type of hearing protection device?
   If yes, what is the type, manufacture and NRR?

7. Calculate the attenuation using (NRR –7)/2 in comparison to db equivalent exposure %.

APPENDIX C: AREA NOISE SURVEY DATA FORM

Sound Level/Octave Band Data

Name: _____ Date: _____

Location: _____ Noise Source: _____

Manufacturer: General Radio Model/Serial #: 1988/0056348

Threshold: 80 dB Exchange Rate: 5 dB

Are Hearing Protectors used? ☐ Yes ☐ No If yes, what percentage? 5%

Monitoring Conducted by:

Calibration Checks

Date/Time	Frequency	Initial Setting		Date/Time	Frequency	Final Setting
	125 Hz	dB			125 Hz	dB
	250 Hz	dB			250 Hz	dB
	500 Hz	dB			500 Hz	dB
	1000 Hz	dB			1000 Hz	dB
	2000 Hz	dB			2000 Hz	dB

Calibrator: General Radio Type 1562-A Serial #: 13237

Testing Results

Sample Location	Result		Sample Location	Result
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA
	dBA			dBA

Comments:

Sketch noise source & room layout.

APPENDIX D: NUISANCE NOISE REPORT LETTER

PURDUE
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PHYSICAL FACILITIES
RADIOLOGICAL & ENVIRONMENTAL MANAGEMENT

MEMORANDUM

TO:
FROM: Stephen Jurss, Industrial Hygiene
DATE:
RE: Noise Monitoring in Room

The information provided below summarizes the sound level measurement data collected. In accordance with the OSHA noise standard, the requirement for providing hearing protection devices is triggered at an exposure level of 85 dBA (decibel A-weighted) for a duration of 8 hours or above. At or above this level, mandatory annual audiometric testing is required. If levels in excess of 90 dBA for an 8-hour duration exist the use of hearing protection becomes mandatory. These requirements were specifically designed to protect exposed employees form permanent hearing damage. Our office is currently responsible for compliance with the OSHA regulations. Levels below the OSHA limits may result in a nuisance problem to the building occupants. At this time, there is no specific policy for levels below the OSHA limits.

Noise Survey Summary

Sample #	Date	Employee/ Location	dBA 8-Hour Average	OSHA Allowed 8-Hour Average	% Dose (8-Hour Equivalent)	OSHA Allowed Dose
Notes:						

If you have any questions please contact me at 494-9227.

APPENDIX E: STS NOTIFICATION LETTER

PURDUE
UNIVERSITY

PHYSICAL FACILITIES
RADIOLOGICAL & ENVIRONMENTAL MANAGEMENT

TO: [Employee name and address]
FROM: [REM representative]
DATE: [Current date]
SUBJECT: Standard Threshold Shift

The results of your recent OSHA physical examination indicate you have sustained a Standard Threshold Shift (STS) in your hearing ability. An STS is a permanent hearing loss of 10 decibels or greater averaged over the 2000, 3000 and 4000 Hertz frequency ranges in either ear. This is based on a comparison of your most recent audiogram with your initial baseline audiogram. Allowances have been made for the contribution of aging to the change in hearing level.

The 2000 to 4000 Hertz frequency range is considered to be part of the speech frequency range. Losses in this range will eventually make it difficult to understand normal conversation. You may start to notice that people have to shout to make you understand. Telephone and radio use will be affected due to the absence of face-to-face contact. Reduction of these types of problems with the use of effective hearing conservation methods will enhance your quality of life.

As your employer, it is our responsibility to inform you of this hearing loss and provide you with information to preserve your present hearing level without additional losses. It is necessary to continue to wear effective hearing protection, earplugs, or muffs, when working in noisy environments. Noise induced hearing loss is a gradual process that you may not realize is occurring until it's too late and there is no treatment for it.

A meeting was held with you on [mm/dd/yy] to discuss information related to your noise exposure on and off the job, methods of controlling your personal noise exposure, the effective use of hearing protection. REM may also conduct additional monitoring of workplace noise exposure levels in your area in the future. If so, you will be provided a copy of the results.

