

Department of the Navy



OCCUPATIONAL AUDIOLOGY

HEARING CONSERVATION
TRAINING COURSE:

INSTRUCTOR NOTES

to POWERPOINT TRAINING UNITS

This manual includes the Instructor Notes written for each PowerPoint slide in each training unit. The goal is to provide consistency in information presented and assistance to new instructors. These notes appear in the “Presenter View” screen if this option is available (two screens connected to computer with adaptor). A second setup option is to have two computers: one connected to the classroom projector and one used by the instructor in the “Normal View” to see both the slide and notes. Finally these notes can be modified for personal font preferences and printed for instructor reference.

28 January 2013

Contents

1.1. OVERVIEW OF HCP	3
1.2 PHYSICS OF SOUND	20
1.3 NOISE MEASUREMENT AND CONTROL	42
1.4 ANATOMY AND PHYSIOLOGY OF THE EAR	56
1.5 EAR DISORDERS AND HEARING LOSS	74
1.6 OTOSCOPIC EXAMINATION AND TYMPANOMETRY BASICS.....	109
1.7 AUDIOMETER AND TEST ENVIRONMENT	139
1.8 AUDIOMETRIC TESTING: PROTOCOLS and TESTING.....	158
1.9 AUDIOMETRIC TESTING: RESULTS FOLLOW UP AND REFERRAL	180
1.10 HEARING PROTECTION	203
1.11 HC EDUCATION AND MOTIVATION.....	232
1.12 RECORDKEEPING and HCP EVALUATION.....	245
1.13 REGULATIONS AND COMPENSATION	262
1.14 OHC TECHNICIAN: ROLE and RESPONSIBILITIES	283
CLINICAL ANECDOTES and EXAMPLES	298

**Developed by Dr. Connie Barker and LT Chris Duhon
See Acknowledgments in Student Manual**

1.1. OVERVIEW OF HCP

Slide 1	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>OVERVIEW</u></p>    <p>28 Jan 2013</p>
----------------	---

HEARING CONSERVATION PROGRAM

OVERVIEW and INTRODUCTION

(NEXT SLIDE)

Slide 2	<p><u>LEARNING OBJECTIVES</u></p> <ol style="list-style-type: none">1. Describe the potential effects of noise2. List the purposes of the Hearing Conservation Program (HCP)3. Describe the five elements of the HCP4. Identify the team members of the HCP and their general duties
----------------	--

LEARNING OBJECTIVES

1. Describe the potential effects of noise
2. List the purposes of the Hearing Conservation Program
3. Describe the five elements of the HCP
4. Identify the team members of the HCP and their general duties

(NEXT SLIDE)

Slide 3

Hearing? What's the big deal?



HEARING? WHAT'S THE BIG DEAL?

1. Listen to the following audio clips

(CLICK) TOP AUDIO ICON

2. Normal hearing

(CLICK) BOTTOM AUDIO ICON

3. What a person with a mild hearing loss hears

4. Good hearing equates to:

- a. less safety mishaps, injuries and deaths
- b. more lethal/effective service members
- c. increased mission readiness

(NEXT SLIDE)

Slide 4



NIHL
Noise-Induced
Hearing Loss
#1
Occupational
Health Hazard
in the military

NIHL

1. Noise-Induced Hearing Loss is the #1 Occupational Health Hazard in the military (Veterans Administration Benefits Report 2010).

- a. sudden HL due to "sudden" explosions
- b. gradual progressive HL due to continuous exposure to noise over TIME

2. NIHL negatively affects

- a. Combat and mission readiness
- b. Fitness for Duty

- c. Retention for job specialty
 - d. Quality of life
3. Loss of communication ability, difficulty understanding conversations
 - a. Combination effects of noise and aging
 - b. Hearing aids help, but don't cure
 - c. Ringing in the ears/tinnitus

(NEXT SLIDE)

Slide 5	 <p style="text-align: center;">Financial Impact</p> <p style="text-align: center;">Hearing Loss (as major disability claim) Tinnitus (as major disability claim) Other Known Expenses Related to Hearing Loss</p> <p style="text-align: center;">\$1.8+ Billion (in 2010)</p>
----------------	---

FINANCIAL IMPACT

1. One way to understand some of the financial impact of hearing loss is to look at the VA disability compensation payments.
2. Veterans who claim Hearing Loss as their major disability *PLUS...*
3. Veterans who claim Tinnitus as their major disability *PLUS...*
4. Other Known Expenses Related to Hearing Loss, i.e. professional services, hearing aids, batteries, cochlear implants, etc. *EQUAL...*
5. Over 1.8 Billion Dollars in 2010 (re: Veteran's Administration Benefits Report 2010).
6. It is difficult to equate that vast sum of money to something we can relate to

(NEXT SLIDE)

Slide 6

What could \$1.8+ Billion Buy?

**18+
Joint Strike Fighters
@ \$100M each**



**450+
M1A1 Abram Tanks
@ \$4M each**



**19+
Years of
Employment for
535 elected
Congressmen
and Senators**

WHAT COULD \$1.8+ BILLION BUY?

18+ Joint Strike Fighters @ \$100M each OR.....

450+ M1A1 Abram Tanks @ \$4M each OR.....

19+ Years of Employment for 535 elected Congressmen and Senators @ \$174,000 each/year

(NEXT SLIDE)

Slide 7

Auditory Effects of Noise

- **Loss of hearing sensitivity**
- **Loss of communication ability**
- **Tinnitus or “ringing”**
- **Missing parts of conversation**
- **Slower/Inaccurate localization**

- **Increase errors and safety accidents**
- **Embarrassment, frustration, withdrawal**
- **Possible loss of employment!**

AUDITORY EFFECTS OF NOISE

- 1. Hearing loss does not affect our ability to hear, it affects our ability to understand!**
- 2. Hearing Loss affects our social communication and possibly a person’s comfort in social situations.**
- 3. Tinnitus or “ringing” is generally associated with hearing loss and will likely be constant and permanent**
- 4. Hearing loss causes a person to miss parts of a conversation – this can lead to continual requests for the speaker to repeat or responding inappropriately because the person guessed incorrectly**

5. Hearing Loss will affect how quickly and accurately you are able to localize where sounds originate from.

(CLICK) for arrow

6. Hearing loss increases the chances of errors and safety accidents due to not understanding others, particularly in critical situations.

7. These auditory effects often result in embarrassment and frustration which then can lead to the individual withdrawing from social communication that is part of being part of a work team.

8. The inability to hear accurately and consistently can lead to loss of employment!

(NEXT SLIDE)

Slide 8	<p><u>Non-Auditory Effects of Noise</u></p> <p><u>HEALTH RISKS</u></p> <ul style="list-style-type: none">➤ Raises blood pressure➤ Raises heart rate➤ Increases stress hormone levels➤ Disrupts healthy sleep patterns➤ Above can contribute to obesity <div style="text-align: right;"><p>Noise gets on our NERVES!</p><p><small>8</small></p></div>
----------------	--

NON-AUDITORY EFFECTS OF NOISE

1. Noise not only can cause hearing loss but other health problems too.

2. Research shows that noise can

- a. raises blood pressure
- b. raises heart rate
- c. increases stress hormone levels
- d. disrupts healthy sleep patterns

e. above conditions can contribute to obesity – research has shown stress and lack of effective sleep plus other health disorders have an association with obesity or difficulty maintaining healthy weight or losing weight.

(CLICK)

It is true that Noise Gets on Our Nerves!!!

(NEXT SLIDE)

Slide 9

Hearing Loss Demonstration



AUDITORY EFFECTS OF NOISE – HEARING LOSS DEMONSTRATION

1. Musical selections are filtered to simulate 40 years of progressive noise-induced hearing loss in 5-year increments, with each 5-year increment indicated by a “beep.”
2. At the end of the selection, the filtering is removed.

Linked animated video demonstration file: 14music_rock (0:59)

Musical content on tracks 5 and 12 to 21 is licensed from the respective copyright owners. All Rights Reserved. Unauthorized duplication is a violation of applicable laws. (Need to consult with legal.....not reproducing for sales, only education; plus NASA is part of DOD right?)

(NEXT SLIDE)

Slide 10

THERE IS NO CURE!

NOISE INDUCED HEARING LOSS IS.....

1. NIHL -- usually is Painless -- Means little warning that it is happening
2. NIHL – is Progressive -- Means typically slow and gradual
3. NIHL – is Permanent -- Cannot be fixed with medication or surgery

(CLICK)

4. **THERE IS NO CURE!**

(NEXT SLIDE)

Slide 11

HOWEVER
NOISE INDUCED
HEARING LOSS
IS
PREVENTABLE!

HOWEVER

1. Noise Induced Hearing Loss (NIHL) is Preventable!
2. Those are the Four (4) P's of Hearing Loss – painless, progressive, permanent, and preventable!
3. Why Hearing Conservation Program is essential
 - a. military readiness
 - b. maintaining health and quality of life
 - c. containing medical costs and compensation

(NEXT SLIDE)

Slide 12

Occupational Hearing Conservation Program



- ★ Prevent occupationally related Noise Induced Hearing Loss (NIHL)
- ★ Maintain combat readiness
- ★ Maintain fitness for duty
- ★ Retain job or work specialty
- ★ Reduce cost of hearing loss
- ★ Promote healthy hearing & quality of life

OCCUPATIONAL HEARING CONSERVATION PROGRAM

1. OHCP has six (6) parts to its overall purpose
 - a. prevent occupationally related Noise Induced Hearing Loss (NIHL)
 - b. maintain combat readiness
 - c. maintain fitness for duty
 - d. retain job or work specialty
 - e. reduce cost of hearing loss (\$, social)
 - f. promote healthy hearing and quality of life
2. All these goals are related to
 - a. desired employment
 - b. desired quality of life
 - c. mission readiness

(NEXT SLIDE)

Slide 13



Hearing Conservation Program



FIVE MAJOR ELEMENTS

- 1. Noise Hazard Identification**
- 2. Engineering Controls**
- 3. Audiometric Monitoring**
- 4. Hearing Protective Devices (HPDs)**
- 5. Hearing Conservation Education**

13

HEARING CONSERVATION PROGRAM FIVE MAJOR ELEMENTS

- 1. Noise Hazard Identification**
 - a. identification of noise hazardous work environments and equipment**
 - b. noise hazard levels**
 - i. ≥ 85 dBA steady state/continuous noise**
 - ii. ≥ 140 dBP SPL impulse/impact noise**
 - c. primarily the responsibility of Industrial Hygienist**
- 2. Engineering Controls**
 - a. purpose - reduce or eliminate noise level at source**
 - b. surrounding area: baffles or sound absorbing material - ceiling, walls, floor**
 - c. equipment**
 - i. preventive maintenance**
 - ii. purchase new, quieter**
 - d. isolation**
 - i. noisy equipment from worker**
 - ii. worker from noisy equipment**
 - e. consultation by Industrial Hygienist or Audiologist**
- 3. Audiometric Monitoring**
 - a. reference audiogram (DD 2215)**
 - i. required of all military and civilian personnel**
 - ii. obtained during first 30 days of employment**
 - b. annual audiogram (DD 2216)**
 - i. required of all military and civilian personnel routinely exposed to noise**
 - ii. enrollment in HCP**
 - c. compared to reference audiogram to determine if change (STS) has occurred**
 - d. statistics on amount of STS among a certain population used to determine effectiveness of HCP**
- 4. Hearing Protective Devices (HPDs)**
 - a. must be provided to noise exposed personnel**
 - b. free and easily accessible**
 - c. more than one type for personal preference and effective use -- Navy does have finite number of approved HPDs**
 - d. double protection required in noise levels greater than 96 dBA**
- 5. Hearing Conservation Education**
 - a. initial one (1) hour training required when enrolled in HCP**
 - b. annual training required**

- c. OHC technician must provide “mini” training at time of annual hearing tests
- d. work site supervisors and safety officers responsible for providing regular refresher education

Let's discuss each of these elements in more detail. . . .

(NEXT SLIDE)

Slide 14	#1 <u>NOISE HAZARD IDENTIFICATION</u> 1. Identify potentially hazardous noise sources 2. Determine individuals employed in hazardous noise areas 3. Recommend personnel who should be enrolled in HCP to Command Safety 4. Label noise hazardous areas and equipment with appropriate labels
-----------------	---

HCP ELEMENT #1 NOISE HAZARD IDENTIFICATION

- 1. Identify potentially hazardous noise areas
 - a. ≥ 85 dBA steady state/continuous noise (based on 8 hour TWA measurement)
 - b. ≥ 140 dBP SPL impulse/impact noise
- 2. Determine individuals and/or work space areas exposed to hazardous noise using measurements obtained with dosimeters or sound level meters.

(CLICK)

- 3. Recommend personnel for inclusion in HCP based on noise measurements –
 - a. Safety Officer generates and maintains a roster of employees that are enrolled in HCP from IH Report (recommendations)
 - b. Provides the cognizant MTF the total number of personnel enrolled in the HCP semi-annually.
- 4. Label noise hazardous areas and equipment with appropriate labels

(NEXT SLIDE)

Slide 15

#2 ENGINEERING CONTROLS

1. **PRIMARY** means to reduce or control noise
2. **Dampen, enclose and/or isolate noise**
3. **Use HPD only after engineering controls prove unfeasible or cost prohibitive**
4. **Exceptions: high performance ships , aircraft, tactical vehicles or weaponry**

15

HCP ELEMENT #2 ENGINEERING CONTROLS

1. **Engineering controls are the first or primary means for reducing or controlling noise levels**
2. **Various methods are used to**
 - a. **dampen noise - acoustic treatment of physical properties/characteristics of area**
 - b. **enclosure around noise source**
 - c. **isolate source to fewer personnel**

(CLICK)

3. **Hearing Protection Devices (HPD) are used only after engineering controls prove unfeasible or cost prohibitive**
4. **Exceptions: high performance ships, tactical vehicles, aircraft and/or military weaponry.**

(NEXT SLIDE)

Slide 16

#3 AUDIOMETRIC MONITORING

1. **Conduct annual hearing tests to identify hearing shifts**
2. **Reference and Annual audiograms compared to determine hearing changes**
3. **Determine disposition, referral needs and Fitness for Duty**
4. **Statistics on hearing changes determine HCP effectiveness**

16

HCP ELEMENT #3 AUDIOMETRIC MONITORING

1. **Audiology personnel conduct hearing tests according to required protocols.**
 - a. **OHC Technicians do the routine audiometric monitoring .**
 - b. **Occupational Audiologists perform full audiology evaluation of hearing from a Fitness for Duty perspective.**

2. Reference and Annual audiograms compared to determine hearing changes
 - a. OHC Technicians compare audiograms to determine STS --Significant Threshold Shift--and necessity for follow up testing and referral to audiologist
 - b. Occupational Audiologist compares audiograms to determine PTS --Permanent Threshold Shift.

(CLICK)

3. Determine disposition, referral needs and Fitness for Duty
 - a. OHC Technicians refer to Occupational Audiologists or Medical personnel
 - b. Occupational Audiologists make recommendations about Fitness for Duty and referral for further medical evaluation.
4. Audiologists use statistics on hearing changes to determine HCP effectiveness, i.e. education about hearing conservation, proper use of HPDs, compliance to HCP regulations by the command.

(NEXT SLIDE)

Slide 17	<p>#4 <u>PERSONAL HEARING PROTECTIVE DEVICES</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; padding: 5px;"><u>Single Protection</u></td> <td style="width: 50%; text-align: center; padding: 5px;"><u>Double Protection</u></td> </tr> <tr> <td style="text-align: center; padding: 5px;">Hazardous Noise Levels ≥ 85 dBA</td> <td style="text-align: center; padding: 5px;">Hazardous Noise Levels > 96 dBA</td> </tr> <tr> <td style="text-align: center; padding: 5px;">Insert earplugs OR use earmuffs</td> <td style="text-align: center; padding: 5px;">or ≥ 140 dB Peak SPL</td> </tr> </table> <p style="text-align: center; padding: 5px;">Administrative controls should be combined with double protection when noise > 100 dBA (to have exposure < 8-hour TWA of 85dBA or 140dB)</p>	<u>Single Protection</u>	<u>Double Protection</u>	Hazardous Noise Levels ≥ 85 dBA	Hazardous Noise Levels > 96 dBA	Insert earplugs OR use earmuffs	or ≥ 140 dB Peak SPL
<u>Single Protection</u>	<u>Double Protection</u>						
Hazardous Noise Levels ≥ 85 dBA	Hazardous Noise Levels > 96 dBA						
Insert earplugs OR use earmuffs	or ≥ 140 dB Peak SPL						

HCP ELEMENT #4 PERSONAL HEARING PROTECTIVE DEVICES

1. Single Protection is required in hazardous noise levels .
 - a. greater than or equal to 85 dBA
 - b. use either insert plugs or earmuffs
2. Double Protection is required in hazardous noise levels.
 - a. is greater than 96 dBA (Continuous Noise)
 - b. is greater than or equal to 140 dB Peak SPL ****HIGHLY recommend DOUBLE HPD for all Impulse/Impact (weapons/explosive) situations**
 - c. use combination of insert plugs and earmuffs

(CLICK)

3. Administrative controls should be combined with double protection when noise > 100 dBA

a. goal is to have exposure less than an 8-hour TWA of 85dBA or peak exposure of 140dB

b. administrative controls include reducing exposure time and relocating personnel

(NEXT SLIDE)

Slide 18	<p>#5 <u>EDUCATION and TRAINING</u></p> <p>Regulations Mandate: Initial and Annual Training <i>differences on shore vs. on ship</i></p> <ol style="list-style-type: none">1. Elements and rationale of the HCP2. Effects of noise on hearing3. Purpose, styles, and proper use of various HPDs4. Command and employee responsibilities for HC5. Impact hearing loss may have on career, safety and mission6. Off-duty hearing health practices7. Purpose of hearing tests and procedures <p style="text-align: right; font-size: small;">18</p>
-----------------	---

HCP ELEMENT #5 EDUCATION AND TRAINING

BACKGROUND FOR INSTRUCTOR'S NOTES:

Regulations mandate: Initial and Annual training – differences on shore and on ship

*Per DODI 6055.12, all personnel routinely working in designated hazardous noise areas shall receive annual training on the nine (9) above elements. OPNAVINST 5100.23G states that the “refresher training can be given by local medical personnel at the time of the annual audiogram”, however, given the length of time needed to cover all aspects of the required training, this option is less than ideal.

Initial Training Requirements per OPNAVINST 5100.19E and OPNAVINST 5100.23G

a. Shore Based Training and Education: OPNAVINST 5100.23G – supervisors and HCP enrollees must receive initial and refresher hearing conservation training. This instruction states that the “refresher training can be given by local medical personnel at the time of the annual audiogram”, however, given the length of time needed to cover all aspects of the required training, this option is less than ideal.

b. Shipboard Training and Education: OPNAVINST 5100.19E - the medical department representative (MDR) shall conduct training for all hands during indoctrination. The MDR shall ensure annual, refresher training for the HCP-enrolled personnel is performed. In conjunction with this annual training, the member often receives additional refresher training upon taking the annual audiogram.

c. Annual/Refresher Training Requirements per DoDI 6055.12

For this overview – nine (9) elements from the instructions have been combined into six. All elements and details that must be discussed during the required initial training will be provided later in the course. Some information differs whether training is provided on shore or on ship.

POWERPOINT SLIDE: Required elements of HCP

1. HCP elements and rationale (Initial training only)
2. The effects of noise on hearing
3. Purpose, styles, proper use and maintenance of various HPDs
4. Command responsibilities
5. Individual's responsibilities protecting their own hearing impact hearing loss has on career, safety and mission
6. Off-duty hearing health practices
7. Purpose of hearing tests and procedures (Annual only)

(NEXT SLIDE)

Slide 19	 <u>Occupational Hearing Conservation Team</u> Complies with Instructions Manages CO's Program Conducts Noise Survey & Recommend HCP Enrollment <small>19</small>
-----------------	--

OCCUPATIONAL HEARING CONSERVATION TEAM

OHC Team involves personnel at all levels of command
This is the sequence or process of implementing HCP

1. **Commanding Officer** -- RESPONSIBLE FOR COMPLYING WITH ALL INSTRUCTIONS
 - a. overall responsibility for THEIR HCP
 - b. supported by Safety, IH, Medical, Audiology, Supervisor and Employees
 - c. role model for good HC behaviors
2. **Safety Officers** -- MANAGE CO'S PROGRAMS - makes sure all aspects of HCP available
 - a. report/communicate potential noise hazards to Industrial Hygienist
 - b. monitors HPD use and ensure HCP compliance
 - c. assist supervisors and commanding officers in HCP training
 - d. maintains current rosters of noise exposed personnel and semi-annually provides the cognizant MTF the number of personnel enrolled in the HCP - via data software programs (SAMS, E-SAMS, MRRS)
 - e. ensures all HCP personnel receive required hearing tests
 - f. maintains adequate supply of hearing protection devices at command
3. **Industrial Hygienists** -- NOISE SURVEYS and HCP RECOMMENDATIONS
 - a. perform noise hazard survey

- i. areas – Sound Level Meters
 - ii. individual TWA exposures – Dosimetry
 - b. maintain reports of noise hazard surveys with recommendations and corrective actions
 - c. provide reports to Commanding Officers and Safety Officers/Supervisors
- (NEXT SLIDE)**

Slide 20	 <p>Occupational Hearing Conservation Team cont...</p> <p>Participates and Complies with HCP</p> <p>Monitors Hearing Levels</p> <p>Evaluates Hearing and Fitness for Duty</p> <p style="font-size: small;">20</p>
-----------------	---

OCCUPATIONAL HEARING CONSERVATION TEAM CONT...

1. **Personnel working in noise hazardous environments** -- PARTICIPATES AND COMPLIES WITH HCP
 - a. report for annual and follow-up hearing tests
 - b. attend HCP training
 - c. wear approved, properly fitted HPDs when exposed to hazardous noises (both on/off duty)
 - d. report any hearing problems or difficulties to supervisors

2. **Occupational Hearing Conservation Technician** -- MONITORS HEARING LEVELS
 - a. most important team member – The “Face” of HCP or “Gatekeeper”
 - b. administers air conduction hearing tests to noise exposed personnel
 - c. determines follow-up and appropriate referral needs
 - d. counsels and motivates personnel to practice good HC behaviors – fits/refits HPDs when appropriate
 - e. provide hearing documentation in individual medical records
 - f. provide accurate data to DOEHRS-HC
 - g. perform daily equipment calibrations, maintenance and troubleshooting tasks

3. **Audiologists** –EVALUATES HEARING and FITNESS FOR DUTY
 - a. administer diagnostic hearing evaluations to HCP personnel w/ STS
 - b. counsel patients and refer if necessary for further medical attention
 - c. make recommendations for Fitness for Duty based on hearing thresholds and other HCP criteria
 - d. conduct Hearing Conservation Technician Certification courses

- e. provides guidance, training assistance and support to all other members of HCP team
- f. uses hearing data and statistics to evaluate HCP participation and effectiveness

(NEXT SLIDE)

Slide 21	 <p>Occupational Hearing Conservation Team cont...</p> <p>Completes Medical Referrals</p> <p>Monitors HPD Use & Ensure HCP Compliance</p> <p style="font-size: small;">21</p>
-----------------	--

OCCUPATIONAL HEARING CONSERVATION TEAM CONT...

1. **MD, ENT Specialists, Independent Duty Corpsmen** -- **COMPLETES MEDICAL REFERRALS**
 - a. evaluates and treats outer and middle ear pathologies
 - b. refers patients for audiology medical evaluations

2. **Safety Officer and Supervisor** -- **COMPLETING THE LOOP**
 - a. takes feedback from Medical to input data into SAMS/E-SAMS/MRRS to manage CO's Program.
 - b. monitors HPD use and ensure HCP compliance
 - c. reports hearing injuries to OSHA and/or Navy Safety Center

3. **All team members are essential**
 - a. to carry out OSHA/DOD instructions for the CO's HCP
 - b. to maintain Combat Readiness
 - c. to ensure Quality of Life

(NEXT SLIDE)

Slide 22

OHC Technicians

**Critical Role
in the
Hearing Conservation Program**

**W
H
Y
?**

- ☛ you see personnel first
- ☛ you fit their HPDs
- ☛ you educate and motivate them
- ☛ you answer their questions!

22

OHC TECHNICIANS

1. OHC Technicians play a critical role in achieving the goals and purposes of the Hearing Conservation Program (HCP)

(CLICK)

2. Why?

(CLICK)

3. You see personnel first – for initial reference audiogram and annual hearing testing

4. You fit their hearing protection devices (HPDs)

5. You educate and motivate them during counseling test results and setting up referrals

6. You answer their questions!

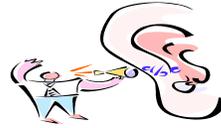
7. The OHC Technician is the “face” or representative of Occupational Audiology for all active military personnel and for civilian personnel enrolled in HCP.

(NEXT SLIDE)

Slide 23

SUMMARY

**The HCP team strives
to protect one of our
most precious abilities:**



**Hearing and
Understanding
“sound and speech”**

23

1.2 PHYSICS OF SOUND

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>PHYSICS OF SOUND</u></p> 
-----------------------	--

PHYSICS OF SOUND

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Explain the parameters of sound and how they are measured.2. Apply the parameters of sound to the sensitivity of the human ear.3. Apply the parameters of speech and sound to an audiogram.4. State the intensity levels related to hazardous noise.
-----------------------	---

LEARNING OBJECTIVES

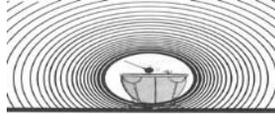
1. Explain the parameters of sound and how they are measured.
2. Apply the parameters of sound to the sensitivity of the human ear.
3. Apply the parameters of speech and sound to an audiogram.
4. State the intensity levels related to hazardous noise.

(NEXT SLIDE)

SLIDE 3

What is Sound? Definition #1 re: Physics

**A rapid variation
in atmospheric pressure
caused by some disturbance or agitation
of air molecules or any elastic medium.**



WHAT IS SOUND?

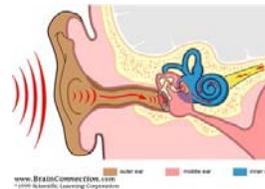
1. We can define sound in two ways: the physical definition and the human hearing definition.
2. Definition #1 re: Physics is a rapid variation in atmospheric pressure caused by some disturbance or agitation of air molecules or any elastic medium.
3. This is the scientific physical definition of sound. Therefore, ...
4. Sound occurs whenever the air molecules are pushed or disturbed into pressure waves regardless of whether any human is around to hear it.

(NEXT SLIDE)

SLIDE 4

What is Sound? Definition #2 re: Human Hearing

**The sensation resulting
from stimulation of the
auditory mechanism
by air waves or other
vibrations transmitted
through the air or other
medium.**



WHAT IS SOUND?

1. Definition #2 re: Human Hearing is the sensation resulting from stimulation of the auditory mechanism by air waves or other vibrations transmitted through the air or other medium.
2. This is the psychological definition of sound.
3. Therefore, sound is heard only when air pressure waves enter the ear and mechanically move the eardrum and other parts of the ear which then stimulates auditory nerves.

(NEXT SLIDE)

<u>SLIDE 5</u>	<p><u>What is Noise?</u></p> <p>Any <i>unwanted</i> sound</p> <p>Definition of “noise” varies from person to person</p> <p>Can be any intensity level but usually louder than conversation level</p> 
-----------------------	--

WHAT IS NOISE?

1. Noise is any sound that is unwanted, irritating, or interferes with desired activity, i.e. talking, listening, sleeping, working, etc.
2. We have all experienced situations when sounds are “noise” to one person but music to another’s ears.
3. According to large numbers of animal and human studies, sound becomes damaging to our hearing at intensity levels of 85 dBA or greater.
4. This number will be more meaningful as we progress through the course.

(NEXT SLIDE)

<u>SLIDE 6</u>	<p><u>Required Elements of Sound</u></p>  <p><i>Path or Medium</i></p>  <p><i>Receiver</i></p>
-----------------------	--

REQUIRED ELEMENTS OF SOUND

(CLICK)

1. The first two elements required for sound to be generated are a source of vibration—something to vibrate . . .and a source of energy or force that makes the object vibrate.

(CLICK)

2. Third, there must be a path or medium – something to carry the vibration.

3. The most common medium for sound is air.

(CLICK)

4. Communication and noise control requires a fourth element – a receiver (person or animal).

(NEXT SLIDE)

SLIDE 7	How Sound Waves Are Made																
	 <i>Source of</i> 1. Energy 2. Vibration	<table><tr><td colspan="2">Radio</td></tr><tr><td>Energy Source</td><td>Electricity</td></tr><tr><td>Vibration Source</td><td>Speaker cone</td></tr><tr><td>Path or Medium</td><td>Air</td></tr></table>	Radio		Energy Source	Electricity	Vibration Source	Speaker cone	Path or Medium	Air							
	Radio																
Energy Source	Electricity																
Vibration Source	Speaker cone																
Path or Medium	Air																
<i>Path or Medium</i>	<table><tr><td colspan="2">Submarine</td></tr><tr><td>Energy Source</td><td>Fuel</td></tr><tr><td>Vibration source</td><td>Propeller</td></tr><tr><td>Path or Medium</td><td>Water</td></tr></table> <table><tr><td colspan="2">Speech</td></tr><tr><td>Energy Source</td><td>Lungs/Muscles</td></tr><tr><td>Vibration Source</td><td>Vocal Cords</td></tr><tr><td>Path or Medium</td><td>Air</td></tr></table>	Submarine		Energy Source	Fuel	Vibration source	Propeller	Path or Medium	Water	Speech		Energy Source	Lungs/Muscles	Vibration Source	Vocal Cords	Path or Medium	Air
Submarine																	
Energy Source	Fuel																
Vibration source	Propeller																
Path or Medium	Water																
Speech																	
Energy Source	Lungs/Muscles																
Vibration Source	Vocal Cords																
Path or Medium	Air																

HOW SOUND WAVES ARE MADE

1. Here are some examples of how sound waves are made.

(CLICK)

2. For a radio to make sound, electricity is the energy source that drives the speaker cone which vibrates making the surrounding air move into a sound wave.

(CLICK)

3. Sound of a submarine is carried through the water – the medium – because the propeller vibrates when it receives power from the engine upon fuel combustion.

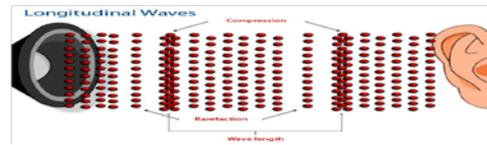
(CLICK)

4. When we talk, the lungs and chest muscles provide force to move air over the vocal cords, causing them to vibrate as sound is created and carried through air.

(NEXT SLIDE)

SLIDE 8

Sound Wave Creation
Alternating series of
high pressure or **compressions** of air molecules
and
low pressure or **rarefactions** of air molecules



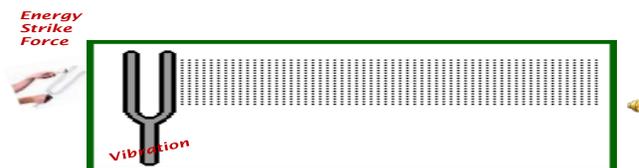
SOUND WAVE CREATION

1. What exactly is happening inside of a sound wave?
2. Sound waves are created by alternating series of high pressure or compressions of air molecules and low pressure or rarefactions of air molecules.
3. All sound waves are made up of single waveforms called sine waves caused by air molecules moving in a distinct pattern.
4. The vibrating speaker diaphragm pushes air molecules close together so there are areas of high molecule density or pressure and areas of low molecule density.
5. The high pressure areas of the wave are called compressions and the low pressure areas are called rarefactions.

(NEXT SLIDE)

SLIDE 9

Sound Wave Animation
Pure Tone or Sine Wave



SOUND WAVE ANIMATION – PURE TONE OR SINE WAVE

1. All sound waves are made up of single waveforms called sine waves caused by air molecules moving in a distinct pattern of compressions and rarefactions.
2. Sine waves can be generated by an electronic oscilloscope. Tuning forks are the closest we can get using a real object to generate a sine wave.

3. Watch the vibrating tuning fork push air molecules so there are areas of high molecule density or pressure and areas of low molecule density.

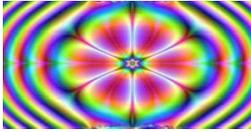
(CLICK AUDIO ICON FOR ANIMATION)

4. Again, you can see the high pressure areas of the wave called compressions and the low pressure areas called rarefactions.

5. This is a pure tone – the simplest most basic sound wave which can only be generated in a lab.

6. In the real world, anything that vibrates has mass and length which creates harmonic sound waves in conjunction with the fundamental frequency of the object.

(NEXT SLIDE)

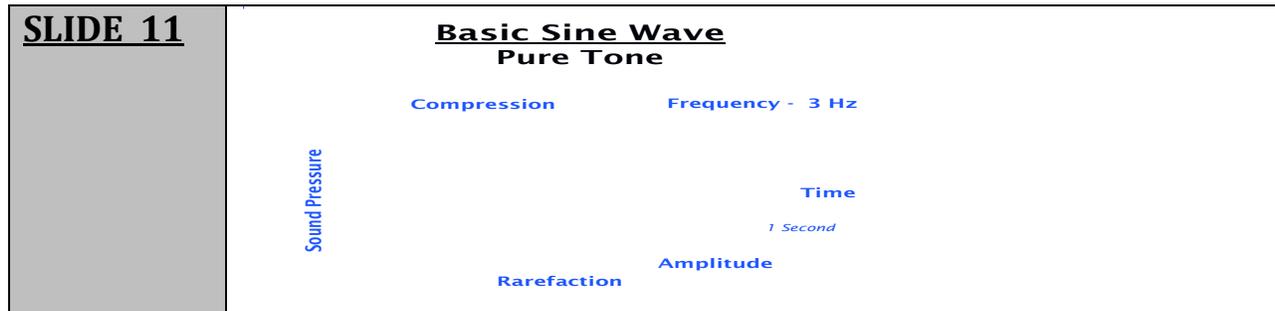
SLIDE 10	<h3><u>Sound Wave Movement</u></h3> <p>Sound waves move out in ALL directions from a vibrating object</p>  <p>Speed of sound increases with density of the medium</p> <table><tr><td>Air</td><td>1,100 ft/sec</td></tr><tr><td>Water</td><td>4,500 ft/sec</td></tr><tr><td>Steel</td><td>15,000 ft/sec</td></tr></table> <p style="text-align: right; font-size: small;">10</p>	Air	1,100 ft/sec	Water	4,500 ft/sec	Steel	15,000 ft/sec
Air	1,100 ft/sec						
Water	4,500 ft/sec						
Steel	15,000 ft/sec						

SOUND WAVE MOVEMENT

1. Sound waves move out from a vibrating object in all directions.
2. However, barriers can interfere with or stop the sound wave.
--- Depending on its power, the sound wave bounces/reflects off of the barrier and causes reverberation or echoes.
3. The speed of sound is dependent on density of the medium – how close the medium’s molecules are bonded to each other.
4. The molecules of a gas, like air are far apart relative to a solid medium like steel.
5. Therefore, it takes longer for the air molecules to move and bump each other into a sound wave.
6. The speed that sound travels increases as the density of the medium increases.
 - a. speed of sound in air is 1,100 feet per second

- b. speed of sound in water is 4,500 feet per second (water is denser than air)
- c. speed of sound in steel is 15,000 feet per second (can hear a train through rails before can hear it coming normally)

(NEXT SLIDE)



BASIC SINE WAVE OR PURE TONE

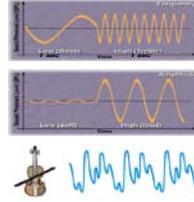
1. This graph identifies the parts of a basic sine wave or pure tone that we have been talking about.
2. First, the wave happens over time – horizontal line – the characteristic of duration.
3. The vibration pushes the air molecules together into a high pressure or compression area.
4. This makes areas of low pressure or rarefactions.
5. These three (3) cycles of compression and rarefaction, over time, determine frequency (3 Hz) and perception of pitch.
6. The height or displacement of the air molecules is the amplitude which determines the intensity of the object and perception of loudness.
7. Sine Waves typically are not considered to have the characteristic of spectrum because it is one basic wave instead of many waves together.

(NEXT SLIDE)

SLIDE 2

Characteristics/Parameters of Sound Waves

1. **Frequency – Pitch**
Measured in Hertz - Hz
2. **Intensity – Loudness**
Measured in decibels - dB
3. **Time -- Duration**
Measured in seconds
or hours (exposure)
4. **Spectrum -- Quality**
Hz – dB – time combined



CHARACTERISTICS OR PARAMETERS OF SOUND WAVES

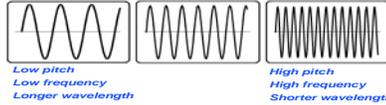
1. Sound has four (4) major paired characteristics or parameters.
 - a. every sound wave has these characteristics/parameters and is described or labeled with these terms.
 - b. first three parameters are measured in specific units of measurement.
2. Frequency is perceived as pitch.
 - a. measured in Hertz, abbreviated as Hz.
 - b. number of complete cycles that occur over a given length within one (1) second.
 - c. picture shows 1 Hz and 8 Hz.
3. Intensity is perceived as loudness
 - a. measured in decibels, abbreviated as dB (little d big B).
 - b. how far the air molecules move or are displaced within the movement cycle.
 - c. picture shows a low intensity soft sound and a louder more intense sound.
4. Duration is perceived as time.
 - a. typically measured in milliseconds and seconds.
 - b. when describing duration of exposure to hazardous noise, duration is measured in minutes and hours.
5. Fourth physical parameter of sound is Spectrum.
 - a. spectrum is all the other three parameters – frequency, intensity and duration – combined.
 - b. remember in the real world, all sources of vibration produce multiple sound waves simultaneously.
 - c. complex waves are perceived as the quality of the sound and is how we identify what or who is making the sound.

