NPSafe

Safe Acts & Attitudes Foster Excellence

Hearing Loss Prevention Program Implementation Workshop:

You Should Hear What They're Missing!

TELNPS Participant Guide

Prepared by
NPS Risk Management Division

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How to Interact with the Instructor

We encourage you to ask questions and share your comments with the instructors throughout this TELNPS course.

If you were physically in the classroom with the instructor, you would raise your hand to let him know you had a question or comment. Then you would wait for the instructor to recognize you and ask for your question. We are all familiar with that "protocol" for asking questions or making comments.

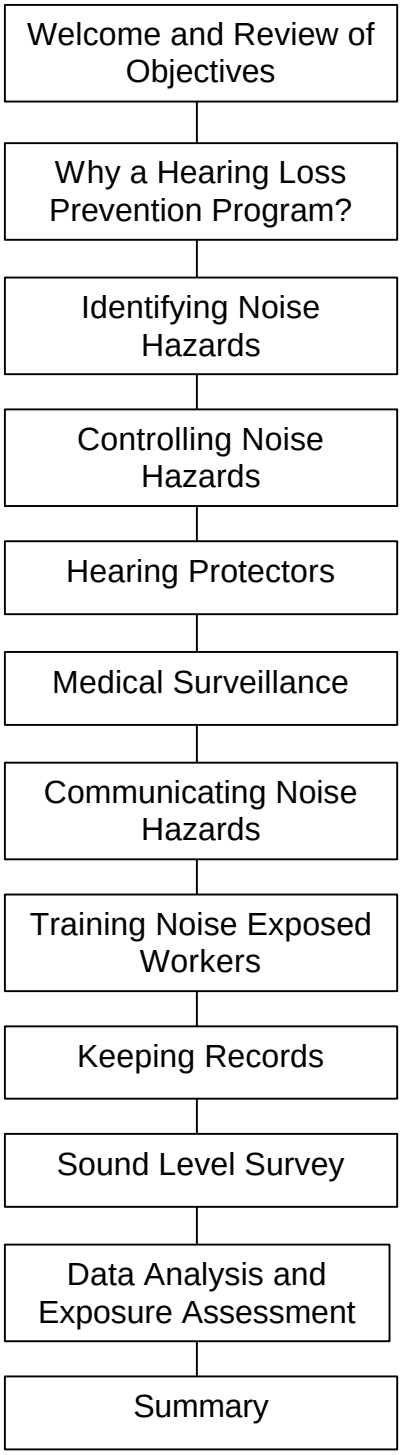
With TELNPS courses there is also a "protocol" to follow to ensure you can easily ask questions and others can participate as well. It may seem a little strange at first asking a question of a TV monitor. Remember, it is the instructor you are interacting with and not the monitor. As you ask more questions and participate in more TELNPS courses, you will soon be focusing only on the content of your question and not the equipment you are using to ask it.

As part of the TEL station equipment at your location, there are several push to talk microphones. Depending on the number of students at your location, you may have one directly in front of you or you may be sharing one with other students at your table.

When you have a question, press the push to talk button and say,
"Excuse me [instructor's first name], this is [your first name]
at [your location]. I have a question (or I have a comment)."
Then release the push to talk button. This is important.
Until you release the button, you will not be able to hear the instructor.

The instructor will acknowledge you and then ask for your question or comment. Stating your name and location not only helps the instructor, but also helps other students who are participating at different locations to get to know their classmates.

Hearing Loss Prevention Program Implementation– Course Map



Course Objectives

At the conclusion of this course, you should be able to--

1. Explain how permanent hearing damage can result from harmful noise levels.
2. Identify other health hazards that may result from harmful noise levels.
3. List the seven elements of a HLP program.
4. Demonstrate how to determine employee noise hazard exposure levels to determine what exposures are acceptable.
5. Identify noise hazards in the workplace.
6. Explain how to control noise hazards through engineering and administrative control measures.
7. Explain how proper use of hearing protectors reduces the risk of NIHL.
8. Determine the appropriate hearing protectors required for a specific noise hazard.
9. Explain the proper care and maintenance program and identify providers of audiometric test services in your area.
10. Explain the role of audiometric testing in a HLP.
11. Explain the park's responsibility to communicate noise hazards to employees.
12. Identify options for conducting employee training on HLP.
13. Identify the documentation required for a HLP program.
14. Demonstrate the correct use of sound level meters when measuring noise hazards.
15. Demonstrate how to properly conduct a sound level survey in the workplace.

Why All the Noise About Noise?
Or Why Implement a Hearing Loss Prevention Program?

Notes

Today's Top Ten List -
What are the top ten noise hazards NPS employees are exposed to on a regular basis?