The following items were discussed:

- Explanation of STS and ways to prevent hearing loss
- Use of properly fitted hearing protection
- Workplace noise levels data and future monitoring

Criterion Met: ☐ **STS** ☐ **OSHA Reportable STS**

REM Representative:_____ Date:_____

Employee:_____ Date:_____

cc: [Employee's Home Department Business Office Files]

APPENDIX F: NOISE COMPARISON CHART

Noise Source	Decibel Level (dBA)	Comments
Jet take-off (at 25 meters)	150	Eardrum rupture
Aircraft carrier deck	140	
Military jet aircraft take-off from aircraft carrier with afterburner at 50 ft (130 dB).	130	
Thunderclap; chain saw; Oxygen torch (121 dB).	120	32 times as loud as 70 dB; Painfully loud
Steel mill; Auto horn at 1 meter; turbo-fan aircraft at takeoff power at 200 ft (118 dB); riveting machine (110 dB); live rock music (108 - 114 dB)	110	16 times as loud as 70 dB; average human pain threshold
Jet take-off (at 305 meters); use of outboard motor; power lawn mower; motorcycle; farm tractor; jackhammer; garbage truck; Boeing 707 or DC-8 aircraft at one nautical mile (6080 ft) before landing (106 dB); jet flyover at 1000 feet (103 dB); Bell J-2A helicopter at 100 ft (100 dB).	100	8 times as loud as 70 dB; serious damage possible in 8 hour exposure
Boeing 737 or DC-9 aircraft at one nautical mile (6080 ft) before landing (97 dB); power mower (96 dB); motorcycle at 25 ft (90 dB); newspaper press (97 dB).	90	4 times as loud as 70 dB; likely damage in 8 hour exposure
Garbage disposal; dishwasher; average factory; freight train (at 15 meters); Car wash at 20 ft (89 dB); propeller plane flyover at 1000 ft (88 dB); diesel truck 40 mph at 50 ft (84 dB); diesel train at 45 mph at 100 ft (83 dB); food blender (88 dB); milling machine (85 dB); garbage disposal (80 dB)	80	2 times as loud as 70 dB; possible damage
Passenger car at 65 mph at 25 ft (77 dB); freeway at 50 ft from pavement edge 10 a.m. (76 dB); living room music (76 dB); radio, TV-audio or vacuum cleaner (70 dB)	70	Arbitrary base of comparison; Upper 70s annoyingly loud to some people.
Conversation in restaurant or office; background music; air conditioning unit at 100 ft	60	Half as loud as 70 dB; fairly quiet
Quiet suburb; conversation at home; large electrical transformers at 100 ft.	50	One-fourth as loud as 70 dB
Library; bird calls (44 dB); lowest limit of urban ambient sound	40	One-eighth as loud as 70 dB
Quiet rural area	30	One-sixteenth as loud as 70 dB; very quiet
Whisper; rustling leaves	20	
Breathing	10	Barely audible

SOURCES: Temple University Department of Civil/Environmental Engineering (www.temple.edu/departments/CETP/environ10.html), and *Federal Agency Review of Selected Airport Noise Analysis Issues*, Federal Interagency Committee on Noise (August 1992). Source of the information is attributed to *Outdoor Noise and the Metropolitan Environment*, M.C. Branch et al., Department of City Planning, City of Los Angeles, 1970.

APPENDIX G: HEARING CONSERVATION PROGRAM EVALUATION CHECKLIST

Training and Education

Failures or deficiencies in hearing conservation programs (hearing loss prevention programs) can often be traced to inadequacies in the training and education of noise-exposed employees and those who conduct elements of the program.

	1. Has training been conducted at least once a year?
	2. Was the training provided by a qualified instructor?
	3. Was the success of each training program evaluated?
	4. Is the content revised periodically?
	5. Are managers and supervisors directly involved?
	6. Are posters, regulations, handouts, and employee newsletters used as supplements?
	7. Are personal counseling sessions conducted for employees having problems with hearing protection devices or showing hearing threshold shifts?