(NEXT SLIDE)

SLIDE 13

Frequency Facts

- Frequency is the rate of sound vibration
- Measured in cycles per second or Hertz (Hz)
- Frequency is perceived as pitch
Low frequency = bass pitch
High frequency = treble pitch



FREQUENCY FACTS

- We are being somewhat repetitive for clarity.

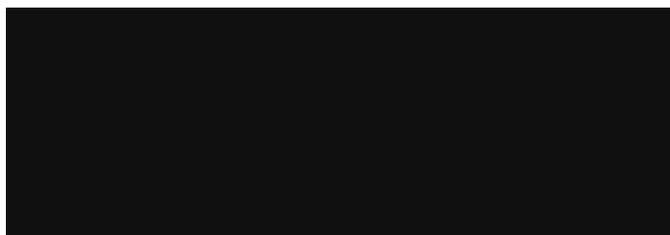
1. Frequency is the rate of vibration or complete cycles of compression and rarefactions occurring within one (1) second).
--- So if 1000 cycles occur in one (1) second, then the sound has a frequency of 1000 Hz.
2. Frequency is perceived as pitch
 - a. small frequency number (Hz) is a low or bass pitch
 - b. large frequency number (Hz) is a high or treble pitch
3. Example: A man's larynx and vocal cords are larger and longer than a woman's larynx and vocal cords.
--- Overall, the man's vocal cords vibrate slower or less cycles per second which is a lower fundamental frequency or perceived pitch than a woman's voice.

INSTRUCTOR: Explain graph as needed.

- (NEXT SLIDE)

SLIDE 14

Musical C Note Octave Pure Tone Sine Waves



MUSICAL C NOTE - OCTAVE PURETONE SINE WAVES

INSTRUCTOR NOTES: There are two links to this video:

1st Option: Click on Picture

2nd Option: If you have internet access, click on text hyperlink

<http://www.youtube.com/watch?v=lKaQzgwxyVg>

1. Here's an example of a Pure Tone Sine Wave.
2. It begins at higher frequencies that most of you may not be able to detect.
3. It decreases in musical C-note octaves that you can hear.
4. You may not be able to detect the lowest frequencies.
5. Notice the amplitude (vertical height) of the sine wave does not change, only the frequencies change.
6. Notice that the longer the sine wave becomes, the lower the pitch or frequency becomes.

(NEXT SLIDE)

<u>SLIDE 15</u>	<p style="text-align: center;"><u>Human Frequency Range</u></p> <ul style="list-style-type: none">▪ Frequency range for humans is 20 - 20,000 Hz▪ Most adults hear maximum of 12,000 Hz▪ Doubling frequency increases pitch one octave▪ Octaves define audiometric test frequencies 500, 1000, 2000, (3000)*, 4000, (6000)* Hz▪ Critical frequencies to understand speech between 500-4000 Hz <p style="text-align: center;"><small>*inter-octave frequency</small></p>	
------------------------	--	--

HUMAN FREQUENCY RANGE

1. The human ear does not hear all frequencies and does not hear all frequencies with equal sensitivity, i.e. dog whistle.
2. Humans who are young and healthy can hear a frequency range of 20 to 20,000 Hz.
3. However, most healthy adults hear about 100 to 12,000 Hz.

(CLICK)

4. Those of you who have studied music are familiar with octaves which relate to changes in pitch.
 - a. an octave is defined as a doubling of frequency.
 - b. typical octaves are 500, 1000, 2000, 4000, 8000 Hz.

c. NOTE: Middle C on the piano is approximately 250 Hz (Middle C usually 256Hz or 262Hz).

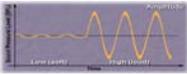
5. The frequencies that are tested during hearing tests are octaves 250 to 8000 Hz. OHC hearing tests assess octaves 500 to 4000 Hz plus the interoctaves 3000 and 6000 Hz.

(CLICK)

6. The frequencies at which we are most sensitive - meaning we can hear at very soft levels -- are ALSO those that are most critical for understanding speech sounds - 500 to 4000 Hz.

7. More about hearing speech later - we need to discuss intensity first.

(NEXT SLIDE)

SLIDE 16	<p style="text-align: center;"><u>Intensity Facts</u></p> <ul style="list-style-type: none">▪ Acoustic power or sound pressure▪ In Audiology <p style="text-align: center;">Intensity is expressed as the sound pressure level - SPL , which is a function of distance that the vibrating object is displaced (amplitude), which depends on energy applied.</p> <ul style="list-style-type: none">▪ Perceived as loudness.▪ Measured in decibels (dB) 
-----------------	--

INTENSITY FACTS

1. Second physical parameter of sound is intensity.
2. Intensity can be measured according to acoustic power or sound pressure levels.
3. Sound pressure level or SPL is how we measure sound intensity as it relates to human hearing.

(CLICK)

4. So in Audiology - Intensity is expressed as the sound pressure level - SPL - which is a function of distance that the vibrating object is displaced or amplitude which depends on energy applied.
5. In the picture, soft low intensity sound would have little height or amplitude, but a louder more intense sounds would have greater height or amplitude (more displacement or movement of the air molecules).

6. Intensity is perceived as loudness and is measured in decibels or dB's.

(NEXT SLIDE)

<u>SLIDE 17</u>	<p><u>The Decibel (dB)</u></p> <p>A <u>decibel (dB)</u> is a measurement unit related to the <u>logarithm of the ratio of two measures:</u> the quantity being measured and a known reference quantity.</p> <p><u>Reference level for Sound Pressure Level (SPL)</u> 20 micropascals (20 μPa), or 0.02 mPa. <i>This amount of pressure is the smallest pressure that will barely move the eardrum.</i></p>
------------------------	---

THE DECIBEL (DB)

1. A decibel (dB) is a measurement unit related to the logarithm of the ratio of two measures: the quantity being measured and a known reference quantity.
2. This means the decibel is not an absolute thing; like a table is so many inches long, or an engine has so many horsepower (start at nothing and count identical units).
3. Instead the dB scale is a ratio between a reference measurement and the quantity of sound that you are measuring.
4. The 0 point or reference for the SPL decibel scale is 20 microPascals for all frequencies.
5. The 0 dB SPL was based on 20 μ Pa across all frequencies. (20 μ Pa was chosen because it is how much sound pressure is required to barely move the eardrum at 1000 Hz.)
6. Or the reference measurement might be the decibel scale we use to test hearing.
7. The hearing decibel scale is called the Hearing Level or HL dB scale. It is adjusted to accommodate human hearing sensitivity which changes across frequencies.
8. Again, the decibel is a LOGARITHMIC RATIO of a reference measurement and the intensity measurement of the sound you are interested in.

(NEXT SLIDE)

SLIDE 18

Why Logarithms?

To compress the very large range of pressure that our ears can hear into a small range of numbers for convenience.

Human intensity range:

0 - 140+ dB SPL

a sound pressure range
of
1:10,000,000 units

WOW!



18

WHY LOGARITHMS?

1. Why is a dB a ratio or logarithmic scale?
2. Remember logarithmic scale means values are multiplied, i.e. $10 \times 10 \times 10 \times 10$.
3. Because we hear such a huge range of intensities - 0 to 140 plus dB SPL
 - a. we can't manage the huge numbers
 - b. numbers up to 9 or more zeros!

(CLICK) (CLICK)

4. That is a ratio of 10 million to 1 sound pressure unit!
5. Logarithm Examples
 - a. compounding interest in the stock market -- offer students 1 cent/day x 30 days or \$10,000 cash now.
 - b. difficulty managing large numbers -- exchanging 1000 us dollars for 1,500,000 Italian lira
6. Using a logarithmic scale or ratio allows us to manipulate the measurements easier.

-
(NEXT SLIDE)

SLIDE 19

<u>Sound Pressure Level SPL</u>		
Sound Pressure Level (decibels dB SPL)		Sound Pressure (micro pascals mPa)
160	JET ENGINE	2,000,000,000
140	PAIN GUN BLAST	200,000,000
120	CHAIN SAW	20,000,000
100	HAMMER DRILL	2,000,000
80	VACUUM CLEANER	200,000
60	CONVERSATION	20,000
40	QUIET ROOM	2,000
20	WHISPER	200
0	HEARING THRESHOLD	20

SOUND PRESSURE LEVEL (SPL)

1. This diagram shows you the relationship of the SPL decibel scale with the actual sound pressure measurements in micro pascals.
2. Notice the logarithmic scale and growth in the dB scale.
--- It is not additive -- 40 dB +10 dB is not 10 more microPascal units but 10 times more!
3. It also gives sample sounds to give an everyday idea of what decibel levels mean.
4. Note that conversation averages about 60 dB SPL, a hammer drill is 100 dB SPL and ear pain is typically experienced at 140 dB HL.
5. 0 dB SPL is typically the softest volume that can be heard, but sound energy is also present below 0 dB.
 - a. intensity range for human hearing range is 0-140 dB SPL.
 - b. 140 dB SPL is the threshold of pain.
 - c. 170-180 dB causes tissue damage.
 - d. 180 dB+ can cause death!
6. DoD and OSHA regulations require hearing protection be worn when sounds are 85 dBA or greater (we will explain the dBA in the next unit).

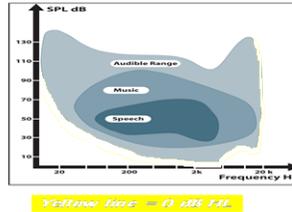
(INSTRUCTOR TIP: You may want to use a favorite dB graph or Noise “thermometer” to provide examples of everyday events or items and their intensities. See Materials List)

(NEXT SLIDE)

SLIDE 20

Hearing Level (HL)

- Reference level based on young adults with healthy ears
- Our ears do not respond equally at all frequencies
0 dB HL ≠ 0 dB SPL
varies by frequency
- Audiogram is flipped
-0 dBHL is on top



HEARING THRESHOLD LEVEL (HL)

1. Our ears are not made to analyze and recreate every sound with perfect fidelity. Ears are made of bone and tissue with various mass and elasticity.
2. The sensitivity of human hearing is not equal at all frequencies.
 - a. most sensitive – can hear almost at 0 dB SPL – at 1000 and 2000 Hz.
 - b. our threshold or beginning of hearing requires more SPL intensity in the low frequencies and very high frequencies.
3. The audibility or hearing range of average human hearing is shown on the SPL graph.
 - Zero dB SPL is on the bottom and 140 dB SPL is at the top of the graph.
4. When testing people, we want to use the normal range of hearing for humans.
5. The hearing threshold decibel scale or dB HL is referenced to this human sensitivity or audibility range.
6. This means that on the Hearing Threshold graph or audiogram, 0 dBHL is NOT the same SPL intensity level at all frequencies.
7. Later we will discuss how we have to account for that when calibrating the hearing testing equipment.

(NEXT SLIDE)

SLIDE 21



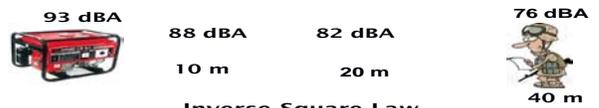
AUDIOGRAM

1. Scientists took the curving sensitivity curve from the preceding SPL graph and made a human testing audiogram in Hearing Level.
2. This is a picture of a hearing evaluation audiogram in graphic form.
3. Notice that 0 dBHL is at the top left corner – so frequency tones across the top of the graph would become more intense or louder as you move down the graph to the bottom.
4. When a person responds to the lowest or least intense sound they can hear, a symbol is placed on the graph at that particular frequency and intensity.

(NEXT SLIDE)

SLIDE 22

Interaction of Intensity and Distance



Inverse Square Law

Doubling the distance from a sound source (in air) **decreases** intensity level by **6 dB***

*applies in far field only, at several meters distance

➤ This principle is used to define noise hazard radius.

INTERACTION OF INTENSITY AND DISTANCE

1. The relationship between sound intensity and distance is described by the Inverse Square Law.

(CLICK)

2. The Inverse Square Law states that when the distance from a sound source is doubled, the intensity level decreases by 6 dB.

3. Intensity is NOT cut in half by doubling the distance but reduces the intensity only by 6 dB.

4. Now this law is only true in far free field – not inside where sound could reflect off surfaces. Let's look at the example . . .

5. In the diagram, at 10 meters (relative near field) the generator's noise level has only been reduced by 5 dB.

(CLICK)

6. However at 20 meters (relative far field), the intensity has dropped a full 6 dB to 82 dBa.

(CLICK)

7. When the distance from the source is doubled to 40 meters, the intensity of the generator decreases only an additional 6 dB to 76 dBA.

8. This principle is used to define noise hazard radius of a sound source.

(NEXT SLIDE)

SLIDE 23

More than One Sound Source #1
Sound Is NOT Additive!

 93 dBA
93 dBA

 96 dBA

➤ Combining two different sound sources of equal loudness will increase overall intensity by 3 dB.

MORE THAN ONE SOUND SOURCE #1

1. As stated previously, sound decibel levels are not additive – remember the dB scale is a multiple logarithmic measurement scale.

2. What happens when there is more than one sound source in the same area generating sound or noise simultaneously?

3. Resulting intensity is NOT the two (2) intensities added together.

4. If they are generating the same intensity level, the combined dB measurement will indicate an increase of 3 dB.

5. Example: the intensities of the two generators individually measure at 93 dBA.

(CLICK)

6. Combined, the overall intensity level is 96 dBA.

(NEXT SLIDE)

SLIDE 24

More than One Sound Source #2
Sound Is NOT Additive!

 93 dBA

 95 dBA

 97 dBA

Combined intensity of two sound sources of unequal loudness will vary with amount of dB difference

Difference in dB Values	Add to Higher Level
0-1 dB	3 dB
2-3 dB	2 dB
4-9 dB	1 dB
10 dB or more	0 dB

MORE THAN ONE SOUND SOURCE #2

1. What happens when the multiple sound sources in the same area generate unequal sound levels simultaneously?

(CLICK)

2. If the two sound sources are generating different intensities, the combined intensity will vary depending on the amount of dB difference.

3. A chart is used to determine how many dBs to add to the more intense sound level.
a. However, when the difference in 10dB or more, the combined intensity will be the level of the more intense sound source - no dB added.
b. But overall PERCEPTION of the combined noise will be TWICE AS LOUD.

4. Example: The two generators are emitting intensities of 93 dBA and 95dBA.
a. Difference is 2-3 dB.
b. According to the chart, add 2 dB to the greater intensity for an overall dB level.

(CLICK)

c. Final combined noise exposure level is $95\text{dBA} + 2\text{dB} = 97\text{ dBA}$.

(NEXT SLIDE)

SLIDE 25



Duration

- Perceived as Time
- Can range from thousandths of a second to several hours or all day
- Occupational noise can be a continuous (steady-state) or an impulse (impact) noise
- Consequences of exposures of hazardous noise levels vary with duration



DURATION

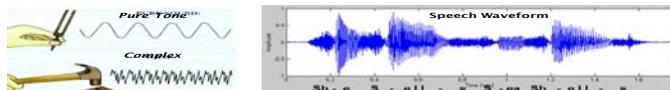
1. Duration is perceived as time and can range from a millionth of a second or, when discussing noise exposure, several hours a day.
2. Occupational noise can be a continuous or steady state sound (engine noise or flight line) or be an impulse noise (gunfire, needle gun, explosion).
3. Noise is defined as hazardous when it's equal to or greater than 85dBA for continuous noise and equal or greater than 140 dBA for impulse noise.
4. Consequences of hazardous noise levels vary with duration of exposure.
5. While hearing injuries due to extreme levels like an explosion may be severe, the majority of hearing injuries are from exposure to continuous noise over long duration.

(NEXT SLIDE)

SLIDE 26

Spectrum

Combination of other three sound characteristics or parameters: frequency, intensity, and duration



Perceived as Quality of sound provides the identification of a sound source

SPECTRUM

1. Spectrum describes the real world sounds that we hear everyday.
2. Spectrum is the complex combination of all components of the sound – all frequencies at all intensities over the duration/time that the sound is generated.

(CLICK)

3. Spectrum is perceived as the quality and tone of the sound.
4. We use the combination of sound characteristics unique to the sound source (vibrator) to identify what it is - a truck passing, a glass breaking, a child crying, a friend's voice, rifle versus handgun fire.
5. These drawings show the differences between a pure sine wave and the spectrum of a hammer striking, a piano note and a person saying "She sells seashells."

(NEXT SLIDE)

SLIDE 27	<p>Physics of Speech</p> <p>Human speech is made of very complex sounds that rapidly occur in patterns that are meaningful to specific populations</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="color: blue; padding-right: 10px;">VOWELS</td> <td> <p>Louder High energy Low frequency 80% of power of speech</p> </td> </tr> <tr> <td style="color: blue; padding-right: 10px;">CONSONANTS</td> <td> <p>Softer Low energy High frequency 80% of understanding of speech</p> </td> </tr> </table>	VOWELS	<p>Louder High energy Low frequency 80% of power of speech</p>	CONSONANTS	<p>Softer Low energy High frequency 80% of understanding of speech</p>
VOWELS	<p>Louder High energy Low frequency 80% of power of speech</p>				
CONSONANTS	<p>Softer Low energy High frequency 80% of understanding of speech</p>				

PHYSICS OF SPEECH

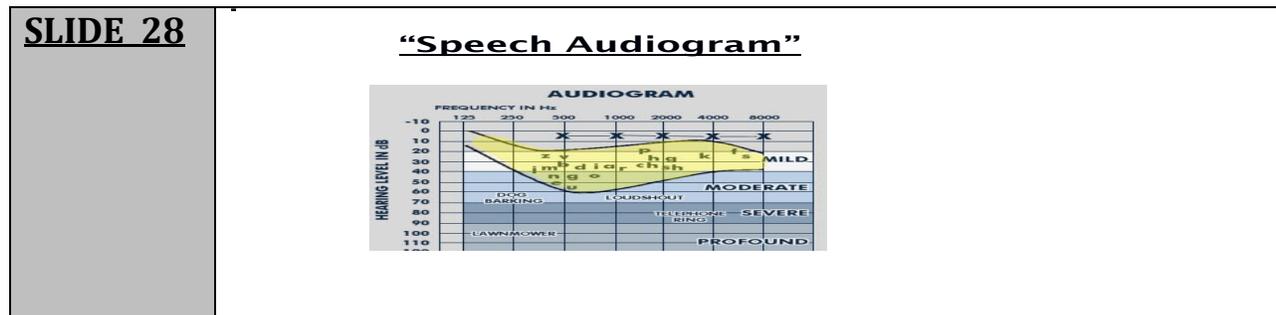
1. Human speech is made of very complex sounds that rapidly occur in patterns that are meaningful to specific populations.
 - a. vibrating air that leaves the vocal folds is modified by the movements of the palate, jaw, tongue and lips.
 - b. therefore, speech sounds in all languages follow similar acoustic rules.
2. Vowels have the following general acoustic characteristics when compared to consonants
 - a. louder sounds
 - b. have higher energy
 - c. have lower frequency components
 - d. carry about 80% of the power of speech utterances
3. In contrast, consonants have the following general acoustic characteristics when compared to vowels
 - a. softer, weaker sounds
 - b. have lower energy
 - c. have higher frequency components than vowels
 - d. carry about 80% of the understanding or intelligibility of speech.

(INSTRUCTOR TIP: Use visual analogy to stress the critical importance of consonants in understanding speech. Write " ee ae ou oe? " and ask for guesses on its meaning.

Then write “Whr r yr shs?” Most students will immediately answer “Where are your shoes?”

4. So how does the physics of speech relate to the hearing audiogram?.....

(NEXT SLIDE)



“SPEECH AUDIOGRAM”

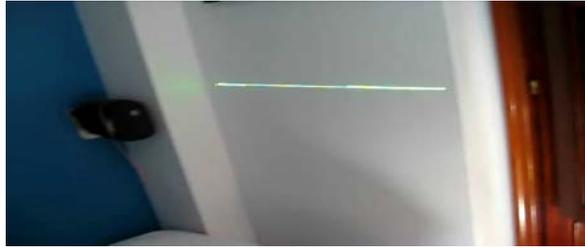
1. This audiogram has many of the English speech sounds plotted according to their frequency and intensity characteristics.
2. As discussed previously, the bulk of the sounds are found between 500 and 4000 Hz (the frequencies listed left to right at the top of the graph).
3. Remember vowels are found mainly in the lower frequencies with greater intensities (carry the power of speech).
4. Although consonants are plotted throughout the highlighted area, the majority are in the higher frequencies, particularly those consonants made without vibrating the vocal cords, i.e. /p/, /h/, /t/, /f/, /sh/.
5. Noise typically damages the high frequencies the most; that is why people with NIHL will have the most trouble knowing the difference between weaker high frequency sounds. Example is “What kind is it?” vs “What time is it?”
6. The ear changes or transduces the complex sounds into frequency, intensity and duration components that are transmitted as nerve impulses to the brain. Analysis and reorganization occurs all along the anatomic pathway to result in meaning within milliseconds of time.
7. It is an astounding event that we all use almost unconsciously everyday!

(NEXT SLIDE)

SLIDE 29

Questions?

[Complex Wave Form via Laser Displayed Oscilloscope](#)



QUESTIONS?

There are two links to this video:

1st Option: Click on Picture

2nd Option: If you have internet access, click on text hyperlink

This is a home mounted laser connected to an oscilloscope, an instrument used to depict sounds waves (energy) from an electrical voltage into a measurable quantity.

(END OF PRESENTATION)

1.3 NOISE MEASUREMENT AND CONTROL

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>NOISE MEASUREMENT and CONTROL</u></p> 
-----------------------	---

NOISE MEASUREMENT and CONTROL

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Define hazardous noise re: military service regulations.2. State the purposes of noise surveys.3. Identify noise measurement equipment.4. Explain the major methods of measuring noise
-----------------------	--

LEARNING OBJECTIVES

1. Define hazardous noise re: military service regulations.
2. State the purposes of noise surveys.
3. Identify noise measurement equipment.
4. Explain the major methods of measuring noise.

(NEXT SLIDE)

SLIDE 3

<u>Hazardous Noise Levels</u>	
Time person can be exposed without hearing protection before there is damage to the ear	
Re: DODINST 6055.12	
Exchange Rate = 3 dB	
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 min
100	15 min
103	7.5 min

HAZARDOUS NOISE LEVELS

1. This chart gives examples of the noise levels in dBA and the amount of exposure time at each level that will damage hearing without protection devices.
2. DoD uses NIOSH's recommendations which are more stringent than OSHA's minimum recommendations.
 - a. NIOSH: the United States' federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness.
 - b. NIOSH is part of the Centers for Disease Control and Prevention (CDC) within the U.S. Department of Health and Human Services.
3. Industrial Hygienists working in the DoD, per the DODINST 6055.12, use NIOSH's recommended 3dB exchange rate of sound level against time.
 - a. exchange rate means that with every 3 dB increase in noise level, the permitted exposure time is halved.
 - b. until recently, the DoD used OSHA's recommended 5dB exchange rate
 - c. a larger exchange rate saves money in the workplace but injures more workers
4. Remember these facts:
 - a. exchange Rate is every 3dB increase = doubles the energy
 - b. every 10dB increase = doubles the "perception" of loudness by the ear

(NEXT SLIDE)

SLIDE 4

<u>What Matters Most ...</u>				
Rustle of leaves	15		85 dBA	8 hrs
Soft whisper	30		88	4 hrs
Normal conversation	55		91	2 hrs
Bird singing	60		94	1 hr
Vacuum cleaner	70		97	30 mins
Normal street traffic	75		100	15 mins
Alarm clock ringing	80		103	7 mins, 30 secs
Heavy city traffic	92		106	~ 3 mins, 45 secs
Punch press	100		109	~ 1 min, 45 sec
Steel plate falling	105		112	~ 1 min
Hard rock music	110		115	~ 30 secs
Jet passing overhead	115		118	~ 15 secs
Jack hammer	120		121	~ 7.5 secs
Jet plane taking off	150		124	~ 3 secs
			127	~ 1 sec

WHAT MATTERS MOST ...

1. What matters most is establishing a concept of noise intensities in our minds.

2. Chart on the left is a list of sound situations and the typical intensity of each.
3. Chart on the right lists the time a person could be exposed to that level of sound before hearing damage occurs (using no hearing protection).
4. Other factors that can increase an individual's susceptibility to Noise Induced Hearing Loss (NIHL) is fatigue, stress, heavy metals, chemical solvents, asphyxiates and drugs.

(NEXT SLIDE)

SLIDE 5	<p><u>Noise Hazard Evaluation</u> <u>“Noise Survey”</u> <i>Details later about each of these purposes</i></p> <ol style="list-style-type: none"> 1. Identify sources of hazardous noise re: equipment, areas, operations 2. Determine if engineering controls can reduce or eliminate noise hazards 3. Identify and label noise hazards 4. Recommend enrollment of personnel in the HCP
----------------	---

NOISE HAZARD EVALUATION Or “Noise Survey”

1. Events that prompt a noise hazard evaluation may include the following:
 - a. new or modified equipment
 - b. new or modified process or procedure
 - c. employees complain of excessive noise and difficulties communicating effectively
 - d. employees complain of muffled hearing and tinnitus after work
 - e. changes in work requirements in hazardous noise
2. There are multiple purposes for a noise hazard evaluation or “noise survey” to be completed.
3. Identify sources of hazardous noise re: equipment, areas, operations
4. Determine if engineering controls can reduce or eliminate noise hazards
5. Identify and label noise hazards
6. Recommend enrollment of personnel exposed to hazardous noise in the HCP

More details later about each of these purposes . . . First, we are going to talk about tools used in conducting a noise survey.

INSTRUCTOR TIP: See resources about Risk Assessment Code (RAC1, RAC 2, RAC-3)

(NEXT SLIDE)

<u>SLIDE 6</u>	<p style="text-align: center;"><u>Responsibility for Noise Surveys</u></p> <ol style="list-style-type: none">1. Industrial Hygienists (IH) have primary responsibility2. Audiologists3. Trained technicians under IH supervision <p style="text-align: center;">OHC Technician is NOT directly responsible for noise evaluation and control</p> 
-----------------------	--

RESPONSIBILITY FOR NOISE SURVEYS

1. Industrial Hygienists (IH) have primary responsibility for conducting noise surveys
2. Audiologists' professional training allows them to conduct noise surveys, although it is not a typical responsibility in the military.
3. OHC Technicians may be trained to assist IH in conducting portions of a noise survey but be under an IH supervision.

(CLICK)

4. NOTE: OHC Technician is NOT directly responsible for noise evaluation and control.

(NEXT SLIDE)

<u>SLIDE 7</u>	<p style="text-align: center;"><u>Noise Measurement Equipment</u></p> <div style="display: flex;"><div style="flex: 1;">  </div><div style="flex: 2;"><p><u>Sound Level Meters (SLM)</u> screen environmental <u>areas</u> or <u>spaces</u> for noise hazards</p><p><u>Dosimeters</u> measure average noise levels an individual <u>worker</u> is exposed to over 8 hours</p><p><u>Octave Band Analyzers</u> measure intensity of specific ranges or bands of frequencies in <u>equipment</u> noise</p></div></div>
-----------------------	--

NOISE MEASUREMENT EQUIPMENT

1. **Sound Level Meters (SLM)** screen environmental areas or spaces for noise hazards
2. **Dosimeters** measure average noise levels that an individual worker is exposed to over 8 hours
3. **Octave Band Analyzers** measure intensity of specific ranges or bands of frequencies in equipment noise.

Let's discuss each of these tools in more detail . . .

(NEXT SLIDE)

SLIDE 8	<p>Sound Level Meter (SLM) Facts</p> <p><i>Two types - Both can be used in HCP</i></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center; vertical-align: top;"> <p><u>TYPE 1</u></p> <p>Precision SLM</p> <p>Very expensive</p> <p>Very accurate ± 1 dB</p> <p>Used for octave band measurements, audiometer calibration, sound booth certification</p> </td> <td style="width: 50%; text-align: center; vertical-align: top;"> <p><u>TYPE 2</u></p> <p>General purpose in field</p> <p>Less expensive - "rugged"</p> <p>Accurate ± 2 dB</p> <p>Used for screening and environmental samples</p> </td> </tr> </table>	<p><u>TYPE 1</u></p> <p>Precision SLM</p> <p>Very expensive</p> <p>Very accurate ± 1 dB</p> <p>Used for octave band measurements, audiometer calibration, sound booth certification</p>	<p><u>TYPE 2</u></p> <p>General purpose in field</p> <p>Less expensive - "rugged"</p> <p>Accurate ± 2 dB</p> <p>Used for screening and environmental samples</p>
<p><u>TYPE 1</u></p> <p>Precision SLM</p> <p>Very expensive</p> <p>Very accurate ± 1 dB</p> <p>Used for octave band measurements, audiometer calibration, sound booth certification</p>	<p><u>TYPE 2</u></p> <p>General purpose in field</p> <p>Less expensive - "rugged"</p> <p>Accurate ± 2 dB</p> <p>Used for screening and environmental samples</p>		

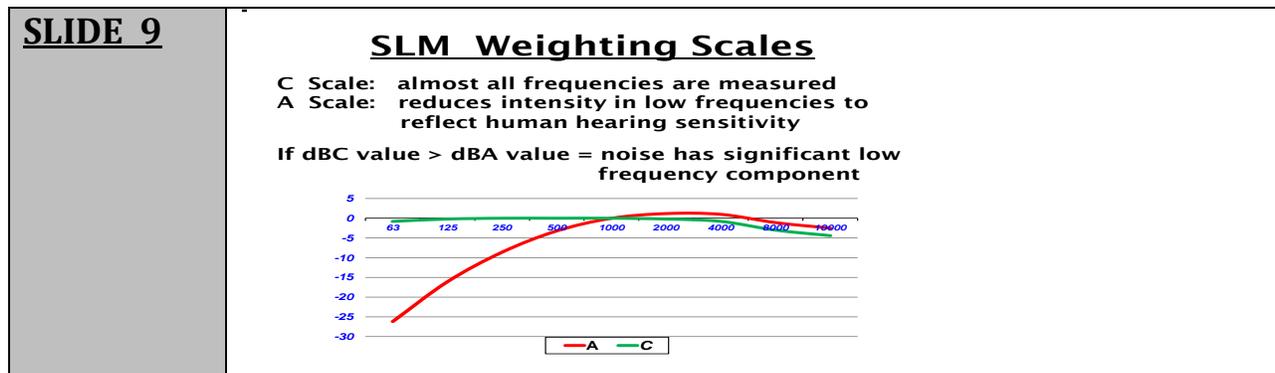
SOUND LEVEL METER (SLM) FACTS

1. There are two types of sound level meters - both types can be used in OHC program depending on the measurement need.
2. TYPE 1 is a precision SLM that provides measurement of sound in a number of ways.
 - a. very expensive - handle with care
 - b. very accurate ± 1 dB
 - c. typically includes an octave band analyzer
 - d. also used to calibrate audiometers and certify sound booth
3. TYPE 2 is a general purpose SLM that screens noise levels in the field.
 - a. less expensive - more "rugged"
 - b. accurate ± 2 dB
 - c. used for screening and environmental samples
4. Taking sound level measurements require attention to details that may affect validity -
 - a. weak battery
 - b. microphone issues - size (larger better for broad frequency ranges), angle and placement of microphone (body baffle, shielding from object or tester's body)
 - c. environmental conditions - humidity and wind noise can affect accurate reception by microphone
 - d. operator errors

ADDITIONAL INFORMATION:

5. A SLM Calibrator is a device that emits 1000 Hz at 70 dB SPL.
 - a. it must be used to check the calibration of the SLM before and after each daily use of the SLM.
 - b. it must be sent into a calibration laboratory itself to be calibrated

(NEXT SLIDE)



SLM WEIGHTING SCALES

1. Sound Level Meters measures sound or noise in dB SPL; however, it's response or sensitivity to sound can be "weighted".
2. The "C Scale" switch will make the SLM measure all frequencies that are present according to 0dB SPL.
3. The "A Scale" switch measures frequencies with a low frequency filter that reflects human hearing sensitivity (reduced in low frequencies).
4. Industrial Hygienist compare the dBC value to the dBA value;
--- if the dBC value is greater than the dBA value, then the noise has a significant low frequency component.

(NEXT SLIDE)

SLIDE 10

Octave Band Analyzer Facts

1. Measures SPL intensity of sound in specific frequency ranges
2. Provides guidance on engineering solutions for noise control
3. Available as part of SLM or as a filtering attachment
4. Used to calibrate audiometers and certify sound booths



OCTAVE BAND ANALYZER FACTS

1. Measures intensity of specific ranges or bands of frequencies in equipment noise.
2. Provides guidance on engineering solutions for noise control
 - a. Example: a machine creates intense low frequency noise but relatively safe levels of high frequency noise.
 - b. An IH uses this data to recommend specific engineering controls to block/reduce the low frequency noise.

(CLICK)

3. Available as part of SLM or as a filtering attachment

(CLICK)

4. Used to calibrate audiometers and certify sound booths

(NEXT SLIDE)

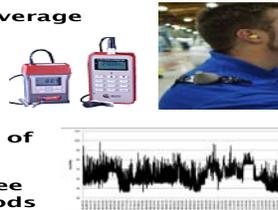
SLIDE 11

Dosimeter – Dosimetry Facts

Measures Time Weighted Average average dBA exposure projected over 8 hrs accounts for noisy & quiet periods

Only reliable method for determining noise dose of individual employees

Dosimeter worn by employee various sampling methods



DOSIMETER – DOSIMETRY FACTS

1. Dosimeters measures “Time Weighted Average” (TWA) for an individual worker exposed to noise over 8 hours.
 - a. average dBA exposure according to the reference of 8 hours work time
 - b. accounts for noisy and quiet periods

(CLICK)

2. Dosimetry is the only reliable method for determining the noise dose of individual employees.
3. A dosimeter is worn by the employee on his/her clothing or in a carrying “pocket”
 - a. microphone must be within a certain distance of the person’s ear

(CLICK)

- b. various sampling methods used
4. TWA samples should be typical of the employee’s regular work day exposures.
5. EXAMPLE: What if a person worked in multiple rooms, some quiet, some with hazardous noise?
 - a. How would the IH determine the worker’s risk exposure without following him/her around all day?
 - b. Person may work in an office for 4 hours/day @ 68dB, an intense area for 1 hour/day @ 99dB and then the hanger for the other 3 hours/day @ 87dB.
 - c. Data in the dosimeter would then be plugged into a PC and a day’s worth of information could be calculated.
6. NOTE: Dosimeter is a general term related to devices that gather data about exposure to a variety of hazards, i.e. noise, radiation, chemical, etc.

(NEXT SLIDE)

SLIDE 12	<p style="text-align: center;">Step 1: Identify Sources of Hazardous Noise</p> <p>A. Hazardous Noise is > 84dBA or ≥ 140 dBA Peak</p> <p>B. Identify primary noise sources by :</p> <table border="0"><tr><td>Screening</td><td>continuous, intermittent, impulse</td></tr><tr><td>Mapping</td><td>noise levels within area</td></tr><tr><td>Time studies</td><td>by location and operations</td></tr><tr><td>Dosimetry</td><td>workers' TWA exposures</td></tr><tr><td>Octave band analysis</td><td>specific frequencies</td></tr></table> <p>C. Identify ototoxins increasing susceptibility to NIHL : heavy metals, organic solvents, asphyxiants, and drugs</p>	Screening	continuous, intermittent, impulse	Mapping	noise levels within area	Time studies	by location and operations	Dosimetry	workers' TWA exposures	Octave band analysis	specific frequencies
Screening	continuous, intermittent, impulse										
Mapping	noise levels within area										
Time studies	by location and operations										
Dosimetry	workers' TWA exposures										
Octave band analysis	specific frequencies										

STEP 1: IDENTIFY SOURCES OF HAZARDOUS NOISE

Now that we have discussed the tools used by an IH to conduct a noise survey, let’s go back to the purposes or steps in completing a full Noise Hazard Evaluation . . .

1. Step One (1) is identify sources of hazardous noise
--- Hazardous noise is defined as intensity levels of sounds ≥ 85 dBA for continuous sound or ≥ 140 dBA peak/impulse sound.

2. Identify primary noise sources by . . .

(CLICK)

- a. screening: continuous, intermittent, impulse (Type 2 SLM)
 - b. mapping: describe noise levels within area (Type 2 SLM)
 - c. time studies: by location and operations (Type 2 or dosimetry)
 - d. dosimetry: workers' TWA exposures (dosimeter)
 - e. octave band analysis: specific frequencies (OBA)
- 3. Identify synergistic exposures.**
- a. noise plus toxins like heavy metals, organic solvents, asphyxiates
 - b. combination of noise with any of these substances can be the catalyst for more hearing loss.

(NEXT SLIDE)

<u>SLIDE 13</u>	<p style="text-align: center;">Step 2: Engineering Controls</p> <ul style="list-style-type: none">A. Defined as controlling noise at the source, blocking the path to receiver or making a change to procedure or process.B. Primary means of protecting personnel from hazardous noiseC. Engineering control study is mandated where workers are exposed to noise > 100 dBA for ≥ 4 consecutive hoursD. Engineering controls include any or a combination of approaches
------------------------	---

STEP 3: ENGINEERING CONTROLS

1. An engineering control is defined as controlling noise at the source, blocking the path to the receiver or making a change to a procedure or process in an effort to reduce the intensity level of the noise.
2. Engineering controls are the primary means of protecting personnel from hazardous noise within constraints of maintaining combat readiness.
3. An engineering control study is mandated to occur where workers are exposed to noise >100 dBA for ≥ 4 consecutive hours.
4. Consider all practical engineering approaches to reduce noise levels to below hazard criteria.

(FOLLOWING SLIDES demonstrate these engineering approaches)

- a. purchase new equipment should have lowest feasible noise levels
- b. modify and perform proper maintenance of current equipment

- c. install barriers for damping and absorption of sound
- d. enclosures for isolation of equipment or the operator
- e. change the process/procedure of an operation

(NEXT SLIDE)

SLIDE 14	<p>Engineering Controls</p> <p>Damping</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Change Procedure or Process</p>
-----------------	---

ENGINEERING CONTROLS

- 1. Damping is the adding of weight to a surface to help reduce its vibration potential.
- 2. Think of a rattling sheet of metal on the side of a machine. If you put your hand on it, the rattle is reduced.
- 3. Change the procedure or process of the operation so noise is reduced

(NEXT SLIDE)

SLIDE 15	<p>Engineering Controls</p> <p>Isolation</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <p>Suspension or Enclosure</p> <p>Barrier & Enclosures</p> </div>
-----------------	---

ENGINEERING CONTROLS

- 1. Isolating the equipment by suspension or enclosure
- 2. Barriers and enclosures between the source of noise and the operator/workers.
 - Equipment may be inside the enclosure or the worker may be inside.

