THE UNIVERSITY OF OKLAHOMA
HEARING CONSERVATION PROGRAM

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I. INTRODUCTION

The Occupational Safety and Health Administration (OSHA) has established regulations for the control of occupational noise exposure in 29 Code of Federal Regulations (CFR) 1910.95 for General Industry (see http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735) and 1926.52 for Construction (see http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10625).

The University of Oklahoma (OU) has numerous shops and departments that have equipment or provide maintenance in locations where equipment is operated which may generate high noise levels. Employees of these shops and departments are potentially exposed during activities or while in areas which exceed 85 decibels (dB) when measured with a standard sound level meter on the A-scale (dBA) at slow response.

II. SCOPE

This program applies to all employees of the University of Oklahoma (OU) who may be potentially exposed to noise levels equal to or greater than 85 dBA on the A scale (slow response). Known identified areas or departments include: General Services, Landscape, OU-Norman Power Plant and Facilities Management Operations, OU Health Sciences Center (OUHSC) Steam and Chilled Water Plant (SCWP), and OU-Tulsa Operations. Occupational exposure to noise may also occur though employee use of power tools, lawn equipment, cleaning equipment, or performance of other noisy activities while performing University-related duties.

III. GENERAL

A. When employees will be subjected to sound levels exceeding those listed below in Table 1, engineering and administrative controls will be investigated and recommended by the Environmental Health and Safety Office (EHSO), when feasible.

Table 1 - Permissible Noise Exposures

Hours per Day	Sound Level, dBA
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110

Hours per Day	Sound Level, dBA
0.25 or less	115

B. When employees will still be subjected to sound levels exceeding those listed in Table 1 after use of engineering or administrative controls (where feasible), personal protective equipment (PPE) will be provided and used to reduce sound levels within the levels of the table.

C. Whenever employee noise exposures equal or exceed the action level of an 8-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale, slow response, or, equivalently, a dose of fifty percent, the employee will be included in this hearing conservation program.

D. Employee noise exposures will be computed in accordance with the Tables A-1 and A-2 in Appendix A and without regard to any attenuation provided by use of PPE.

IV. RESPONSIBILITIES

A. The EHSO is responsible for:

1. administering, overseeing, and reviewing the *Hearing Conservation Program*;

2. conducting surveys of areas with potential sound levels greater than or equal to 85 dBA;

3. recommending a selection of personal protective equipment (PPE) to supervisors for their employees;

4. periodically monitoring those employees whose exposure may equal or exceed the action level of an 8-hour TWA of 85 dBA;

5. verifying that the instruments used to measure employee noise exposure are properly calibrated;

6. conducting training classes for those employees covered in this program, (see Section VIII,. *Training*), and

7. maintaining training records required by this program.

B. Supervisors are responsible for:

1. notifying each employee exposed at or above the 8-hour TWA of the results of any monitoring that has occurred;

2. annually scheduling each employee covered in this program for an audiogram at the

recommended medical facility for their campus, and advising the employee of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination;

3. rescheduling any employee for a retest within 30 days of his/her annual audiogram at an appropriate medical facility if the annual audiogram shows that employee has suffered a standard threshold shift;

4. ensuring that the following wear hearing protection:

    a. any employee required by this program to wear hearing protection;

    b. any employee that is exposed to an 8-hour TWA of 90 dBA or greater;

    c. any employee that is exposed to an 8-hour TWA of 85 or greater and has not yet had a baseline audiogram established;

    d. any employee that is exposed to an 8-hour TWA of 85 or greater and has experienced a standard threshold shift; and

    e. all visitors, including other employees, entering any hearing conservation areas;

5. offering a variety of suitable choice of hearing protectors to employees and visitors;

6. notifying the EHSO whenever there is a change in equipment or controls which may increase noise exposures to the extent that:

    a. additional employees may be exposed above 85 dB, or

    b. the hearing protection used by employees may be inadequate to meet the requirements of this program; and

7. ensuring employees covered by this program annually attend a hearing conservation training class.

C. Employees are responsible for:

1. complying with the *Hearing Conservation Program*;

2. attending hearing conservation training sessions annually and other safety training as required;

3. selecting and properly wearing PPE in accordance with safety precautions and donning/doffing instructions communicated to them during training sessions and

other educational programs;

4. complying with the requirement for avoiding high levels of non-occupational noise exposure before audiogram testing; and

5. annually attending audiogram testing at the recommended medical facility identified by their supervisor.