1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

4. _____ 9. _____

5. _____ 10. _____

Noise Induced Hearing Loss (NIHL) can occur when employees are exposed to average noise levels of ____ dB or greater during an 8-hour workday.

Hearing loss is especially dangerous because it is **painless**; therefore, it can easily become permanent before we detect it and take preventative steps. It is also **progressive**

Other health issues that often accompany hearing loss are:

- Tinnitus
- Fatigue
- Stress
- Heart Disease
- Increased Lost-time Accidents
- Decreased Productivity

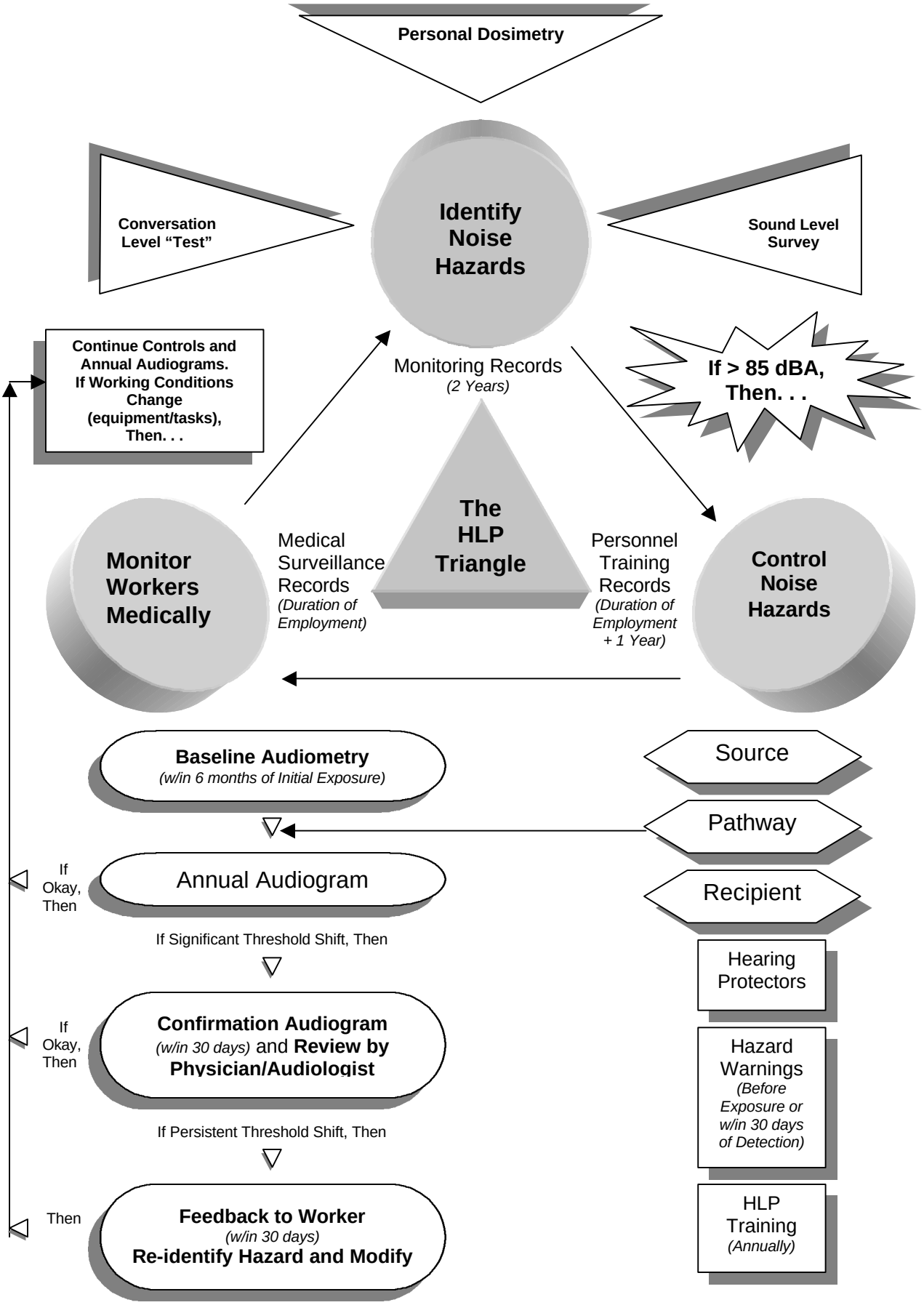
The Seven Elements of a HLP Program

Notes

Seven Elements:

1. Identify Noise Hazards
2. Control Noise Hazards
3. Provide and Use Hearing Protectors
4. Provide Medical Surveillance
5. Communicate Noise Hazards
6. Train Noise Exposed Workers
7. Keep Records

See the flowchart, “The HLP Triangle” on the next page.