Supervisor Involvement

Data indicate that employees who refuse to wear hearing protectors or who fail to show up for hearing tests frequently work for supervisors who are not totally committed to the hearing loss prevention programs.

	1. Have supervisors been provided with the knowledge required to supervise the use and care of hearing protectors by subordinates?
	2. Do supervisors wear hearing protectors in appropriate areas?
	3. Have supervisors been counseled when employees resist wearing protectors or fail to show up for hearing tests?
	4. Are disciplinary actions enforced when employees repeatedly refuse to wear hearing protectors?

Noise Measurement

For noise measurements to be useful, they need to be related to noise exposure risks or the prioritization of noise control efforts, rather than merely filed away. In addition, the results need to be communicated to the appropriate personnel, especially when follow-up actions are required.

	1. Were the essential/critical noise studies performed?
	2. Was the purpose of each noise study clearly stated? Have noise-exposed employees been notified of their exposures and apprised of auditory risks?
	3. Are the results routinely transmitted to supervisors and other key individuals?
	4. Are results entered into health/medical records of noise exposed employees?
	5. Are results entered into shop folders?
	6. If noise maps exist, are they used by the proper staff?
	7. Are noise measurement results considered when contemplating procurement of new equipment? Modifying the facility? Relocating employees?
	8. Have there been changes in areas, equipment, or processes that have altered noise exposure? Have follow-up noise measurements been conducted?
	9. Are appropriate steps taken to include (or exclude) employees in the hearing loss prevention programs whose exposures have changed significantly?

Engineering and Administrative Controls

Controlling noise by engineering and administrative methods is often the most effective means of reducing or eliminating the hazard. In some cases, engineering controls will remove requirements for other components of the program, such as audiometric testing and the use of hearing protectors.

	1. Have noise control needs been prioritized?
	2. Has the cost-effectiveness of various options been addressed?
	3. Are employees and supervisors appraised of plans for noise control measures? Are they consulted on various approaches?
	4. Will in-house resources or outside consultants perform the work?

	5. Have employees and supervisors been counseled on the operation and maintenance of noise control devices?
	6. Are noise control projects monitored to ensure timely completion?
	7. Has the full potential for administrative controls been evaluated? Are noisy processes conducted during shifts with fewer employees? Do employees have sound-treated lunch or break areas?

Monitoring Audiometry and Record Keeping

The skills of audiometric technicians, the status of the audiometer, and the quality of audiometric test records are crucial to hearing loss prevention program success. Useful information may be ascertained from the audiometric records as well as from those who actually administer the tests.

	1. Has the audiometric technician been adequately trained, certified, and recertified as necessary?
	2. Do on-the-job observations of the technicians indicate that they perform a thorough and valid audiometric test, instruct and consult the employee effectively, and keep appropriate records?
	3. Are records complete?
	4. Are follow-up actions documented?
	5. Are hearing threshold levels reasonably consistent from test to test? If not, are the reasons for inconsistencies investigated promptly?
	6. Are the annual test results compared to baseline to identify the presence of an OSHA standard threshold shift?
	7. Is the annual incidence of standard threshold shift greater than a few percent? If so, are problem areas pinpointed and remedial steps taken?
	8. Are audiometric trends (deteriorations) being identified, both in individuals and in groups of employees? (NIOSH recommends no more than 5% of workers showing 15 dB Significant Threshold Shift, same ear, same frequency.)
	9. Do records show that appropriate audiometer calibration procedures have been followed?
	10. Is there documentation showing that the background sound levels in the audiometer room were low enough to permit valid testing?
	11. Are the results of audiometric tests being communicated to supervisors and managers as well as to employees?
	12. Has corrective action been taken if the rate of no-shows for audiometric test appointments is more than about 5%?
	13. Are employees incurring STS notified in writing within at least 21 days? (NIOSH recommends immediate notification if retest shows 15 dB Significant Threshold Shift, same ear, and same frequency.)

Referrals

Referrals to outside sources for consultation or treatment are sometimes in order, but they can be an expensive element of the hearing loss prevention program, and should not be undertaken unnecessarily.