V. MONITORING

A. Noise dosimeters which meet American National Standards Institute (ANSI) standard S.125 1991 will be used to monitor employee exposures.

1. All noise sampling equipment will be calibrated before and after use with the appropriate calibration equipment.
2. Documentation of calibration will be kept in the EHSO records for a minimum of two years.

B. When information indicates that any OU employee's exposure may equal or exceed an 8-hour time-weighted average of 85 decibels, and no current monitoring records for that task or area have already been collected, the EHSO should be notified by the employee's supervisor to monitor employee exposure.

C. Additional monitoring should occur whenever a change in work practices, equipment, or controls increases noise exposure to the extent that:

1. additional personnel may be exposed at or above 85 dBA; or

2. the attenuation provided by hearing protectors being used by employees is inadequate to meet the requirements of this program (see Section VI., *Hearing Protectors*).

D. Area sampling may be done periodically by the EHSO to identify potential problem noise areas. Forms for monitoring are provided in Appendix B.

E. The EHSO shall provide affected employees or their representatives with an opportunity to observe any noise measurements conducted pursuant to this *Hearing Conservation Program*.

VI. HEARING PROTECTORS

A. Hearing protectors shall be made available to all employees who are potentially exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employee. Hearing protectors shall be replaced as necessary at no cost to the employee. Costs associated with this program are an obligation of the employees' department.

B. Employees shall be given the opportunity to select hearing protectors from a variety (a minimum of three of any type or style of plug and/or muff) of suitable hearing protectors provided by the supervisor.

C. The EHSO will evaluate the minimum level of hearing protector attenuation required for employees in accordance with personal dosimetry sampling results. The EHSO will use a sound level meter or dosimeter that is capable of C-weighted measurements to utilize the OSHA method for C-weighted measurement for estimating the adequacy of hearing protector attenuation (see Appendix C).

D. Hearing protectors must attenuate employee exposure at least to an 8-hour time-weighted average of 90 decibels. For employees who have experienced a standard threshold shift, hearing protectors must attenuate employee exposure to an 8-hour time-weighted average of 85 decibels or below.

1. All hearing protection used at OU should have a minimum Noise Reduction Rating (NRR) of 25.

2. Because calculated attenuation values reflect the actual attenuation values only to the extent that the protectors are properly fitted, training of employees by the EHSO will be designed to minimize the problem of improperly fitted or worn hearing protectors.

3. The adequacy of hearing protector attenuation will be evaluated by the EHSO whenever employee noise exposures increase to the extent that the hearing protectors provided may no longer provide adequate attenuation.

E. Dual hearing protection may be issued in situations when warranted.

VII. AUDIOMETRIC TESTING PROGRAM

A. GENERAL

1. Employees whose exposure is equal to or exceeds an 8-hour time-weighted average of 85 dBA will participate in this audiometric testing program.

2. The program is provided at no cost to employees. Costs associated with this program are an obligation of the employees' department.

3. Audiometric tests are to be performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence in administering audiometric examination, obtaining valid audiogram, and properly using, maintaining and checking calibration and proper functioning of the audiometers being used. A technician who performs

audiometric tests must be responsible to an audiologist, otolaryngologist, or physician. Recommended facilities for medical examinations or medical treatment under this program are as follows:

a. Norman Campus

Industrial Mobile Testing Services
12128 Windmill Court
Oklahoma City, Oklahoma 73126
Phone: 800-264-9428 or 405-848-4327

b. OUHSC

Employee Health
OU Physicians Building Suite 2C
825 NE 10th Street
Suite 2C
Oklahoma City, OK
Phone: 405-271-9675

c. OU-Tulsa

MedCenter Immediate Care 2929 South Garnett Tulsa, Oklahoma Phone: 918- 665-1520	or	MedCenter Immediate Care 1623 South Utica Tulsa, Oklahoma Phone: 918-392-5100

4. All audiograms obtained pursuant to this program are required to meet the requirements of OSHA Hearing Conservation Standards, 29 CFR 1910.95 and 29 CFR 1926.52.

B. BASELINE AUDIOGRAM

1. Within 6 months of an employee's date of first exposure at or above 85 dBA, the supervisor is responsible for scheduling an audiogram at a recommended facility to establish a valid baseline audiogram against which subsequent audiograms can be tested.

2. Any employee who has not obtained a baseline audiogram at the end of the 6 month period must wear hearing protection until a baseline has been established.

3. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for the requirements that baseline audiogram be preceded by 14 hours without exposure to workplace noise.