Personal Dosimetry
Conversation Level "Test"
Identify Noise Hazards
Sound Level Survey
Continue Controls and Annual Audiograms. If Working Conditions Change (equipment/tasks), Then. . .
Monitoring Records (2 Years)
If > 85 dBA, Then. . .
Monitor Workers Medically
Medical Surveillance Records (Duration of Employment)
The HLP Triangle
Personnel Training Records (Duration of Employment + 1 Year)
Control Noise Hazards
Baseline Audiometry (w/in 6 months of Initial Exposure)
Source
Pathway
Recipient
If Okay, Then
Annual Audiogram
If Significant Threshold Shift, Then
Hearing Protectors
If Okay, Then
Confirmation Audiogram (w/in 30 days) and Review by Physician/Audiologist
Hazard Warnings (Before Exposure or w/in 30 days of Detection)
If Persistent Threshold Shift, Then
Then
Feedback to Worker (w/in 30 days) Re-identify Hazard and Modify
HLP Training (Annually)

Element One: Identifying Noise Hazards in the Workplace

Notes

Three ways of **monitoring employee noise level exposure** are

1. *Conversation level.* If you have to raise your voice to hold a conversation with someone who is within arm's length of you, proceed with more accurate monitoring.
2. *Personal noise monitoring or noise_____*.
3. *Area noise monitoring or _____ level survey.*

The Magic Numbers:

- Any average exposure over ___ dBA we will consider hazardous to the employee and require that we implement a HLP program.
- Any exposure to continuous, intermittent, or impulse noise shall never exceed ___ dBA.

Scenario 1:

How long can Randy work safely at a machine that cranks out an average noise level of 97 dBA? [Refer to Table A1 in Appendix A.]

Scenario 2:

Randy begins work in the carpenter shop. He spends ½hour getting briefing his supervisor and getting assignments for the day while enjoying a cup of coffee. Background noise levels in the break room are 60 dB. Randy begins work in the carpenter shop. He spends 2 hours operating a shaper that produces 87 dB. Then he spends the 2 hours before lunch doing keyboard entry on work orders. Background noise levels in the shop are 75 dB. When he returns after lunch he operates the planer for 1.5 hours. The planer produces 102 dB. Randy finishes his day working on the bandsaw for 1.5 hours and then cleaning up for 30 minutes. The bandsaw produces 98 dB and clean up involves only the shop background noise. What is his *dose* or *daily noise exposure*? Calculate below.
[Refer to Appendix A.2.]

Element Two: Controlling Noise Hazards

Notes

Examples of **Source** Treatment:

- Dynamically balance rotating equipment.
- Maintain equipment in good working order.
- Reduce operating speeds of equipment.
- Control vibratory energy transfer. Energy can be transferred along materials such as a pipe, becoming a problem at considerable distance from the original source. Vibration in one material may also set up reverberations in other materials.
- Eliminate or modify vibrating surfaces of machine casings or apply vibration-dampening materials or isolate vibrating panels.
- Use flexible connectors such as steel springs or elastomeric materials to isolate vibrating equipment, and flexible tubing and cables.
- Install silencers or mufflers or noise cancellation devices. A great example of this is the installation of noise cancellation devices and mufflers on generator equipment. Compressed air lines can be fitted with pneumatic silencers.

Examples of **Path** Treatment:

- Use *sound absorptive materials*. (Absorption coefficient is used to describe a material's ability to absorb sound. A coefficient of 0 means that all of the incoming sound is reflected. A coefficient of 1 means that all of the sound is absorbed by the material. Some examples: Terrazzo floors = 0.02, wood floor = 0.09, 2" polyester foam (2 lb/ft3) = 0.82, glass fiber (1", 3 lb/ft3) = 0.76, Gypsum board ½ nailed to 2X4s = 0.07, and window glass = 0.16).
- Use *acoustical enclosures* or *partial barriers*. (Separate the source and the receiver with walls, set the compressor on a rubber pad to eliminate the floor as an indirect pathway for noise, and suspend pipes and ductwork instead of anchoring it to walls and ceiling.)
- Use *acoustical pipe lagging* for pipes moving high velocity liquids and use *isolating pipe hangers*.
- Create *distance* between the source of the noise and the recipient or worker.

Examples of **Recipient** Treatment:

- Control noise during the *design or procurement* of equipment. (Dealing with these issues upfront can eliminate significant noise hazards and program implementation requirements.)
- *Worker Rotation* or limiting the *duration* of employee exposure to hazardous noise.
- Instruct the employee in the proper use of *hearing protection*.