	1. Are referral procedures clearly specified?
	2. Have letters of agreement between the company and consulting physicians or audiologists been executed?
	3. Have mechanisms been established to ensure that employees needing evaluation or treatment actually receive the service (i.e., transportation, scheduling, reminders)?
	4. Are records properly transmitted to the physician or audiologist, and back to the company?
	5. If medical treatment is recommended, does the employee understand the condition requiring treatment, the recommendation, and methods of obtaining such treatment?
	6. Are employees being referred unnecessarily?

Hearing Protection Devices

When noise control measures are infeasible, or until such time as they are installed, hearing protection devices are the only way to prevent hazardous levels of noise from damaging the inner ear. Making sure that these devices are worn effectively requires continuous attention on the part of supervisors and program implementers as well as noise-exposed employees.

	1. Have hearing protectors been made available to all employees whose daily average noise exposures are 85 dBA or above? (NIOSH recommends requiring HPD use if noises equal or exceed 85 dBA regardless of exposure time.)
	2. Are employees given the opportunity to select from a variety of appropriate protectors?
	3. Are employees fitted carefully with special attention to comfort?
	4. Are employees thoroughly trained, not only initially but at least once a year?
	5. Are the protectors checked regularly for wear or defects, and replaced immediately if necessary?
	6. If employees use disposable hearing protectors, are replacements readily available?
	7. Do employees understand the appropriate hygiene requirements?
	8. Have any employees developed ear infections or irritations associated with the use of hearing protectors? Are there any employees who are unable to wear these devices because of medical conditions? Have these conditions been treated promptly and successfully?
	9. Have alternative types of hearing protectors been considered when problems with current devices are experienced?
	10. Do employees who incur noise-induced hearing loss receive intensive counseling?
	11. Are those who fit and supervise the wearing of hearing protectors competent to deal with the many problems that can occur?
	12. Do workers complain that protectors interfere with their ability to do their jobs? Do they interfere with spoken instructions or warning signals? Are these complaints followed promptly with counseling, noise control, or other measures?
	13. Are employees encouraged to take their hearing protectors home if they engage in noisy non-occupational activities?
	14. Are new types of or potentially more effective protectors considered as they become available?
	15. Is the effectiveness of the hearing protector program evaluated regularly?
	16. Have at-the-ear protection levels been evaluated to ensure that either over or under protection has been adequately balanced according to the anticipated ambient noise levels?
	17. Is each hearing protector user required to demonstrate that he or she understands how to use and care for the protector? The results documented?

Administrative

Keeping organized and current on administrative matters will help the program run smoothly.

	1. Have there been any changes in federal or state regulations? Have hearing loss prevention program's policies been modified to reflect these changes?
	2. Are copies of company policies and guidelines regarding the hearing loss prevention program available in the offices that support the various program elements? Are those who implement the program elements aware of these policies? Do they comply?
	3. Are necessary materials and supplies being ordered with a minimum of delay?
	4. Are procurement officers overriding the hearing loss prevention program implementer's requests for specific hearing protectors or other hearing loss prevention equipment? If so, have corrective steps been taken?
	5. Is the performance of key personnel evaluated periodically? If such performance is found to be less than acceptable, are steps taken to correct the situation?
	6. Safety: Has the failure to hear warning shouts or alarms been tied to any accidents or injuries? If so, have remedial steps been taken?

APPENDIX H: OSHA STANDARDS AND APPENDICES

HEARING LOSS RELATED

OSHA Occupational Noise Exposure Standard and Appendices
29 CFR 1910.95

https://www.osha.gov/laws-regs/standardinterpretations/standardnumber/1910/1910.95%20-%20Index/result