4. The supervisor should also notify the employee to take his/her choice of hearing protection to the recommended facility on the day of the audiometric evaluation so that the healthcare provider may evaluate the fit.

C. ANNUAL AUDIOGRAM

1. At least annually after obtaining the baseline audiogram, each employee exposed at or above an 8-hour time-weighted average of 85 decibels shall receive a new audiogram.

2. Testing for the annual audiogram should be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for the requirements that annual audiogram be preceded by 14 hours without exposure to workplace noise.

D. EVALUATION OF AUDIOGRAM

1. Each employee's audiogram shall be compared to that employee's baseline audiogram to determine whether the audiogram is valid and whether a standard threshold shift has occurred. This comparison will be done by the recommended healthcare provider for each campus.

2. If the annual audiogram shows that an employee has suffered a potential standard threshold shift, the recommended healthcare provider for each campus or the employee’s supervisor should schedule a retest audiogram within 30 days and will consider the results of the retest as the annual audiogram.

3. Unless a physician determines that the standard threshold shift is not work-related or not aggravated by occupational noise exposure, the supervisor shall ensure that the following steps are taken when a standard threshold shift occurs:

   a. If not already notified by the healthcare provider, the employee will be informed of the threshold shift within 21 calendar days of such determination.

   b. The employee who shows a standard threshold shift should be refitted and retrained by the EHSO in the use of hearing protectors and provided with hearing protectors offering greater attenuation.

E. REVISED BASELINE

An annual audiogram may be substituted for the baseline audiogram when, in the judgement of the healthcare provider.

1. the standard threshold shift revealed by the audiogram is persistent, or

2. the hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

F. COMPLIANCE AND RECORDKEEPING

1. Each healthcare provider providing audiometric testing services is responsible for compliance with testing and recordkeeping requirements of the OSHA standard.

2. Each employee will be provided with a copy of the audiometric test results.

3. Summary information from the healthcare provider regarding the audiology test results will be provided to the employee and the employee's supervisor for retention in the employee's personnel file.

VIII. TRAINING PROGRAM

A. Employees covered by this standard will be trained by the EHSO within 30 days of employment and annually thereafter.

B. Training information will include, at a minimum, the following information:

1. the effects of noise on hearing;

2. the purpose of hearing protectors;

3. the advantages, disadvantages, and attenuation of various types;

4. instructions on selection, fitting, use, and care of hearing protectors;

5. the purpose of audiometric testing, and an explanation of the test procedures; and

6. the requirement to not be exposed to workplace noise for 14 hours immediately preceding an audiometric examination.

C. Information provided in the training program shall be reviewed annually and updated to be consistent with changes in protective equipment and work processes.

IX. ACCESS TO INFORMATION AND TRAINING MATERIALS

A. The EHSO or supervisor shall make available to all employees or their representatives copies of the appropriate OSHA Hearing Conservation Standard and shall post a copy in the workplace. The OSHA General Industry Standard (29 CFR 1910.95) is found at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735 and the OSHA Construction Standard (29 CFR 1926.52) is found at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_

id=10625). The OU *Hearing Conservation Program* will also be available for examination by all employees.

B. The EHSO will provide to supervisors and affected employees any informational materials pertaining to the standards that are supplied to OU by the Oklahoma Department of Labor.

C. The EHSO will provide, upon request, all materials related to OU training and education program pertaining to this standard to any requesting official from the Oklahoma Department of Labor.

X. RECORDKEEPING

A. EXPOSURE MEASUREMENTS

1. A report containing results of personal dosimetry exposure measurements will be sent by the EHSO to the supervisor and employee within 15 working days.

2. The EHSO will maintain an accurate record of all noise measurements required by the OU *Hearing Conservation Program* and the OSHA Hearing Conservation Amendment.

3. Noise exposure measurement records will be retained for a minimum of two years.

B. TRAINING RECORDS

The EHSO will maintain all hearing conservation training records for a period of at least three years.

C. ACCESS TO RECORDS

All records required by the *OU Hearing Conservation Program* and the OSHA Hearing Conservation Amendment will be provided to the employee or the employee's representative upon written request. This written request should be sent to the employee's supervisor who will then forward the written request to the appropriate department. All records will be provided to the employee or employee's representative within 15 working days of receipt of the written request.

D. TRANSFER OF RECORDS

If OU ceases to do business, OU will transfer to the another agency of the State all records required to be maintained by OU in this OU *Hearing Conservation Program* and the OSHA Hearing Conservation Amendment.