Element Three: Providing and Using Hearing Protectors

Notes

When worn correctly, hearing protectors will greatly reduce the risk of NIHL by lowering the level of sound that can reach and damage the ear.

Refer to Appendix B for tables comparing and contrasting hearing protectors.

Element Three Continued: Choosing the Right Hearing Protector

Notes

What Do You Think?

Kate operates a piece of equipment that produces a 100 dBA exposure level. She is given muff-type hearing protectors with a 20 dB NRR. What is Kate's "real-world" exposure level? Are the hearing protectors adequate? Calculate below.

How to Calculate Real "Real World" Exposure Levels:
To compensate for known differences between laboratory-derived noise attenuation values and the protection obtained by a worker in real-life situations,

- Subtract 25% of the manufacturer's NRR for earmuffs, 50% for formable earplugs, and 70% for all other earplugs.

Scenario 4:

To remain in compliance with OSHA standards in the case of Kate's hearing protectors, we derate by 25% and then subtract that value from her 100 dBA exposure level. What, then, is Kate's "real-world" exposure level, and are the hearing protectors adequate? What if Kate were given foam ear plugs with an NRR of 20 db? What would her hearing protectors have to be rated off the shelf in order to be adequate in her situation? Calculate below.

K.I.S.S. (Keep It Simple Supervisors!) Keep the park in compliance and protect workers consistently by getting them in the simple routine of:

- *Wearing hearing protectors any time they are exposed to noise at or above 85 dBA*.
- *Wearing double hearing protection (i.e., ear plugs and earmuffs simultaneously) whenever they are exposed to noise at 104 dBA or higher*.

Rule: The best hearing protection is the one that workers will wear correctly.

Element Three Continued: Using Hearing Protectors

Notes

Our training should **motivate** workers to use hearing protectors **correctly** so that the **noise reduction rating** is achieved.

Maintenance and Disposal

- Wash reusable earplugs with soap and water daily. Dry them and store them in a closed container to keep them clean.
- Replace earplugs when they are cracked or worn, brittle or stiff, or no longer fit.
- Wipe earmuffs clean when necessary. Wash foam inserts and rubber cushions with soap and water.
- Replace worn cushion, bent headbands and flaking foam inserts.

Element Four: Providing Medical Surveillance

Notes

Annual Testing – What Gets in the Way?

Because annual testing takes time and money, some would be tempted to let it slide under the philosophies that "ignorance is bliss" and "what we don't know won't hurt us." What are some of the challenges to accomplishing the annual testing? What can you as supervisors do to help overcome some of those challenges?

Once a year, all workers exposed to noise hazardous work conditions are retested to determine changes in hearing relative to the baseline audiogram. When the *audiogram* detects a change in the hearing threshold level in either ear that equals or exceeds an average of 10 dB or more at 2000, 3000, and 4000 Hz, or, there is a change of 15 dB or more at any of the test frequencies (500, 1000, 2000, 3000, 4000, or 6000 Hz) this is referred to as a *significant threshold shift*.

Does She or Doesn't She? The Threshold Shift Question.

Look at the results of Kate's audiometric testing below. Does she or doesn't she have a significant threshold shift? If so, what year did it happen in? Is any follow-up action required?

Annual Audiometric Testing Results			
Frequency	Baseline Testing Hiring	Annual Testing End of 1st Year	Annual Testing End of 2nd Year
500 Hz	10	10	10
1000 Hz	10	10	10
2000 Hz	10	15	20
3000 Hz	15	20	25
4000 Hz	20	30	35
6000 Hz	15	15	20

Element Five: Communicating Noise Hazards

Notes

Go to "Appendix D Noise Hazard Communication."

- Note the information communicated by the sample noise hazard signs.
- Highlight the important numbers that indicate the *who*, *when*, and *where* of noise hazard communication.

Scenario 6:

As Kate's supervisor, you have decided to post noise hazard warning signs. You are having trouble deciding just how many signs to order. What negative results could come from posting too few signs? What negative results could come from posting too many signs? Brainstorm in your site groups for half a minute and note your ideas below:

Caution! Two cautions to remember in using signs are the "_____ phenomenon" and the need to compliance to sign instructions.

Element Six: Training Noise Exposed Workers

The **training program** should address, at a minimum, the following topics:

- The physical and psychological effects of noise and hearing loss.
- Hearing protector selection, fitting, use, and care.
- Audiometric testing.
- The roles and responsibilities of both park and workers in preventing noise induced hearing loss.

Element Seven: Keeping Records

Notes

Identifying noise hazards, evaluating them, and controlling them successfully depend on **three main types of records**:

1. *Area noise and personal exposure monitoring records*—All exposure records from sound level surveys and personal dosimetry must be retained for a period of 2 years.