(NEXT SLIDE)

SLIDE 16	Engineering Controls
	Absorption
	 Maintenance
	

ENGINEERING CONTROLS

1. Absorption material can be around the equipment or installed in/on the structures within the work area.
2. Ceiling tiles are the most common type of absorption material in a meeting room.
3. Proper maintenance of equipment can reduce noise intensity – no grinding of gears, etc.

(NEXT SLIDE)

SLIDE 17	Step 3: Label Noise Hazards
	 Signs & labels inform workers when it is necessary to wear hearing protection Signs are placed on doors only if entire space is noise hazardous Exception: no labels on combat equipment and tactical vehicles
	

STEP 2: LABEL NOISE HAZARDS

1. Signs and labels inform workers when it is necessary to wear HPDs.
2. Signs are placed on doors only if entire space is noise hazardous.
3. Signs are placed on individual pieces of equipment as reminders that operation presents a noise hazard.
4. Exception: no labels on combat equipment and tactical vehicles

(NEXT SLIDE)

SLIDE 18

Step 4: Recommend Enrollment of Personnel in the HCP

- A. Enrollment criteria based on ≥ 85 dBA TWA
- B. Absence of noise data does not prevent HCP enrollment
- C. HPD use required in identified hazardous noise areas **regardless** of worker enrollment in HCP
- D. **Administrative Controls** are used to limit exposure time by rotating, removing, substituting workers

18

STEP 4: RECOMMEND ENROLLMENT OF PERSONNEL IN THE HCP

1. The enrollment criteria of an individual worker is based on a routine measurement of ≥ 85 dBA (TWA). Routine exposure is defined as ≥ 85 dBA (TWA) on average more than 2 days in any month.
2. Absence of noise data does not prevent HCP enrollment.
3. HPD use required in identified hazardous noise areas regardless of worker enrollment in HCP.
4. If workers' TWA exposures cannot be reduced ≤ 85 with the use of HPDs, then ADMINISTRATIVE CONTROLS should be used to limit exposure times, either by rotating, removing or substituting workers in areas of hazardous noise.
5. Safety Officer takes recommendations from IH to make up final roster of enrollment.
 - a. CO has discretion to enroll all workers in the command in the HCP.
 - b. Example: On ship, IH has measured some departments as noise hazardous. Workers rotate from area to area. It is difficult to monitor individual workers and their time in each area. Therefore, CO will decide that ALL workers are in HCP (particularly true on smaller ships).

(NEXT SLIDE)

SLIDE 19

Personal Noise Controls



19

PERSONAL NOISE CONTROLS

1. Hearing Protection Devices – earplugs, noise muffs, helmets, etc – are the last type of noise control.
2. Personal HPD use is the least effective for overall noise control because it is dependant on human compliant behavior and proper use.
3. However, this is the type of noise control that you as an OHC Technician will be responsible for on a daily basis –

(CLICK)

--- fitting employees enrolled in the HCP with proper fitting HPDs (particularly earplugs) and educating the employee on their proper use and care.

-
(NEXT SLIDE)

<u>SLIDE 20</u>	<p><u>Hearing Protection Requirements</u> DoD "Action Level"</p> <div style="border: 1px solid red; padding: 5px;"><p>Use of single HPD at noise levels ≥ 85 dBA continuous sound ≥ 140 dBP impulse/impact sound</p><p>Use of double HPD at noise levels > 96 dBA continuous sound</p></div>
------------------------	---

HEARING PROTECTION REQUIREMENTS

1. The Action Level requiring use of hearing protection devices (HPDs) according to DoDI 6055.12, OPNAVINST 5100.19/23 & BUMED NOTE 6260 includes the following:
 - a. ≥ 85 dBA of continuous or steady state sound/noise
 - b. ≥ 140 dBA impulse or impact sound/noise
 - c. > 96 dBA continuous sound requires use of double protection, i.e. earplugs and earmuffs
2. These numbers are based on Time Weighted Average sound level measurements.
3. If HPD does not provide sufficient attenuation, administrative control of exposure shall be necessary, i.e. limiting time working in hazardous noise area.

(NEXT SLIDE)

SLIDE 21

Summary

Measure & Identify

The HCP begins with noise measurement and IDENTIFICATION of noise hazards.

Engineer & Control

HPD

SUMMARY

1. The Hearing Conservation Program begins with noise measurement and identification of noise hazards.
2. The preferred method for noise control is to . have engineer controls ; followed by preventing the noise from entering worker's ears using HPDs.
3. Administrative controls should be used if either of the above doesn't reduce noise $\leq 85\text{dB}$.

(NEXT SLIDE)

SLIDE 22

Questions?



QUESTIONS?

(END OF PRESENTATION)

1.4 ANATOMY AND PHYSIOLOGY OF THE EAR

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>EAR ANATOMY</u> <u>and</u> <u>PHYSIOLOGY</u></p>  
-----------------------	--

EAR ANATOMY AND PHYSIOLOGY

(NEXT SLIDE)

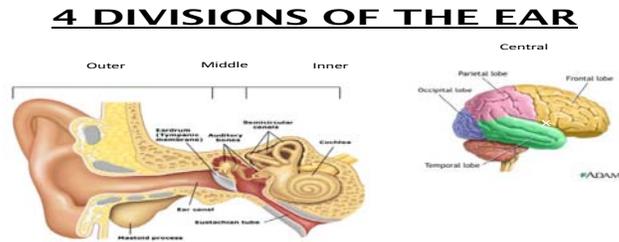
<u>SLIDE 2</u>	<p>LEARNING OBJECTIVES</p> <ol style="list-style-type: none">1. Identify the basic anatomical and functional divisions of the ear.2. Describe the basic anatomical and functional structures of each division.3. Summarize how sound travels through the ear and is transmitted to the brain.
-----------------------	--

LEARNING OBJECTIVES

1. Identify the basic anatomical and functional divisions of the ear.
2. Describe the basic anatomical and functional structures of each division.
3. Summarize how sound travels through the ear and is transmitted to the brain.

(NEXT SLIDE)

SLIDE 3



FOUR (4) DIVISIONS OF THE EAR -

Overview of Whole auditory system >>> 4 major divisions.
Outside to the brain -----

1. Outer Ear
 - a. part you see
 - b. sound collector
2. Middle Ear
 - a. air filled
 - b. mechanical part that transmits sound waves into inner ear
3. Inner Ear
 - a. fluid filled
 - b. real hearing begins with sensory cells
4. Central Auditory System
 - a. nerve fibers carry sound signals through brainstem
 - b. auditory areas in the brain
5. Ear located in temporal bones
 - a. side of the head
 - b. hardest section of bone in body
 - c. mastoid bone
 - i. back wall of outer and middle ear
 - ii. feel hard bulge behind ear/pinna

>>>> Will now discuss each division more closely.

(NEXT SLIDE)

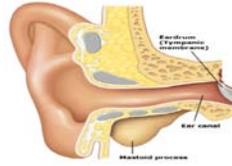
SLIDE 4

DIVISION #1: OUTER EAR

Pinna or Auricle
Visible part
Sound collector
Sound amplifier
Location of sound

External Auditory Canal
Cartilage and bone
Channels sound
Protects eardrum

Note: Mastoid Bone "behind" outer ear



DIVISION #1: OUTER EAR

Outer ear has two major structures

1. pinna - also referred to as the auricle
2. external auditory canal

(CLICK)

Pinna or Auricle

1. Visible part - hang glasses and earrings
2. Main function --- collect sound
3. Amplifier
 - a. higher frequencies
 - b. resonate among ridges and creases
4. Location of sound or what direction sound is coming from
 - a. pinnas on each side of head
 - b. sound arrives at each pinna at slightly different times ---- except directly in front or behind
 - c. brain computes difference --- tells us where sound source is
 - d. ability called localization
 - i. strong developmental skill - safety is basic reason
 - ii. how we test an infant's hearing behaviorally
 - e. unilateral hearing loss - person has to use eyes to find source

(CLICK)

External Auditory Canal - External Auditory Canal/Meatus (EAC or EAM)

1. 1 to 1 ½ inches long - slightly curved
2. Flexible cartilage 1/3 - bone 2/3
 - a. thin skin over bone
 - b. scrubbing ear canal >>>> abrasions, infected

3. Main function is to channel acoustic sound energy to eardrum

4. Protects eardrum

- a. "hidden" back from surface of head
- b. hair and wax deters insects and debris

Note: The mastoid bone or process is located behind the outer ear to provide it with support.

1. It is the hardest bone in the body and protects the inner ear from head trauma.
2. It is full of "holes" or air pockets which can be a reservoir for infection.

(NEXT SLIDE)

SLIDE 5	<p>Division #1 Outer Ear cont...</p> <p>Cerumen or ear wax (and hair)</p> <p>Normal Protects Color varies - age/race</p>  <p><i>OHC Technician concerns: too much cerumen for accurate hearing test and fitting HPDs</i></p>
----------------	---

CERUMEN OR EAR WAX

1. Vital part of ear canal
2. NORMAL and PROTECTS ear canal and eardrum
 - a. anti - fungal
 - b. anti - bacterial
 - c. anti - insects/bugs
3. Made by glands in the skin in cartilage portion
 - a. waxy substance
 - b. color varies
 - i. light yellow/brown when created
 - ii. becomes dark brown when exposed to air over time
 - c. color varies with age (lighter) and race (often matches hue of skin) age and race
4. Amount produced varies with age and race
5. Noxious to insects
6. Catches dust and other airborne particles

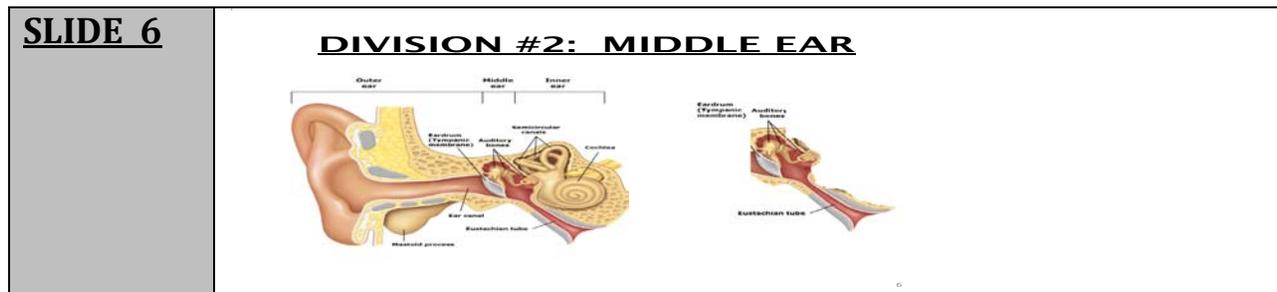
(CLICK)

OHC TECHNICIAN CONCERN – EXCESSIVE CERUMEN

Two (2) situations.

1. Occluded ear canal
 - a. prevents sound from reaching eardrum
 - b. fails hearing test
2. Interferes with correct fitting and use of earplugs.
 - a. use otoscope to check
 - b. daily use of earplugs prevents natural removal --- migration of wax with skin toward exterior of canal
3. Refer to medical officer or physician for removal before follow up testing or referral for audiology evaluation.

(NEXT SLIDE)



DIVISION #2: MIDDLE EAR

1. Air filled
2. Regular ventilation required for.....
 - a. vibration of eardrum and ear bones
 - b. high sensitivity to slightest air/sound vibrations
 - c. healthy tissues and air space
3. Three (3) main structures
 - a. the eardrum or tympanic membrane
 - b. the ear bones or ossicles
 - c. the auditory tube or Eustachian tube.

>>>> Look at each structure -- detail

(NEXT SLIDE)

<u>SLIDE 7</u>	<p>Division #2 Middle Ear cont...</p> <p><u>Tympanic Membrane</u> (eardrum) Vibrates Very sensitive <u>Converts sound energy</u> acoustic mechanical</p> 
-----------------------	--

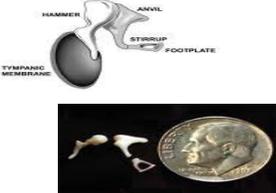
DIVISION #2: MIDDLE EAR ... CONT...

1. First middle ear structure >>>> eardrum or tympanic membrane (TM)
2. Vibrates when sound waves hit it
3. Three (3) different layers
 - a. strong and flexible
 - b. very sensitive and responsive to wide range of frequencies
---- different sections of drum vibrate depending on frequency
 - c. wide range of intensities
---- movement of hydrogen molecule or less than one billionth of atmospheric pressure to 10^{16} (160 dBHL - instant TM perforation)

(CLICK)

4. Main function -- convert or transduce sound energy
---- acoustic sound wave energy to mechanical (vibrating) sound energy

(NEXT SLIDE)

<u>SLIDE 8</u>	<p>Division #2 Middle Ear cont...</p> <p><u>Ossicles</u> - 3 bones Connects eardrum to inner ear Matches impedance Amplifies sound energy 50-60dB</p> 
-----------------------	--

DIVISION #2: MIDDLE EAR ... CONT...

Second main structure of Middle Ear

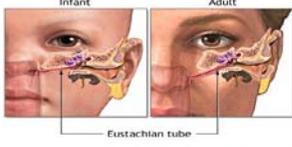
1. Ossicles or three (3) Middle Ear Bones
 - a. malleus (hammer)
 - b. incus (anvil)
 - c. stapes (stirrup)
2. Smallest bones in body – full size at birth

(CLICK)

Three Critical Functions

1. Connects eardrum to inner ear
 - a. vibrates with eardrum
 - b. conducts the vibrations or mechanical sound energy to the opening of inner ear.
2. Matches impedance or density difference between air (outer ear) and fluid (inner ear).
 - a. Loss of 25-30 dB intensity if sound vibrations hit fluid-filled inner ear directly (50-60dBHL on audiogram)
 - b. accomplishes this impedance match by
 - size and shape of each bone
 - linkage
 - lever action
 - area difference between eardrum and footplate of stapes >>> large to small focuses intensity of sound vibrations
3. Middle ear requires air to vibrate/transmit sound energy accurately.
 >>>>>How does fresh air get into the middle ear space?

(NEXT SLIDE)

<u>SLIDE 9</u>	<p>Division #2 Middle Ear cont...</p> <p><u>Eustachian Tube</u></p> <p>“THE EQUALIZER”</p> <p>HEALTHY EAR</p>  <p><small>#ADAM</small></p>
-----------------------	--

DIVISION #2: MIDDLE EAR ... CONT...

1. Eustachian Tube

- a. membranous tube that connects back of nose and upper throat (pharynx) to middle ear space.
 - b. opening near the nose normally closed
 - c. muscles relax when we swallow or yawn
 - d. puff of air travels up to middle ear space
2. Air in the middle ear absorbed by middle ear tissues ---- must be replenished
3. Main function of Eustachian tube
- a. replenishes air in middle ear space so....
 - b. maintains equal air pressure on both sides of eardrum

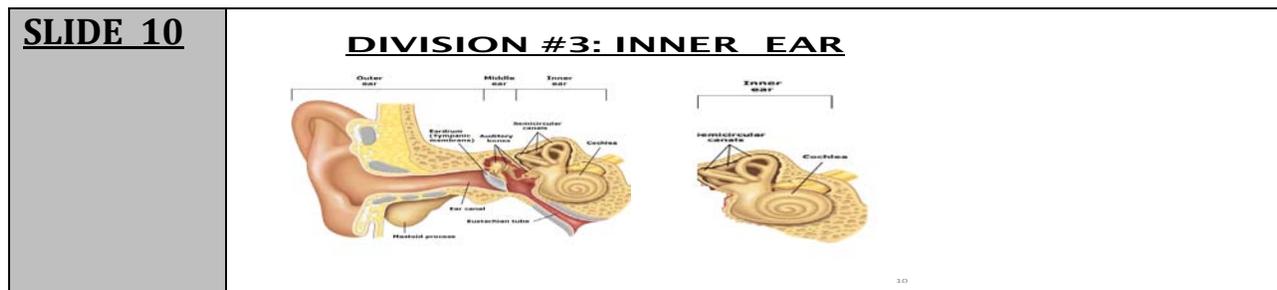
THEREFORE.....

(CLICK)

4. "The Equalizer" maintains healthy ears
- a. healthy tissues
 - b. eardrum and ossicles vibrate normally
5. EXAMPLE:
- a. Flying - change altitude
 - b. Ears feel plugged
 - c. Sound is muffled
 - d. You yawn, drink or chew gum (swallow), do Valsalva (force air up E tube)
 - e. You are using "The Equalizer"!

OPTIONAL: Infant head smaller -- Eustachian tube shorter and more horizontal than adult. Easier for nasal secretions, fluids in mouth to travel up to middle ear. Ear infection is a "childhood disease"—number one reason for pediatrician sick visits. Don't put baby to bed with bottle -fluid may enter in middle ear when baby swallows.

(NEXT SLIDE)



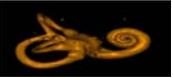
DIVISION #3: INNER EAR

Third major division

Begins “real” hearing – holds the sensory cells and first nerve fibers

Tiny encapsulated structure protected in hardest bone of skull --- the temporal bone.

(NEXT SLIDE)

<u>SLIDE 11</u>		<p style="text-align: right;">Division #3 Inner Ear cont...</p> <p style="text-align: right; font-size: small;">11</p>
------------------------	---	---

DIVISION #3: INNER EAR...CONT....

- 1. Inside curvy bony channels are membranous tubes like tire inner tubes**
 - a. filled with fluid**
 - b. two (2) major structures within Inner Ear**

- 2. Cochlea is snail looking structure – responsible for hearing**
--- contains sensory cells that respond to sound energy (now fluid or hydraulic energy).

- 3. Vestibular system is the oldest mechanism in living organisms that move >>> balance mechanism**
 - a. humans have three (3) semicircular canals and 2 other small sensory areas**
 - b. responsible for providing information related to head movement.**
 - c. We will discuss more details later.**

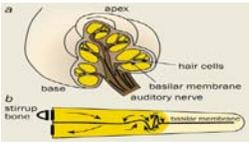
- 4. The cochlea has two (2) openings or windows covered with membranes.**
 - a. oval window**
 - i. last ossicle/stapes rocks in and out**
 - ii. causes the cochlear fluid to move in waves through “tube”**
 - b. round window**
 - i. located in lower part of middle ear wall**
 - ii. pressure release “valve” as fluid waves move through cochlea**

- 5. The cochlea has membranous tubes or tunnels filled with different fluids**
 - a. Organ of Corti is located inside of the most inner tube or tunnel**

- b. It has several critical structures and very specific chemicals in the fluids.
6. Inside the Organ of Corti are rows and rows of sensory “hair” cells
- a. hair cells are embedded in a flexible membrane which moves with the inner ear fluid movements/vibrations
 - b. this begins the analysis of frequencies and intensities of complex sound

Let's discuss the cochlea in more detail.....

(NEXT SLIDE)

SLIDE 12	<div style="text-align: center;"> <p>Division #3 Inner Ear cont...</p>  </div> <div style="text-align: center;"> <p>Cochlea Organ of Corti - inner tube Orderly sensitivity High Hz - base Low Hz -- tip Converts sound energy mechanical-hydraulic electrical</p> </div> <div style="text-align: center;">  </div>
-----------------	---

DIVISION #3 INNER EAR...cont...

1. Cochlea - (again) Snail shape with several turns filled with fluid
 - a. size of a green pea
 - b. inner tube or tunnel that contains the Organ of Corti
2. Sensitivity of sensory cells is very orderly like a piano keyboard
 - a. oval window base responds to high frequencies
 - b. middle part responds to mid frequencies
 - c. tip or apex responds to lower frequencies

(CLICK)

3. Main function of cochlea is to convert mechanical (hydraulic sound energy) into electrical energy
4. Breaks down complex sound into individual ...
 - a. frequencies
 - b. intensities
 - c. time and sequence elements

Here is a short video that demonstrates a sound wave entering the ear and stimulating the cochlea. It shows how different frequencies stimulate different sections of the Organ of Corti .

(NEXT SLIDE)

<u>SLIDE 13</u>	<p><u>Frequency Sensitivity in the Cochlea</u> <i>high frequencies at narrow base (opening) low frequencies at wider apex (tip)</i></p>  <p>53</p>
------------------------	---

FREQUENCY SENSITIVITY IN THE COCHLEA

High frequencies at narrow base (opening)

Low frequencies at wider apex (tip).

INSTRUCTOR NOTE: There is no audio until basal membrane unrolled.

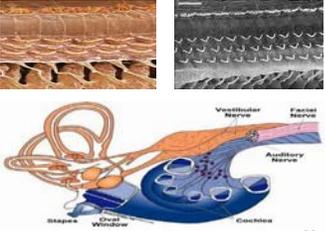
There are two links to this video:

1st Option: Click on Picture

2nd Option: If you have internet access, click on text hyperlink

http://www.youtube.com/watch?v=dyenMluFaUw&feature=player_detailpage Piano Cochlea - Frequency Sensitivity in the Cochlea

(NEXT SLIDE)

<u>SLIDE 14</u>	<p><u>Division #3 Inner Ear cont...</u></p> <p><u>Organ of Corti</u> Outer Hair Cells mechanically amplifies low intensity frequencies</p> <p>Inner Hair Cells relays amplified frequencies to nerves</p>  <p>34</p>
------------------------	--

DIVISION #3 INNER EAR...cont...

(Level of detail can be used later to show how noise causes permanent damage to hair cells)

1. Organ of Corti houses sensory cells

- a. sensory cells have little protrusions like hairs
- b. "hairs" move or bend with fluid sound waves
- c. bending movement causes chemical reaction within sensory cells
- d. chemical reaction causes nerve fibers at "bottom" of sensory cells to fire and transmit sound information to brain

2. Two (2) types of sensory "hair" cells

3. One type is called Outer Hair Cells

(CLICK)

- a. three (3) rows
- b. chief sensitivity or function is to mechanically amplify low intensity frequencies

4. Second type is called Inner Hair Cells

(CLICK)

- a. one (1) row
- b. chief sensitivity or function is to transform and transmit amplified sounds to nerves
- c. more protected in the Organ of Corti than the Outer Hair Cells
- d. critical in our differentiating one sound from another (frequency sensitivity)
--- examples: pat/bat, sit/set, I need a wrench/bench from the garage, What kind/time is it?

OPTIONAL: Individual hair cell nerve fibers come together in center of cochlea turns and leave inner ear. Vestibular and facial nerve fibers travel in same bony channel. If tumor grows in channel, can affect balance, hearing and/or facial movement - separate yet connected

>>>> Here are two (2) short videos:

1. First, a single hair cell is shown responding to sound.
2. Second, how the Organ of Corti is moved by the fluid movements which bend the hair cells which cause the nerve impulses to the brain.

(NEXT SLIDE)

SLIDE 15

Dancing Outer Hair Cell

an individual hair cell is responding to its particular intensity/frequencies within the music



DANCING OUTER HAIR CELL

An individual hair cell is responding to its particular intensity/frequencies within the music

There are two links to this video:

1st Option: Click on Picture

2nd Option: If you have internet access, click on text hyperlink

<http://www.youtube.com/watch?v=bB3x7kp9El8&feature=related> *Dancing Outer Hair Cell*

<http://www.youtube.com/watch?v=lioNIbtFxSY&feature=related> *Cochlear Animation*

This animation may be used, copied, and distributed, without modification and with the foregoing copyright notice included, for non-commercial scientific or educational purposes only; any other use requires the written permission of Howard Hughes Medical Institute (contact bricken@hhmi.org).

(NEXT SLIDE)

SLIDE 16

Organ of Corti & Hair Cells

Mechanical movement of hair cells create electrical auditory signals



ORGAN OF CORTI and OUTER/INNER HAIR CELLS

Mechanical movement of hair cells create electrical auditory signals

There are two links to this video:

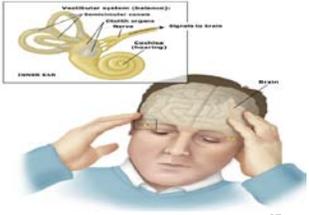
1st Option: Click on Picture

2nd Option: If you have internet access, click on text hyperlink

<http://www.youtube.com/watch?v=lioNlbtFxSY&feature=related> Organ of Corti and Hair Cell

This animation may be used, copied, and distributed, without modification and with the foregoing copyright notice included, for non-commercial scientific or educational purposes only; any other use requires the written permission of Howard Hughes Medical Institute (contact bricken@hhmi.org).

(NEXT SLIDE)

SLIDE 17	<p style="text-align: center;">Division #3 Inner Ear cont...</p> <div style="display: flex; justify-content: space-between;"><div style="width: 45%;"><p><u>Vestibular System</u> Balance and sense of orientation in space</p><p>Semicircular canals rotational movements twisting/turning</p><p>Otolith system linear movements up - down left - right</p></div><div style="width: 45%; text-align: center;"></div></div>
-----------------	---

VESTIBULAR SYSTEM

1. The vestibular system is the non-hearing part of the inner ear.
 - a. It provides information to the brain as one of three ways we maintain balance and to our sense of spatial orientation
 - b. As the head moves, fluid moves inside the two (2) major vestibular structures and stimulates sensory cells.
2. Three (3) semicircular canals are placed in three (3) spatial planes.
 - a. senses rotational movements or angular acceleration of the head

(CLICK)

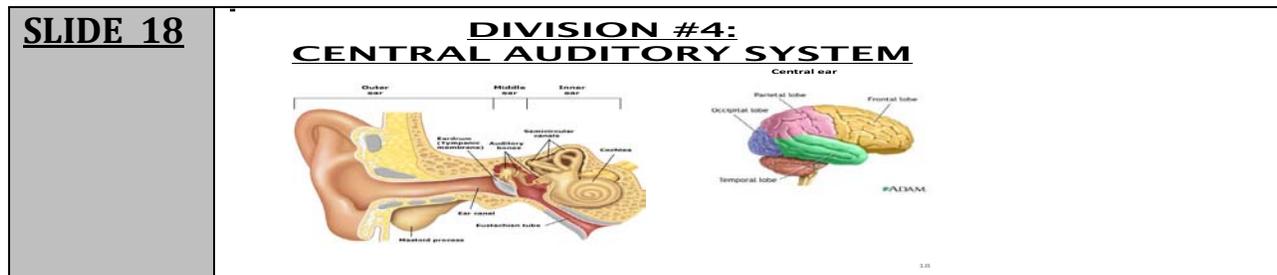
- b. whenever you turn or twist your head
 - c. examples of the semicircular canals at work are a Ferris wheel, turning a sharp corner in a car, and gravity accelerating carnival rides like Tea Cups or Tilt-a Whirl.
3. The otolith organs are located in the bulb or big bump part of the inner ear labyrinth.
 - a. senses linear movements or accelerations of the head

(CLICK)

- b. whenever you move your head directly right, left, up or down
 - c. examples of the otolith organs at work are accelerating in a car, standing up or sitting down, bungee jumping.

4. The vestibular system has a small connecting duct with the cochlea so some sharing of fluid system . Therefore ...
 - a. problem with balance can result in hearing loss
 - b. problem in cochlea can affect balance

(NEXT SLIDE)



DIVISION #4: CENTRAL AUDITORY SYSTEM

1. Last major division of ear is the Central Auditory system
2. Involves all auditory nerves that leave inner ear and travel through brainstem to auditory centers in brain or cortex
3. Auditory nerves transmit electrical signals from cochlea to auditory centers in brain or cortex

(NEXT SLIDE)



DIVISION #4: CENTRAL AUDITORY SYSTEM...cont...

1. Auditory Nerve
 - a. Eighth (VIII) cranial nerve in body
 - b. bundles all nerve fibers exiting cochlea in a orderly manner
(e.g., high frequency information on the outside and low frequency on the inside of bundled nerves "rope")
 - c. transmits electrical sound energy to brainstem

2. Brainstem Auditory Pathways

- a. parallel “relay” nerve centers on each side of brainstem
- b. orderly sensitivity and processing of all elements of sound: frequencies, intensities, timing and sequencing
- c. crossing of nerves so information from each ear received and compared
 - i. critical to understanding speech, particularly in noise
 - ii. critical to locating source or direction of sound (localization)
- d. creates “redundancy” in system to assist in points “a” and “b” and if there is abnormal hearing ability

3. Auditory Cortex

- a. language interpretation -- typically in left temporal lobe
- b. music and non-language sounds in right temporal lobe and other areas of brain
- c. works with speech and language centers and memory areas

4. All of this activity happens in microseconds....

(CLICK) (BE PATIENT - TEXT DOESN'T APPEAR FAST ON INSTRUCTOR NOTES - LOOK AT AUDIENCE SCREEN)

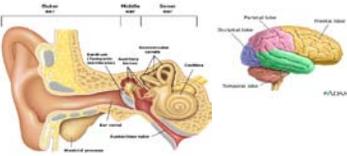
.....processing..... analyzing.... interpreting....

(CLICK)

Ah ha! I heard “Take cover!”

>>>>>So in Summary.....

(NEXT SLIDE)

SLIDE 20	<p style="text-align: center;">How Sound Travels Through the Ear...</p> <table border="0"><tr><td>1. Pinna</td><td>ENERGY</td></tr><tr><td>2. Ear Canal</td><td>Outer ear</td></tr><tr><td>3. Eardrum</td><td>Acoustic</td></tr><tr><td>4. Ossicles</td><td>Middle ear</td></tr><tr><td>5. Cochlea</td><td>Mechanical</td></tr><tr><td>6. Organ of Corti</td><td>Inner ear</td></tr><tr><td>7. Hair Cells</td><td>Hydraulic-</td></tr><tr><td>8. Auditory Nerve</td><td>Electrical</td></tr><tr><td>9. Brainstem</td><td>Central ear</td></tr><tr><td>10. Brain</td><td>Electrical</td></tr><tr><td></td><td>“Meaning”</td></tr><tr><td></td><td>Comprehension</td></tr></table> 	1. Pinna	ENERGY	2. Ear Canal	Outer ear	3. Eardrum	Acoustic	4. Ossicles	Middle ear	5. Cochlea	Mechanical	6. Organ of Corti	Inner ear	7. Hair Cells	Hydraulic-	8. Auditory Nerve	Electrical	9. Brainstem	Central ear	10. Brain	Electrical		“Meaning”		Comprehension
1. Pinna	ENERGY																								
2. Ear Canal	Outer ear																								
3. Eardrum	Acoustic																								
4. Ossicles	Middle ear																								
5. Cochlea	Mechanical																								
6. Organ of Corti	Inner ear																								
7. Hair Cells	Hydraulic-																								
8. Auditory Nerve	Electrical																								
9. Brainstem	Central ear																								
10. Brain	Electrical																								
	“Meaning”																								
	Comprehension																								

HOW SOUND TRAVELS THROUGH THE EAR

Let’s put everything together>>>>> As sound waves enter the ear,

(CLICK)

The Outer Ear collects and conducts the Acoustic sound wave

(CLICK)

Into the Pinna and Ear Canal.

(CLICK)

The Acoustic sound waves enter the air-filled Middle Ear which is converted to Mechanical energy

(CLICK)

By vibrating the Eardrum and Ossicles.

(CLICK)

The Mechanical vibrations travel into the fluid filled Inner Ear where the Mechanical energy is changed to Hydraulic energy.

(CLICK)

The Cochlea with the Organ of Corti and Sensory Hair Cells convert hydraulic energy into Electrical energy.

(CLICK)

The Central Ear structures transmit the Electrical sound energy

(CLICK)

Via the Auditory Nerve, up through the Brainstem Auditory Pathways, and finally to the Brain's Auditory Centers

(CLICK)

Where Meaning and Understanding of the sound occurs

(NEXT SLIDE)

SLIDE 21

QUESTIONS ?



Wait for animation 21

QUESTIONS?

(WAIT - picture has animation)

(END OF PRESENTATION)

1.5 EAR DISORDERS AND HEARING LOSS

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>EAR DISORDERS AND HEARING LOSS</u></p> 
-----------------------	--

HEARING CONSERVATION PROGRAM

EAR DISORDERS AND HEARING LOSS

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>LEARNING OBJECTIVES</p> <ol style="list-style-type: none">1. Define the five types of hearing loss2. Describe medical and communication symptoms that are characteristic of each type of hearing loss3. List common causes of and basic treatment for each type of hearing loss4. Explain how impact and continuous noise exposure affects ear structures and functions
-----------------------	--

LEARNING OBJECTIVES

This unit has the following learning objectives.

1. Define the five types of hearing loss
2. Describe medical and communication symptoms that are characteristic of each type of hearing loss
3. List common causes of and basic treatment for each type of hearing loss
4. Explain how impact and continuous noise exposure affect ear structures and functions

(NEXT SLIDE)

SLIDE 3

**OHC TECHNICIAN
RESPONSIBILITY**

YES

General
Knowledge
for
Referrals

NO

Diagnosis of
> Type of Hearing Loss
> Ear Disease
Recommendations of
Treatments

OHC TECHNICIAN RESPONSIBILITY

What is the responsibility of the OHC Technician in learning about ear disorders?

OHC Technician needs general knowledge

1. Common types of hearing loss and ear disorders
2. Recognize normal and abnormal
3. To make appropriate referrals to medical officers and audiologists

OHC Technician should NOT use general knowledge to

1. Diagnose type of hearing loss
2. Diagnose specific ear disease or
3. Recommend treatments

(NEXT SLIDE)

SLIDE 4

**FIVE TYPES
OF HEARING LOSS**



FIVE TYPES OF HEARING LOSS

Hearing loss is named according to type of dysfunction.
Name of hearing loss relates to where problem occurs in ear.

(INSTRUCTOR: Give very brief description – specific details coming)

1. Conductive hearing loss
 - a. outer and middle ear
 - b. name relates to function of channeling or conducting sound to inner ear

- c. cause is blockage or malfunction preventing complete conduction of sound wave into cochlea
- d. can typically “see” conductive problem or disease
- e. typically temporary

2. Sensorineural hearing loss

- a. inner ear
- b. name relates to function of hair cells sensing, responding and stimulating nerves to fire
- c. cause is damage or malfunction of cochlear structures and nerve fibers
- d. cannot typically “see” sensorineural hearing loss except in behaviors
 - normally, affects higher frequencies more than lower frequencies
 - difficulty understanding speech, especially in noisy surroundings
- e. typically permanent

3. Mixed hearing loss

- a. outer/middle ear AND inner ear involved
- b. name relates to location of problems
- c. both conductive and sensorineural hearing loss/problems are present simultaneously for any period of time.
- d. cause is blockage in the outer and/or middle ear AND sensory or nerve damage in inner ear.
- e. typically permanent SNHL overlaid with temporary conductive disease

(CLICK)

4. Central hearing loss

- a. Auditory nerve, Brainstem Auditory Pathways or Auditory centers of Brain
- b. Name relates to location of problem
- c. Cause is disease or malfunction of nerve transmission of signal and possible impaired analysis and interpretation of sounds

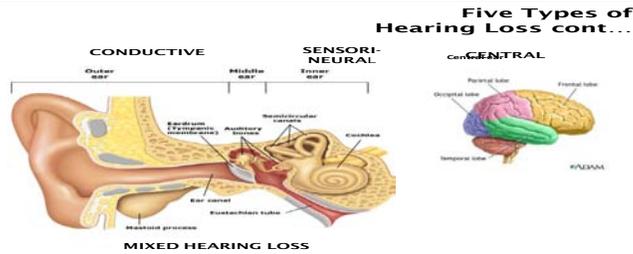
5. Non-organic or Functional hearing loss

- a. Name relates to fact that no biologic or organic cause can be found
- b. Occurs when a person does not respond to test tones or speech in an expected manner
 - Re: behavior
 - Re: symptoms
 - Re: medical and work history
- c. Variety of motivations – discuss later

>>>>>Using ear diagram, the location of each type of hearing loss is.....

(NEXT SLIDE)

SLIDE 5



FIVE TYPES OF HEARING LOSS...CONT...

Diagram divided to show where each of the four (4) true hearing losses occur.

1. **Conductive hearing loss**
 - a. outer ear
 - b. middle ear
 - c. both divisions.
2. **Sensorineural hearing loss**
--- inner Ear
3. **Mixed hearing loss**
 - a. two or more divisions of the ear at the same time
 - b. common situation
 - i. permanent sensorineural hearing loss from noise exposure, suddenly noticed
 - ii. with onset of a conductive, middle ear problem
4. **Central hearing loss**
 - a. auditory nerve
 - b. brainstem auditory centers
 - c. brain auditory centers

(OPTIONAL: Non-organic or Functional hearing loss could be said to be in other parts of the brain - "emotional and motivational" areas.)