APPENDIX A

EMPLOYEE NOISE EXPOSURE COMPUTATION

EMPLOYEE NOISE EXPOSURE COMPUTATION

Compliance with the OSHA Hearing Conservation Amendment and the *OU Hearing Conservation Program* is determined by the amount of exposure to noise in the workplace. The amount of such exposure is calculated as an eight hour time weighted average exposure (8-hour TWA) and/or dose (D) from measurements collected either by the use of a sound level meter or an audio dosimeter as follows.

I. DOSE

A. When the sound level (L) is constant over the entire work shift, the noise dose (D) in percent, is given by:

$$D = 100\ C/T$$

where C is the total length of the work day, in hours, and T is the reference duration corresponding to the measured sound level, L, as given in Table A-1 or by the formula $T = 8/2^{(L-90)/5}$.

B. When the work shift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by:

$$D = 100\ (C_1/T_1 + C_2/T_2 + \ldots + C_n/T_n),$$

where C_n indicates the total time of exposure at a specific noise level, and T_n indicates the reference duration for that level as given by Table A-1 or by the formula $T = 8/2^{(L-90)/5}$.

II. TWA

A. For an eight-hour work shift with the noise level constant over the entire work shift, the 8-hour TWA is equal to the measured sound level (L).

B. To convert dose (D), in percent, from either a dosimeter reading or the calculated dose from Section I. above, to an 8-hour TWA, see Table A-2 which applies to dosimeters that are set by the manufacturer to calculate dose or percent exposure according to the relationships in Table A-1, or use the formula:

$$TWA = 16.61\ \log_{10}\ (D/100) + 90$$

TABLE A-1

A-weighted sound level, L(decibels)	Reference duration T(hour)	A-weighted sound level, L(decibels)	Reference duration T(hour)
80	32	106	0.87
81	27.9	107	0.76
82	24.3	108	0.66
83	21.1	109	0.57
84	18.4	110	0.5
85	16	111	0.44
86	13.9	112	0.44
87	12.1	113	0.38
88	10.6	114	0.29
89	9.2	115	0.25
90	8	116	0.22
91	7.0	117	0.19
92	6.1	118	0.16
93	5.3	119	0.14
94	4.6	120	0.125
95	4	121	0.11
96	3.5	122	0.095
97	3.0	123	0.082
98	2.6	124	0.072
99	2.3	125	0.063
100	2	126	0.054
101	1.7	127	0.047
102	1.5	128	0.041
103	1.3	129	0.036
104	1.1	130	0.031
105	16		

TABLE A-2

Dose or percent noise exposure	TWA	Dose or percent noise exposure	TWA
10	73.4	107	90.5
15	76.3	108	90.6
20	78.4	109	90.6
25	80.0	110	90.7
30	81.3	111	90.8
35	82.4	112	90.8
40	83.4	113	90.9
45	84.2	114	90.9
50	85.0	115	91.1
55	85.7	116	91.1
60	86.3	117	91.1
65	86.9	118	91.2
70	87.4	119	91.3
75	87.9	120	91.3
80	88.4	125	91.6
81	88.5	130	91.6
82	88.6	135	92.2
83	88.7	140	92.4
84	88.7	145	92.7
85	88.8	150	92.9
90	89.2	155	93.2
91	89.3	160	93.4
92	89.4	165	93.6
93	89.5	170	93.8
94	89.6	175	94.0
95	89.6	180	94.2
96	89.7	185	94.4
97	89.8	190	94.6
98	89.9	195	94.8
99	89.9	200	95.0
100	90.0	210	95.4
101	90.1	220	95.7
102	90.1	230	96.0
103	90.2	240	96.3
104	90.3	250	96.6
105	90.4	260	96.9
106	90.4	270	97.2

TABLE A-2 cont.

Dose or percent noise exposure	TWA
280	97.4
290	97.7
300	97.9
310	98.2
320	98.4
330	98.6
340	98.8
350	99.0
360	99.2
370	99.4
380	99.6
390	99.8
400	100.0
410	100.2
420	100.4
430	100.5
440	100.7
450	100.8
460	101.0
470	101.2
480	101.3
490	101.5
500	101.6
510	101.8
520	101.9
530	102.0
540	102.2
550	102.3
560	102.4
570	102.6
580	102.7
590	102.8
600	102.9
610	103.0
620	103.2
630	103.0
640	103.4
650	103.5
660	103.6
670	103.7
680	103.8
690	103.9
700	104.0
710	104.1
720	104.2
730	104.3
740	104.4
750	104.5
760	104.6
770	104.7
780	104.8
790	104.9
800	105.0
810	105.1
820	105.2
830	105.3
840	105.4
850	105.4
860	105.5
870	105.6
880	105.7
890	105.8
900	105.8
910	105.9
920	106.0
930	106.1
940	106.2
950	106.2
960	106.3
970	106.4
980	106.5
990	106.5
999	106.6