2. *Medical surveillance records*—These comprise all audiometric test records for each worker including tester identification, conditions of the test, the etiology of any significant threshold shift, and the identification of the reviewer. These records must be retained by the employer for the duration of employment.

3. *Personnel training records*—The park should maintain a record of educational and training programs completed for each worker. On termination of employment, the employer should provide a copy of the training record to the worker. These records must be kept for the duration of the worker's employment plus one year.

Field Trip: Conducting the Sound Level Survey

Notes

Helpful Hints for Getting More Accurate Meter Readings:

- Avoid *physical damage* and *ambient conditions* (water, temperature) that can decrease the sensitivity and frequency response of your SLM microphone.
- Take sound level measurements at the operator's *hearing zone*—with the microphone placed within a couple of inches of the ear.
- Watch your *distance from sound-reflective surfaces*. Avoid standing directly behind the SLM while taking a measurement.
- Avoid standing in front of the microphone where you will cast an *acoustic shadow*. Use of a tripod or position yourself to the side of the path of the noise when taking readings.
- Direct the microphone at recommended "*angle of incidence*"—0 degrees for a directional microphone, 70 degrees for a free-field microphone.
- Remember that *condensing water vapor* can block transmission, for example when storing your instrument in an air-conditioned room and then taking it outdoors on a humid summer day.
- Check calibration at the same *temperature* in which the SLM will be used (usually room temperature). Most SLMs will operate in the range of -13 to +131 degrees F (-25 to +50 C) so this should not impact most of us. However, in relatively extreme temperatures, sensitivity may vary.
- Use a windscreen to reduce *airflow noise*. If using the windscreen lowers the level by 10 dB or more then you know that the reading is dominated by turbulence.

Sound Level Survey Action List:

- ❑ Check to make sure sound level meter is calibrated and functioning properly.
- ❑ Choose site and subject for noise level monitoring.
- ❑ Take sound level readings of 2-3 dozen data points (pieces of equipment).
- ❑ Make sure that you choose pieces of equipment that represent what an employee would use during a normal workday so that you can later calculate his daily exposure.
- ❑ Record data on your "Sound Level Survey Field Data Collection Form," accurately and consistently describing the equipment you are measuring.
- ❑ Post cautionary signs and label equipment and locations >85 dBA to warn of noise hazards.
- ❑ Enter data on spreadsheet at the following website: http://www.govlearning.net/nps

Evaluating the Data and Planning Our Course of Action

Notes

1. Calculate the noise exposure using the "Noise Exposure Dose Calculation Worksheet" in Appendix F.

2. Highlight values that exceed safe exposure limits—85 dBA, 104 dBA, and 140 dBA.

3. Take some time at your site to begin outlining a plan of action for controlling any noise hazardous conditions you identified through the sound level survey. As you do, be aware of the time limits mandated by the HLP Program (see flowchart).

Hearing Loss Prevention Program Implementation Action Items

Element	*Person Responsible*	*Date to Be Completed*	*Remarks*
1 Identify Noise Hazards (Sound level survey, personal noise monitoring)			
2 Communicate Noise Hazards (Post warning signs/labels, Verbal warning)			
3 Control Noise Hazards (Source, Pathway, Recipient Control Measures)			
4 Provide and Use Hearing Protectors (Motivate correct use)			
5 Provide Medical Surveillance (Baseline audiometric testing and annual medical monitoring)			
6 Train Noise Exposed Workers (Educate all exposed workers in all required topics)			
7 Keep Records (Set up system to maintain/access three types of records)			

Summary

Notes

Did we meet the course objectives?

Look at the objectives we set out to meet at the beginning of this course. Highlight the ones that have been met to your satisfaction today. Put a question mark by any you are still unclear about. Let's answer those questions now.

Helpful Resources:

- OSHA Noise and Hearing Conservation Web site. www.osha.gov/sltc/noisehearingconservation.
- NIOSH Hearing Loss Prevention web site. www.cdc.gov/niosh/topic/noise
- NIOSH. 1998. Occupational Noise Exposure: Criteria for a Recommended Standard.
- Berger, E.H., Royster, L.H., Royster, J.D., Driscoll, D.P., and Layne, M., Eds. 2000. The Noise Manual, 5th Ed. AIHA Press, 796 pp.
- Hearnet.com. A non-profit hearing information source for musicians and music lovers. "Hearing protection is a cool thing"—dpb.

Appendix A Exposure Criteria

National Park Service hearing loss prevention programs are based on an occupational exposure limit (OEL) of 85 decibels, A-weighted, (dBA) as an 8-hour time-weighted average (TWA). Exposure to continuous, intermittent, or impulse noise shall never exceed 140 dBC (C-weighted). A hearing loss prevention program will be implemented for all employees whose daily exposure is equal to or greater than 85 dBA TWA.