(NEXT SLIDE)

SLIDE 6

CONDUCTIVE HEARING LOSS: Symptoms

Talks softly or reports "talking in a barrel"	Low frequency or flat hearing loss
Understands speech with increased volume	Hearing Test Results 500 1000 2000 3000 4000 6000Hz 35 30 25 15 10 10 dB
Congestion - cold	Abnormal otoscopic exam tympanogram
Low pitched ringing or crackling sounds	

CONDUCTIVE HEARING LOSS: Symptoms

Person/patient

1. Talks softly or reports "I sound like I'm talking in a barrel".
 - a. normally hear ourselves via bone/skull vibration and airborne sound waves
 - b. with airborne sound muffled/blocked, voice sounds extra loud and hollow
 - c. naturally reduce voice volume
 - d. called Occlusion Effect
2. Understands speech normally under two (2) conditions
 - a. other's speech is loud (increased intensity) - FIRST CONDITION
 - b. gets through conductive blockage
 - c. normal inner ear
3. Noisy situations - SECOND CONDITION
 - a. background noise is muffled by conductive problem
 - b. speakers naturally raise voice volume in noise to be heard
 - c. Called Lombard Effect
4. Congestion from recent head cold (URI), allergies, altitude change
--- Eustachian tube is malfunctioning and outer/middle ear pressure not equal
5. Patient reports hearing low pitched sounds in affected ear(s)
--- crackling or bubbling sounds caused by fluid behind eardrum

(CLICK)

6. Audiogram indicates hearing loss in the low frequencies. Example is ...
 - a. larger numbers mean higher intensity required for the tone to be barely heard
 - b. more loss in the lower frequencies

(OPTIONAL: Conductive loss hearing test levels can never be more than 60 dB HL)

(CLICK)

7. Other abnormal test results
 - a. otoscopy - what you see when using an otoscope abnormal
 - b. tympanometry is test for middle ear function

Tympanogram is abnormal if conductive problem in middle ear
>>>> Let's look at what you might see

(NEXT SLIDE)



NORMAL VIEW --_Color differences among these examples may be influenced by photo settings

1. Must gain experience viewing normal ear canals and eardrums. Only way to recognize something abnormal
2. Wide range of normal
3. Some cerumen is normal in ear canal
4. Eardrum needs to be visible
5. Normal eardrum characteristics
 - a. pearly appearance
 - b. reflects light from otoscope --- Cone of Light is triangular bright reflection (center to lower side edge)
 - c. might see shadows of ossicles
 - d. color differences among races and health condition/history

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES and DISORDERS

Impacted Cerumen – Complete Occlusion of Ear Canal

1. Possible causes

- a. over production of cerumen
- b. natural progression out of ear canal impeded by
 - i. excessive hair
 - ii. narrow canal
 - iii. sharp bend in canal
 - iv. daily use of Q-tips, ear plugs, earmolds

2. Specific symptoms

- a. plugged up feeling
- b. sounds slightly softer/muffled
- c. low frequency tinnitus

3. Amount of hearing loss

- a. mild – 35 dB HL or less
- b. must be fully occluded for hl to occur
- c. abnormal tympanogram
 - i. flat with full occlusion
 - ii. can use to see if fully occluded or small opening for sound wave to enter

4. Referral

- a. medical officer or trained corpsman for removal
- b. otc methods may soften up hard plugs for removal but should be medically removed
- c. candling is not recommended!

(NEXT SLIDE)

SLIDE 9	<p style="font-size: small;">Conductive Hearing Loss: Diseases/Disorder cont...</p> <p>External Otitis or Infection</p> <div style="display: flex; justify-content: space-around;"></div>
----------------	--

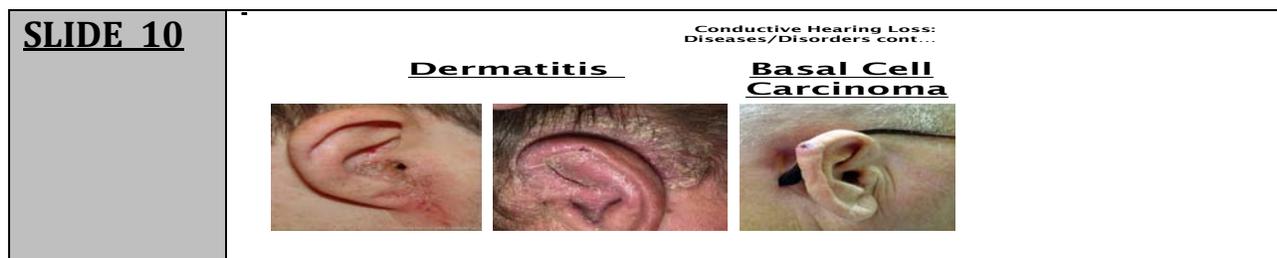
CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

External Otitis or Infection

1. Bacterial or viral infection
 - a. may involve pinna, mastoid area, ear canal
 - b. commonly called swimmer's ear

2. Possible causes
 - a. abrasion or cut in skin in ear canal (scrubbing with objects) or on pinna
 - b. swimming – bathing
 - i. bacterial/viral organism in water
 - ii. water doesn't clear the canal
3. Specific symptoms
 - a. pain – sometimes extreme
 - b. redness, swelling (ear canal can swell completely shut)
 - c. fever or at least heat around ear
 - d. “gunk” in ear canal – pus, dead cells, tissue debris and fluid, cerumen
4. Amount of hearing loss
 - a. none to mild – less than 35 db
 - b. depends on whether ear canal has closed with swollen tissue
 - c. do not attempt tympanometry
5. Referral
 - a. immediate medical treatment
 - b. may involve oral and topical medications

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

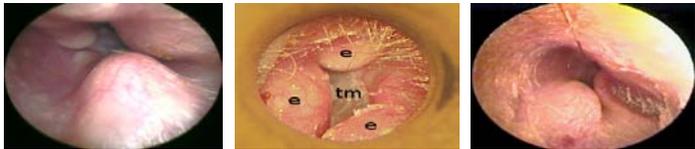
External Otitis

1. External Otitis is inflammation of the pinna, ear canal and surrounding skin
2. Dermatitis is skin inflammation which can occur on the pinna or inside the ear canal or a combination of both sites
3. Chronic (long standing) external otitis will have inflammation and skin debris. It can be very difficult to cure or manage

(CLICK)

4. Another outer ear disease is basal cell carcinoma
 - a. common on the pinna after years of sun exposure
 - b. grows slowly
 - c. remove surgically to avoid developing into malignant skin cancer.

(NEXT SLIDE)

<u>SLIDE 11</u>	<p>Conductive Hearing Loss: Diseases/Disorders...cont...</p> <p>Exotosis Bony Growths or Protrusions</p>  <p>11</p>
------------------------	--

CONDUCTIVE HEARING LOSS: DISEASES/DISORDER...CONT...

1. Exotosis
 - a. bony growths protrude up under the skin into the ear canal
 - b. seen in people who are in cold water a lot, i.e. divers, swimmers, surfers
 - c. no serious concern unless the growths begin to close off the ear canal
 - d. caution when fitting earplugs or making custom mold impressions
2. Referral
 - a. medical referral for documentation
 - b. impacted cerumen may be chronic problem
 - c. typically no treatment

(NEXT SLIDE)

<u>SLIDE 12</u>	<p>Conductive Hearing Loss: Diseases/Disorders...cont...</p> <p>Foreign Objects</p> <table border="0"><tr><td style="text-align: center;">Ball Bearing</td><td style="text-align: center;">Stick</td><td style="text-align: center;">Insect</td></tr><tr><td></td><td></td><td></td></tr></table> <p>12</p>	Ball Bearing	Stick	Insect			
Ball Bearing	Stick	Insect					
							

CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

Foreign Objects

1. The small diameter and curved shape of the ear canal protects the eardrum from foreign objects and invaders.

2. Foreign objects and insects, beans, raisins, small pieces of slender vegetation – anything small enough to crawl into , randomly fly in or be blown into ear canal

3. Left picture is a ball bearing that a child put in his/her ear (perhaps with the “encouragement” of a sibling!)

(CLICK)

4. Middle picture is a wood shaving randomly blown into canal through the air

(CLICK)

5. Right picture is small beetle which randomly flew or crawled into the canal

6. Person may be unaware of foreign object or small bug

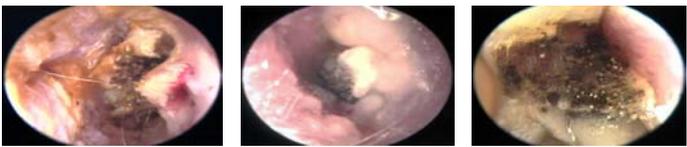
7. The foreign object can become embedded in the ear canal skin and wax over time

8. Amount of hearing loss

- a. none typically
- b. yes, if full blockage or damage to eardrum
- c. do not attempt tympanometry

9. Referral -- Medical professional should extract the foreign object

(NEXT SLIDE)

SLIDE 13	<p>Conductive Hearing Loss: Diseases/Disorders cont</p> <p>Ear Canal Fungus</p>  <p style="text-align: right; font-size: small;">13</p>
-----------------	--

CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT

Ear Canal Fungus

1. Possible Causes

- a. fungal colonies can grow in warm moist environment of ear canal

- b. subtropical and tropical areas – problem for military personnel
2. Specific symptoms
 - a. may be unaware of problem
 - b. itching
 - c. drainage
 - d. foul odor
 3. Amount of hearing loss
 - a. typically none unless canal becomes occluded or damage occurs to eardrum
 - b. do not attempt tympanometry unless TM is visualized
 4. Referral
 - a. medical officer
 - b. topical medications, “wicking”
 - c. can be very difficult to cure and manage

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT

Congenital Atresia

1. Atresia means no opening. However the term is used often as an umbrella term for any narrowing of the ear canal to complete absence of the external ear canal and pinna.
2. Typically it occurs during fetal development. Therefore, there may also be changes in the shape of the pinna (microtia) and indicate malformations of middle and inner ear structures.
3. Left picture indicates a normal appearing pinna but no ear canal opening. Right pictures demonstrates a incomplete pinna and no opening.
4. Depending on radiology test results, surgery may be able to create an opening.
5. Hearing loss will be up to a maximum conductive hearing loss (60-70dBHL).

ADDITIONAL INFORMATION: Bone conduction hearing aids can provide “normal” hearing to the individual if there is no inner ear involvement.

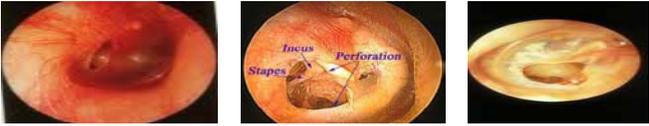
(NEXT SLIDE)

<u>SLIDE 15</u>	<p><u>Reminder: Normal Eardrum</u></p>  <p style="text-align: right; font-size: small;">15</p>
------------------------	--

REMINDER: NORMAL EARDRUM

Know what a normal eardrum looks like to recognize abnormal conditions

(NEXT SLIDE)

<u>SLIDE 16</u>	<p style="font-size: x-small;">Conductive Hearing Loss: Diseases/Disorders cont...</p> <p><u>Tympanic Membrane Perforation</u></p>  <p style="text-align: right; font-size: x-small;">16</p>
------------------------	---

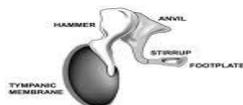
CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

- 1. Eardrum or tympanic membrane (TM) Perforation**
 - a. hole in eardrum from external or internal forces
 - b. size of hole varies re: cause
 - c. surgical perforation for Pressure Equalization (PE) tubes
 - d. treatment for poor Eustachian tube function and recurrent ear infections
 - e. temporary or long term

- 2. Possible Causes**
 - a. foreign object inserted or flies into ear canal with force
 - b. sudden sound pressure wave
 - c. weapon / artillery fire
 - i. explosion
 - ii. head trauma that causes severe pressure wave to enter ear canal (cupped hand slap)
 - d. unequal pressure on each side (outer/middle ear) of the eardrum
 - i. middle ear space fills with fluid from ear infection -- most common

- ii. sudden severe change of altitude -- flying or diving
3. Specific symptoms of a tympanic membrane/eardrum perforation
 - a. acute pain at time of injury -- quickly subsides
 - b. slight bleeding
 - c. drainage of any middle ear fluid
 - i. one time event – infection -- person feels relief of middle ear pain and pressure
 - ii. chronic -- ongoing or recurrent infection – foul odor and color
 4. Amount of Hearing Loss
 - a. none to mild – less than 35 dB
 - b. depends on size of hole
 - c. abnormal tympanogram
 - i. flat with large volume
 - ii. can use to check for hidden perforation
 - iii. use caution
 5. Referral
 - a. medical officer
 - b. small holes heal naturally
 - c. large perforations need surgical repair
 - d. however any hole of any size can lead to further disease (cholesteatoma)
 - e. swim plug protection needed while swimming or bathing to keep water out of middle ear space

(NEXT SLIDE)

SLIDE 17	<p style="text-align: center;">Ossicles (middle ear bones)</p> <p>Detached</p> <p>Stiff – fixated</p> <p>Eroded</p> <p>Birth related</p> <div style="text-align: right; margin-top: 20px;"> <p style="font-size: small;">Conductive Hearing Loss: Diseases/Disorders cont...</p>  </div>
-----------------	---

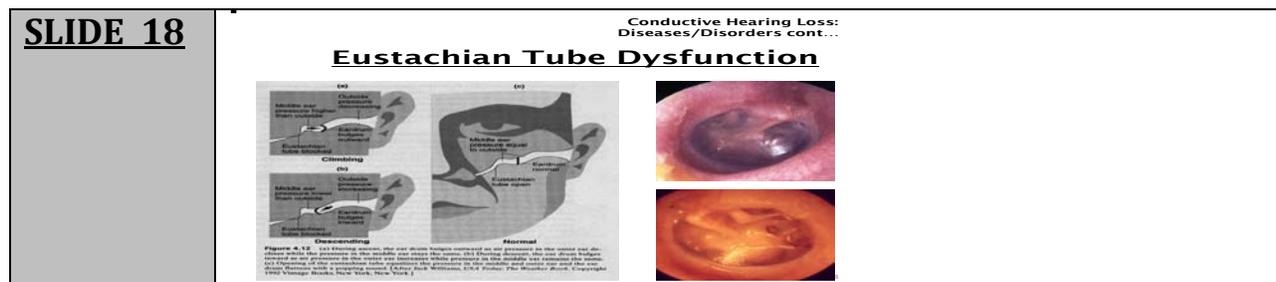
CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

Disorders involving Ossicles (middle ear bones)

1. Detached or disarticulated from each other
 - a. head trauma
 - b. severe sound pressure wave - explosion, IED
 - c. physical object forced through eardrum

2. Stiff or fixated – inadequate to no movement
 - a. disease process (otosclerosis)
 - b. aging – slight effect
3. Eroded
 - a. loss of mass, shape, linkage
 - b. disease process (cholesteotoma, chronic otitis media)
4. Birth related (congenital)
 - a. genetic or abnormal fetal development
 - b. malformed, absent, not connected properly
5. Specific symptoms ---
 - a. trauma related – acute pain and blood from eardrum perforation
 - b. hearing loss
 - c. low pitched tinnitus
6. Amount of Hearing Loss
 - a. mild to moderate severe hearing loss - 0 to 60 dB
 - b. slow progression (disease)
 - c. abnormal tympanogram (flattened or very flexible)
7. Referral
 - a. medical officer – diagnostic testing, surgery
 - b. audiologist for diagnostic hearing evaluation
 - c. hearing aid evaluation and fitting

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

1. Eustachian (Auditory) Tube Dysfunction
 - a. normally opens when we swallow to replenish air in middle ear
 - b. maintains equal air pressure on each side of eardrum
 - c. Eustachian tube muscles do not open due to inflammation or spasm
 - d. vacuum in middle ear space

2. Possible Causes

- a. change of outside air pressure – change of altitude

EXPLAIN DIAGRAM RE PRESSURE EQUALIZATION

- b. inflammation of nasal/throat area surrounding Eustachian tube opening
 - i. upper respiratory infection (URI), head cold, sinus problems
 - ii. allergies

3. Specific Symptoms

- a. ears feel clogged
- b. sounds are muffled
- c. congestion – recent cold or allergies
- d. recent airplane trip or diving activity
- e. mild pain – eardrum being stretched inward (vacuum)

(CLICK) PICTURE – SLIGHT RETRACTION OF EARDRUM

(CLICK) PICTURE – SEVERE RETRACTION – eardrum sucked back around ossicles

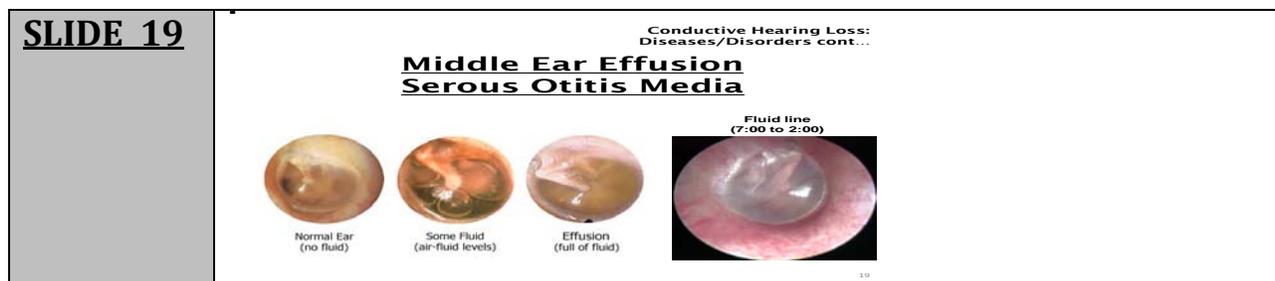
4. Amount of Hearing Loss

- a. none to slight loss in lower frequencies
- b. abnormal tympanogram (negative pressure peak)

5. Referral

- a. often resolves itself with time and otc decongestant/antihistamine medications
- b. can quickly progress to otitis media – middle ear fluid and infection
- c. medical referral ? Depends on patient history

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

1. Middle Ear Effusion or Serous Otitis Media

- a. fluid has been pulled out of middle ear tissues due to Eustachian tube dysfunction – vacuum environment

- b. fluid is NOT infected – c lear

(CLICK)

Pictures show fluid and air bubbles, full effusion

(CLICK)

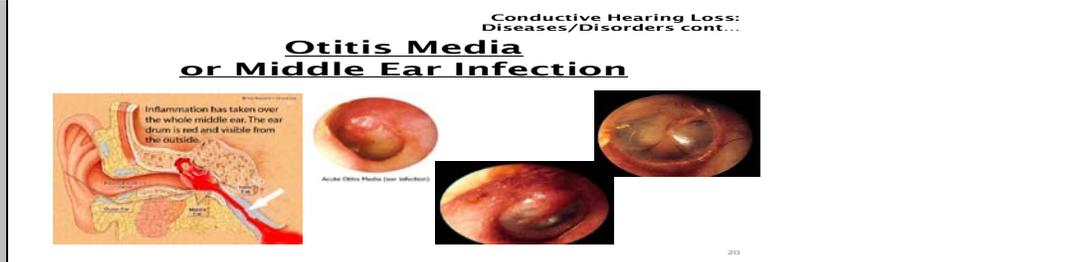
Third picture shows fluid line indicating middle ear half full of fluid

2. Cause -- result of Eustachian Tube dysfunction that is not resolved.
3. Specific symptoms -- same as Eustachian Tube dysfunction
 - a. ears may feel full or clogged
 - b. sounds may sound muffled
 - c. may hear bubbling, water sloshing, crackling sounds in ear
 - d. doesn't respond to soft sounds or speech
 - e. mild pain – if eardrum being stretched inward (vacuum)
 - f. congestion – recent cold or allergies
 - g. recent airplane trip or diving activity
4. Amount of Hearing Loss
 - a. mild to moderate –
 - i. less than 60 dB
 - ii. depends on how much fluid is in ear and retraction of eardrum
 - b. sudden onset – recovers immediately if fluid drained and/or Eustachian tube functioning
 - c. abnormal tympanogram (negative pressure or flat)
5. Referral
 - a. medical officer
 - b. decongestants, myringotomy (lancing TM to drain fluid)

(OPTIONAL: Many children under six (6) years have serous otitis media and indicate no symptoms except mild hearing loss, i.e. do not respond when called, turns up TV volume or sits close, talks with soft voice)

(NEXT SLIDE)

SLIDE 20



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

- 1. Otitis Media or Middle Ear Infection**
 - a. middle Ear space becomes inflamed
 - b. bacteria or viruses proliferate
 - c. most common conductive ear disease, particularly in children -- #1 reason for pediatrician visits
- 2. Possible Causes**
 - a. Eustachian tube dysfunction
 - b. bacteria or Viruses associated with URI/cold are “blown” (sneeze, improper nose blowing) and travel up Eustachian tube
 - c. food or drink particles travel up Eustachian tube – especially infants and toddlers

USE DIAGRAM TO DESCRIBE STAGES OF DISEASE

- 3. Specific Symptoms**
 - a. pain in affected ear(s)
 - b. fever
 - c. sounds are muffled
 - d. recent URI/cold/allergies
 - e. full feeling in ear
 - f. low frequency tinnitus
 - 4. Amount of Hearing Loss**
 - a. mild to moderate - less than 40 dB
 - b. temporary – improves upon fluid drainage, resolution of infection OR TM perforation
 - c. abnormal tympanogram (flat)
- (CLICK) (CLICK) 2X Pictures show otitis media – inflamed TM, fluid bulging TM**
- 5. Referral**
 - a. medical officer
 - b. medications: antibiotics, decongestants, pain/fever relief
 - c. surgery: myringotomy (lancing eardrum) to drain fluid or control potential perforation

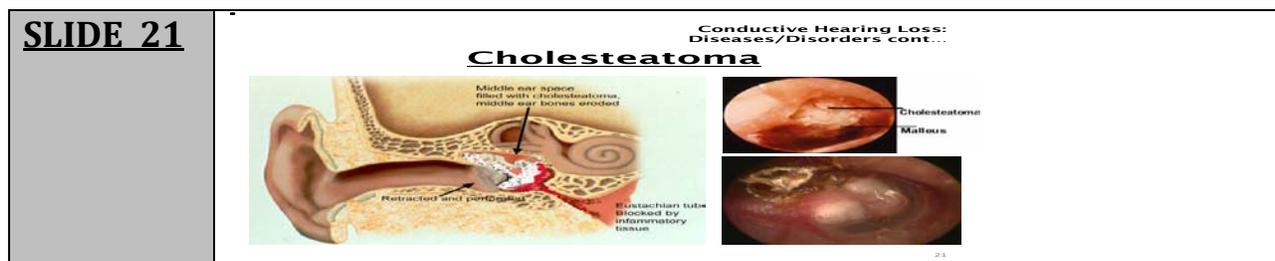
6. SEQUENCE

- a. disease follows sequence of events which can occur within 24 hour period
- b. resolution generally reverses sequence
- c. can track sequence with tympanometry

OPTIONAL: Chronic Otitis Media

1. Recurrent otitis media within specific time period
2. Draining perforated eardrum which doesn't heal
3. Organisms become resistant to drug treatment
4. Can lead to serious complications involving the surrounding structures
 - a. cholesteatoma
 - b. eardrum thinning and abnormal flexibility/flaccidity
 - b. mastoiditis
 - c. facial nerve infection and paralysis
 - d. ossicle erosion
 - e. sensorineural hearing loss (constant fluid manages to transverse oval/round windows)
 - f. meningitis
 - g. brain abscess

(NEXT SLIDE)

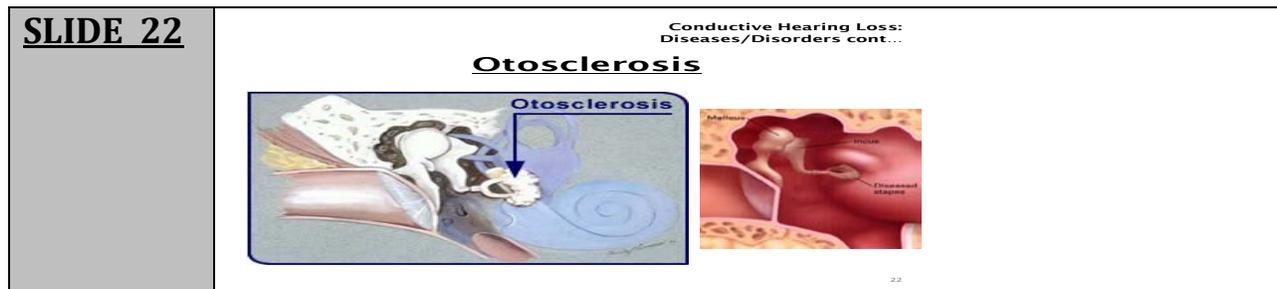


CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

1. Cholesteatoma is a “marshmallow” like sac of skin cells and debris that can grow in the middle ear space.
2. Cholesteatomas are caused typically by a tear or retraction of part of the eardrum with a history of middle ear inflammation and/or perforation.
3. Squamous epithelium (skin cells) migrate and fill the “pocket” or “sack”.

4. Cholesteatomas can be very destructive as they grow, filling any amount of space, therefore putting pressure on surrounding structures and tissues.
5. Symptoms typically include history of middle ear infection and/or eardrum perforation, conductive hearing loss, and sometimes smelly discharge.
6. Refer to medical officer. Surgery must remove ALL of the cholesteatoma cells in order to cure and/or prevent its reoccurrence.

(NEXT SLIDE)



CONDUCTIVE HEARING LOSS: DISEASES/DISORDERS...CONT...

1. Otosclerosis is a stiffening of the stapes at the oval window due to ossification or abnormal bone growth around the footplate of the stapes.
2. More common in females by a 2:1 ratio and often accelerates during pregnancy, usually occurs between 30-40 years of age.
3. Treatment includes hearing aids or surgery. Hearing aids can be very helpful because this is a conductive hearing loss. Therefore, if sound is loud enough to push through the middle ear barrier, the person will hear well with the inner ear.
4. Surgery is performed by an otologist (ENT) who will replace the stapes with a prosthetic one, often restoring some/most of the person's hearing loss.

(NEXT SLIDE)

The second major type of hearing loss is Sensorineural Hearing Loss

- 1. Problem is in the Inner Ear**
 - a. sensory hair cells and nerves are temporarily or permanently damaged**
 - b. can not transmit all parts of speech sounds**
 - c. understanding is key issue/problem**

Major symptoms of SNHL

- 2. Understanding sounds and speech is the key problem for individuals with sensorineural hearing loss.**
 - a. common complaint is “I can hear people talking just fine but I don’t always understand them”**
 - b. nerve damage makes sounds distorted or missing**
 - c. increased intensity/loudness can help but never 100% understanding**
 - d. examples: confuse /k/ and /t/ -- What kind is it? What time is it?
confuse /b/ and /p/ -- I need to find that bill! I need to find that pill!**

OPTIONAL: Vowels carry the energy or intensity of speech while consonants carry the intelligibility or understanding of speech.

Example: What is this sentence? Ee ae ou oe? Whr r yr shs?

- 4. Noise increases the problem**
 - a. noise smears or covers up (mask) the distorted sounds**
 - b. another result of nerve damage is reduced ability to ignore or “put noise in the background”**
 - c. common statement: “I can hear fine when it’s quiet but I can’t understand when it is noisy.”**
- 5. Increasing loudness or intensity can help**
 - a. amplifies sounds that are softer than the person’s threshold of hearing**
 - b. BUT too much amplification will further distort the speech signal.**
- 6. Talks with louder than normal voice**
 - a. person is trying to hear the parts of his or her own speech that sound distorted or inaudible**
 - b. hearing by bone conduction (within head) does not help like it does in conductive loss**
- 7. Tinnitus is when person perceives a ringing or other sounds in ears**
 - a. most often mid to high pitch -- constant or intermittent**
 - b. most common is ringing -- also buzzing, roaring, chirping, fog horn and more**
 - c. warning of hazardous noise exposure and some diseases**
 - d. most often heard when the environment becomes quiet -- trying to fall asleep**
- 8. Balance difficulties**

- a. perception of spinning (self or surroundings) all the time or only in certain positions
- b. remember cochlea and the vestibular system are connected by narrow channel

(CLICK)

9. Audiogram – hearing loss

- a. more loss in high frequencies – “sloping” down on audiologist’s graph
- b. noise-induced hearing loss -- sharp loss of hearing at 3000 or 4000 Hz – “noise notch”
- c. example: larger numbers in higher frequencies than lower tones (meaning higher intensity required for frequency tone to be barely heard)

(CLICK)

10. Otoscopic exam and tympanogram will be normal

- a. normal because test of conductive outer and middle ears
- b. sensorineural HL involves damaged inner ear sensory cells and nerves

(NEXT SLIDE)

SLIDE 25	<p style="text-align: center;">SENSORINEURAL HEARING LOSS: Diseases & Disorders</p> <p style="text-align: center;">Basic Problem</p> <p>Organ of Corti and Hair Cells are</p> <ul style="list-style-type: none"> ▶ damaged ▶ destroyed ▶ undergoing pressure <p style="text-align: center;">Result</p> <p>Complete sounds can't be detected and/or transmitted creating.....</p> <p><small>* "distorted speech"</small></p>
-----------------	---

SENSORINEURAL HEARING LOSS: DISEASES and DISORDERS

1. Basic problem of a sensorineural hearing loss is that
 - a. the Organ of Corti and hair cells are damaged, destroyed or undergoing pressure.
 - b. therefore, they cannot respond normally to components of speech (frequency, intensity, timing)

(CLICK)

2. The Result is –
 - a. complete sound information can't be detected and it cannot be transmitted accurately, if at all ----

b. resulting in distorted speech and misunderstanding and possibly negative feelings and consequences.

(CLICK) “distorted speech”

(NEXT SLIDE)

SLIDE 26	SENSORINEURAL HEARING LOSS:	
	<u>Causes</u>	
	Ototoxins	Diseases
	drugs	bacterial/viral
	chemicals	fluid pressure
	Head trauma	Birth related
	Aging	genetic (DNA)
	Auto-immune or unknown	fetal or birth
		Hazardous Noise Exposure

SENSORINEURAL HEARING LOSS: DISEASES and DISORDERS...cont....

Causes of sensorineural hearing loss

Difficult to show pictures of sensorineural disorders because structures hidden and microscopic in size.

Amount of hearing loss can vary from minimal to profound deafness.

Majority of sensorineural hearing losses are permanent.

1. Ototoxins

- a. destroys delicate sensory hair cells and other structures inside cochlea
- b. toxicity determined by amount/dosage, exposure time, AND synergistic effects with noise or other toxins
- c. drugs
 - i. antibiotics with “mycin” suffix (streptomycin, gentamycin, erythromycin, neomycin)
 - ii. diuretics combined with aminoglycosides (-mycin) – lasix (furosemide), bumex (bumetanide)
 - iii. quinine derivatives
 - iv. chemotherapy – cisplatin
- d. chemicals
 - i. more damage in combination with noise exposure
 - ii. metals – Toluene
 - iii. solvents - ethyl Ac , ethanol, styrene
 - iv. accidental poisoning or intentional inhalation

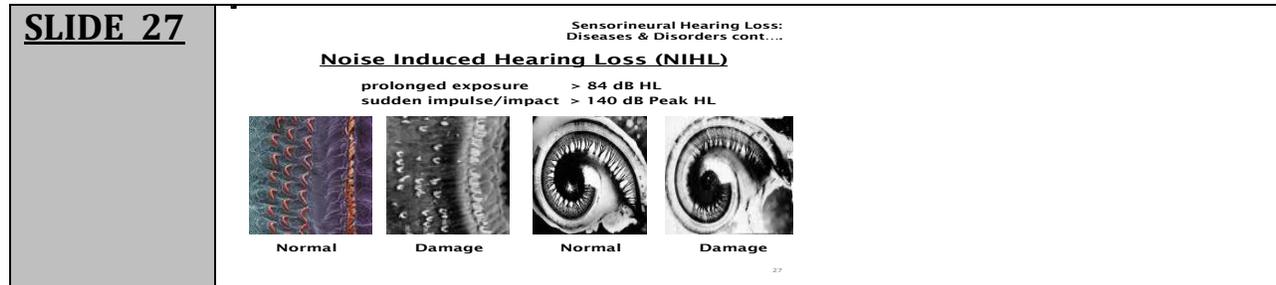
Both active military and civilian personnel are often exposed to toxic chemicals in their work and combat situations. Safety precautions should be strictly followed.

2. Head Trauma

- a. side of head or temporal lobe
 - b. skull fracture through temporal lobe
 - i. cross through cochlea
 - ii. loss of inner ear fluid
 - iii. deafness
 - c. accidents, explosions, combat injury
3. Aging
- a. presbycusis
 - b. males more hearing loss (especially high frequencies) than females
 - c. tolerance decreases for noise and other distractions while conversing
 - d. difficult to isolate aging factors from lifetime of health/noise/ototoxin factors
4. Auto-immune or unknown
- a. sudden onset – within 12-24 hours
 - b. needs immediate medical attention – EMERGENCY!!!
 - c. often results in total deafness – some recovery especially with immediate drug treatment
- (CLICK)**
5. Diseases
- a. bacterial and viral organisms
 - i. meningitis, measles, mumps, chronic otitis media
 - ii. STDs – syphilis, AIDs related conditions
 - iii. disagreement about whether the organism, accompanying fever/illness, or drug treatment causes majority of damage
 - b. Meniere’s Disease
 - i. involves both cochlea and vestibular system
 - ii. hearing loss and balance problems
 - iii. too much fluid in cochlea puts pressure on Organ of Corti structures
6. Birth related
- a. genetic conditions --
 - i. dominant and recessive genes for hearing loss/deafness
 - ii. many syndromes have hearing loss as a characteristic
 - iii. hearing loss may be present at birth or develop over years – however, most genetic HL present by 20”s
 - b. fetal development during pregnancy (prenatal)
 - i. maternal illness/disease – rubella, influenza, cytomegalovirus (CMV), alcoholism and drugs/medications
 - ii. accident, random DNA/chromosomal abnormalities, anoxia
 - c. at birth (perinatal) -- anoxia, life saving drugs
7. Hazardous noise exposure -- most relevant area for the OHC professional

Let's look at hazardous noise exposure in more detail.....

(NEXT SLIDE)



SENSORINEURAL HEARING LOSS: DISEASES and DISORDERS...cont....

1. Noise Induced Hearing Loss or NIHL is our greatest concern
 - a. purpose of HCP is to prevent NIHL as much as possible.
 - b. NIHL is acoustic trauma or injury – hearing loss is an injury to the body
2. Single exposure to impact noise at or more than 140 dB HL
 - a. explosion, weapon fire, IED
 - b. sound pressure wave severely damage/destroy Organ of Corti and sensory hair cells --- looks like “hurricane” went through the ear
3. Long-term exposure to hazardous noise levels
 - a. prolonged (years) of noise ≥ 85 dB HL
 - b. most typical NIHL - gradual damage and destruction from chronic ongoing exposure to hazardous levels of noise
 - c. work environments AND recreational/at home activities
 - d. amount of loss and length of noise exposure varies from person to person; some more susceptible to NIHL
4. Typical hearing loss is high frequency, particularly between 3000 Hz and 6000 Hz – “noise notch”

(CLICK)

5. Picture shows NORMAL healthy rows of outer and inner hair cells

(CLICK)

6. Picture shows DAMAGED hair cells after noise exposure – missing, damaged, in disarray
--- Research shows other delicate structures in cochlea & Organ of Corti show similar destruction after noise exposure

(CLICK)

7. Picture shows cross-sectional view of a NORMAL cochlea with nerve fibers clearly seen coming from array of sensory cells.

(CLICK)

8. Picture shows complete DESTRUCTION of nerve fibers -- this example shows damage in the mid frequency region

9. NIHL is permanent and irreversible

- a. body does not regenerate these damaged/destroyed sensory cells and nerve fibers
- b. we do not know how to replace them!

10. Variables of NIHL

- a. intensity level of hazardous noise
- b. type of noise – impact, impulse, steady, frequency characteristics
- c. time of specific exposure
- d. long-term time of overall exposure
- e. appropriate use of hearing protection devices
- f. individual personal factors/characteristics

(NEXT SLIDE)

SLIDE 28	SENSORINEURAL HEARING LOSS: Treatment 1. Medications & Surgery - limited 2. Hearing Aids 3. Adaptive Skills Sensorineural Hearing Loss a) permanent b) understanding problem
-----------------	---

SENSORINEURAL HEARING LOSS: TREATMENT

Because the majority of sensorineural hearing losses are permanent...

1. Medication and surgery very limited to certain conditions – critical timing factor to “reverse” sensory damage
2. Treatment is use of amplification or hearing aids
 - a. hearing aids very advanced technologically
 - b. can improve understanding of speech significantly
 - c. BUT hearing aids are “aids”, not cures and not hearing replacements

3. Adaptive skills must be learned
 - a. using hearing aids to best advantage in variety of listening environments
 - b. often by time person gets hearing aids, they must relearn listening and attention skills

4. Critical to remember is that in almost all cases.....

(CLICK)

5. Sensorineural hearing losses are permanent and irreversible

6. Key problem is understanding sounds and speech

(NEXT SLIDE)

SLIDE 29	<p><u>MIXED HEARING LOSS</u></p> <p>Conductive + Sensorineural = Mixed HL</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); text-align: center;"> C O M B I N A T I O N </div> <div style="text-align: center;"> <p><u>MOST COMMON</u></p> <p>Permanent Sensorineural HL with Outer/Middle Ear disorder or Impacted Cerumen (temporary conductive HL)</p> </div> </div>
-----------------	--

MIXED HEARING LOSS

1. Combination of conductive and sensorineural hearing losses
2. Any combination of previous discussion
 - a. symptoms
 - b. hearing test results
 - c. types of disease or disorders
 - d. treatments

(CLICK)

3. Most common kind of mixed hearing loss
 - a. permanent, long standing sensorineural hearing loss... and then.....
 - b. person becomes ill with an outer/middle ear infection or occluded cerumen
4. Middle ear infection can be treated medically and when it clears

>>>> the person will have the sensorineural hearing loss remaining
5. Therefore many mixed hearing losses are temporary

(NEXT SLIDE)

<u>SLIDE 30</u>	CENTRAL HEARING LOSS: <u>Symptoms</u> Asymmetrical hearing loss* Tinnitus - typically constant Atypical difficulty with understanding speech in noisy conditions Balance difficulties Head trauma
------------------------	--

CENTRAL HEARING LOSS: SYMPTOMS

1. Central Hearing Loss is when the damage or malfunction is beyond the cochlea up to the brain. Specifically this includes the
 - a. auditory nerve
 - b. auditory nerve fibers traveling through brainstem
 - c. auditory centers of the brain.