APPENDIX B

AREA NOISE MONITORING AND DOSIMETRY DATA FORMS

AREA NOISE MONITORING FORM

Building and Room #:_____ **Date**:_____

Project or Action Report #:_____

Noise Sources:_____

_____

Sound Level Meter #:_____

Overall dBA:_____

No.	63	125	250	500	1K	2K	4K	6K	8K

Dosimeter #:_____

Pre-Cal.	Start	Stop	Total	Reading	Post-Cal.

Description of Building Materials

Walls: Concrete / Sheet Rock / Wood / Other:_____ **Floors:** Concrete / Tile / Carpet / Wood / Other:_____

Door: Wood / Metal / Other: _____ **Ceilings**: Concrete / Ceiling Tile / Wood / Acoustic / Other:____

(Room Sketch, Equipment Layout, and Measurement Locations)

PERSONAL NOISE DOSIMETRY FORM

TWA:_____

Employee:_____ **Employee ID #**:_____

Project or Action Report #:_____ **Date**:_____

Department / Shop:_____

Work Performed:_____

_____

_____

_____

Location of Work:_____

_____

Machines / Equipment Used:_____

_____

Dosimeter #:_____

Pre-Cal Start Stop Reading Post Cal.

(Calculations / Notes)

_____

APPENDIX C

METHODS FOR ESTIMATING THE ADEQUACY OF HEARING PROTECTOR ATTENUATION

METHODS FOR ESTIMATING THE ADEQUACY OF HEARING PROTECTOR ATTENUATION

The following methods will be used to estimate the adequacy of hearing protectors.

I. SINGLE PROTECTION (EITHER MUFFS OR PLUGS)

A. Determine the laboratory-based noise attenuation provided by the hearing protection device. This is referred to as the Noise Reduction Rating (NRR) and is listed on the packaging.

B. Subtract 7dB from the NRR if the noise is measured on the A-weighted scale. (Skip this step if noise is measured on the C-weighted scale.)

C. Divide the result of step B (NRR-7) by 2. This is known as "derating".

D. Subtract the result from the measured noise exposure.

E. Determine whether the result is below the applicable level. The protector must reduce employee exposures to at least 90 dB or, for employees who have experienced a significant (standard) threshold shift, hearing protector attenuation must be sufficient to reduce employee exposure to a TWA of 85 dB.

Example for Single Protection

Measured 8-hour TWA noise exposure	93 dBA
A. NRR of hearing protector	26 dB
B. Subtract 7 dB from the NRR	26 dB- 7 dB = 19 dB
C. Divide by 2	19 dB ÷ 2 = 9.5 dB
D. Subtract result from measured noise exposure	93 dBA - 9.5 dB - 83.5 dBA
E. Determine whether result is below required level	83.5 dBA is below 90 and is below 85. This device would be acceptable for all employees

II. DUAL PROTECTION (EAR MUFFS AND PLUGS ARE USED SIMULTANEOUSLY)

A. Determine the laboratory-based NRR for the **higher** rated protector.

B. Subtract 7dB from the NRR if the noise is measured on the A-weighted scale. (Skip this step if noise is measured on the C-weighted scale.)

C. Divide the result of step B (NRR-7) by 2.

D. Add 5 dB to this adjusted NRR to account for the use of the second hearing protector.

E. Subtract the result from the measured noise exposure.

F. Determine whether the result is below the applicable level. The protector must reduce employee exposures to at least 90 dB or, for employees who have experienced a significant (standard) threshold shift, hearing protector attenuation must be sufficient to reduce employee exposure to a TWA of 85 dB.

Example for Dual Protection

Measured 8-hour TWA noise exposure	95 dBA
A. NRR of hearing protector (plug)	26 dB
NRR of muff	20 dB
B. Subtract 7 dB from the NRR of higher rated plug	26 dB- 7 dB = 19 dB
C. Divide by 2	19 dB ÷ 2 = 9.5 dB
D. Add 5 dB	9.5 dB + 5 dB = 14.5 dB
D. Subtract result from measured noise exposure	95 dBA - 14.5 dB - 80.5 dBA
E. Determine whether result is below required level	80.5 dBA is below 90 and is below 85. This device would be acceptable for all employees