OSHA Determination of Work Relatedness
29 CFR 1904.5

https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.5

OSHA Recording Criteria for Cases Involving Occupation Hearing Loss
29 CFR 1904.10

https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.10

APPENDIX I: AUDIOMETRIC TESTING DATA SHEET

PURDUE UNIVERSITY/REM AUDIOMETRIC TESTING PROGRAM
M.D. STEER AUDIOLOGY CLINIC

FULL NAME (LAST) (FIRST) (MIDDLE)	HIRE DATE	SEX	SOCIAL SECURITY NO.
SCHOOL, DEPARTMENT, OR OFFICE	BUILDING		BIRTH DATE

(1) A=Annual; B=Baseline; R=Retest
(2) Hours between most recent exposure and test. If 14 hours fill out (3).
(4) P=Plug; M=Muff; C=Custom; Ca=Cap
(5) A=Annual; R=Retest; M=Medical referral; R/B= Revise Baseline; O=Other

(1) TEST TYPE AND NUMBER	DATE MONTH YEAR	24-HOUR TIME	CHANGES IN MEDICAL HISTORY? Y/N	RIGHT EAR						LEFT EAR						AUDIO-METER CALIBRA-TION DATE	MAKE AND MODEL OF AUDIO-METER	JOB TITLE/AREA	NOISE EXPOSURE		(4) EAR PRO-TEC-TION USED	AUDIOLOGIST PRINT NAMEAND INITIAL	(5) ACTION
				500	1000	2000	3000	4000	5000	500	1000	2000	3000	4000	5000				(2) TIME LAPSE	(3) HPD PRIOR? Y/N			

HISTORY: PUT AN "X" IN THE BOX NEXT TO ANY ITEM THAT APPLIES TO YOU **NOW** OR IN **YOUR PAST**:

MEDICAL HISTORY
- ☐ MEASLES
- ☐ MUMPS
- ☐ SCARLET FEVER
- ☐ DIABETES
- ☐ ALLERGIES
- ☐ DIZZINESS
- ☐ HEAD INJURIES
- ☐ KIDNEY DISEASE
- ☐ HIGH BLOOD PRESSURE

EAR PROBLEMS
- ☐ DRAINING EARS
- ☐ EARACHES
- ☐ EAR SURGERY
- ☐ EAR MEDICATION
- ☐ RINGING/BUZZING NOISES
- ☐ EAR WAX REMOVAL
- ☐ SAW PHYSICIAN FOR EARS
- ☐ SAW AUDIOLOGIST FOR EARS
- ☐ PUNCTURED EAR DRUM
- ☐ PLUGGED FEELING

HEARING PROBLEMS
- ☐ YOURSELF-BOTH EARS
- ☐ YOURSELF- LEFT EAR
- ☐ YOURSELF- RIGHT EAR
- ☐ YOUR PARENTS (NOT IN OLD AGE)
- ☐ YOUR CHILD/CHILDREN
- ☐ YOUR BROTHER(S)/SISTER(S)
- ☐ OWN HEARING AID
- ☐ PRIOR OCCUPATIONAL NOISE EXPOSURE

OFF-JOB NOISE
- ☐ SHOOTING
- ☐ POWER TOOLS/EQUIPMENT
- ☐ MOTORCYCLE
- ☐ SPEEDBOAT
- ☐ SNOWMOBILE
- ☐ LOUD MUSIC
- ☐ FARM MACHINERY
- ☐ MILITARY-NOISE AND/OR GUNFIRE
- ☐ MOTORIZD COMPETITION
- ☐ OTHER

IN YOUR OPINION, YOUR HEARING IS: GOOD ☐ FAIR ☐ POOR ☐

APPENDIX J: DROP FROM PROGRAM NOTIFICATION LETTER

PURDUE
UNIVERSITY

PHYSICAL FACILITIES
RADIOLOGICAL & ENVIRONMENTAL MANAGEMENT

MEMORANDUM

TO: Carol Tebben, AUS, HEAV
FR: Stephen Jurss, Industrial Hygienist, REM
DA: Today's Date
RE: Removal of Employee from the Audiometric Testing Program

Please remove ( ) from the schedule of employees requiring annual audiometric testing. Mr./Ms. ( ) no longer works in an environment that exceeds the OSHA Hearing Conservation requirements of exposure at or above 85 dBA. If you have any questions please contact me at 494-9227.