2. It can be difficult to identify central hearing loss because...
 - a. many other health and behavior problems have same symptoms
 - b. complexity and redundancy in central nervous system makes exact problem difficult to isolate

(CLICK)

3. Most important symptom for OHC technicians
 - a. asymmetrical hearing loss
 - b. hearing test results show difference of 20db or more between ears at 2 consecutive frequencies.
 - c. refer to audiologist
 - d. NOTE: hearing loss does not have to be asymmetrical but it is an important symptom for referral

4. Tinnitus
 - a. constant (typically)
 - b. often the patient can report exactly when the ringing or perceived sound began

5. Difficulty understanding speech in noise although hearing may be normal in quiet - very big definite difference

(CLICK)

6. Balance difficulties

7. Head trauma as discussed previously – difference is closed head trauma condition affecting brain centers.

(NEXT SLIDE)

SLIDE 31	<p>Central Hearing Loss: Symptoms cont...</p> <p><u>Symptoms</u></p> <p>Often hearing for tones is normal Other neurological disorders present Easily distracted by other sounds May have learning difficulties Confused with behavioral problems</p> <p style="text-align: right;">95</p>
-----------------	---

CENTRAL HEARING LOSS: SYMPTOMS...cont...

OPTIONAL SLIDE -- Pertains mainly to children – however, brain injured adults also show these behaviors

1. Hearing test for pure tones will be normal, and sometimes the person’s hearing will be hypersensitive hearing
2. Other neurological disorders present – multiple sclerosis, stroke (CVA), “soft” conditions like ADD and CAPD.

(CLICK)

3. Easily distracted by other sounds . Difficult to concentrate with other activities going on around them
4. Central auditory processing disorder is a recognized learning disability in many states and school districts
 - a. found in adults but most often in children
 - b. controversy:
 - i. Is it an auditory or language based problem?
 - ii. Do people mature out of problem or learn to adapt and sublimate as adults?
5. Auditory processing difficulties often confused with emotional/organic behavioral problems
 - a. person distractible, acts out, doesn’t follow directions, poor achievement and reading skills
 - b. due to frustration with inability to understand what they hear or don’t hear
 - c. misdiagnosis and delays in evaluation and accurate diagnosis of the problem

(NEXT SLIDE)

SLIDE 32

**CENTRAL HEARING LOSS:
Treatment**

Surgery for tumors/growths

Educational therapy

Adaptive techniques

**Central
Hearing Loss**

**understanding
problem**

32

CENTRAL HEARING LOSS: TREATMENT

- 1. Audiologist uses specialized electrophysiologic and behavioral test procedures to diagnose central hearing disorders**
- 2. Amount of hearing loss and difficulty varies greatly with the listening conditions and the type of auditory signal or message**
- 3. If the problem is a tumor on Auditory Nerve or elsewhere in central auditory system**
 - a. surgery techniques conserve as much hearing as possible**
 - b. early diagnosis is critical to conserve hearing**
- 4. If the problem is a processing and integrating problem of auditory signals/sounds, then treatment involves**
 - a. educational therapy and training in adaptive techniques**
 - b. examples:**
 - i. controlling listening environment**
 - ii. use of assistive listening devices**
 - iii. learning how to use other sensory and language skills to figure out the auditory message**

(CLICK)

- 5. Central Hearing Disorders affects understanding of sounds and speech**
- 6. Training and adaptive techniques can minimize effects/problems in individuals**

(NEXT SLIDE)

SLIDE 33

NON-ORGANIC HEARING LOSS

Malingering

History

enlistment, deployment,
discipline, avoid work,
retirement, attention,
monetary compensation

Inconsistent behaviors
Testing behaviors

Hearing Test results **inconsistent with**

- hearing behaviors
- previous tests
- how ear functions

33

NON-ORGANIC HEARING LOSS - MALINGERING

1. Last major type of hearing loss is not a true organic hearing loss
 - a. malingering – someone who is pretending to have a hearing loss
 - b. psychological trauma or conversion Disorder – very rare

Focus on Malingering

2. OHC Technician responsibility is to
 - a. obtain best air conduction pure tone responses from the patient
 - b. observe irregular behaviors
 - c. refer to audiologist to determine if person is malingering
 - d. NEVER accuse, label, or argue with person taking the test
3. Note what the patient's history is or purpose for hearing loss. For example

(CLICK)

- a. enlistment issues – recruit wants to go home
 - b. deployment -- excuse/avoidance
 - c. discipline – excuse/avoidance
 - d. avoid work assignment
 - e. retirement is approaching
 - f. needs attention (particularly in children)
 - g. monetary compensation
4. Observe if the patient demonstrates inconsistent behaviors
 - a. understands speech but suddenly remembers that s/he can't hear or makes unreasonable guesses
 - b. responds to soft speech and "automatic statements" ("turn right here") or when speaker is facing away
 - c. talks in too loud of a voice – may be inconsistent in keeping up volume
 - d. exaggerated gestures – cups hand behind ear, leans forward and intensely stares at speaker
 - e. observed in conversation with another person in normal manner
 - f. details of hearing loss story are vague, inconsistent, doesn't make sense re: physical laws

5. Be aware of the patient's testing behaviors
 - a. asks lots of detailed questions about how to take test and/or exactly how to respond to tones
 - b. presses earphone to ear
 - c. multiple responses to tone presentation or frequency
 - d. threshold pattern is inconsistent across frequencies – wide “zigzag” pattern
6. Hearing Test results inconsistent with

(CLICK)

- a. hearing behaviors
 - i. thresholds are greater/worse than person's earlier response to sound or conversation
 - ii. average speech is between 50 – 60 dB HL
- b. previous tests -- big change in thresholds without supporting medical or exposure history
- c. how ear functions
 - i. responds with one ear normal and one ear severe/profound loss
 - ii. tone will crossover to good ear through skull after 40-50 dB difference

(NEXT SLIDE)

SLIDE 34	Central Hearing Loss: Symptoms cont . . .
	<u>Conversion or Psychological Trauma</u>
History Traumatic event – Assault, rape IED, war trauma Not trying to avoid work Not trying to obtain \$\$	Hearing Test results inconsistent Flat Affect Emotionless Face Patient believes has hearing loss
Very rare condition	

NON-ORGANIC HEARING LOSS – CONVERSION DISORDER

1. Conversion Disorder is when a patient presents with neurological symptoms, such as numbness, blindness, paralysis, seizures or hearing loss.
 - a. however, there is no physical evidence of a neurological cause for the symptom.
 - b. it is thought that a patient “converts” their trauma or anxieties into physical symptoms. It is considered a psychiatric disorder.

(CLICK)

2. Patient has history of a traumatic event -- IED, war trauma, rape, assault, etc.

3. Patient's behavior and report indicate the he/she is NOT trying to avoid work or obtain monetary compensation

(CLICK)

4. Hearing test results are inconsistent or follow a strange pattern. Results may be consistent within the test but inconsistent with patient's communication behaviors.

5. Patient has a flat affect (lack of physical animation and energy) and/or an emotionless face (if true)

6. Patient truly believes he or she cannot hear normally.

7. CAUTION: This disorder is extremely rare

(NEXT SLIDE)

<u>SLIDE 35</u>	<p style="text-align: center;">NON-ORGANIC HEARING LOSS: "Treatment"</p> <ol style="list-style-type: none">1. Follow regular protocols2. Give reinstruction for test3. Give person an "out"4. Refer to audiologist<ul style="list-style-type: none">• special test techniques• special tests• counseling
------------------------	---

NON-ORGANIC HEARING LOSS: "TREATMENT"

1. Remember person has some kind of motivation or seeks personal gain to not give true hearing test results

2. **NOT** the responsibility of OHC technician to ...

a. confront the person

b. suspect "faking" or "lying" or "malingering"

c. do not use these words to patient or loud enough to be overheard

DO THE FOLLOWING

(CLICK)

3. Follow regular protocols

a. follow-up testing

b. use of otoscopy and tympanometry

c. referral to audiologist

4. Give the person the benefit of doubt or an "out" for the first retest -

- a. give the instructions again
- b. make sure the headphones and connections are working properly
- c. acknowledge that it is hard to hear these tones
 - i. in a group testing situation,
 - ii. it is hard to stay awake,
 - iii. it is hot and stuffy

5. You can make a statement that “the results don’t make sense, let’s try it again”

6. If possible, give the person an “out” without embarrassment to give truer responses.

(CLICK)

- 7. Refer to audiologist
 - a. audiologist’s responsibility to determine reliable and valid hearing thresholds
 - b. special test techniques and test procedures available to validate if person is exaggerating hearing loss
 - c. can usually obtain person’s true hearing thresholds or very close
 - d. responsible to counsel patient and report outcome

(NEXT SLIDE)

SLIDE 36	<p><u>SUMMARY</u></p> <p>The five types of hearing loss are based on the divisions and functions of the ear</p> <ol style="list-style-type: none"> 1. Conductive 2. Sensorineural 3. Mixed 4. Central 5. Non-Organic 	<p>Q U E S T I O N S</p>
-----------------	--	---

SUMMARY

This unit has been about Diseases and Disorders of the Ear.

- 1. Five types of hearing loss are based on divisions and functions of ear
- 2. Discussed most common ear disorders within each type
 - a. description
 - b. symptoms
 - c. impact or amount of hearing loss
 - d. treatments
- 3. Five types of hearing loss

- a. **conductive hearing loss,**
- b. **sensorineural hearing loss**
- c. **central hearing loss**
- d. **mixed hearing loss and**
- e. **non-organic hearing loss**

4. Purpose and responsibility of OHC Technician

- a. **recognize abnormalities**
- b. **refer appropriately to medical officers and audiologists**

(CLICK)

QUESTIONS?

(END OF PRESENTATION)

1.6 OTOSCOPIC EXAMINATION AND TYMPANOMETRY BASICS

SLIDE 1



HEARING CONSERVATION PROGRAM

OTOSCOPIC EXAMINATION and TYMPANOMETRY BASICS



OTOSCOPIC EXAMINATION

(NEXT SLIDE)

SLIDE 2

Learning Objectives

1. Explain the purpose of otoscopic examination and tympanometry.
2. Describe the basic characteristics of a normal and an abnormal tympanogram.
3. Describe normal and abnormal physical findings.
4. State conditions requiring medical referral.
5. Perform otoscopy and tympanometry using proper technique.

LEARNING OBJECTIVES

1. Explain the purpose of otoscopic examination and tympanometry.
2. Describe the basic characteristics of a normal and an abnormal tympanogram.
3. Describe normal and abnormal physical findings
4. State conditions requiring medical referral.
5. Perform otoscopy and tympanometry using proper technique.

(NEXT SLIDE)

SLIDE 3

OTOSCOPIC EXAMINATION

Definition

The examination of the ear canal and tympanic membrane through the use of an otoscope. An otoscope is a hand-held tool with a speculum and light source to see into the ear canal

Purpose

The otoscopic exam is to ensure that the ear canals are free of any obvious problems prior to fitting hearing protection, performing tympanometry and administering hearing tests

OTOSCOPIC EXAMINATION

An otoscopic exam or inspection is defined as follows.....

(CLICK)

1. DEFINITION

The examination of the ear canal and tympanic membrane (eardrum) through the use of an otoscope. An otoscope is a hand-held tool with a speculum and light source to see into the ear canal

(CLICK)

2. The PURPOSE of

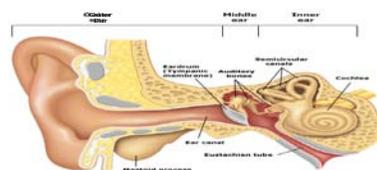
The otoscopic exam is to ensure that the ear canals are free of any obvious problems prior to fitting hearing protection, performing tympanometry and administering hearing tests

NOTE: OHC Technician typically performs otoscopy after a hearing test screening

(NEXT SLIDE)

SLIDE 4

Otoscopy Rules Out Disorders of the Outer Ear



WHAT AREAS OF THE EAR DOES OTOSCOPY ASSESS?

1. Otoscopy conducted by a skilled physician/medical officer can identify or rule out disorders of the outer ear and middle ear disorders involving the eardrum.

2. OHC Technician should be able to rule out obvious abnormalities or potential disease problems
3. Please note that viewing the tympanic membrane/eardrum through the otoscope provides information about condition of Middle Ear ...
4. However, main purpose of otoscopy is to rule out disorders of the Outer Ear

(NEXT SLIDE)

<u>SLIDE 5</u>	<p><u>Otoscope Check</u></p> <ul style="list-style-type: none"> ✓ Check if batteries are fully charged ✓ Adjust rheostat to bright white light ✓ Fiber-optic better than older bulb-types <div style="display: flex; justify-content: space-around; align-items: center;">   </div>
-----------------------	--

OTOSCOPE CHECK

1. There are many models of otoscopes but only two (2) major types
 - a. portable scopes that use batteries
 - b. scopes that are attached to wall and use electricity
2. In order to have the brightest light to illuminate the ear canal, batteries need to be at full power (disposable or rechargeable).
 - a. become familiar with the light (rheostat) and magnification controls for easiest and best viewing/illumination
 - b. fiber optic otoscopes are better than older bulb-types but are more expensive

ADDITIONAL NOTES: Otoscopes can be digital and can take pictures of the image for viewing on a monitor and/or printing .

(NEXT SLIDE)

SLIDE 6

Preparation for Otoscopic Exam

1. Observe proper hygiene
wash hands or use gloves
note any bodily fluid or secretion
2. Select a speculum of proper size
larger size ensures a good view
3. Lock speculum into place
4. Change/discard the speculum
after each patient
after each ear of any patient
with draining ear(s)



PREPARATION FOR OTOSCOPIC EXAM

1. Observe proper hygiene and infection control procedures for yourself and patient.
 - a. wash hands or use gloves
 - b. note any bodily fluid or secretion
2. Select a speculum of proper size – diameter of view opening and length of speculum varies.
 - a. look at the ear canal opening with the naked eye to generally judge whether small-medium-large
 - b. larger size ensures a good view
3. Lock speculum into place – twist onto otoscope . There is usually some type of protrusion on speculum and groove/slot on otoscope .
4. Change/discard the speculum
 - a. after each patient
 - b. after each ear of any patient with draining ear(s)

(NEXT SLIDE)

SLIDE 7

Examination Method

KEY: #1 Otoscope placement
#2 Eye placement

1. Grip otoscope firmly and comfortably
2. Grasp upper edge of the ear (helix) with the opposite hand
3. Pull pinna gently upward & back to straighten the ear canal
4. Insert lighted otoscope past the first canal bend
5. Rest your fingers against the patient's head to avoid injury if patient moves suddenly
6. **NOW** put your eye up to the otoscope eyepiece



EXAMINATION METHOD

Picture: Ralph Raymond Chase, MD 1923-2012

1. It may seem obvious but the KEY to using an otoscope properly is....
 - a. NUMBER ONE -- Otoscope placement
 - b. NUMBER TWO -- Eye placement
 - c. don't ever reverse this order! Otoscope placement first, Eye placement second.
 - d. prevents possible injury and discomfort to patient.

2. **STEP 1: Grip otoscope firmly and comfortably.**
 - a. some people hold the body of otoscope down in the palm of their hands
 - b. other people hold the otoscope by the neck so the body is sticking up
 - c. may depend on your handedness (right or left handed) and which ear you are viewing
3. **STEP 2: Grasp upper edge of the ear (helix)**
 - a. for adults – best to grip at 1100 position (right ear) and 0200 position (left ear)
 - b. for children – best to grip at 0900 position (right ear) and 0300 position (left ear)
4. **STEP 3: Pull pinna gently upward and back to straighten ear canal**
5. **STEP 4: Insert lighted otoscope past the first canal bend using the naked eye**
6. **STEP 5: Rest 1-2 fingers of your otoscope hand against patient’s head/face . This braces and stabilizes the otoscope in case of sudden movement**
7. **STEP 6: NOW bring your eye up to the otoscope eyepiece to view the ear canal and eardrum WITHOUT moving otoscope**

There is a natural tendency to move the otoscope inward/deeper as you move your eye toward it – THAT’s why you brace your otoscope hand

(NEXT SLIDE)

<u>SLIDE 8</u>	<p style="text-align: center;"><u>Examination Method cont...</u></p> <p>7. Examine the ENTIRE canal and tympanic membrane</p> <p>8. Dispose speculum, turn off otoscope light</p> <p style="text-align: center;">Don’t be satisfied with a partial viewing NO discomfort to the patient if properly conducted</p> <p style="text-align: center;">YOUR GOAL “Within Normal Limits” or “Abnormal” Do not diagnose or label pathology</p>
-----------------------	--

EXAMINATION METHOD CONT...

8. **STEP 7: Examine ENTIRE ear canal and tympanic membrane SLOWLY moving otoscope if needed to see all of visible canal and eardrum.**
9. **STEP 8: Dispose speculum, turn off otoscopic light**
10. **Take your time – Don’t be satisfied with a partial viewing -- you might miss something significant.**

11. If you take your time and use proper procedures, you will NOT hurt the patient

(CLICK)

12. Your goal as an OHC Technician is to determine if condition of the ear canal and eardrum are “Within Normal Limits” or “Abnormal”

13. DO NOT diagnose or label a problem or pathology -- it is OK to describe what you see – for example ...

- a. “your ear canal appears very swollen”
- b. “there is too much wax to see anything”
- c. “your eardrum looks very red”
- d. “there is blood and yellowish wetness in your ear”
- e. “I need to refer you to your PCM/MO”

14. It is NOT acceptable to say ...

- a. “Oh #@%), what is that?!”
- b. “Wow, I’ve never seen THAT before!”

15. Never hesitate to ask a fellow technician, if available, to look if you are uncertain of what you are viewing

(NEXT SLIDE)

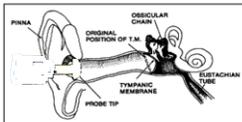
<u>SLIDE 9</u>	<u>When to Do an Otoscopic Examination</u>	
	Testing, IF there is an ENT complaint	A positive STS is discovered
	Tympanometry	A low frequency or flat hearing loss is detected
	HPD Fitting	

WHEN TO DO AN OTOSCOPIK EXAMINATION

1. What are recommendations for WHEN to perform otoscopic examination?
 - a. ideally, otoscopy should be done before any testing to rule out impacted cerumen
 - b. however, not typical practice, particularly when testing more than one person at a time
 - c. NOTE: Supported by fact that adults ages 20-40 have low incidence of impacted cerumen
2. Recommended Protocol:
 - a. ALWAYS perform otoscopy BEFORE any testing if there is an ENT/medical related complaint

- b. ALWAYS perform otoscopy BEFORE conducting tympanometry
- c. ALWAYS perform otoscopy BEFORE fitting HP devices
- d. ALWAYS perform otoscopy AFTER test results WHEN a positive STS is indicated
- e. ALWAYS perform otoscopy AFTER test results WHEN a low frequency or flat hearing loss is indicated

(NEXT SLIDE)

SLIDE 10	<div style="display: flex; align-items: center;"> <div style="background-color: #0070c0; color: white; padding: 5px; transform: rotate(-15deg); font-weight: bold; margin-right: 10px;">DEFINITION</div> <div> <h3 style="text-decoration: underline;">What is Tympanometry?</h3> <p>A measurement technique that assesses function of the middle ear</p> <p>The technique uses:</p> <ul style="list-style-type: none"> a) an acoustic input signal b) air pressure c) electronic measurement </div> </div> <div style="text-align: right; margin-top: 10px;">  </div>
-----------------	---

WHAT IS TYMPANOMETRY?

Let's move on to Tympanometry

1. Tympanometry is a measurement technique that assesses function of the middle ear.
2. It is a quick simple test, although it is based on a complicated interaction of sound physics and the ear's mechanical characteristics.

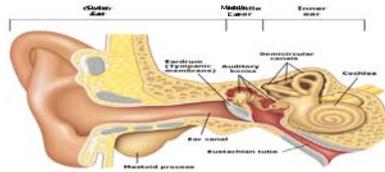
(CLICK)

3. The technique uses
 - a. an acoustic input signal
 - b. air pressure
 - c. electronic measurement
4. By sealing the ear canal and sending in a low frequency tone while varying air pressure against the eardrum—
 - a. we can measure the stiffness or flexibility of the eardrum.
 - b. these measurements consistently tell us if there is a middle ear disorder/disease present.

(NEXT SLIDE)

SLIDE 11

Tympanometry Rules Out Disorders of the Middle Ear



TYMPANOMETRY RULES OUT DISORDERS OF THE MIDDLE EAR

1. What area of the ear does tympanometry assess? The Middle Ear
2. Main purpose of tympanometry is to give us information on Middle Ear and rule out Middle Ear disorders/diseases.
3. However, there is overlap between otoscopy and tympanometry.
4. Just as otoscopy can give information about the Middle Ear from viewing the condition of the eardrum
5. Tympanometry can tell us if there is a channel or passageway for the sound wave to get through to the eardrum if an ear canal looks occluded.

(NEXT SLIDE)

SLIDE 12

Why use Tympanometry?

- ✓ To identify patients who require medical referral for middle ear pathology
- ✓ To differentiate conductive from sensorineural hearing disorders
- ✓ To track the progress of middle ear pathologies under medical treatment
- ✓ Fast, objective, highly accurate



WHY USE TYMPANOMETRY?

So the main reasons to use Tympanometry are -----

1. To identify patients/employees who require medical referral for middle ear pathology
2. To differentiate conductive from sensorineural hearing disorders
3. To track the progress of middle ear pathologies under medical treatment

4. It is a fast, objective, highly accurate assessment tool for middle ear problems

ADDITIONAL NOTES:

For those of you who may work in clinics with dependents, tympanometry is very useful with children who are prone to get ear infections.

Middle ear fluid and infections are #1 reason for doctor's visits for the 0-3 years age group

Because tympanometry is objective (can't be controlled by employee), results can be used as a "counseling" or "motivation" tool with employees who may not be responding at their lowest thresholds.

(NEXT SLIDE)

<u>SLIDE 13</u>	<p><u>When will you use Tympanometry?</u></p> <ol style="list-style-type: none">1. After otoscopy2. Part of the referral procedure3. If positive STS is present4. If patient complains of ear fullness or pressure <p><i>NEVER USE TYMPANOMETRY WHEN THERE HAS BEEN MIDDLE EAR (BONE) SURGERY</i></p>
------------------------	--



WHEN WILL YOU USE TYMPANOMETRY?

OHC Technician should use tympanometry in the following situations:

1. After otoscopy - always check ear canal for obstructions before inserting a probe tip.
2. Part of referral procedure for audiology assessment - must check if medical referral is needed first.
3. If a positive STS is present - again to check if a medical referral - rather than Occupational Audiology - is needed.
4. If employee/patient complains that there is a feeling of fullness or pressure in his or her ear regardless of test results.

(CLICK)

5. IMPORTANT NOTE: *NEVER USE TYMPANOMETRY WHEN THERE HAS BEEN MIDDLE EAR (BONE) SURGERY*

Changes in pressure may cause serious problems

(NEXT SLIDE)

SLIDE 14

How Does Tympanometry Work?



- Probe inserted and seals ear canal*
 - Pump varies pressure against eardrum
 - Pure tone is sent into ear
 - Tympanometer measures how much sound gets through the eardrum
 - Results indicate the flexibility of the eardrum and middle ear
- * Always perform otoscopy first*

14

HOW DOES TYMPANOMETRY WORK?

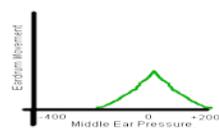
Tympanometry is based on physical principles and mathematical algorithms but conducting the test is fast and simple.

1. A soft tipped probe is inserted just inside the ear canal and seals it. The test will not work or continue if an air pressure seal is not obtained.
2. A pump varies pressure against eardrum.
3. Simultaneously a pure tone is sent into the ear (typically 240 Hz).
4. Tympanometer measures how much sound gets through the eardrum under the various pressure conditions.
5. Results indicate the flexibility or the stiffness of the eardrum and middle ear stem/bones. Results are displayed in numerical form and in a graph called a tympanogram.

(NEXT SLIDE)

SLIDE 15

Normal Tympanogram "Type A"



Inverted "V" or Mountain

Peak placement

Horizontal	Vertical
-150 to +50	0.2 to 1.8

Display uses "box" or shaded area to show normal range

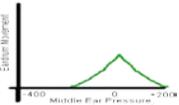
15

NORMAL TYMPANOGRAM "TYPE A"

1. Tympanometer displays and prints a graph with measurement values.
 - a. horizontal axis/line indicates amount of pressure inside middle ear cavity
 - b. vertical axis/line indicates amount of movement or flexibility of the eardrum

- c. often there will be a shaded box or outline to indicate normal range
- 2. Normal tympanogram – referred to as Type A – will show an inverted “V” or mountain within the normal ranges.
- 3. The peak of the inverted “V” or mountain must be within the numerical ranges indicated (on the slide) in terms of height (eardrum movement or vertical axis) and horizontal placement (negative or positive middle ear pressure).
- 4. OHC Technician needs to be able to recognize the pattern or configuration to determine if tympanogram is normal or abnormal (middle ear pathology)

(NEXT SLIDE)

SLIDE 16	<p style="text-align: center;"><u>Interpretation – Type A</u></p> <p>Normal eardrum movement Normal middle ear pressure Eustachian Tube is functioning normally</p> <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <p>Normal Outer/Middle Ear No conductive HL STS is inner ear related</p> </div> </div>
-----------------	---

INTERPRETATION – TYPE A

- 1. A Type A tympanogram indicates normal eardrum movement and middle ear pressure.
- 2. A Type A tympanogram indicates that Eustachian tube is functionally normally.

THEREFORE

(CLICK)

- 3. Patient/employee has a normal outer and middle ears which means there is no conductive hearing Loss.
- 4. That means any hearing loss --- STS – is due to inner ear problems.

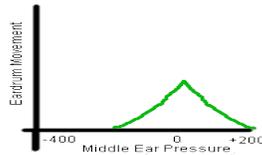
(NEXT SLIDE)

SLIDE 17

Variations of Normal Type A

Peak
Horizontal
-150 to +50

Vertical
0.2 to 1.8



17

VARIATIONS OF NORMAL TYPE A

1. People have different shapes and sizes of ear canals and middle ear bones. As in all health situations, there is a range of normal function.
2. Type A tympanogram can vary – tall, short, skewed left or right of “0”.

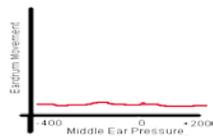
HOWEVER

3. Peak must always be within normal range values for both horizontal and vertical axis / dimensions OR within shaded box or area indicating normal range

(NEXT SLIDE)

SLIDE 18

Abnormal Tympanogram “Type B”



Flat or poorly defined peak

Peak Placement

Absent or poorly defined
Horizontal **Vertical**
> -150 **< 0.2**

18

ABNORMAL TYMPANOGRAM “TYPE B”

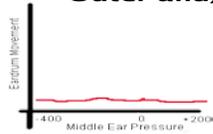
1. There are several patterns of tympanograms that indicate abnormal middle ear function.
2. OHC Technician needs to recognize two major types of abnormal tympanograms.
3. Type B tympanogram has little shape, is flat . . .
4. OR may have a poorly defined, very rounded peak typically placed far to the left in negative pressure area.

(NEXT SLIDE)

SLIDE 19

Interpretation - Type B

**Eardrum movement minimal or absent
Outer and/or middle ear disorder present**



**Ear canal may be occluded
Eustachian Tube not
functioning normally
Otitis Media or ME Effusion
Eardrum has perforation
Mild hearing loss in low Hz**

INTERPRETATION - TYPE B

- 1. Type B tympanogram is abnormal**
- 2. Type B indicates that eardrum movement is minimal or totally absent**
- 3. Type B means that there is an outer and/or middle ear problem**

(CLICK)

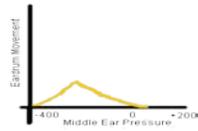
- 4. Abnormal conditions that would result in a Type B tympanogram include ---**
 - a. ear canal is occluded – cerumen, foreign body, disease, etc.**
 - b. Eustachian Tube is not functioning normally so that eardrum is sucked into the middle ear space due to negative pressure or vacuum within the middle ear space (Eustachian tube is not able to ventilate middle ear space with fresh air).**
 - c. otitis media or middle ear effusion – middle ear cavity is full of infectious material or clear fluid because the Eustachian Tube is swollen shut, creating a perfect environment for bacteria/virus to have a party.**
 - d. eardrum has a significant perforation.**
- 5. Typically , a low frequency hearing loss will be present with a Type B tympanogram – usually a mild hearing loss, not more than 35-40 dB HL.**

ADDITIONAL NOTE: A mnemonic device is Type “B” = “blah” or “blocked” (something is preventing eardrum from moving).

(NEXT SLIDE)

SLIDE 20

Abnormal Tympanogram "Type C"



**Inverted "V" off center to left
Clearly defined peak**

Peak placement

Horizontal > -150 Vertical 0.2 to 1.8

20

ABNORMAL TYMPANOGRAM "TYPE C"

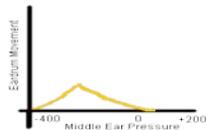
1. Second major type of tympanogram that the OHC Technician needs to recognize is the Type C tympanogram.
2. Type C tympanogram has a clearly defined peak that is skewed to the left
3. Height or eardrum movement often is normal - but it always has negative middle ear pressure outside normal range

(NEXT SLIDE)

SLIDE 21

Interpretation - Type C

**Negative middle ear pressure
Eustachian Tube function abnormal**



**Recent air flight or diving
Symptoms of congestion
Hearing normal or slight loss
@ 500-1000Hz**

21

INTERPRETATION - TYPE C

1. Type C tympanogram is abnormal - it indicates negative middle ear pressure.
2. Type C tympanogram occurs because Eustachian tube function is abnormal.
3. Eustachian tube might be swollen shut, in spasm or has chronic problems in allowing air into middle ear space.

(CLICK)

4. Conditions that would result in a Type C tympanogram include ----
 - a. person recently experienced a quick severe change in air pressure, such as in a recent airplane flight or diving experience.
--- person has not been able to "clear" his or her ears - ears have not "popped" open.

b. Eustachian tube could have had a muscle spasm or was already swollen due to congestion or upper respiratory infection – allergies or “cold”.

c. employee complains of and/or demonstrates signs of nasal congestion due to allergies or head cold

--- Eustachian tube would be swollen or have edema – preventing normal opening to allow fresh air into middle ear space

5. Often there will be no hearing loss with a Type C tympanogram. However, a slight hearing loss could be present in the low frequencies but rarely more than 20-25 dBHL

ADDITIONAL NOTES: Mnemonic devices include a) Type C is “closed” Eustachian tube, b) middle ear vacuum (“c” in vacuum), c) eardrum “curved in” or “sucked in”

(NEXT SLIDE)

SLIDE 22	<u>Disposition of Patients with Abnormal Tympanograms</u>
	General Rule Medical referral
	Final Decision Local resources and SOP
	<u>To Determine Referral</u>
	Request return for follow-up tympanogram
	<u>Otitis Media or Middle Ear Effusion</u>
onset to resolution	
Tympanograms can progress	
Type C >> Type B >> Type C >> Type A	
over 10-14 day period	
	22

WHAT IS THE DISPOSITION OF PATIENTS WITH ABNORMAL TYMPANOGRAMS?

1. Abnormal tympanograms are an accurate indication of outer and/or middle ear disorders.

--- Majority of these conditions require medical attention /referral

2. However, a Type C tympanogram may be a very temporary condition, i.e. ears “pop” open finally from an airplane flight.

On the other hand, a Type C can lead to a Type B tympanogram after otitis media develops in the closed off middle ear space.

3. General Rule is to refer when there is an abnormal tympanogram. Local SOP and clinic resources may provide more specific guidelines.

(CLICK)

4. Depending on the patient and clinic circumstances, you may want to delay immediate referral to a medical officer.

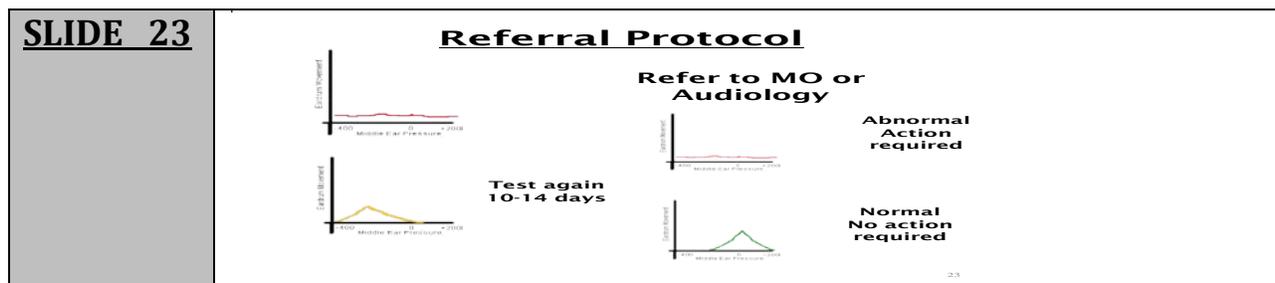
a. eardrum is not red

b. can see clear fluid line or bubbles through eardrum

c. employee does not have immediate access to medical care

5. Request that patient return for a follow-up tympanogram in 10 to 14 days to see if problem has resolved itself.
6. You can track the progression of otitis media and middle ear effusion from onset to resolution with tympanograms.
 - a. a healthy ear progresses with Eustachian tube dysfunction resulting in Type C
 - b. progresses to middle ear full of clear or infected fluid resulting in Type B
 - c. begins to resolve itself back to Type C
 - d. full resolution or wellness results to a normal Type A tympanogram
7. Typically this pattern can occur over a 10 to 14 day period

(NEXT SLIDE)



REFERRAL SUMMARY

Using a graphic or flowchart for the Referral procedure . . .

1. If a Type B >> Refer to Medical Officer or Audiology, particularly if eardrum has red and infected appearance.
2. If a Type C >> Test again in 10-14 days.
3. Then if Type A, no action is required (normal).
4. Then if Type B, refer to Medical Officer or Audiology.

TEACHING IDEA: Use this slide as a mini quiz. Ask student(s) to verbalize what the flowchart means.

(NEXT SLIDE)

SLIDE 24

SUMMARY

**Referral to
Medical Officer when...**

- Pain or discomfort is reported
- Drainage is visible
- Perforation is visible
- Tympanic membrane is bulging
- Ear canal is blocked by cerumen or foreign body
- Complaint of sudden severe hearing loss with tinnitus and/or dizziness
- When in doubt



STAT!

24

SUMMARY OF REFERRAL TO MEDICAL OFFICER WHEN...

A second summary slide of what we have discussed.

Refer to a Medical Officer or physician (civilian employees) when

1. Pain or discomfort is reported
2. Drainage is visible
3. Perforation is visible
4. Tympanic membrane is bulging
5. Ear canal is blocked by cerumen or foreign body
6. Complaint of sudden hearing loss with tinnitus and/or dizziness >>>

(CLICK)

STAT! Emergency! Immediate medical intervention may save hearing!

7. When in doubt Refer or consult with available MO

(NEXT SLIDE)

SLIDE 25

SUMMARY

OHC Technician Responsibilities

1. Always perform otoscopy first
2. Interpret tympanograms as "Normal" or "Abnormal" only
3. Consider all information before referral
 - ✓ Patient history
 - ✓ Otoscopy
 - ✓ Tympanogram
 - ✓ Audiograms

25

OHC TECHNICIAN RESPONSIBILITIES

In summary, the OHC Technician responsibilities related to otoscopy and tympanometry

1. Always perform otoscopy first before tympanometry or HPD fitting
2. Interpret tympanograms as "Normal" or "Abnormal" only
3. Consider all information before referral
 - a. patient history
 - b. otoscopy
 - c. tympanograms
 - d. audiograms

(NEXT SLIDE)

SLIDE 26

**PUTTING
OTOSCOPY
AND
TYMPANOMETRY
TOGETHER**



26

PUTTING OTOSCOPY AND TYMPANOMETRY TOGETHER

Now let's review clinical situations integrating otoscopy and tympanometry information

(INSTRUCTOR: This information is repetitive of information that was presented in Ear Disorders in text form. The purpose of the remaining slides is to integrate subjective and objective data with four (4) patient scenarios for practice on Slides 39-42.)

(NEXT SLIDE)

SLIDE 27

“Within Normal Limits”

Ear Canals clear and free of obvious problems
discharge, masses, impacted cerumen, foreign bodies, inflammation

Tympanic membrane appearance
translucent, pearly gray healthy color

Eardrum landmarks
Cone of light from center to membrane edge
Shadow of first middle ear bone attached to center



Cerumen is normal unless occludes view of TM > 50%

27

“WITHIN NORMAL LIMITS”

(Instructor may want to quiz students before clicking for arrow information)

What does “within normal limits” look like?

1. Using Otoscopy, you should see
 - a. ear canals that are clear and free of obvious problems such as . . .

(CLICK)

- b. discharge, masses, impacted cerumen, foreign bodies, inflammation.

2. Appearance of the tympanic membrane/eardrum should be . . .

(CLICK)

--- translucent, pearly gray and healthy color (no to few spidery capillaries).

3. Landmarks that should be visible on the eardrum include . . .

(CLICK)

- a. cone of light should be seen from center of TM fanning out to edge of the membrane
 - b. shadow of the first middle ear bone (malleus/hammer) attached to center of TM

4. Some cerumen is normal -- unless occludes view of TM > 50%.

(NEXT SLIDE)

SLIDE 28

“Within Normal Limits”



“WITHIN NORMAL LIMITS” continued...

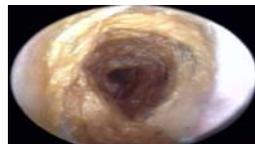
Putting everything together....