1. Allowable Exposure.

Occupational noise exposure shall be controlled so that worker exposures are less than the combination of exposure level (*L*) and duration (*T*), as calculated by the following formula, where 5 = the exchange rate and 90 = the OEL, or as shown in Table A1.

$$T(\text{min}) = \frac{480}{2^{(L-85)/3}}$$

Table A1. Allowable exposure duration at given noise levels.

If the noise level is…	…then workers may be exposed for…	
dBA	**Hours**	**Minutes**
85	8	0
86	6	21
87	5	2
88	4	0
89	3	10
90	2	31
91	2	0
92	1	35
93	1	16
94	1	0
95	0	48
96	0	38
97	0	30
98	0	24

If the noise level is…	…then workers may be exposed for…	
dBA	**Hours**	**Minutes**
99	0	19
100	0	15
101	0	12
102	0	9
103	0	8
104	0	6
105	0	5
106	0	4
107	0	3
108	0	2
109	0	2
110-114	0	<1
115-140	0	0

Appendix A Exposure Criteria (continued)

2. Daily Noise Dose.

When the daily noise exposure consists of periods of different noise levels, the daily dose (*D*) shall not equal or exceed 100, as calculated according to the following formula:

$$D = [C_1/T_1 + C_2/T_2 + ... + C_n/T_n] \text{ X } 100$$

where

C_n = total time of exposure at a specified noise level, and

T_n = exposure duration for which noise at this level becomes hazardous.

The daily dose can be converted into an 8-hr TWA according to the following formula (or as shown in Table 1-2):

$$TWA = 10.0 \text{ x } \text{Log}(D/100) + 85$$

3. Monitoring.

Monitoring of the work site or of noisy work tasks shall be conducted to determine the noise exposure levels representative of all workers whose 8-hr TWA noise exposures may equal or exceed 85 dBA. For workers remaining in essentially stationary, continuous noise levels, either a sound level meter or a dosimeter may be used. However, for workers who move around frequently or who perform different tasks with intermittent or varying noise levels, a task-based exposure monitoring strategy may provide a more accurate assessment of the extent of exposures.

Noise exposure is to be measured without regard to the wearing of hearing protectors. In determining TWA exposures, all continuous, varying, intermittent, and impulsive sound greater than 80 dBA shall be integrated into the noise measurements. An exchange rate of 3 will be used.

4. Instrumentation.

Instruments used to measure workers' noise exposures shall conform to the *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983 and S1.4A-1985, Type 2 [ANSI 1983, 1985] or, with the exception of the operating range, to the *American National Standard Specification for Personal Noise Dosimeters*, ANSI S1.25-1991 [ANSI 1991a]. Sound level meters shall be set at SLOW response. Sound level meters shall be calibrated to ensure measurement accuracy.

Appendix B Hearing Protector Selection

Comparing Ear Plugs and Ear Muffs		
	Ear plugs	**Ear muffs**
Compatibility	Glasses, earrings, hair and safety gear do not interfere with the seal.	Acoustic seal against the head can be interrupted by hair, eyeglass temples, safety gear. Can also interfere with hairstyles.
Use in tight spaces	Ideal for tight spaces. Can be used in conjunction with certain safety equipment	Can interfere with movement in tight spaces.
Monitoring Use (compliance)	Difficult for supervisor assure use. Difficult to assess fit.	Use easily checked. Difficult to assess fit
Hot environments	Cooler than muff. Some individuals may experience sweating in ear canal.	May be uncomfortable in hot climates. Sweat likely to buildup under ear cups.
Cold environments	Can be worn under hats and mufflers. Not easily inserted in cold temperatures or gloved hands.	Ear cups can provide warmth. Easily donned and adjusted with gloved hands. Cushions and seals can stiffen in cold temperatures
Storage, portability	Easy to store and carry. Easy to lose	Bulky. Not as easily lost.
Modification	May be readily modified to improve comfort at expense of protection.	Bands may be stretched to relieve pressure, cups may be modified for ventilation, at expense of protection.
Infection, cerumen buildup	Cannot be used if wearer has an ear infection, impacted wax, or ear canal medical condition.	May be used in presence of internal and minor external ear medical conditions. Should not be used when pinna or circumaural skin conditions exist.