1. Normal appearance outer ear
2. Normal looking tympanic membrane/eardrum
3. Should result in normal Type A tympanogram

(NEXT SLIDE)

SLIDE 29

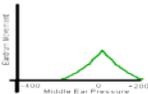
Excessive Cerumen



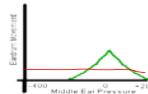
If you can't see at least half the TM, then cleaning is recommended

If the TM is normal, proceed with hearing test and refer for removal

Type A
If not fully occluded



Type B
If fully occluded



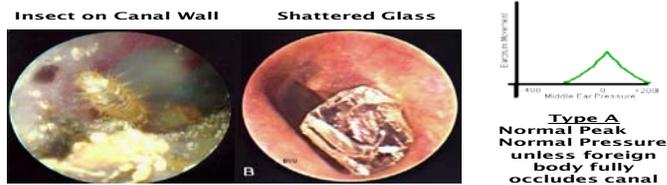
EXCESSIVE CERUMEN

1. Cleaning or ear lavage is recommended if you can't see at least half of eardrum through the otoscope.
2. You should obtain a normal Type A tympanogram as long as there is any amount of passageway for sound wave.
3. If you obtain a abnormal Type B tympanogram, refer for ear lavage because full occlusion will negatively affect hearing test results.
4. NOTE: Remember home cleaning methods are not recommended for occluded wax, i.e. Q-tips and candling. It may be beneficial to soften ear wax with OTC solutions in preparation for professional ear lavage.

(NEXT SLIDE)

SLIDE 30

Foreign Bodies



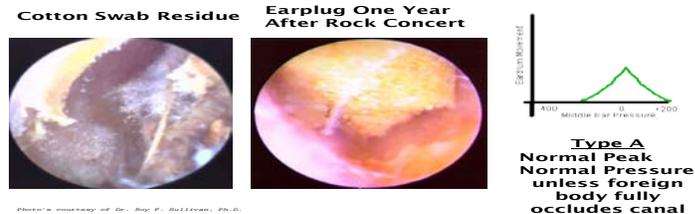
FOREIGN BODIES

1. As long as the foreign body does NOT fully occlude the ear canal, a sound wave can reach the eardrum.
2. Therefore, tympanometry should result in a normal Type A.
3. If foreign object DOES fully occlude the ear canal (i.e. bead), test will result in a Type B similar to impacted cerumen.

(NEXT SLIDE)

SLIDE 31

Cotton Swab/Earplug Residue



COTTON SWAB/EARPLUG RESIDUE

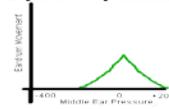
1. Same situation - if ear canal is NOT fully occluding ear canal, sound can get through.
2. Tympanometry will indicate a Type A - normal middle ear function.

(NEXT SLIDE)

SLIDE 32

Collapsing Canals

When patients display a "flat" hearing loss, rule out by observing ear canal as you press pinna



Type A
Normal Peak
Normal Pressure
tension of
headphone
collapses canal

Photo's courtesy of Dr. Roy P. Sullivan, Ph.D.

32

COLLAPSING CANALS

1. When hearing test thresholds indicate a flat horizontal hearing loss, it may be the person's ear cartilage is very pliable.
2. Tension of the earphones close the ear canal and create a false mild hearing loss.
3. However, otoscopy indicates no outer ear or eardrum concerns.
4. Tympanometry will indicate Type A -- normal peak and pressure -- normal middle ear function.
5. Check for collapsing canals by pressing on the pinna like the earphone would to see if the canal opening closes

(NEXT SLIDE)

SLIDE 33

Exostoses

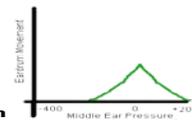


Will not affect the hearing test unless ear canal fully occluded

Interferes with earplug insertion

Interferes with otoscopy

Photo's courtesy of Dr. Roy P. Sullivan, Ph.D.



Type A
Normal Peak
Normal Pressure
unless fully occludes canal

33

EXOSTOSES

1. Exostoses or bony growths in the ear canal will NOT affect the hearing test unless ear canal fully occluded.
2. However it does interfere with proper earplug insertion.
3. It can also interfere with otoscopy if the growths block visualization of the eardrum.
4. Tympanometry should result in a Normal Type A tympanogram unless canal is fully occluded.

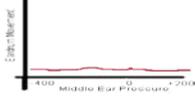
(NEXT SLIDE)

SLIDE 34

Eardrum Perforations



Size of hole will affect hearing test



Type B
Flat
Large Ear Canal
Volume

34

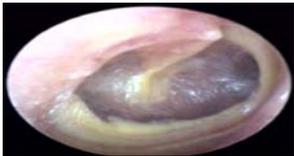
EARDRUM PERFORATIONS

1. Size of perforation/hole will determine if Type A or Type B tympanogram will result.
2. A very small perforation (1-3 mm) in lower half of eardrum will probably not affect mobility of eardrum >>> Type A.
3. Larger perforations/holes will result in a Type B tympanogram.
4. **ADDITIONAL NOTES:** Many tympanograms will have an ear volume reading.
 - a. Normally this number is small (less than 2.0) because it is measuring only the volume of ear canal between the probe tip and eardrum.
 - b. However, if there is a perforation of any size, then volume number will be large (5.0-7.0) because it is measuring the ear canal PLUS the volume of middle ear cavity.
 - c. This is an accurate way to know if a small perforation is present but not observed through the otoscope.

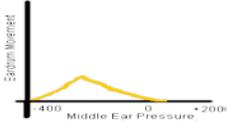
(NEXT SLIDE)

SLIDE 35

Retracted Eardrum



Photo's courtesy of Dr. Ray F. Sullivan, Ph.D.



Type C
Abnormal
Negative Pressure

35

RETRACTED EARDRUM

1. A retracted eardrum is being sucked into the middle ear space because of negative pressure

(ASK STUDENTS: Why? >>> Eustachian tube dysfunction)

2. An abnormal Type C tympanogram - defined peak but in negative pressure area - will occur with this condition

(NEXT SLIDE)

SLIDE 36

Otitis Media / Middle Ear Effusion

Photo's courtesy of Dr. Ray F. Sullivan, Ph.D.

Type C
Flat - no peak
Normal ear canal volume

36

OTITIS MEDIA

1. Inflammation and infection will show an angry red eardrum, possibly bulging from increased fluid in middle ear space.
2. Or eardrum may show air bubbles or a fluid line indicating non-infectious effusion - may appear before or after infection.
3. Fluid restricts eardrum movement resulting in an abnormal Type C tympanogram

(NEXT SLIDE)

SLIDE 37

Pressure Equalization (PE) Tubes or Ventilation Tubes

Photo's courtesy of Dr. Ray F. Sullivan, Ph.D.

Type C
Flat straight line
Huge ear canal volume

37

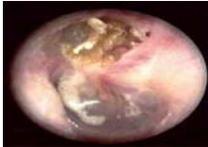
PRESSURE EQUALIZATION (PE) TUBES OR VENTILATION TUBES

1. Pressure Equalization or PE tubes are surgically implanted in TM to ventilate middle ear cavity when Eustachian tube is chronically non-functional and causes recurrent or chronic middle ear infections/effusion.
2. PE tubes' color and type vary -- may be plastic or metal

3. Typically implanted in lower half of eardrum
4. A functioning “open” PE tube will result in a totally flat Type B tympanogram
5. Although the eardrum is moving normally with sound waves, the PE tube doesn’t allow for a “seal” so that the tympanometer can measure eardrum movement
6. If you DO get a normal Type A tympanogram with a PE tube inserted in the eardrum, it means the tube is clogged/occluded.
 - the tube occlusion is “sealing” the eardrum so that tympanometer can measure eardrum movement

ADDITIONAL NOTE: A functioning open PE tube will also indicate a large ear volume measurement because it is allowing the tympanometer to measure the ear canal and whole middle ear cavity. Therefore, a nonfunctioning closed PE tube would have a volume measurement within the “normal range” – the occlusion allowing the tympanometer to measure ear canal volume alone as it does in a normal healthy ear.

(NEXT SLIDE)

SLIDE 38	<p><u>Other Middle Ear Diseases</u></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Cholesteatoma</p> </div> <div style="text-align: center;">  <p>Tympanosclerosis</p> </div> <div style="font-size: small;"> <p><u>Tymp Types Vary</u> depends on - stiffness of TM & - size of mass in middle ear</p> </div> </div>
-----------------	--

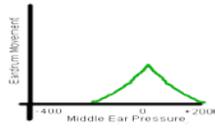
OTHER MIDDLE EAR DISEASES

1. Tympanograms will vary – Type A, B, or C – with other middle ear diseases.
2. It will depend on how the disease process is affecting the movement of the eardrum and ossicles inside the middle ear cavity.
3. Two examples are cholesteatoma and tympanosclerosis.
4. Cholesteatoma may result in a Type A or B depending on size and location of growth and if erosion of ossicles has occurred. Remember otoscopy may reveal a moist pale mass, a perforation and purulent drainage – often foul smelling
5. Tympanosclerosis typically results in a Type A unless scarring and chalky growth on eardrum is extensive.

(NEXT SLIDE)

SLIDE 39

Patient Scenario #1



PATIENT SCENARIO #1

Let's look at four (4) different patient scenarios and determine if an OHC Technician should refer the patient or not.

1. Patient history includes recent head cold with congestion on the day of testing.
2. Patient has a positive STS on the hearing test .
3. Greatest threshold shifts are at 500 Hz and 1000 Hz (lower frequencies).
4. Otoscopy reveals a slightly red TM/eardrum.
5. Tympanometry indicates a (Type B with information provided - might be a severely retracted TM - Type C).

DO YOU REFER?

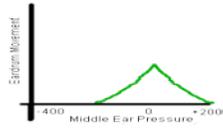
(AFTER DISCUSSION)

6. All four (4) data points - history/complaint, low frequency hearing loss; otoscopy; tympanometry - are consistent with otitis media.
7. General Rule - YES, refer to medical officer.
8. Consider local SOP and medical care circumstances - may request return in 10-14 days for repeat tympanogram.

(NEXT SLIDE)

SLIDE 40

Patient Scenario #2



- **Patient Complaints:**
sounds are muffled
gradually noticed it
- **Positive STS for most frequencies**
- **Otoscopy - cerumen in canal**
--unsure if fully occluded

PATIENT SCENARIO #2

1. Patient complains that sounds are muffled and he/she noticed trouble hearing over time.
2. Positive STS for most frequencies.
3. Otoscopy revealed cerumen in canal but unsure if fully occluded – you can't see the eardrum.
4. Tympanometry indicates a flat Type B tympanogram (Additional: ear volume measurement is small).

DO YOU REFER?

(AFTER DISCUSSION)

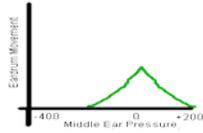
5. All four (4) data points – history/complaint of gradual onset, flat even hearing loss; otoscopy- can't visualize eardrum; flat tympanogram – are consistent with impacted cerumen.
6. Therefore, YES, refer to medical officer for ear lavage.

ADDITIONAL NOTE: Another possibility is related to equipment troubleshooting. Take off probe tip and look at end (the openings) of probe. If any of the tiny openings are clogged with wax, carefully dig out wax with stretched open paper clip or very thin wire. Ladies – a dangling pierced earring wire is the perfect size – remember to disinfect it with alcohol afterwards!

(NEXT SLIDE)

SLIDE 41

Patient Scenario #3



- > **Patient Complaints:**
feels plugged up
recent airplane flight
- > **Positive STS,**
decreased hearing
in lower frequencies.
- > **Otoscopy**
eardrum good color
ossicles very visible

PATIENT SCENARIO #3

1. Patient complains of a plugged up feeling since a recent airplane flight.
2. Positive STS, including a decrease in hearing in the lower frequencies.
3. Minimal STS , including lower frequencies.
4. Otoscopy reveals normal appearing eardrum in terms of color and landmarks (cone of light).
--- middle ear ossicles – malleus/hammer and incus/stirrup are very visible – almost sticking out
5. Tympanometry – skewed high negative pressure Type C tympanogram.

DO YOU REFER?

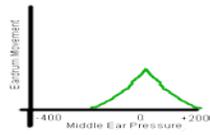
(AFTER DISCUSSION) . . .

6. All four (4) data points – patient history, slight hearing loss, otoscopy showing a retracted eardrum, tympanometry indicating negative middle ear pressure – are consistent with Eustachian tube dysfunction.
7. Recommend that patient waits for 10-14 days to see if ear “opens” up -- Upon retest, if tympanometry is normal, no STS, then NO action is required.
8. Upon retest, if tympanometry continues to indicate a Type B or Type C pattern, and hearing test indicates a positive STS and/or a decrease in low frequencies, then YES, refer to medical officer.
9. Return for follow up tympanogram if plugged feeling persists – if Type B tympanogram occurs, YES, refer to medical officer.
10. If any discomfort/pain/fever occurs, YES, immediately seek medical attention (has developed into otitis media).

(NEXT SLIDE)

SLIDE 42

Patient Scenario #4



- > **Patient Complaints:**
trouble hearing in noise
ringing in both ears
- > **Positive STS**
in high frequencies
- > **Otосcopy**
clear canal
TM normal color

42

PATIENT SCENARIO #4

1. Patient complains of trouble hearing in background noise and ringing sound in both ears.
2. Positive STS on hearing test and the loss is in the high frequencies.
4. Otосcopy reveals a normal appearing ear canal and eardrum.
5. Tympanometry indicates normal middle ear pressure and eardrum movement --- Type A tympanogram.

DO YOU REFER?

(AFTER DISCUSSION)...

6. All four (4) data points - difficulty hearing/understanding in noisy surroundings; hearing loss in higher frequencies, normal otосcopy and tympanometry - is consistent with sensorineural hearing disorder (normal outer and middle ears).
7. YES, refer to Occupational Audiologist for audiology evaluation to determine if STS is valid.

(NEXT SLIDE)

SLIDE 43

SUMMARY

Otoscopy and Tympanometry

- * Otoscopic examination reveals condition of ear canal and eardrum
- * Tympanometry is a fast, objective, accurate assessment of middle ear status and function
- * A Tympanometer measures eardrum movement during controlled pressure changes
- * A Tympanogram shows results in graphic form
- * Refer to medical officer or audiologist for possible conductive disorders

43

SUMMARY: TYMPANOMETRY

To summarize what we have discussed in this unit.....

1. Otoscopic examination reveals condition of ear canal and eardrum.
2. Tympanometry is fast, objective, accurate assessment test of middle ear status and function.
3. A tympanometer measures eardrum movement during controlled pressure changes.
4. A tympanogram shows results in graphic form.
5. Refer to medical officer or audiologist for possible conductive disorders.

(NEXT SLIDE)

SLIDE 44

QUESTIONS ?



44

QUESTIONS?

END OF PRESENTATION

1.7 AUDIOMETER AND TEST ENVIRONMENT

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>THE AUDIOMETER</u> and <u>TEST ENVIRONMENT</u></p> 
-----------------------	--

THE AUDIOMETER and TEST ENVIRONMENT

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Describe the critical components of the audiology test environment.2. Identify the equipment required for audiology testing.3. Explain required audiometer calibration and equipment checks.4. List infection control procedures.5. Troubleshoot temporary and permanent equipment problems.
-----------------------	---

LEARNING OBJECTIVES

1. Describe the critical components of the audiology test environment
2. Identify the equipment required for audiology testing
3. Explain required audiometer calibration and equipment checks
4. List infection control procedures
5. Troubleshoot temporary and permanent equipment problems

(NEXT SLIDE)

SLIDE 3

FOUNDATION
of
**Accurate &
Valid
Hearing Tests**
is the
**1. Test Environment
2. Test Equipment**

Foundation of Accurate Valid Hearing Tests is

1. Test Environment
2. Audiometer

1. What does this statement mean?

2. Many variables or factors can influence accuracy and truth (validity) of a person's test results –

- a. patient's ability and attitude
- b. tester's skills and attention
- c. equipment and test setting

3. In order to set up the test situation to obtain best results, we need to be sure the test environment is as free of ambient noise as possible and test equipment is working properly and consistently.

4. Otherwise, even with the most willing patient and skilled technician, results will be questionable.

5. Let's discuss each of these two critical factors in detail.

(NEXT SLIDE)

SLIDE 4

Equipment Used for Testing

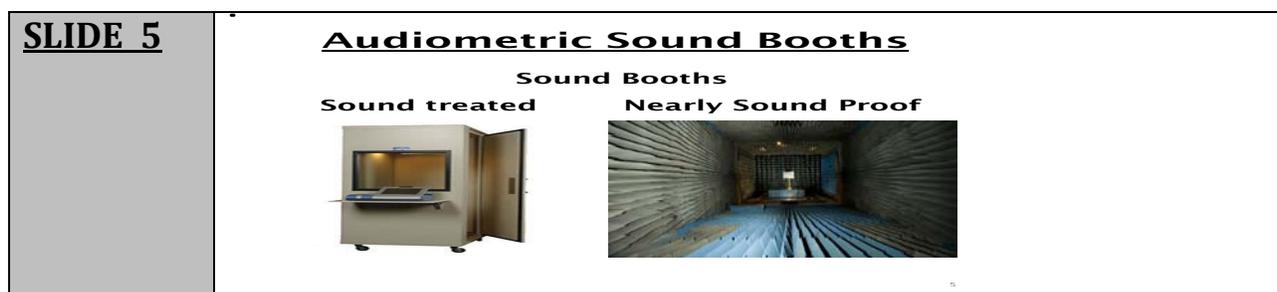
- ✓ Test booth
- ✓ Audiometer
- ✓ Computer and data management software – DOEHRs-HC
- ✓ Headphones/earphones
- ✓ Hand switch or response button
- ✓ Artificial (electroacoustic) ear -- "Bio-Joe" -- or human listener with normal hearing

EQUIPMENT USED FOR TESTING

There are six (6) major pieces of equipment necessary for the OHC Technician to conduct hearing tests.

1. Test booth to provide a sound treated or sound resistant listening environment (not sound proof!).
 2. An audiometer to present each test frequency at various intensity levels.
 3. Computer and data management software to interface with the audiometer.
 - a. software used worldwide by Navy, Army and Air Force is referred to as DOEHRSHC (“doors”)
 - b. acronym for Defense Occupational and Environmental Health Readiness System
- (CLICK)
4. Headphones or earphones that deliver the test tones (stimuli) to the patient’s ears.
 5. Hand switch or response button for the patient to indicate he or she hears test tones.
 6. Artificial ear –formally referred to as an electroacoustic ear but commonly referred to as “Bio-Joe”.
 - a. Bio-Joe is used to simulate a normal hearing listener to determine if the audiometer and headphones are delivering calibrated test signals (expected intensity values) every day
 - b. In situations where a Bio-Joe is unavailable or malfunctioning, a second Bio-Joe or a human listener with documented normal hearing can be used.
 7. Let’s look at each of these pieces of equipment more closely and what specific responsibilities the OHC Technician has for each one.

(NEXT SLIDE)



AUDIOMETRIC SOUND BOOTHS

There are two major types of sound booths . . .

1. Sound treated booths

- a. enclosures built with materials which muffle or reduce the intensity of sounds occurring outside of the booth to a listener inside the booth.
- b. excessive environmental noise - within test room or outside room/building/mobile unit - can interfere with test results .
- c. excessive background noise can elevate patient thresholds, particularly in the lower test frequencies (500-1000Hz).
- d. these booths are NOT sound proof.

2. Sound proof or anechoic chambers are highly treated to create a near perfect silent environment (like outer space).

3. We don't test patients in anechoic chambers.

(NEXT SLIDE)

SLIDE 6

Audiometric Booth Certification

- Required annually
- Performed by
 - Industrial Hygienist
 - or Audiologist
 - or trained technician
- Decibel (dB) Levels
 - inside & outside booth
 - pierside & underway
- Displayed clearly



AUDIOMETRIC BOOTH CERTIFICATION

1. Audiometric Booths must be certified annually - every year - every 365 days.

(CLICK)

2. Instructions state that booth certification is completed by an Industrial Hygienist (most typically) or an Audiologist.

--- In special circumstances, a trained technician may complete booth certification.

(CLICK)

3. Certifying a sound booth means that ambient or environmental noise intensity levels are measured from within the booth.

4. The standard noise levels that are acceptable/allowed are determined by ANSI S3.1 regulations.

--- (American National Standard Institute establishes and publishes standards for all types of equipment and materials, i.e. one pound is the same across all weighting devices.)

5. Noise levels measured inside the booth must be **BELOW** the maximum levels (ANSI S3.1).
6. These measurements must be repeated if the environmental conditions change.
 - For example, ongoing construction, on-ships in port vs. on-ships underway.
7. The booth certification document with all measurements listed must be clearly displayed on a booth's outer wall or wall nearby.

(NEXT SLIDE)

<u>SLIDE 7</u>	<p><u>Excessive Noise in Booth</u></p> <ul style="list-style-type: none"> - deteriorate - leaks - motor noise - air noise - patient noise - technician noise - outside noise
-----------------------	--

EXCESSIVE NOISE IN BOOTH

Potential sources of excessive background noise interfering with testing are usually caused by one of four (4) things.

1. Door seals on the booth have deteriorated with age or environmental conditions (excessive hot dry air or humidity)
 - Seal is not tight allowing noise to enter the booth around the door
2. Jack panels are the areas where the inside equipment is connected to the outside equipment
 - For example, where the audiometer and PC electrical connections go in/out of the booth wall.
3. Ventilation system of the booth is too noisy
 - a. motor cycling the air is too noisy (needs to be oiled or replaced)
 - b. movement of the cycling air is too noisy (too much pressure)
4. Noise created by activity inside and outside the booth
 - a. moving patients – can be particularly troublesome in multiple person booths
 - b. technician or technicians talking, answering telephones, etc.
 - c. activity outside test room in the hallway (conversation, clinic public announcements, equipment movement, remodeling, ship operations) or outside building (construction, band practice, bad weather)

(NEXT SLIDE)

SLIDE 8

Excessive Noise Solutions

- ✓ Repair and/or replace equipment
- ✓ Patients remove jackets, electronic devices
- ✓ OHC Technicians control talking and noise in test area
- ✓ Change testing schedule due to interference from exterior noise
- ✓ Relocate test booth



EXCESSIVE NOISE SOLUTIONS

What are solutions to excessive noise?

1. First, repair or replace any equipment that may be allowing noise to leak into sound booth – door seals, jack panels, ventilation motor/fan.

(CLICK)

2. To reduce patient related noise, request that all jackets be removed (particularly those with “swishy” material).

--- should note whether someone is coughing, sniffing, or moving around excessively inside booth

3. OHC Technician generated noise is the most controllable.
- a. reduce talking -- post “no talking” signs if necessary
 - b. reduce telephone ring volume
 - c. close audiology room doors securely while testing
 - d. monitor noise levels of radios, fans, printers

(CLICK)

4. Testing schedule may need to be changed either temporarily (a few hours or few days) or permanently (months or more) due to construction or change in use of the surrounding building and outside areas.

5. Finally, the test booth location may need to be relocated to another area in order to meet ambient noise standards for accurate and valid hearing testing to be accomplished.

(NEXT SLIDE)

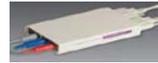
SLIDE 9

What is an Audiometer?

- **Electronic instrument**
- **Measures hearing sensitivity**
- **Generates pure tone signals of known frequency and intensity**

Manual
Audiometer

gsi
GSI 61 Audiometer



Microprocessor
Audiometer
Benson Medical Inc
CCA-200 mini

WHAT IS AN AUDIOMETER?

- 1. An Audiometer is an electronic instrument.**
- 2. It measures hearing sensitivity or thresholds for sound.**
- 3. An Audiometer generates pure tone signals of known frequency and intensity which typically are delivered to a listener through some type of headphones.**
- 4. OHC Technicians typically use a Microprocessor Audiometer to administer reference, monitoring and Non HCP audiograms.**
 - Currently, the most commonly used Microprocessor Audiometer in the military is the Benson Medical Inc CCA-200 mini audiometer.**

(Instructor Tip: Good idea to show students a BMI CCA-200 mini audiometer or typically used model)

- 5. Microprocessor Audiometer software allows for automated hearing testing.**
 - a. automated hearing testing means the audiometer is connected to a computer that controls everything.**
 - b. software is used to vary the intensity of each frequency/tone according to listener's response using an averaging formula to determine final threshold level.**
 - c. OHC Tech starts and stops test presentation.**
 - d. BMI CCA-200 mini audiometer has option that allows for manual manipulation of both frequency and intensity for difficult to test patients**
- 6. Manual audiometers are machines that are totally under the user's control.**
 - a. basic manual audiometers are used when portability is necessary, such as administering hearing screenings in schools and community centers, bedside hospital testing, and general medical care clinics.**
 - b. it is possible that an OHC Technician might have to use one of these types of manual audiometers at some testing sites.**
- 7. Audiologists use larger complex manual audiometers, such as the GSI 61 audiometer.**
 - a. also referred to as a diagnostic audiometer, this type of audiometer presents various sounds**

- i. frequency tones, speech (recorded or live microphone), noise bands in various ways
 - ii. to one ear at a time or to both ears simultaneously
 - iii. to perform a variety of hearing test procedures
- b. audiologists control presentation of all sounds generated and presented to the listener.
- c. diagnostic audiometers can be connected to a computer for data management and printing audiograms and reports.

8. Next two (2) slides compare microprocessor or automated audiometers to manual audiometer (or function)

(NEXT SLIDE)

<u>SLIDE 10</u>	<p><u>Audiometers Used by OHC Technician</u></p> <p style="text-align: right; font-size: small;"><i>Continued...</i></p>
------------------------	---

AUDIOMETERS USED BY OHC TECHNICIAN – comparisons

Microprocessor	Software controls testing – audiometer is connected to computer
Manual	Examiner controls testing

Microprocessor	Patient controls stimulus by responding (i.e., signal intensity automatically increases with no response)
Manual	Examiner controls stimulus (i.e., changes stimulus intensity according to observation of patient response)

Microprocessor	Can test one (1) to eight (8) patients at one time (depends on sound booth configuration)
Manual	Tests one (1) patient at one time

Microprocessor	Calculates STS automatically
Manual	Tech or Audiologist must calculate STS

(NEXT SLIDE)

SLIDE 11

11

MICROPROCESSOR and MANUAL AUDIOMETERS -- comparisons

Microprocessor Prints audiogram forms - 2215, 2216, Non HCP and daily calibration form 2217

Manual Tech or Audiologist manually completes (handwrites) audiogram forms (uses "X" for left ear, "0" for right ear on graph)

Microprocessor All patient and test data are exported/uploaded to central data repository

Manual Tech or Audiologist types or transcribes patient and test data from handwritten audiogram into computer database before uploading

Microprocessor Option for technician to manually control stimulus presentation

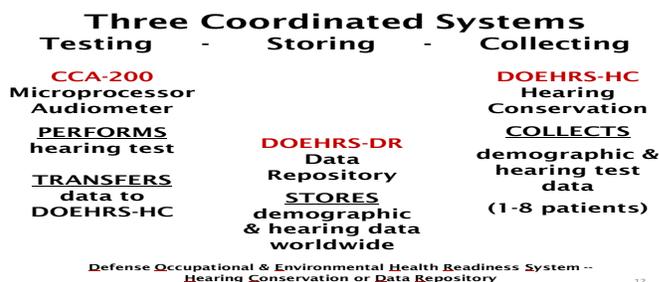
Manual Tech or Audiologist has full control of frequency and intensity presentation and final determination of threshold

Microprocessor Requires maintenance, software upgrades, data backup and calibration (annual electroacoustic and daily biologic checks)

Manual Requires maintenance and annual calibration (listening check before each day's use)

(NEXT SLIDE)

SLIDE 12



THREE COORDINATED SYSTEMS

DoD Hearing Conservation Programs use three (3) systems in a coordinated and interfacing manner to test/monitor hearing.

These three systems test hearing --- collect --- and store data.

(CLICK)

1. The CCA-200 Microprocessor Audiometer performs the hearing test and transfers the data to DOEHRS-HC (e.g. the local computer database)

(CLICK)

2. DOEHRS-HC --Hearing Conservation- collects employee demographic and hearing data on 1 to 8 employees at one test session

(CLICK)

3. DOEHRS-DR – Data Repository – stores all DOEHRS-HC demographic and hearing data uploaded world-wide into a central database.

--- DOEHRS-DR is also used to analyze data to generate reports, and to evaluate and manage Hearing Conservation Programs

4. These three (3) systems work together:

- a. DOEHRS-HC downloads previous demographic and test data from DOEHRS-DR**
- b. DOEHRS –HC transfers 2215 reference data to CCA-200 audiometer**
- c. CCA-200 software compares reference data to current test thresholds to determine significant threshold shifts (STS)**
- d. DOEHRS-HC retrieves test data from CCA-200 audiometer**
- e. DOEHRS- HC uploads to DOEHRS-DR to store updated employee data so it is available to other test sites/personnel**
- f. DOEHRS – DR provides HCP Managers useful data to provide to local commands concerning their HCP effectiveness.**

ADDITIONAL NOTES:

DOEHRS stands for Defense Occupational and Environmental Health Readiness System -- Hearing Conservation or Data Repository

The following is an excerpt from DOEHRS website:

“The Defense Health Services Systems (DHSS) manages the development of the Defense Occupational and Environmental Health Readiness System (DOEHRS). The DOEHRS will integrate Force Health Protection (FHP) information by providing automated support for the Military Health System (MHS), Industrial Hygiene (IH), Environmental Health (EH), and Hearing Conservation (HC) Communities. The DOEHRS will support health care demand management by enabling exposure based Occupational Medicine (OM) and IH interventions. DOEHRS-HC collects, maintains, compares, and reports hearing readiness, deployment and hearing conservation program (HCP) data for DoD personnel who meet the requirements for monitoring audiometry. The DOEHRS-HC and the Data Repository (DR) also provide users with program management opportunities.”

(NEXT SLIDE)

SLIDE 13

Other System Components

Electroacoustic Simulator (“Bio-Joe”)

- **Verifies calibration status of audiometer**
- **Attached to audiometer for Biological Calibration check**



Headphones or Earphones

- **Calibrated with an audiometer as unit**
- **Swapping headphones changes calibration**
- **Must be repaired together**

Hand switch

13

OTHER SYSTEM COMPONENTS

- 1. We have mentioned the Electroacoustic Simulator or Artificial Ear (“Bio-Joe”). It is used for your daily biologic calibration check.**
 - a. this piece of equipment verifies calibration status of audiometer at beginning of test day.**
 - b. the Bio-Joe is mounted on the wall at every listening station.**
 - c. the Bio-Joe is connected to the audiometer; sitting atop a fixed bracket, with the audiometer tucked behind the bracket.**

(CLICK)

- 2. Headphones or earphones deliver the test tones to the listener.**
 - a. Each headphone set is calibrated with each audiometer as a unit**
 - b. Swapping headphones changes calibration**
 - c. Therefore, audiometer and headphone sets MUST be repaired together**
- 3. Response Button or Hand Switch is how the patient indicates he/she has heard the tone signal. It is heavily used in group testing booths so it needs to be checked as part of the daily calibration check.**

(NEXT SLIDE)

SLIDE 14

Testing Equipment Checks



14

TESTING EQUIPMENT CHECKS

There are three (3) equipment checks that are mandatory – one is performed annually, two are performed daily before testing begins.

Some of this information has been discussed previously – now we discuss in more detail

(NEXT SLIDE)

<u>SLIDE 15</u>	<ul style="list-style-type: none">• Required annually• Performed by NMCPHC• Verifies all frequency & intensity outputs• Each audiometer has a calibration sticker• Daily Biologic Calibrations (DD2217) established following annual calibration
------------------------	--

ELECTROACOUSTIC CALIBRATION

1. Electroacoustic calibration is required annually.
 - a. DOEHRS-HC software will begin showing a warning about the due date about one (1) month prior to the expiration date
 - b. DOEHRS-HC software will stop functioning if electroacoustic calibration is not completed by due date

2. Electroacoustic calibration is completed by the Navy Marine Corps Public Health Center.
 - a. results are recorded on standard NMCPHC form
 - b. a Type I sound level meter is used
 - c. completed by an industrial hygienist, an audiologist or trained technician. This is NOT a responsibility of OHC Technician.
 - d. a specific audiometer is always calibrated with a specific pair of headphones (i.e. a set, a total sound system).
 - e. note if one of these two (2) pieces of equipment need repair or replacement during the calibration year, electroacoustic calibration must be completed on the new pairing of audiometer and headphones

3. Purpose of electroacoustic calibration is to verify the audiometer is generating known outputs at all frequencies and intensities.
 - In other words, if the audiometer says it is presenting 1000 Hz at 40 dBHL to the listener, the output is truly 1000 Hz at 40 dBHL.

4. Each audiometer has a calibration sticker indicating serial number and date of calibration.

5. Immediately after electroacoustic calibration is completed by NMCPHC, the OHC Tech must perform an initial biologic calibration for each audiometer, recorded automatically on a DD2217 by the DOEHRS-HC software.
 - a. initial dB levels recorded on this baseline (DD2217) performed on Day 1, will be compared to each additional daily calibration (Days 2-365)
 - b. the dB values should not change significantly from the initial (Day 1) baseline results
 - c. all 365 “daily calibration” results are recorded on same DD2217, but days 2-365 dB values are compared to the initial dB values obtained on day 1.

(NEXT SLIDE)

SLIDE 16	<p>Daily hands-on check of hardware</p> <p>Visually check equipment earphone headband tension earphone cushions and diaphragms cords and connections</p> <p>Listen to pure tones through headphones frequency and intensity changes tone quality crosstalk and static</p> <p style="text-align: right;">16</p>
-----------------	--

FUNCTIONAL LISTENING CHECK

1. Performed daily before testing employees. It is a physical hands-on check of each test listening station. This means that you must go inside sound booth, inspect equipment and put headphones on to listen.
2. A Functional Listening check is the only way to detect problems with the headset, wiring, handswitch, jacks/plugs
3. Set up Functional Listening Check on the CCA-220 computer screen. DO NOT click “START”. Go into the booth. You will begin each listening check by pushing the response button attached to each audiometer/listening station in the booth.
4. Visually inspect test equipment at each listening station.
 - a. earphone headband should have enough tension so the two earphones touch each other. This will make a snug closure on most listeners’ ears to control ambient noise interference.
 - b. look at earphone cushions to check for excessive dryness and cracks – replace the earphone cushions (NOT the whole headphone set)
 - c. look at earphone diaphragm – inspect for obstruction, debris or punctures
 - d. look at cords and connections – jack cords and plugs, response cord and button– there should be no breaks/cracks or loose connections

5. Put on headphones and push response button.
 - a. listen for systematic frequency changes (500-6000Hz) in left earphone and intensity changes (60-0 dBHL) in right earphone
 - b. listen for test tone quality – you should hear pitch and intensity changes that are even -- no crackling or static tones
 - c. when continuous tone appears in left ear, check for crosstalk and static
 - i. pull left earphone from ear to check if you hear tone in right earphone
 - ii. shake earphone cords and run fingers down cords to check for static or breaks in tone
 - iii. repeat for right earphone

6. Prepare for Biologic Calibration.
 - a. place earphones on Bio-Joe matching left/right earphone colors
 - b. adjusting headband into smallest position maximizes tension and therefore tight closure with Bio-Joe receiving cups
 - c. unplug response button cord from bottom of Bio-Joe
 - d. TIP: If light on Bio-Joe is on, then it is engaged and will respond to audiometer

(NEXT SLIDE)

SLIDE 17	<ul style="list-style-type: none"> ▪ Verifies calibration values of audiometer (Day 2-365) have not changed significantly from (Day 1) baseline ▪ Performed daily before first employee is tested ▪ Bio-Joe should be used as primary calibrator normal hearing listener acceptable; as secondary ▪ Bio-Joe thresholds range from 60 - 80 dBHL ▪ Permitted deviations from initial baseline values ± 5 dB at 500-4000 Hz ± 10 dB at 6000 Hz ▪ DD 2217 form established as legal record; maintained for 5 years
-----------------	--

BIOLOGIC CALIBRATION CHECK

1. Purpose of Daily Biologic Calibration Check is to verify that daily output (dB) from audiometer has not changed significantly from dB values obtained on Day 1 calibration immediately performed following annual electroacoustic calibration.

2. Biologic calibration check is performed daily before first employee is tested.
 - DOEHRS-HC will not interact with the audiometer if this task is not completed.

3. Instructions require that the artificial ear – “Bio-Joe -- be used to perform daily biologic calibration.
 - a. however, a backup human listener with documented normal hearing thresholds can be used, if necessary.
 - b. artificial ears typically have a flat response curve across frequencies between 60-80dBHL.

4. Results of daily biologic calibration values, recorded on DD2217 (days 2-365) must not significantly differ from initial baseline DD2217 values recorded (day 1).
5. Allowable deviations are as follows:
 - a. ± 5 dB at 500-4000 Hz
 - b. ± 10 dB at 6000 Hz
 - c. typically, values will be between 65 - 70 dBHL
6. Daily Biologic Calibration results (values) are recorded on DD 2217 form.
 - a. this 2217 form is a legal record.
 - b. printed copies – typically by the month – are required to be maintained for five (5) years at the test site.

(NEXT SLIDE)

<u>SLIDE 18</u>	<p style="text-align: center;"> If audiometer fails calibration check all connections check placement & condition of earphones repeat calibration check </p> <p style="text-align: center;"> Use alternate listener if problem persists </p> <p style="text-align: center;"> If audiometer fails calibration with 2nd listener send out for repair (with earphones) use backup audiometer if available </p>
------------------------	--

BIOLOGIC CALIBRATION CHECK #2

What if the Biologic Calibration results/values fail or are outside of acceptable range of baseline 2217 values (intensity levels at each test frequency)?

1. OHC Technician should perform the following troubleshooting tasks
 - a. check all connections -- jack connections at listening station are tight – use alcohol swab to clean jack plugs
 - b. check placement and condition of earphones -- earphone cushions should be tightly seated in Bio-Joe’s receiving cups
 - c. response button is not attached
2. Repeat calibration check with Bio-Joe
3. Use alternate listener if problem persists -- Back-up Bio-Joe (preferred) or a normal hearing human listener
4. If audiometer fails calibration with 2nd listener
 - a. send audiometer with headphones for repair/calibration within 30 days.

- b. discontinue use of that audiometer/listening station
- c. use backup audiometer if one is available

(NEXT SLIDE)

<u>SLIDE 19</u>	<u>Causes for Failed Calibration Check</u> <ol style="list-style-type: none">1. Improper earphone placement2. Poor connections at jack panel or to audiometer3. Worn out or flattened earphones4. Annual electroacoustic calibration expired5. Malfunctioning artificial ear (Bio-Joe)6. Malfunctioning audiometer <small>19</small>
------------------------	--

CAUSES FOR FAILED CALIBRATION CHECK

For review and to give reasons for a failed biologic calibration check.