Appendix B Hearing Protector Selection (continued)

Advantages and Disadvantages of Hearing Protector Types		
Hearing protector	**Advantages**	**Disadvantages**
Category: Ear Plugs		Small. May be difficult for some with large or blunt fingers to insert
Foam Ear plugs or "Roll-downs"	One size fits most of the population. Even partially fitted, they can provide good seal. Disposable, but may be reused several days if kept clean. Extra small and extra large sizes now available for better fit and comfort Low cost.	Must be rolled with fingers—hand must be clean for insertion so that caustic or irritating substances or sharp or abrasive material are not introduced into ear canal. (How long lasting?)
Pre-molded Ear plugs	Do not require rolling for insertion. Longer lasting than foam (as long as 3 months continuous use).	Rely on flanges or sealing rings to create an acoustic seal—requires several sizes (as many as 5) to properly fit the workforce. Up to 10% of population may require different sizes for right and left ear. Real world attenuation performance low due to difficulty in achieving seal. More expensive than foam.
Formable Ear plugs (cotton/wax, silicon putty)	Malleable silicon earplugs are popular for preventing water entering ear canal during swimming and bathing.	Generally, have little application in the HLP programs. Wax product can be messy to use and leave residue in ear canal. Less flexible—seal can be lost with movement of the jaw.
Custom molded Ear plugs	Less likely to be misinserted in the field. Incorrect insertions easily detected. Customization can serve as incentive to wear earplugs. Generally comfortable to wear (but tighter fit that improves attenuation, decreases comfort).	Good seal in the ear canal relies on adequate hold by the outer ear portion of the mold. Skill and time required to take individual impressions. Often provide less protection than other well-fitted earplugs.
Semi-insert Ear plugs or Canal caps, bands, semi-aural devices	Easily inserted and removed. Conveniently hang on neck when not in use.	"Occlusion effect" may be more pronounced and objectionable. Can lose seal when bumped.
Category: Ear Muffs	Easy to use. One size fits nearly all adult users. Hard hat attachment options available. Good for intermittent exposures. Without the hygiene concerns of earplugs. Use is easily monitored by supervisors.	Unusual features such as prominent cheekbones and depressions behind the jaw may prevent good seal. Require sufficient force to conform to head and provide good seal—headbands will become distorted with time. Attenuation easily compromised by many factors.

Appendix C Medical Surveillance

The park shall provide audiometry to determine hearing threshold levels for all workers whose exposures equal or exceed 85 dBA as an 8-hr TWA. Audiometric tests shall be conducted annually to determine changes in hearing relative to the baseline audiogram.

Audiometric Testing

Workers shall not be exposed to noise levels at or above 85 dBA for a minimum of 14 hr before receiving a baseline audiometric test. Hearing protectors shall not be used in lieu of the required quiet period.

Audiometric tests shall be conducted during the worker's normal work shift.

Audiometric tests shall be performed by a physician, an audiologist, or an occupational hearing conservationist certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC) or the equivalent, working under the supervision of an audiologist or physician.

Audiometric testing shall consist of air-conduction, pure-tone, hearing threshold measures at no less than 500, 1000, 2000, 3000, 4000, and 6000 hertz (Hz). Right and left ears shall be individually tested. The 8000-Hz threshold should also be tested as an option and as a useful source of information about the etiology of a hearing loss.

Audiometric tests shall be conducted with audiometers that meet the specifications of and are maintained and used in accordance with the *American National Standard Specifications for Audiometers*, ANSI S3.6-1996 [ANSI 1996b]. Audiometers shall receive a daily functional check, an acoustic calibration check whenever the functional check indicates a threshold difference exceeding 10 dB in either earphone at any frequency, and an exhaustive calibration check annually or whenever an acoustic calibration indicates the need—as outlined in Section 5.5.2. The date of the last annual calibration shall be recorded on each worker's audiogram.

Audiometric tests shall be conducted in a room where ambient noise levels conform to all requirements of the *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms*, ANSI S3.1-1991 [ANSI 1991b]. Instruments used to measure ambient noise shall conform to the *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983 and S1.4A-1985, Type 1 [ANSI 1983, 1985] and the *American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters*, ANSI S1.11-1986 [ANSI 1986]. For permanent onsite testing facilities, ambient noise levels shall be checked at least annually. For mobile testing facilities, ambient noise levels shall be tested daily or each time the facility is moved, whichever is more often. Ambient noise measurements shall be obtained under conditions representing the typical acoustical environment likely to be present when audiometric testing is performed. Ambient noise levels shall be recorded on each audiogram or made otherwise accessible to the professional reviewer of the audiograms.

Appendix C Medical Surveillance (continued)

Baseline Audiogram

The park shall provide audiometric testing to determine hearing threshold levels for all workers whose exposures equal or exceed 85 dBA as an 8-hr TWA. A baseline audiogram shall be obtained for each worker within 6 months of their initial exposure to noise levels at or above 85 dBA. Audiometric tests shall be conducted annually to determine changes in hearing relative to the baseline audiogram.