(INSTRUCTOR TIP: Quiz students before showing the six major causes.)

(CLICK)

1. Improper earphone placement.
2. Poor connections at jack panel or to audiometer.
3. Worn out or flattened earphones.

(CLICK)

4. Annual electroacoustic calibration expired.
5. Malfunctioning artificial ear (Bio-Joe).
6. Malfunctioning audiometer.

(NEXT SLIDE)

SLIDE 20

**Audiometer Care and
End of Day Procedures**

- ✓ Clean earphones & cords *(if not done in a.m.)*
- ✓ **Hang** earphones on hook - **NOT on Bio-Joe**
- ✓ **Back up** audiometric data on external drive
- ✓ **Export** audiometric data to DOEHRS-DR daily
- ✓ Completely **shut down** system to prevent data corruption *(before CAC removal)*
- ✓ Store or dispose of employee data re: HIPAA regulations

20

AUDIOMETER CARE END OF DAY PROCEDURES

First of all, go into sound booth

1. Clean the earphones, hand switch, cord, chair and stools with disinfecting disposal wipes (non-alcohol). Some technicians prefer to do this task in the morning after daily biologic calibration as they reattach the response switch to the audiometer.
2. **Hang** earphones on hook -- **NOT** artificial ear - increases life of appropriate headband tension.

(CLICK)

3. **Back up** audiometric data on external drive.
4. **Export** audiometric data to DOEHRS-DR daily or weekly if you lack internet access.

(CLICK)

5. Completely **shut down** system* to prevent data corruption (before CAC removal) - *this does not include the computer itself.
6. Store or shred any employee data (demographic forms, End of Day list) according to HIPAA regulations.

(NEXT SLIDE)

SLIDE 21

Infection Control Procedures

Critical Equipment

IF

Objects touch . . .
blood, mucous, ear drainage,
cerumen, other bodily fluids

THEN

Clean & sterilize after each use

1. Probe tips for tympanometry
2. Otoscope speculae (non-disposable)
3. Ear gauges

21

INFECTION CONTROL PROCEDURES

1. Equipment that comes into physical contact with any patient is considered critical equipment
2. IF any equipment or surface comes into contact with blood, mucous, ear drainage, cerumen (ear wax) or other bodily fluids,
3. THEN it should be cleaned and sterilized before using again.
4. Equipment that is used to touch or enter the outer ear is used one time --- it must be cleaned and sterilized before using it again
 - a. probe tips for tympanometry
 - b. otoscope speculae (non-disposable)
 - c. ear gauges

(NEXT SLIDE)

SLIDE 22	<p><small>Infection Control Procedures ...</small></p> <p>Non-Critical Equipment</p> <p>Clean & Disinfect</p> <p>disposable germicidal pre-moistened wipes hospital grade disinfectant</p> <ol style="list-style-type: none">1. Headphones2. Headbands3. Response buttons4. Environmental surfaces <p style="text-align: right;"><small>22</small></p>
-----------------	---

NON-CRITICAL EQUIPMENT

1. Non-critical equipment includes those objects that come into contact with skin/hair/hands.
2. They should be cleaned daily with disposable pre-moistened wipes/cloths with hospital grade disinfectant .
--- Caution: Gloves needed when using some types of disinfectants.
3. This equipment includes ----
 - a. earphone cushions – use caution that moisture does NOT enter the diaphragm
 - b. headbands
 - c. response buttons and cords
 - d. environmental surfaces – tables, chairs in testing and counseling areas

(NEXT SLIDE)

SLIDE 23

SUMMARY

**FOUNDATION
of
Accurate Valid
Hearing Tests**

1. Quiet Environment
2. Calibrated Working Equipment

23

SUMMARY

As stated in the beginning of this unit-----

1. The Foundation of Hearing Test Results that are accurate and valid is dependent on two critical elements ...
 - a. a controlled quiet test environment
 - b. calibrated test equipment in proper working condition - audiometer (headphones and response buttons), sound booth, software
2. Someone might ask, "If this audiology test system is so automated, the OHC Tech's job must be just an on-off button pusher and an usher showing patients in and out of the sound booth."
3. CERTAINLY NOT!
4. OHC Technician's job requires you ...
 - a. to review the test for accuracy and validity,
 - b. to confirm that calculation of possible STS is accurately based on the most recent valid reference audiogram
 - c. to accurately interpret and EXPLAIN results to employee
 - d. to follow through with appropriate disposition and referral procedures
 - e. is responsible for ensuring these two (2)critical elements are present and consistent for each employee tested.
5. Automated equipment improves accuracy and efficiency of the testing process but cannot complete these responsibilities.
6. OHC Technician's job is critical/essential in meeting the mission of Occupational Audiology.

(NEXT SLIDE)

SLIDE 24



24

1.8 AUDIOMETRIC TESTING: PROTOCOLS and TESTING

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>AUDIOMETRIC TESTING</u> PROTOCOLS and TECHNIQUES</p> 
-----------------------	---

AUDIOMETRIC TESTING PROTOCOLS and TECHNIQUES

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Name types of audiograms and purposes.2. List patient characteristics that need consideration before testing.3. Explain the method used to establish hearing thresholds.4. Name factors affecting test validity and reliability.5. Role play pre-test activities with "patient".
-----------------------	---

LEARNING OBJECTIVES

1. Name types of audiograms and purposes
2. List patient characteristics that need consideration before testing
3. Explain the method used to establish hearing thresholds
4. Name factors affecting test validity and reliability
5. Role play pre-test activities with a "patient"

(NEXT SLIDE)

SLIDE 3

Purpose of Audiometric Testing

- **Measuring individual hearing thresholds**
- **Determining change in hearing thresholds**
- **HC education and HPD fitting**
- **Proper referral**
- **First step in Fitness for Duty evaluation**
- **Monitor effectiveness of HCP**

PURPOSE OF AUDIOMETRIC TESTING

There are two primary purposes for audiometric testing

1. First primary reason for performing Audiometric Testing is to measure hearing thresholds of individual employees.
2. Second primary purpose is to determine if there has been any change in those hearing thresholds for the individual.
3. The other purposes of audiometric testing follow from these two (2) primary reasons.
4. Hearing Conservation education and proper fitting of Hearing Protection Devices (HPDs) and their use can be provided during explanation/counseling of test results
5. Routine testing can identify employees that need referral to Audiologists and Medical Officers for hearing related problems.
6. Audiometric Testing is the first step in evaluating for Fitness for Duty
7. Analysis of large groups of employees' hearing thresholds can provide data to monitor the effectiveness of the HCP.
8. Remember the mission of Occupational Audiology and the HCP -- since we can't "cure" hearing loss, we must make every effort to prevent it .

(NEXT SLIDE)

SLIDE 4

Hearing Measurement
by
OHC Technician



Pure Tone Air Conduction only
Frequencies: 500 Hz – 6000 Hz
Threshold of Hearing:
*softest intensity of sound
that can be detected
at least 50% of the time*
Accurate data collection and
recordkeeping

HEARING MEASUREMENT BY OHC TECHNICIAN

1. Audiologists measure hearing in a variety of ways.
--- OHC Technician measures hearing by testing with pure tones delivered to the listener by air conduction (earphones).
2. An employee's sensitivity to specific frequencies (pitches) are measured
--- These specific frequencies are 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz and 6000 Hz
3. Goal of this hearing test is to determine the individual's threshold for hearing each frequency.
--- Definition of threshold is the "*softest intensity of sound that can be detected at least 50% of the time*"
4. OHC Technician is responsible for the accuracy of employee data collected and recording it on appropriate forms and software databases.

(NEXT SLIDE)

SLIDE 5

Types of Audiogram Forms

DD Form DD Form
2215 2216

Non-HCP

TYPES OF AUDIOGRAM FORMS

Three (3) types of forms or audiograms are approved by DoD to record hearing tests (not including diagnostic audiogram form).

Each form or audiogram is used for different reasons or purposes.

We will discuss each one and why it is used for what purpose.

(NEXT SLIDE)

SLIDE 6

Types of Audiograms

**Reference or Baseline Audiogram
DD Form 2215**

- Future tests compared to reference thresholds to measure change in hearing
- Required of all military personnel
- Required of DOD civilians enrolled in HCP
- Completed prior to work in hazardous noise
- Re-established after a confirmed STS

TYPES OF AUDIOGRAMS: REFERENCE OR BASELINE AUDIOGRAM Form DD2215

1. An employee's initial hearing thresholds are established by comparing them to normal hearing standards or range.
--- This test then becomes the reference or baseline audiogram for this person. It is recorded on a Form DD 2215 Reference Audiogram.
2. Future tests will be compared to these reference thresholds in order to measure and monitor any changes in hearing.
3. Form DD 2215 Reference Audiogram is required of ALL military personnel and those DOD civilians enrolled in the HCP working in identified hazardous noise areas.
4. Form DD2215 Reference Audiogram should be completed before beginning work in hazardous noise.
5. When a Significant Threshold Shift (STS) has been confirmed by an Audiologist upon diagnostic evaluation, then
 - a. a new Form DD 2215 Audiogram reference is established with the new or current baseline thresholds.
 - b. previous DD2215 is maintained in the Medical Record but should not be used for comparison with future hearing tests.

(NEXT SLIDE)

SLIDE 7

The image shows a sample of the DD Form 2215 Reference Audiogram. The form is titled 'REFERENCE AUDIOGRAM' and includes sections for 'PATIENT INFORMATION', 'TEST INFORMATION', 'TEST RESULTS', and 'AUGUST INFORMATION'. It contains various fields for recording data such as name, date, test type, and hearing thresholds.

REFERENCE AUDIOGRAM DD FORM 2215

(Instructors Note: Audiograms are explained in detail in Audiometric Protocols unit – suggest that you simply show them this slide for general familiarization).

1. The form is clearly labeled or titled “Reference Audiogram” at the top and has one test recording section.
2. The form number is printed at the bottom of the page, left corner. (Image is cropped for enlargement)

(NEXT SLIDE)

SLIDE 8	<small>Types of Audiograms cont...</small> <u>Hearing Conservation Audiogram</u> DD Form 2216 <ul style="list-style-type: none">▪ Annual hearing test▪ Follow-up #1 and #2 hearing tests▪ Pre-Post Deployment monitoring▪ Termination of active duty or enrollment in HCP▪ Other
----------------	--

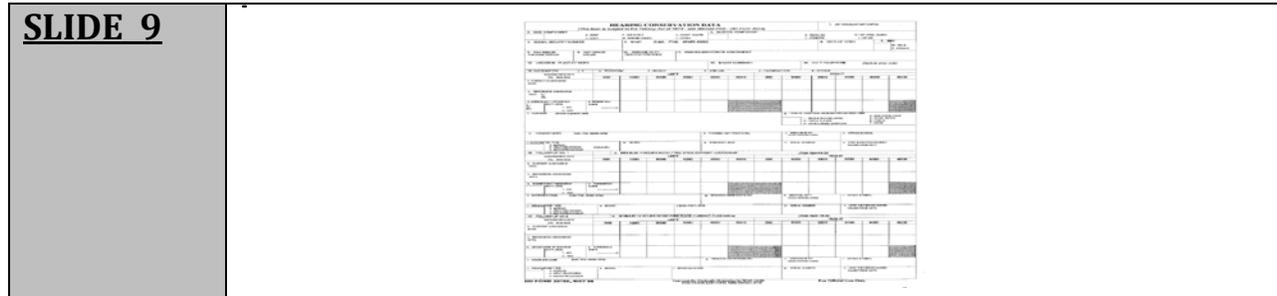
HEARING CONSERVATION AUDIOGRAM DD FORM 2216

(INSTRUCTOR: Just read the list of reasons for using a Form 2216 audiogram. Each will be discussed in detail.)

1. The Hearing Conservation Audiogram DD Form 2216 is used for multiple purposes.
2. It is most often used to record the annual monitoring hearing test for personnel enrolled in the HCP.
3. It is used to record the follow-up tests when results of an annual test indicate a positive STS (significant threshold shift).
4. A 2216 form is used to record hearing levels pre and post deployment to access if any hearing loss is acquired during deployment.
5. All military personnel must have a termination audiogram ...
 - a. prior to leaving active duty (separation or retirement)
 - b. when removed from enrollment in the HCP
6. All civilians enrolled in the HCP need to have a termination audiogram when they are no longer enrolled in the HCP due to changes in working conditions or job re-assignment.

7. Other work situations may require use of a DD FORM 2216 as long as the patient is enrolled in HCP.

(NEXT SLIDE)



HEARING CONSERVATION AUDIOGRAM DD FORM 2216

(Instructors Note: Audiograms are explained in detail in Audiometric Protocols unit – suggest that you simply show them this slide for general familiarization).

1. The form is clearly labeled or titled “HEARING CONSERVATION DATA” at the top and has three (3) test recording sections.
2. The form number is printed at the bottom of the page, left corner.

(NEXT SLIDE)

ANNUAL HEARING TEST DD Form 2216

1. DD Form 2216 is the audiogram used to record hearing test results of all employees, active duty military and civilians, who are enrolled in HCP.
 - a. an annual hearing test for those enrolled in the HCP is the primary --most typical—reason to complete a DD Form 2216.
 - b. NOTE: By instruction, all Marines and Army active duty personnel are enrolled in HCP and must be tested annually.

2. Each employee must have a valid Form DD 2215 Reference audiogram completed in order for a DD 2216 audiogram to be generated. This allows for comparison of thresholds to determine if a STS has occurred.

3. There is no requirement for an employee to be noise-free for 14 hours before completing a 2216 audiogram test

(NEXT SLIDE)

SLIDE 11	<small>Types of Audiograms cont...</small> Annual Follow-up Tests DD Form 2216 <ul style="list-style-type: none">▪ Follow-up tests #1 and #2 performed after STS identified▪ Noise-free requirement – 14 hours▪ Both tests can be completed on same day▪ Must be completed 1-30 days after initial DD 2216 test <small>11</small>
-----------------	--

ANNUAL FOLLOW-UP TESTS FORM DD 2216

1. A third reason/purpose in using a DD Form 2216 audiogram is to record Follow Up tests to the annual hearing test.

2. When a patient's hearing test results indicate an STS (failure to pass), all Follow-up tests are recorded on the Form DD 2216. DOEHRs-HC generates a DD Form 2216 with all the data/thresholds from the 2 or 3 test sessions: Annual Test, Follow Up #1 and Follow Up #2 (if required).

3. Employee is required to be noise-free for 14 hours before taking the test.
a. encourage him/her to come first thing in morning after a quiet evening/weekend.

b. DoD instructions are more stringent than OSHA and does not allow HPDs to be worn in place of being 14 hours noise free

4. Both tests, Follow Up #1 and #2, can be completed on the same day

5. However, patients must return to complete Follow-up tests within 30 days of the initial DD 2216 failed exam.

a. DOEHRs-HC will automatically upload employee demographic info as a Follow Up #1 or #2 within that 30 day time period.

b. past the 30 days, DOEHRs-HC may require an annual test to be re-administered.

(NEXT SLIDE)

SLIDE 12

Types of Audiograms cont...

Pre/Post Deployment Hearing Test **DD Form 2216**

- Administered pre/post deployment
Army and Air Force requirement for pre
and post deployment
Not required for Navy in most cases
- Results compared to reference DD 2215
- Determines HL during deployment

12

PRE/POST DEPLOYMENT HEARING TEST Form DD 2216

1. A second purpose for using a Form DD 2216 is for hearing tests pre or post deployment.
 - a. Army and Air Force require that deployed personnel obtain a hearing test pre and post deployment
 - b. Normally, Navy personnel are not required to obtain a hearing test pre-deployment since our peacetime/wartime deployments are the same; however, it may be requested for some sailors going IA in support of Marines and/or Army Units.
2. A Form DD 2216 allows for current test results to be compared to the DD Form 2215 Reference audiogram in order to determine any change in hearing resulting from the deployment assignment/experience.

(NEXT SLIDE)

SLIDE 13

Types of Audiograms cont...

Termination/Separation Hearing Test **DD Form 2216**

- Every military personnel prior to leaving active duty
- Civilians after removal from HCP
- Civilians enrolled in HCP prior to leaving civil service

13

TERMINATION/SEPARATION HEARING TEST DD FORM 2216

1. Final reason or purpose for using a Form DD 2216 is when employees are separating from active service or are no longer in the HCP.
2. All military personnel must have a DD2216 audiogram completed before receiving military separation papers DD Form 214 regardless of whether they were enrolled in HCP (signed 19 SEPT 2011 by Under Secretary of Defense)
3. All civilians enrolled in an HCP must complete a DD Form 2216 audiogram after being removed from an HCP.

- a. due to job reassignment or leaving employment with the military or other civil service employment (HCP enrollment)
- b. hearing test should be completed as soon as possible after job reassignment
- c. removal from HCP is automatic when individual assumes a Non-HCP job not identified by IH to be noise hazardous.

(NEXT SLIDE)

SLIDE 14	<p style="text-align: right; font-size: small;">Types of Audiograms cont...</p> <p style="text-align: center;"><u>Non-Hearing Conservation Test</u></p> <ul style="list-style-type: none"> - Personnel not routinely exposed to hazardous noise – not enrolled in HCP PHA, flight physicals, dive physicals, Occupational Health physicals, forklift operators, commissioning, pre-hire job applicants, military reserve, “courtesy” hearing tests - Results not compared to reference audiogram (DD 2215) - Referrals generally made to medical clinic <p style="text-align: right; font-size: x-small;">14</p>
-----------------	--

NON-HEARING CONSERVATION TEST

1. Non - Hearing Conservation Test form is used to record test results for personnel not enrolled in the HCP.
2. Ask patient what his/her job is and whether he/she is routinely exposed to hazardous noises (Average 16hrs/month or 2 days/month).

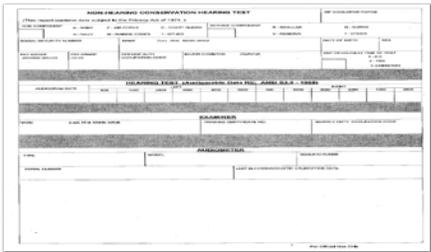
(CLICK)

3. Typical reasons to request a hearing test when not enrolled in HCP is.....
 - a. PHA (Physical Health Assessment)
 - b. flight physicals for administration pilots and physicians
 - c. dive physicals
 - d. Occupational Health physicals (some may be in HCP)
 - e. forklift operators (some may be in HCP)
 - f. officer commissioning physicals - ROTC students
 - g. pre-hire civilian job applicants
 - h. military reserve personnel - unless activated to active duty
 - i. courtesy hearing tests
4. Test results are not compared to DD 2215 Reference audiogram officially
 Note: OHC technician may use judgment whether to visually compare during counseling and if circumstances allow this courtesy
5. Any referrals - hearing loss, medical concerns - are made to medical clinic and personal physicians

6. NOTE: Some commands require all personnel to be enrolled in HCP due to irregular exposure to noise

(NEXT SLIDE)

SLIDE 15



NON-HEARING CONSERVATION FORM – DOEHR5-HC

(Instructors Note: Audiograms are explained in detail in Audiometric Protocols unit – suggest that you simply show them this slide for general familiarization).

1. The form is clearly labeled or titled “NON-HEARING CONSERVATION HEARING TEST” at the top.
2. There is no form number is at the bottom of the page because this is generated by DOEHR5-HC software.

(NEXT SLIDE)

SLIDE 16

Types of Audiograms cont...

Diagnostic Audiology Evaluation

- Administered by audiologists
- Includes patient history, pure tone air and bone conduction, speech recognition in quiet and noise, tympanometry, acoustic reflex, etc.
- Pure tone air conduction results - graph form
“O” = Right ear “X” = Left ear
- Fitness for Duty determination

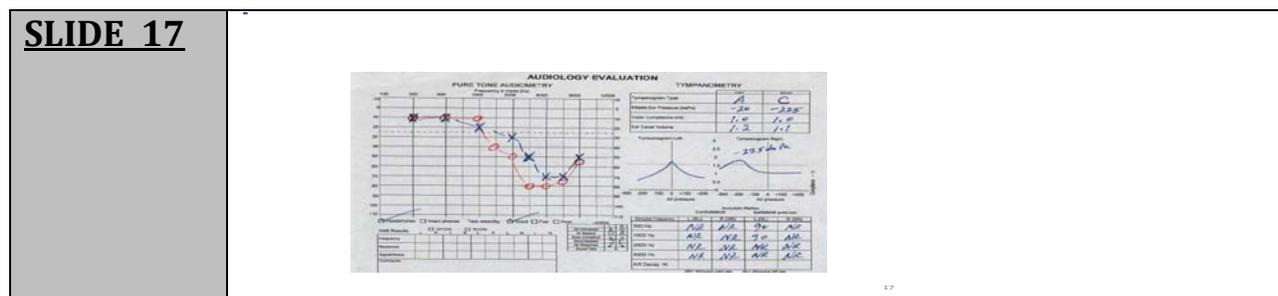
16

DIAGNOSTIC AUDIOLOGY EVALUATION

1. Diagnostic Audiology Evaluations – “audiology assessment” -- are administered by an occupational audiologists.
 - a. only audiologists can confirm validity of a Significant Threshold Shift (STS) and re-establish a patient’s baseline –
DD Form 2215 – when a hearing loss has occurred.
 - b. other personnel, such as a OHC Technician, can re-establish a baseline only when given written authority via local SOP.

2. Assessment takes approximately one hour and procedures include ...
 - a. patient history
 - b. pure tone air and bone conduction
 - c. speech recognition in quiet and noise
 - d. tympanometry and acoustic reflex testing
 - e. if necessary -- procedures specific to non-organic hearing loss and advanced electrophysiologic assessment.
3. Audiologists hand write evaluation results on a graph or audiogram using symbols to record patient responses.
4. OHC Technicians may be required to transfer audiologist's diagnostic audiogram into DOEHRS-HC software.
5. Symbols for pure tone air conduction thresholds are "O" = Right ear, "X" = Left ear.
6. Audiologists confirm or determine Fitness for Duty as it relates to hearing.

(NEXT SLIDE)



DIAGNOSTIC AUDIOGRAM

Here is an example of an audiogram in graphic form.

1. Audiologists manually test patients and record their responses by writing "O" for Right Ear and "X" for Left Ear for Air Conduction testing.
2. If color is used, Red is or Right, Black or Blue is for Left. Memory trick is "Right-Round-Red" (RRR).
3. Other symbols you may see indicate that masking was used in the opposite ear while testing or indicate results for a different type of test, i.e. bone conduction results may be indicated with arrows, triangles, boxes.
4. There is usually a legend for symbols printed on the audiogram.

(NEXT SLIDE)

SLIDE 18	<u>Hearing Testing – Critical Steps</u> <ul style="list-style-type: none">• GETTING PATIENT READY• ADMINISTERING HEARING TEST• RECORDING TEST RESULTS
-----------------	---

HEARING TESTING – CRITICAL STEPS

Now that we have reviewed the types of audiograms and reasons for each one's use, let's discuss actual testing protocols.

Test protocols or procedures can be discussed as three (3) critical steps in obtaining valid hearing test results.

1. Getting the Patient Ready
2. Administering the Hearing Test
3. Recording Test Results

We will discuss each of these critical steps in more detail ...

(NEXT SLIDE)

SLIDE 19	Getting Patient Ready
<ol style="list-style-type: none">1. Obtain all demographic data required by DOEHS-HC2. Write test station # on demographic form3. Best seating position	<p>Ask questions—</p> <ol style="list-style-type: none">a. purpose of testb. UIC & Commandc. hearing difficultiesd. ear problemse. exposure to hazardous noise in last 14 hrsf. use of hearing protection and type

GETTING PATIENT READY

First Step ---

1. These procedures should be followed regardless of test booth size. However reasonable modifications can be used for single person test situations.

2. Obtain all demographic data required by DOEHRS-HC- use a demographic form that patient fills out while waiting.

3. Ask questions to clarify or confirm demographic data

(CLICK)

a. purpose of test (are you routinely exposed to hazardous noises (HCP) or are you here for a PHA or other test?)

b. UIC (unit identification code) = command assignment

c. hearing difficulties (significant head cold or sinus issues today)

d. ear problems

e. Have you been exposed to hazardous noises in the last 14 hrs (on or off duty)?

f. use of hearing protection and type of HPD typically used

(CLICK)

4. Give employee choice of seating position if possible

Large groups typically require seat assignment for efficiency

5. Writing test station number (#) on demographic form is highly recommended

(NEXT SLIDE)

SLIDE 20	<p style="text-align: center;"><u>Special Patient Considerations</u></p> <ul style="list-style-type: none">✓ Glasses, hats, large earrings, gum✓ Jackets, coats✓ Hearing aids✓ Personal electronic devices <p style="text-align: right; font-size: small;">20</p>
-----------------	---

SPECIAL CONSIDERATIONS

These are things that may affect the test for an individual or for others in the booth

1. Glasses, hats, and large earrings can interfere with proper placement of earphones

--- Gum chewing interferes with hearing soft sounds – request employee to remove/discard gum or anything else in mouth.

2. Jackets and coats should be removed for two (2) reasons:

a. test booth becomes too warm, particularly in group testing

b. some jacket materials make noise with body movements

3. Hearing aids must be removed and turned off to prevent squealing or whistling, preventing interference to others.

--- It is recommended that patient keeps the hearing aids rather than leave them outside booth to prevent any possibility of loss or damage

4. Personal electronic devices -- cell phones, pagers, etc -- should be turned off or on vibrate to not disturb anyone.

--- It is highly recommended that electronic devices be left outside the booth because employee can be distracted with vibration, etc.

(NEXT SLIDE)

SLIDE 21	<u>Testing Instructions</u>
	<p style="text-align: center;"><u>Critical Elements</u></p> <ul style="list-style-type: none">▪ What will they hear▪ What they are to do▪ Earphone placement▪ Length of test <p style="text-align: center;"><i>(all personal electronic devices off/outside booth)</i></p>
	<p style="text-align: center;"><small>EXAMPLE</small></p> <p style="text-align: center;"><i>" I'm looking for the softest sounds that you can hear. Even if you barely hear them, I want you to respond. Each time you hear a SERIES of beeps, immediately push and release the button only ONCE. Put the red earphone on the right ear. The test should take about 10 minutes."</i></p>

TESTING INSTRUCTIONS

1. Instructions are a critical factor in getting the patient ready to test.

2. Recorded instructions is an available option with the CCA-200 Audiometer.

--- recorded instructions can reinforce the live instructions

3. However, it is highly recommended that OHC Technician give verbal instructions ALWAYS regardless of using recorded instructions.

a. patient(s) may have hearing loss that interferes with understanding recorded instructions

b. patient's English skills may make understanding recorded instructions incomplete

c. can answer questions and make adjustments to instructions regarding current testing environment, e.g. outside construction noise

d. helps establish personal connection for later counseling

4. Clear instructions and clear understanding by patient(s) is very important.

a. accurate results

b. efficient use of time -- avoids re-testing frequencies that have unacceptable responses

5. Each OHC technician must find a comfortable way to give instructions for the specific test situation.

6. **CLEAR and CONCISE** is the key to the patient understanding. Don't assume that everyone has experience taking the test.

7. Instructions must include 4 critical elements ...

- a. what will they hear
- b. what are they supposed to do
- c. red earphone on right ear (blue earphone on left ear)
- d. encouragement, i.e. listen for faintest sound, approximate length of test

8. An example of instructions is the following: (there is also an example in the student manual) ...

"I'm looking for the softest sounds that you can hear. Even if you barely hear them, I want you to respond. Each time you hear a SERIES of beeps, immediately push and release the button only ONCE. Put the red earphone on the right ear. The test should take about 10 minutes."

9. OHC Technician may put earphones on patient in single/individual testing booth.

10. Patients should wait to be told to put on earphones.

11. OHC Technician should observe/check correct placement before closing booth door for testing.

- a. earphone diaphragm over ear canal
- b. headband on top of head
- c. headband adjusted to fit snugly or close to head

12. Check that every employee has response button in one hand.

(NEXT SLIDE)

SLIDE 22	Administering Hearing Test Computerized Audiometer <ol style="list-style-type: none">1. Organize patients in booth and begin test2. Input demographic data in DOEHRS-HC software3. Transfer (T) patient data to CCA-2004. Retrieve (R) patient threshold data into DOEHRS-HC5. Print (P) all data <small>22</small>
-----------------	---

ADMINISTERING HEARING TEST

Second Step is administering the hearing test using a computerized Audiometer – the CCA-200.

These are the basic steps. Variations and more details will be discussed later.

1. After completing all patient preparation procedures, click on the start icon on the audiometer screen for all test stations being used.
2. Check and update all demographic data in DOEHRS-HC software. OHC Technicians should strive for 100% data accuracy.
3. Transfer (“T” box next to patient station number) patient data to CCA-200 audiometer. Social Security Number will appear on line recording thresholds. Also, any 2215 Reference threshold data will appear on screen.
4. When testing is complete, retrieve (“R” box next to patient station number) patient threshold data to DOEHRS-HC. Test thresholds will appear on that station’s line.
5. Click “STOP” icon on CCA-200 audiometer to end presentation of tones.
--- Note: Audiometer has a “Keep Busy” feature so that individuals continue to hear tones until everyone in the group is finished and can be stopped at same time.
6. Print (“P” box) all audiograms and any referral forms.

(NEXT SLIDE)

<u>SLIDE 23</u>	<p style="text-align: center;"><u>Special Testing Situations</u></p> <ul style="list-style-type: none"> ▪ Asymmetrical loss (crossover) ▪ Excessive tinnitus ▪ Collapsing ear canals ▪ Inconsistent behavior ▪ Severe to profound hearing loss ▪ Claustrophobic patients
------------------------	---

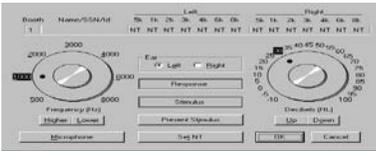
SPECIAL TESTING SITUATIONS

1. Asymmetrical hearing is when there is a difference in hearing thresholds between the ears at the same frequency of 40 dB or greater. Crossover - (or lateralization) means that the signal presented to the poorer ear is being heard in the better ear. These patients need to be tested by an Audiologist since the use of masking may be required to eliminate crossover.
2. Excessive tinnitus is an issue with those with significant hearing loss. “Significant” tinnitus is when the patient reports hearing the sound all the time or whenever the environment allows it, and when it prevents concentration or sleeping. Test alone or manually; ideally refer to audiologist.

3. Find “Manual Audiometer” under “Audiometer” menu on CCA-200 audiometer screen.
4. Select Ear (in middle of screen).
5. Select Frequency by clicking on left “knob” (circles) numbers.
6. Select Decibel Level by clicking on right “knob” (circles) numbers.
7. Click on “Present Stimulus” – third (3rd) bar down in center of screen.
8. Watch for “Response” – first (1st) bar in center of screen -- to blink.

Continued on next slide . . .

(NEXT SLIDE)

<p><u>SLIDE 25</u></p>	<div style="text-align: center;"> <p>Manual Audiometry Computerized Audiometer #2</p>  </div> <ol style="list-style-type: none"> 6. Wait for audiometer to change dB Level 7. Present Stimulus 8. Audiometer will “lock in” threshold 9. Go to next frequency 10. Select OK to finish
-------------------------------	--

MANUAL AUDIOMETRY COMPUTERIZED AUDIOMETER #2

1. Wait for audiometer to change intensity (dB) level – either up or down using an averaging/bracketing technique
2. Present Stimulus again
3. Audiometer will “lock in” threshold -- it will appear in the threshold value line at top of screen
4. Click on to next frequency you want to test
5. Select “OK” under intensity (dB) knob when finished testing
6. Final threshold will be recorded with an “M” after threshold numbers in the CCA-200 screen and when transferred to DOEHRs-HC
 - a. This indicates that a manual audiometer was used to test the frequency threshold.
 - b. These numbers cannot be modified later in “Audiogram Function” in DOEHRs-HC

(NEXT SLIDE)

SLIDE 26	<p>Manual Audiometry Manual Audiometer <i>(Obtain more detailed instructions for this situation)</i></p>  <p>Choose test ear, test frequency, starting intensity Present pulsed tone – vary timing presenting tones Use Bracketing Technique: If response → decrease intensity 10 dB No response → increase intensity 5 dB Final threshold = lowest dB level that patient responds 2 out of 3 ascending presentations Caution in providing visual/auditory cues</p> <p style="text-align: right;"><small>26</small></p>
-----------------	--

MANUAL AUDIOMETRY MANUAL AUDIOMETER

1. Reviewed in case computerized audiometer and DOEHRs-DR software cannot be used.
2. Remember that calibration regulations must be followed for valid hearing test results.
3. Identify all controls – ear selector, frequency , intensity, stimulus presentation, response light (if not depending on patient raising hand).
--- Pictured manual audiometer is one model – manual audiometers vary in size and appearance .
4. Choose test ear, test frequency, starting intensity.
5. Present pulsed tone – vary timing in presenting tones to avoid a rhythm that listener can anticipate.
6. Use Bracketing Technique:
 - a. If listener responds, decrease intensity by 10 dB step
 - b. If listener does NOT respond, increase intensity 5 dB step
7. Continue down 10-up 5 technique until patient responds to same lowest level two (2) out of three (3) ascending presentations
--Patient responded when you were increasing intensity level by 5 dB; NOT when you were decreasing intensity level by 10 dB.
8. Use caution in providing visual/auditory cues to listener.

(NEXT SLIDE)

SLIDE 27

Factors Affecting Test Validity

- Ambient Noise
- Ventilation
- Lighting
- Equipment & booth calibration
- Test instructions
- Earphone placement
- Tone presentation
- Auditory/Visual cues
- OHC Technician
- Health / fatigue
- Tinnitus
- Significant HL
- Understanding of task
- Attention span
- Motivation
- Collapsing ear canals

27

FACTORS AFFECTING TEST VALIDITY

How do you know if the hearing test results are valid or as true as possible at that moment in time?

- 1. Test validity can be affected or compromised by any of these factors related to the test environment, test procedures, and patient characteristics.**
- 2. All of these factors have been discussed in this and previous units.**
- 3. Factors related to the testing environment and equipment are**
 - a. ambient noise inside and outside the test booth**
 - b. ventilation of the test booth - noisy and too warm**
 - c. lighting -- noisy**
 - d. equipment and booth calibration - equipment is not operating correctly**
- 4. Factors related to test procedures are**
 - a. test instructions are not clear and concise**
 - b. earphone placement can include positioning on wrong ear and not snugly fitting over ear canals**
 - c. tone presentation is too rhythmic**
 - d. auditory/visual cues**
 - distracted by other patients during group testing**
 - empty test station that is accidentally enabled**
 - during use of manual audiometer, technician or audiometer lights can cue presentation of test tones**
 - e. OHC technician may not be skilled or be attentive in following protocols and observing these factors**
- 5. Factors related to the listener or patient**
 - a. health / fatigue**
 - b. tinnitus can interfere with or mask test tones**
 - c. significant hearing loss makes task more difficult and can create anxiety**
 - d. collapsing ear canals occur when the pressure of the earphones close the ear canal which result in a low frequency or flat hearing loss; insert a tympanometer probe tip into ear canal to keep canal open**
 - e. understanding of task**

- f. attention span -- remember that this is not the most interesting task to do over a length of time; also brain adapts to repeated stimuli
- g. motivation and cooperation with test procedures and responding accurately

(NEXT SLIDE)

SLIDE 28	<p>Recording Results</p> <p>Use the correct forms</p> <ul style="list-style-type: none"> ➤ DD 2215 Reference Audiogram ➤ DD 2216 Monitoring Audiogram ➤ Non-Hearing Conservation Test <p>Data accuracy and validity is critical</p> <ul style="list-style-type: none"> ➤ Medical-legal documents ➤ HCP effectiveness and planning
-----------------	---

RECORDING RESULTS

Last Step is Recording Results

1. It may seem obvious to use the correct forms to record each employee's test results. --- However, it can be confusing sometimes as employees change job assignments and present atypical circumstances.
2. Use the correct forms.

(CLICK)

3. DD 2215 Reference Audiogram to establish baseline audiograms for ...
 - a. all active military personnel and
 - b. for those civilians working in hazardous noise environments
4. DD 2216 Monitoring Audiogram to monitor ...
 - a. all Marine Corps and Army members,
 - b. all active military and civilians enrolled in HCP,
 - c. pre/post deployment testing, termination of service for all military personnel,
 - d. termination of working in hazardous noise environment for all civilian employees
5. Non-Hearing Conservation Test for ...
 - a. active military and civilian personnel not enrolled in HCP
 - b. military reserve personnel, courtesy hearing tests

(CLICK)

6. Data accuracy and validity is critical - data is used to not only provide appropriate employee health care but in administrative decisions related to HCP, i.e. effectiveness, staffing, decisions, mission readiness of specific commands.

7. Remember that audiograms are medical-legal documents and the OHC Technician's name is on them and in DOEHRS-HC/DR – that is YOUR NAME!

8. Your work has a impact not only on individual employees but also an impact on whole commands.

(NEXT SLIDE)

<p><u>SLIDE 29</u></p>	 <p>Roleplay Interviewing and Setting Up Patients to Test</p> <p><small>29</small></p>
-------------------------------	---

QUESTIONS?

Suggestion: Divide students into groups of 2 or 3 and practice giving test instructions with peer critique.