Annual Monitoring Audiogram

Audiometric tests shall be conducted annually to determine changes in hearing relative to the baseline audiogram. When the monitoring audiogram detects a change in the hearing threshold level in either ear that equals or exceeds an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear, or, there is a change of 15 dB or more at any of the test frequencies (500, 1K, 2K, 3K, 4K, or 6 K Hz) this is referred to as a *significant threshold shift.*

An optional retest may be conducted immediately to determine whether the significant threshold shift is persistent. In most cases, the retest will demonstrate that the worker does *not* have a persistent threshold shift, thereby eliminating the need for a confirmation audiogram and follow-up action. If a persistent threshold shift *has* occurred, the worker shall be informed that his or her hearing may have worsened and additional hearing tests will be necessary.

Confirmation Audiogram and Follow-up Action

When a worker's monitoring audiogram detects a significant threshold shift, he or she shall receive a confirmation audiogram within 30 days. This confirmation test shall be conducted under the same conditions as those of a baseline audiometric test. If the confirmation audiogram shows the persistence of a threshold shift, the audiograms and other appropriate records shall be reviewed by an audiologist or physician.

If this review validates the threshold shift, the shift shall be recorded in the worker's medical record, and the confirmation audiogram shall serve as the new baseline and shall be used to calculate any subsequent significant threshold shift. Whenever possible, the worker should receive immediate feedback on the results of his or her hearing test; however, in no case shall the worker be required to wait more than 30 days.

When a significant threshold shift has been validated, the park shall take appropriate action to protect the worker from additional hearing loss due to occupational noise exposure. Examples of appropriate action include explanation of the effects of hearing loss, re-instruction and refitting of hearing protectors, additional training of the worker in hearing loss prevention, and reassignment of the worker to a quieter work area.

When the reviewing audiologist or physician suspects a hearing change is due to a non-occupational etiology, the worker shall receive appropriate counseling, which may include referral to his or her physician.

Appendix D Noise Hazard Communication

Warning signs

Warning signs shall be clearly visible at the entrance to, or at the periphery of areas where noise exposures routinely equal or exceed 85 dBA and on equipment that produces noise equal to or greater than 85 dBA.

All warning signs shall be in English and, where applicable, in the predominant language of workers who do not read English. Workers unable to read the warning signs shall be informed verbally about the instructions printed on signs in hazardous work areas of the facility. The warning sign shall textually or graphically contain the following information:

Example 1. Warning sign with text and graphics

Warning

Noise Area
Hearing Hazard

Use of Hearing Protectors Required

Example 2. Warning sign with text only

Worker Notification

All workers who are exposed to noise at or above 85 dBA as an 8-hr TWA shall be informed of their exposure, the associated risk, and protective requirements. When noise measurements are initially conducted and confirm the presence of hazardous noise, or when follow-up noise measurements identify additional noise hazards, workers shall be notified within 30 days. New workers shall be alerted about the presence of hazardous noise before they are exposed to it.

Appendix E Sound Level Survey Field Data Collection Form

Park Alpha Code:				
Park Name:				
Date of Data Collection:				
Shop or Location	Equipment Description	Manufacturer	Model	SPL dBA

Appendix F Noise Exposure Dose Calculation Worksheet

Park:	Division & Shop:
Employee Name	Job Title:
Job Description:	

Subtask	Sound Level dba	Time Exposed (C)	Reference Duration (T)	C/T
Total Hours Accounted For:			Noise Dose	

Reference Exposure Durations

If the noise level is…	…then workers may be exposed for…		If the noise level is…	…then workers may be exposed for…	
dBA	**Hours**	**Minutes**	**dBA**	**Hours**	**Minutes**
85	8	0	99	0	19
86	6	21	100	0	15
87	5	2	101	0	12
88	4	0	102	0	9
89	3	10	103	0	8
90	2	31	104	0	6
91	2	0	105	0	5
92	1	35	106	0	4
93	1	16	107	0	3
94	1	0	108	0	2
95	0	48	109	0	2
96	0	38	110-114	0	<1
97	0	30	115-140	0	0
98	0	24			

Appendix G INDUSTRIAL HYGIENE NOISE DOSIMETRY FORM

Date:

Park: _____
Shop: _____
Location: _____

	1	2	3
Name			
ID #			
Operation			
PPE			
Sample #			
Dosimeter Mfg			
Dosimeter Model			
Dosimeter Serial #			
Calibration Date			
Threshold			
Range			
Exchange Rate			
Pre Field Calib. Check			
Post Field Calib. Check			
Time On			
Time Off			
Sample Time (min)			
8 hour TWA			
Dose			
Predicted Dose			

Acoustic Calibrator	Mfg	Model	Serial #	Calib. Date

Time Course of Events:

Surveyed by: _____ Date: _____