(END OF PRESENTATION)

1.9 AUDIOMETRIC TESTING: RESULTS FOLLOW UP AND REFERRAL

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>AUDIOMETRIC TESTING</u></p> <p>RESULTS, FOLLOW-UP and REFERRAL PROTOCOLS</p>
-----------------------	---

AUDIOMETRIC TESTING: RESULTS, FOLLOW-UP and REFERRAL PROCTOCOLS

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Define the degrees of hearing loss.2. Differentiate between STS, TTS and PTS.3. Interpret hearing test data to determine if follow-up testing, a new baseline and/or a referral is required.4. List criteria for referring a patient to an audiologist and to a medical officer.5. Role play the presentation of test results and referral information.
-----------------------	--

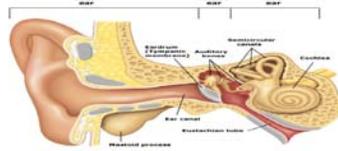
LEARNING OBJECTIVES

1. Define the degrees of hearing loss.
2. Differentiate between STS, TTS and PTS.
3. Interpret hearing test data to determine if follow-up testing, a new baseline and/or a referral is required.
4. List criteria for referring a patient to an audiologist and to a medical officer.
5. Role play the presentation of test results and referral information.

(NEXT SLIDE)

SLIDE 3

What are we testing?



WHAT ARE WE TESTING?

1. We have discussed the three types of assessment a OHC Technician will do along with brief patient history/characteristics.
2. To review how these tests relate to the ear and process of hearing, remember that.....
3. Otoscopy assesses the outer ear (general ear canal and eardrum conditions)
4. Tympanometry assesses the function of the middle ear
5. Audiometry assesses the inner ear's sensitivity or perception of sounds. Specifically, OHC are testing the patient's "Puretone Thresholds" or "The Softest Sounds that a person can detect 50% of the time"
6. This unit is about how the OHC Technician integrates all this data in order to accurately interpret results, counsel the patient and make appropriate referrals.

(NEXT SLIDE)

SLIDE 4

Degrees of Hearing Loss

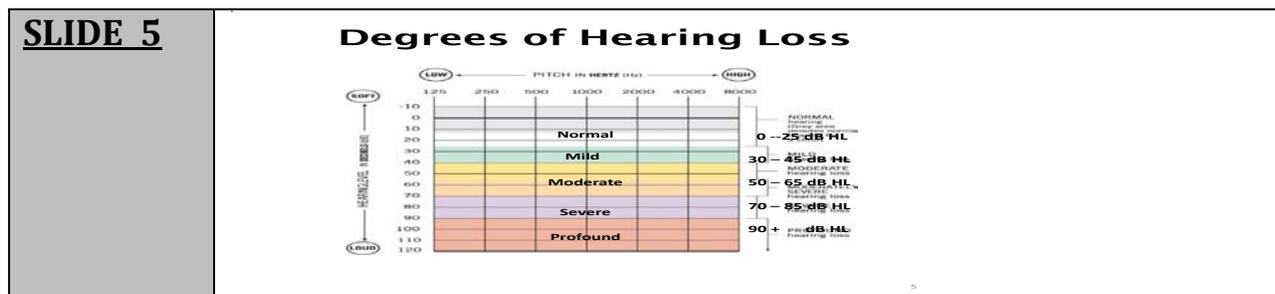


DEGREES OF HEARING LOSS - Definitions

1. This is a picture of an audiogram in graphic form.
2. It has degrees of hearing loss printed on it.
3. Normal hearing range across frequencies (Hz)/itches is between -10 to 25 dB HL

4. Mild hearing loss range is between 30 to 45 dB HL
5. Moderate hearing loss range is between 50 dB HL to 65 dB HL
6. Severe hearing loss range is between 70 dB HL to 85 dB HL
7. Profound hearing loss is 90 dB HL and greater dB HL

(NEXT SLIDE)



DEGREES OF HEARING LOSS - Example

1. Audiologists plot a patient's thresholds using a circle "0" for the right ear responses and an "X" for the left ear responses
2. If a patient has a hearing loss, he or she typically does not have a straight "line" or equal hearing loss across frequencies.
3. An audiologist would describe this patient's hearing as follows----
 - a. Right ear has normal hearing in the low frequencies decreasing to a mild hearing loss in the mid frequencies and falling or decreasing to a moderate hearing loss in the high frequencies (returning to a mild loss at 6000 Hz).
 - b. Left ear has normal hearing through mid frequencies falling/decreasing steeply to a severe hearing loss in the high frequencies.
4. An OHC Technician may be requested to transcribe a handwritten audiogram like this one into DOEHRS-HC database.

(NEXT SLIDE)

SLIDE 6

**Audiogram Forms
DD 2215, DD 2216, N-HC**

**The following three slides
show an example
of the
three hearing test forms
used in the OHCP**

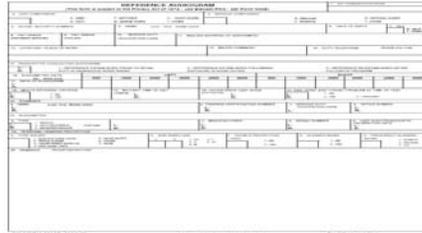
HEARING LOSS DD 2215, DD 2216, Non-HCP

The following three slides show an example of the three hearing test forms used in DOEHRs-HC

(NEXT SLIDE)

SLIDE 7

**DoD Form
2215
Reference
Audiogram**



DOD FORM 2215 REFERENCE AUDIOGRAM

1. Patient demographic and test site information is on the top portion.

(CLICK)

2. Then hearing test results are recorded.

(CLICK)

3. Next section includes OHC Technician and equipment information

--- it also contains information about the patient's use of HPDs which may appear in more detail in the Remarks section.

(CLICK)

4. Remarks section provides standard notes on testing parameters.

--- this is also the area that the technician may type in information particular about the patient.

5. Most importantly, OHC Technicians need to use the Remarks section to document the reason for generating the 2215 Reference audiogram

--- if not the original 2215 Reference/baseline audiogram obtained at enlistment..

(NEXT SLIDE)

<u>SLIDE 8</u>	DD Form 2216 Audiogram	
-----------------------	---------------------------------------	--

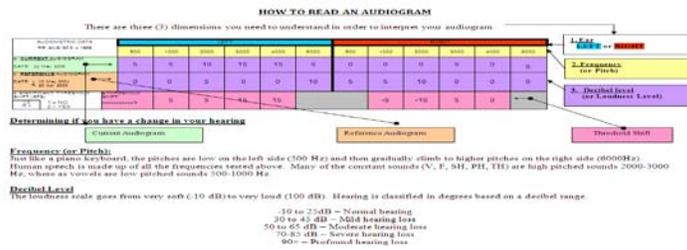
DOD FORM 2216 AUDIOGRAM

1. On a daily basis, OHC Technicians will need to interpret a DD Form 2216 audiogram.
2. It also has patient demographics at the top, plus test site information. Examiner, audiometer and HPD use is also found on the form.
3. However, the most important difference between the 2216 audiogram from the other forms are the three test result sections
4. A DD Form 2216 audiogram is a full page with 3 almost identical sections.
 - a. top section records annual hearing test results
 - b. second section records Follow Up #1 results (if needed)
 - c. bottom section records Follow Up#2 results (if needed)
5. Computerized audiometer (CCA-200) works with DOEHRS-HC software to calculate significant threshold differences between current test results and reference (DD Form 2215) thresholds.
6. There is a remarks section under the first annual test section. DOEHRS-HC will generate basic test details but you should type in information that may be relevant to patient history, symptoms and/or follow-up decisions (e.g. retiring active duty employee states he/she will follow up with VAMC instead of Occupational Audiology).
7. In order to understand the 2216 audiogram, we need to understand a Significant Threshold Shift (STS). We will define it after one more audiogram form.

(NEXT SLIDE)

SLIDE 11

DD 2216 Annual Audiogram



DD 2216 ANNUAL AUDIOGRAM

1. The CC 220 audiometer automatically compares results to reference values to determine STS in each ear and DOEHRs-HC generates the audiogram. This slide shows the test results section of the 2216.
2. Top lines (blue and red) indicate left and right ear.
3. Next yellow line indicates the frequencies (Hz) tested for each ear.
4. First purple line indicate the thresholds (dB levels) obtained during current hearing test.
5. Second purple line indicate the thresholds (dB levels) obtained for the most recent DD Form 2215 References in DOEHRs-DR.
6. The pink line shows the differences between the current test and reference thresholds (dB levels).
7. An STS or Significant Threshold Shift in either ear is when the differences at 2000Hz, 3000Hz, and 4000Hz add up to 30 or greater (or average ≥ 10 dB).
8. An STS is coded, for each ear, as 1 for NO and 2 for YES in the white box at far left of pink line.
9. OHC Technician is concerned about whether there is a STS - Significant Threshold Shift - in either ear

ADDITIONAL NOTE: This graphic is available in a poster size and a 8x11 size. It can be very useful in counseling, particularly group counseling. You will find it in the Student Manual in the Appendix.

(NEXT SLIDE)

SLIDE 12

Other Threshold Shifts

Temporary Threshold Shift -- "TTS"

Increase of hearing threshold after exposure to excessive noise which resolves after 14 hours of auditory rest

Permanent Threshold Shift -- "PTS"

An STS that has not resolved after 14 hours of auditory rest and has been confirmed by an audiologist

12

OTHER THRESHOLD SHIFTS

Remember definitions of two other types of threshold shifts.....

(CLICK)

1. Temporary Threshold Shift -- "TTS" -- Increase of hearing threshold after exposure to excessive noise which resolves after 14-24 hours of auditory rest

(CLICK)

2. Permanent Threshold Shift -- "PTS"

a. an STS that has not resolved after 14-24 hours of auditory rest AND has been confirmed by an audiologist usually after a full audiology evaluation.

b. the audiologist or local SOP will authorize a new 2215 Reference audiogram to be established.

3. Two follow up tests conducted after the first annual hearing test determines

a. if any STS found was a Temporary Threshold Shift (TTS) -- it resolves during the Follow Up hearing tests OR

b. patient needs referral for a possible Permanent Threshold Shift (PTS)

(NEXT SLIDE)

SLIDE 13

Hearing Test Results ...

Early Warning

Definition:

A positive shift in hearing

of 15 dB or more

at

1000, 2000, 3000 or 4000 Hz

in either ear.

13

EARLY WARNING

1. Sometimes test results will NOT indicate an STS – therefore he or she passes the test because the average difference is less than 10dB (again, averaged @ 2,3 and 4kHz in each ear individually) or 3 frequency differences add to less than 30dB.
2. However, the patient receives an “Early Warning” of possible STS because the difference at a specific frequencies (or frequencies) is greater than 10dB.
3. Definition: A positive shift in hearing of 15 dB or more at 1000, 2000, 3000 OR 4000 Hz in either ear.
4. In the Remarks section on the 2216 Audiogram, it will state that results indicate an early warning of possible hearing loss.

(NEXT SLIDE)

<u>SLIDE 14</u>	<p><u>2216 ANNUAL AUDIOGRAM OUTCOMES</u></p> <ol style="list-style-type: none"> 1. If patient has NO STS... 2. If patient has an Early Warning... 3. If patient has a Positive STS... 4. If patient has a Positive STS, but WNL... 5. If patient has Negative STS...
------------------------	--

2216 ANNUAL AUDIOGRAM OUTCOMES

1. After interpreting the audiogram, there are five basic outcomes.
2. A patient will NOT have an STS – it is a “Pass”
3. A patient will NOT have an STS but will have an Early Warning for a specific frequency or frequencies in either ear.
4. A patient will have a positive STS in one or both ears
5. A patient will have a positive STS in one or both ears BUT all thresholds are within normal limits .
6. A patient will have a negative STS – today’s thresholds are better than current 2215 Reference Audiogram.
7. Let’s discuss each of these outcomes in detail to determine what you counsel and do for the patient.

(NEXT SLIDE)

SLIDE 15

Hearing Test Results

No STS

1. Counsel patient about results
2. Counsel patient about hearing protection
3. Properly place 2216 in medical record
4. Give patient completed forms required by local safety officer/command
5. Retest patient in 12 months

15

HEARING TEST RESULTS - NO STS

If no STS is present on the 2216 Annual Audiogram, the OHC Technician should follow these procedures.

1. Explain results to patient - DO NOT tell them "You passed!" only. Orient patient to audiogram number graph; say normal range is indicated by small numbers 25 or less; we are testing for significant changes, numbers on the third line indicate no significant change so the #1's in little box on the left for both ears means you pass, etc.
2. Counsel patient about hearing protection
3. Properly place 2216 in medical record
4. Give patient completed forms (if required) by local safety officer/command
5. Retest patient in 12 months/one year

NOTE: All of this counseling can be done in 1-2 minutes per patient. If everyone in the group has passed, ask them for permission to do a group explanation of audiogram and results. Useful to use wall chart "How to Read an Audiogram" which is in the workbook appendix.

(NEXT SLIDE)

SLIDE 16

Hearing Test Results

Early Warning Disposition

1. Counsel patient about test results
2. Encourage effective HPD use
3. Patient signs DD Form 2216
4. Give patient completed forms required by local safety officer/command
5. Retest patient in 12 months

16

EARLY WARNING DISPOSITION

Procedures to follow for patients with an early warning of possible hearing loss are

1. Counsel patient about test results -- DO NOT say only "You passed except you had a little difficulty for one or two tones"
2. Counsel and encourage patients to wear HPD consistently and as deeply as possible in their ear canals; both on/off duty around hazardous noise.
3. Patient signs DD Form 2216 audiogram in the "Remarks" section , acknowledging counseling about early warning and hearing protection.
4. Give patient completed forms (if required) by local safety officer/command
5. Retest patient in 12 months or one year

(NEXT SLIDE)

SLIDE 17	<p>Hearing Test Results ...</p> <p><u>Positive STS</u></p> <ol style="list-style-type: none">1. Counsel patient about results2. Tell patient to return for Follow-Up test<ol style="list-style-type: none">a. return within 30 daysb. 14 hours auditory rest (hazardous noise)3. Patient signs 2216 <p>Perform otoscopy and tympanometry</p> <table style="margin-left: auto; margin-right: auto;"><tr><td>Problem</td><td>refer to medical officer</td></tr><tr><td>No problem</td><td>return for Follow-Up</td></tr></table> <p style="text-align: right; font-size: small;">17</p>	Problem	refer to medical officer	No problem	return for Follow-Up
Problem	refer to medical officer				
No problem	return for Follow-Up				

POSITIVE STS

When results of the 2216 annual test indicate a positive STS (number "2+") will appear in far left box on form, OHC technician should follow these procedures.....

1. Counsel patient about test results – DO NOT say only "You failed. You will need to come back a second time." Explain the audiogram indicating that the differences between today and reference test is too great, meaning a significant threshold shift as indicated by the #2 (s) in the left box, etc.
2. Explain to patient it is necessary for him or her to return for Follow Up testing to verify the hearing test results
 - a. follow up test must be completed within 30 days or the software will force today's test to be repeated
 - b. patient must be 14 hours free of hazardous noise before the follow up test – so try to come in first thing in the morning before working
 - c. ** DoD is more stringent than OSHA and does not allow HPDs to be worn in place of being 14 hours noise free

3. Patient signs 2216 audiogram indicating acknowledgement of STS and understanding that Follow up testing is required

4. Possible encouragers to motivate them to return:

“you might be tired today,”

“you might have been distracted by others in the booth,”

“these results go back to your supervisor and will affect the unit’s compliance if you don’t return”

(CLICK)

5. Under ideal situations, OHC Technician should perform otoscopy and possibly tympanometry before the patient leaves.

a. rules out impacted cerumen and/or possible middle ear problems as the cause of the STS

b. completing these procedures NOW before Follow Up testing allows the patient to seek medical attention and prevent an unneeded referral test to occur >>> therefore wasting time.

(CLICK)

6. If otoscopy and/or tympanometry reveals a possible outer/middle ear problem, refer the patient to a medical officer.

a. active duty patients to sick call

b. civilian patients to their primary care physician

7. If otoscopy and/or tympanometry reveals no problems/normal appearance and function, then instruct patient to return for Follow up testing within 30 days after 14 hours of auditory rest.

(NEXT SLIDE)

SLIDE 18	<small>Hearing Test Results ...</small>	
	Follow-Up Test #1 Patient must return within 30 days	
	If no STS (resolved)	If STS confirmed
	Counsel about TTS Encourage HPD use Return to annual test status	Follow-Up #2 immediately (if possible)

FOLLOW-UP TEST #1

1. When patient returns for Follow Up Test #1 within 30 days, the patient should be given a complete hearing test

(CLICK)

2. If test results indicate no STS , the OHC Technician should
 - a. counsel patient about test results, referring to temporary threshold shift (TTS)
 - b. encourage appropriate use of HPDs, emphasizing that repeated TTS eventually results in PTS - or permanent hearing loss
3. Give patient completed forms (if required) by local safety officer/command and return patient to annual test status

(CLICK)

4. If test results confirms an STS, the OHC Technician starts Follow Up #2 immediately, if possible.
 - a. retrieve Follow Up #1 test results into DOEHRS-HC
 - b. clear the patient demographic screen and enter SSN and any empty data fields
 - c. begin testing again.

(NEXT SLIDE)

SLIDE 19	<small>Hearing Test Results ...</small> Follow-Up Test #2 May be administered immediately after Follow-Up Test #1	
	If no STS (resolved) Counsel patient Check HPD use Return to annual test status	If STS confirmed Counsel patient Referral protocol re: local SOP to confirm PTS

FOLLOW-UP TEST #2

1. Follow Up Test #2 may be administered immediately after Follow Up Test #1
2. If results of Follow Up #2 indicate no STS - it has been resolved

(CLICK)

3. The technician should follow same procedures suggested for Follow Up #1
 - a. counsel patient about test results, referring to temporary threshold shift (TTS).
 - b. encourage appropriate use of HPDs, emphasizing that repeated TTS eventually results in PTS - or permanent hearing loss.
 - c. give patient completed forms required by local safety officer/command and return patient to annual test status.

(CLICK)

4. If results indicate an STS, then.....
 - a. explain the test results to the patient -- that the STS has appeared in three hearing tests
 - b. refer patient to an Occupational Audiologist for audiology evaluation to verify hearing thresholds and determine if the STS is a permanent threshold shift (PTS).
5. OHC Technician follows referral protocol according to the local Occupational Audiology SOP
6. DOEHRs – HC will generate a Referral form that can be placed with the final 2216 audiogram in the patient’s medical record.

ADDITIONAL NOTE: DOEHRs-HC can have two separate dates for baseline, one for each ear. Currently, MRRS can only support one date. Use the date of the most recent re-established threshold when entering into the MRRS software.

(NEXT SLIDE)

SLIDE 20	<p><u>PTS Within Normal Limits</u></p> <p><small>Hearing Test Results ...</small></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Check Local Command SOP for protocol</p> <p>Written guidelines by regional audiologist</p> <p>Use STS Follow-up procedures</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Example</p> <p>OHC Technician re-establishes new baseline/reference audiogram; hearing thresholds \leq 25 dB HL</p> <p>Remarks entry: <i>"Reference revised per local SOP or guidance of regional; patient's thresholds within normal limits."</i></p> </td> </tr> </table>	<p>Check Local Command SOP for protocol</p> <p>Written guidelines by regional audiologist</p> <p>Use STS Follow-up procedures</p>	<p>Example</p> <p>OHC Technician re-establishes new baseline/reference audiogram; hearing thresholds \leq 25 dB HL</p> <p>Remarks entry: <i>"Reference revised per local SOP or guidance of regional; patient's thresholds within normal limits."</i></p>
<p>Check Local Command SOP for protocol</p> <p>Written guidelines by regional audiologist</p> <p>Use STS Follow-up procedures</p>	<p>Example</p> <p>OHC Technician re-establishes new baseline/reference audiogram; hearing thresholds \leq 25 dB HL</p> <p>Remarks entry: <i>"Reference revised per local SOP or guidance of regional; patient's thresholds within normal limits."</i></p>		

PTS WITHIN NORMAL LIMITS

1. This situation is one of two situations where an OHC Technician can re-establish a baseline or generate a new DD Form 2215 reference audiogram without specific validation from an audiologist.
2. Exact protocol will be set by the local command SOP. Follow written guidelines by the regional audiologist or request a written SOP if needed.
3. Results on the 2216 audiogram indicate a STS; however, all current thresholds are within normal range (-10 to 25 dBHL).
4. Follow the same counseling procedures as you do with a positive STS.
 - a. explain to the patient that there is an STS which requires a return for follow up testing.
 - b. emphasize that 14 hours of auditory rest is required prior to taking the Follow Up hearing test.

(CLICK)

5. If Follow Up #1 or #2 continue to indicate a positive STS **AND** thresholds are within normal limits, establish a new 2215 Reference audiogram .

6. Type into the Remarks section why a new 2215 Reference is being generated/established.

a. “Reference revised per local SOP or guidance of regional audiologist; patient’s thresholds within normal limits.”

b. Note: DOEHRS-HC will want to generate a Referral form but click on “No”.

7. Void former 2215 Reference Audiogram in the medical record by making a single slash across form, write “Reference re-established (date).”

(NEXT SLIDE)

<u>SLIDE 21</u>	<small>Hearing Test Results ...</small> <u>Negative STS</u> Repeat test (or frequencies) immediately			
	<table><tr><td style="text-align: center;">If no STS (resolved)</td><td style="text-align: center;">If STS confirmed</td></tr><tr><td style="text-align: center;">Return to annual hearing test status</td><td style="text-align: center;">Revise reference Write remarks Return to annual hearing test status</td></tr></table>	If no STS (resolved)	If STS confirmed	Return to annual hearing test status
If no STS (resolved)	If STS confirmed			
Return to annual hearing test status	Revise reference Write remarks Return to annual hearing test status			

NEGATIVE STS

1. A Negative STS result is the second of two situations that an OHC Technician can re-establish a baseline reference audiogram (DD Form 2215) without specific validation from an audiologist.

a. Thresholds on the 2216 audiogram indicate “better” hearing than the current 2215 reference audiogram, i.e. 2216 threshold is 0 dBHL and 2215 threshold is 15 dBHL.

b. DOEHRS-HC will indicate a Negative STS or “2—” in STS box.

c. DOEHRS-HC will also acknowledge the negative STS and request permission to retest or complete a Follow Up #1 immediately. Click **YES**.

(CLICK)

2. If Follow Up #1 indicates no negative STS (it was resolved), then follow normal annual hearing test counseling procedures

(CLICK)

3. If Follow Up #1 test results confirm Negative STS, re-establish DD Form 2215 Reference Audiogram. Remember to slash across old 2215 and mark with date.
 - a. provide justification for 2215 revision in the Remarks section, i.e., Per Local SOP/audiologist instruction, etc....
 - b. return to annual hearing test status

(NEXT SLIDE)

<u>SLIDE 22</u>	Hearing Test Results ...
<u>Non-Hearing Conservation Test</u>	
<ul style="list-style-type: none">✓ Individuals not routinely exposed to hazardous noise✓ Not compared to reference or previous Non-HCP audiograms✓ Does not require referral to Occupational Audiology✓ Counsel patient to seek clinical evaluation if appropriate	
22	

NON-HEARING CONSERVATION TEST

1. A Non-Hearing Conservation hearing test is test for individuals that are not enrolled in the HCP.
 - a. not routinely exposed to hazardous noise
 - b. completing a physical for a specific purpose, i.e. pre-hire requirement, forklift driving, etc.
2. No comparison of current test results with any reference or previous audiograms.
 - a. however, good counseling and customer service requires explanation of results and answering questions from patient
 - b. DO NOT just say "You passed!"
3. If a hearing loss is indicated, does not require referral to Occupational Audiologist (patient not enrolled in HCP).
4. Follow local protocol for audiology/medical referrals if warranted.

(CLICK)

5. Remember that in some commands, 100% of active duty are in a HCP regardless of whether the individual is exposed to noise on a daily/hourly basis, e.g., USA and USMC.

(NEXT SLIDE)

SLIDE 23

Data Management
DOEHRS - HC Software
DOEHRS - DR Data Repository

Export hearing tests to DR
→ daily or weekly (minimum)

Input manual audiogram results

Maintain backup file on external media or share folder

23

DATA MANAGEMENT - DOEHRS -HC

1. Export hearing tests to Data Repository (DOEHRS-DR) - daily or weekly at a minimum
2. Input manual audiogram results - for audiologist or testing in special situations
3. Maintain backup file on external media or share folder

(NEXT SLIDE)

SLIDE 24

Data Management cont....

Audiograms

Printed audiograms must be placed
in patient's medical record

File DD 2216 audiogram behind reference
DD 2215 audiogram(s)
most recent audiogram(s) on top

Void former 2215 audiograms
slash and stamp with current date

Never remove audiograms from records

24

DATA MANAGEMENT - AUDIOGRAMS

1. Printed audiograms must be placed in patient's medical record.
2. File DD 2216 audiogram(s) behind reference DD 2215 audiogram(s) with most recent audiogram(s) on top.

(CLICK)

3. Void former 2215 audiograms -- slash and stamp (write) with current date.
4. Never remove audiograms from records.

(NEXT SLIDE)

SLIDE 25

Data Management cont ...

Patient Data

Track patient referrals re: local SOP

Document and code patient encounters using medical data management software (AHLTA, CHCS)

Critical for	Quality patient care
	Workload data used to determine number of OHC Tech positions

25

DATA MANAGEMENT – PATIENT DATA

1. Track patient referrals according to your local SOP so that patients do receive appropriate follow up care with audiologists and medical officers
2. Document and code patient encounters using the medical data management software in your clinic/worksites. Typically, this will be the AHLTA and/or CHCS software.
3. Accurate documentation and coding of patient encounters can be a labor intensive task in busy clinics. However accuracy and completeness are critical for two major reasons.
 - a. high quality patient care and good hearing conservation
 - b. Provides workload data which is used by leadership when determining need for OHC Technician job positions.

(NEXT SLIDE)

SLIDE 26

Reasons to Refer to an Audiologist

*Check local SOP for specific referral protocol
Check medical record for previous evaluation*

- Reference audiogram indicates abnormal hearing
- STS after Follow-Up #2
- Asymmetrical hearing loss
-- 20 dB at two consecutive frequencies
- Tinnitus and/or difficulties in background noise
- Unreliable responses by patient
- Collapsing ear canals
- Fitness for Duty issues – 270 Rule

26

REASONS TO REFER TO AN AUDIOLOGIST

1. Check local SOP for specific referral protocol.
2. Always check medical record for previous audiology evaluation. the report and audiogram may be among other records on right side or recorded only in AHLTA.
 - a. Evaluation results and recommendations may not have been transcribed into DOEHRs.
 - b. If there is a past evaluation, check the disposition or recommendations to see how they may relate to current referral decisions.

The major reasons to refer a patient to an Occupational Audiologist are the following ...

(CLICK)

3. DD Form 2215 Reference audiogram indicates abnormal hearing for the newly enlisted recruit.

4. DD Form 2216 Follow Up #2 test indicates an STS (significant threshold shift).

(CLICK)

5. DD Form 2216 Follow Up #2 test indicates an asymmetrical hearing loss -- differences between ears are 20 dB or greater at two (2) consecutive frequencies. Example: thresholds in right ear at 1000 and 2000 Hz (consecutive) are 10 and 10 dBHL; threshold in left ear at 1000 and 2000Hz are 30dB and 30dBHL.

6. Patient complains of significant difficulty with tinnitus and/or difficulties understanding speech in background noise.

(CLICK)

7. Patient responds inconsistently during testing, regardless of repeated instruction and Follow Up procedures.

8. Patient has collapsing ear canals

- a. flat hearing loss with normal otoscopy and tympanometry
- b. press in front of ear where earphone would rest and view if canal closes

9. Fitness for Duty issues - If patient has 3 re-established 2215's, then a FFD referral is needed. Referral also needed for 270 Rule (discussed in a few slides)

(NEXT SLIDE)

<u>SLIDE 27</u>	<u>Reasons to Refer to Medical Officer/Physician</u> Complaint or Symptom ➤ Ear pain ➤ Ear drainage ➤ Severe or persistent tinnitus of recent or sudden occurrence ➤ Vertigo or severe dizziness ➤ Sudden hearing loss ➤ Visible abnormality - otoscopy, tympanometry
------------------------	---

STAT!

REASONS TO REFER TO MEDICAL OFFICER/PHYSICIAN

The following are patient complaints or symptoms that are reasons a referral should be made to a Medical Officer or Physician

1. Ear pain
2. Drainage from the ear canal
3. Severe or persistent tinnitus of recent or sudden occurrence
4. Vertigo or severe dizziness – may or may not be accompanied by nausea
5. Sudden hearing loss -Vertigo and/or Sudden hearing loss should be evaluated ASAP by physician. Time can be a critical factor between temporary and permanent hearing loss (usually <24 hours).-
6. Visible abnormality observed through otoscopy, tympanometry

(NEXT SLIDE)

SLIDE 28	<u>Audiologist Responsibilities upon Referral</u> <ul style="list-style-type: none"><input type="checkbox"/> Evaluate hearing, counsel and educate patients about their specific hearing needs and care<input type="checkbox"/> Provide patient and his/her command written notification of verified, positive STS which now becomes a PTS<input type="checkbox"/> Make Fitness for Duty recommendation to patient's command <small>28</small>
-----------------	---

AUDIOLOGIST RESPONSIBILITIES UPON REFERRAL

The remaining slides are to provide the OHC Technician information about what happens after a referral is made for an audiology evaluation.

The Occupational Audiologist...

1. Evaluates the patient's medical record, reviews his/her noise history and provides all necessary follow-up assessment tests to determine the nature and extent of the hearing loss.
---Also, the audiologist provides information to each patient about his or her specific hearing abilities, counseling and educating individual patients about strategies to prevent future hearing loss.
2. Provide patient and his/her command written notification of verified positive STS which now becomes a PTS.

3. Make a Fitness for Duty recommendation to the patient's command.

(NEXT SLIDE)

SLIDE 29	<p>Audiologist Responsibilities cont ...</p> <p><u>Fitness for Duty Evaluations</u></p> <p>Any employees who have significant hearing impairment that interferes with communication,</p> <p>which places themselves, their co-workers and/or government property at risk of injury or damage,</p> <p>should be referred for a Fitness for Duty evaluation.</p> <p style="text-align: right;"><small>29</small></p>
-----------------	---

FITNESS FOR DUTY EVALUATIONS

1. Who should be evaluated for Fitness for Duty?
2. Any employees who have significant hearing impairment that interferes with communication

(CLICK)

3. which places themselves, their co-workers and/or government property at risk of injury or damage,

(CLICK)

4. should be referred for a Fitness for Duty evaluation

(NEXT SLIDE)

SLIDE 30	<p>Fitness for Duty Evals cont...</p> <p>NAVY – 270/3 STS Rule</p> <table><tr><td style="text-align: center;">When sum of thresholds at 3000, 4000 and 6000 Hz in both ears is greater than 270 dB*</td><td style="text-align: center;">OR</td><td style="text-align: center;">When reference audiogram has been re-established three times (STS x 3)</td></tr></table> <p>Refer to Audiology or Occupational Medicine</p> <p>Purpose: trigger multi-disciplinary evaluation of Fitness for Duty in individuals showing a marked susceptibility to NIHL</p> <p><small>*OPNAV 5100.19 & 5011.23 series</small></p> <p style="text-align: right;"><small>30</small></p>	When sum of thresholds at 3000, 4000 and 6000 Hz in both ears is greater than 270 dB*	OR	When reference audiogram has been re-established three times (STS x 3)
When sum of thresholds at 3000, 4000 and 6000 Hz in both ears is greater than 270 dB*	OR	When reference audiogram has been re-established three times (STS x 3)		

FITNESS FOR DUTY EVALUATION cont... NAVY – 270/3 STS RULE

1. The Navy uses a 270 or 3 STS Rule to determine Fitness for Duty

2. The 270 Rule is when the sum of thresholds at 3000, 4000 and 6000 Hz in BOTH ears meets or exceeds 270 dB -- as described in OPNAV 5100.19 and 5100.23 series.
3. The 3 STS Rule is when the DD 2215 Reference audiogram has been re-established three (3) times
4. OHC Technician must refer the patient to Audiology or Occupational Medicine for a Fitness for Duty evaluation.
5. Purpose of the 270 and Three STS Rule is to trigger a multi-disciplinary evaluation for fitness for duty in individuals showing a marked susceptibility to noise induced hearing loss.

(NEXT SLIDE)

<u>SLIDE 31</u>	<p style="text-align: right; font-size: small;">Fitness for Duty Evals cont...</p> <p style="text-align: center;"><u>Army and Air Force Profiles</u></p> <p>Profiling system determines FFD</p> <p>H1 - Fully Fit for duty H2 - Fit for duty with limitations H3 - Trigger for FFD H4 - Requires medical board</p> <p style="text-align: right; font-size: x-small;">31</p>
------------------------	--

FITNESS FOR DUTY EVALUATION cont....ARMY AND AIR FORCE PROFILES

1. The Army and Air Force assign a Hearing Profile Number, H1 through H4, to patients according to their hearing thresholds at all frequencies tested
2. The four (4) hearing profiles indicate the patient's Fitness for Duty.
 - a. H1 - Fully Fit for duty
 - b. H2 - Fit for duty with limitations
 - c. H3 - Trigger to evaluate for FFD
 - d. H4 - hearing levels preclude safe or effective job performance with or without hearing aids. A medical board is required.

(NEXT SLIDE)

SLIDE 32

QUESTIONS?



PRACTICE SCENARIOS

INTERPRETING 2216 AUDIOGRAMS

32

QUESTIONS?

Practice Scenarios - Interpreting 2216 Audiograms and Role Play post test counseling session

Recommendation for large groups.

- a. Counsel everyone in group at the same time, especially if no one had an STS.**
- b. Demonstrate to all how to correctly wear HPD.**

Take anyone with an STS aside and counsel individually.

(END OF PRESENTATION)

1.10 HEARING PROTECTION

SLIDE 1



HEARING CONSERVATION
PROGRAM

HEARING PROTECTION



HEARING PROTECTION

This photo shows the type of hearing protection that Hearing Conservation does NOT endorse!

By the end of this unit, you will be familiar with better alternatives!

(NEW SLIDE)

SLIDE 2

Learning Objectives

1. List the considerations used to select hearing protection devices (HPD).
2. Identify and describe the major types of HPDs.
3. Compare the advantages and disadvantages of each type of HPD.
4. Demonstrate proper HPD Fitting on self and others
5. Explain the effect of HPDs on speech understanding for normal and impaired hearing.

LEARNING OBJECTIVES

1. List the considerations used to select hearing protection devices (HPD).
2. Identify and describe the major types of HPDs.
3. Compare the advantages and disadvantages of each type of HPD.
4. Demonstrate proper HPD fitting on self and others
5. Explain the effect of HPDs on speech understanding for normal and impaired hearing.

(NEW SLIDE)

SLIDE 3

Situations Requiring Hearing Protection

A noise hazard are present

Hazard or danger signs indicate noise hazard

Noise levels are

> 84 dBA Continuous Noise
≥ 104 dBA (Double HPD)
≥ 140 dBP Impulse Noise



SITUATIONS REQUIRING HEARING PROTECTION

INSTRUCTION TIP: Ask students “What situations require HP?” before showing slide information.

(CLICK)

1. Any noise hazard is present, i.e. noisy equipment, machinery, tools, planes, helicopters, weapons, etc.

(CLICK)

2. Any area where noise hazard signs are posted. They are there for a reason – noise above safe levels have been measured within the area

•

(CLICK)

3. Any situation – work or recreational activity – when noise levels ≥ 85 dBA for continuous noise or >140 dB Peak for impulse noise.

--- Double hearing protection is required when continuous noise levels are >96 dBA. This will provide an additional 5-6dB of attenuation.

ADDITIONAL INSTRUCTION:

4. Practical Tip to determine if noisy activity or area may be hazardous -- The ARM Rule or Three Foot Rule

a. If you have to shout to someone who is within an arm’s length or 3 foot distance of you, the noise is potentially hazardous to your hearing.

b. Recreationally, stop and think about how long you will be in that situation and how often you engage in that activity.

c. This practical tip is a very good quick counseling tool an OHC technician can use when explaining test results.

(NEW SLIDE)

SLIDE 4

HPD Noise Reduction Ratings

Advertised Attenuation in dBC	≠	IH Measured Attenuation in dBA	
Advertised NRR dB C =		25 dBC HL	<i>NO!</i>
Noise Level dB =		100 dBA HL	
NRR Attenuated Level =		75 dBA HL	
Real World Attenuation =		87 dBA HL	
Real World NRR (dBA) is approximately $\frac{1}{2}$ the advertised NRR (dBC) value			

NOISE REDUCTION RATINGS

1. Noise Reduction Ratings (NRR) are the decibel value measured in dB C that HPDs are advertised to reduce intensity of sounds reaching the ear.
--- NRR values are found on the HPD container and/or in its specifications.
2. However, advertised NRRs values are measured using a dB C scale rather than a dB A scale.
 - a. dB C scale includes all frequencies at all intensity levels - it includes non-hazardous low frequencies that are not included in a dB A scale.
 - b. dB C scale results in a higher number value - good but misleading marketing tool
 - c. Industrial Hygienists measure dangerous decibel levels using dB A scale and make recommendations to commands using the dBA values.
3. Real world attenuation levels are smaller than those advertised because non-hazardous low frequencies are not included. For example ---
 - a. Noise Level dB A = 100 dBA HL Take a 100 dBA noise (measured by IH).
 - b. Advertised NRR dB C = 25 dBC HL Insert HPDs advertised as 25 dBC.
 - c. NRR Attenuated Level = 75 dBA HL Incorrect to believe that noise heard reduced to 75 dBA HL.
4. Truthfully, one half of the NRR value is 12-13 dB which subtracted from 100 dB is really 87 dBA HL, the ACTUAL attenuated decibel level.

(CLICK)

5. YES!!

(CLICK)

6. General Rule: Real World NRR (dBA) is approximately $\frac{1}{2}$ the advertised NRR (dBC) value
7. This fact must be considered when selecting the most effective HPD for an employee.

8. CRITICAL NOTE: An individual will receive the full real world attenuation IF and ONLY IF the HPDs are worn CORRECTLY!!!

(NEW SLIDE)

<u>SLIDE 5</u>	<u>Selection Considerations for HPD</u> Selection criteria <ul style="list-style-type: none"><input type="checkbox"/> Work environment<input type="checkbox"/> Job requirements (pilot vs mechanic)<input type="checkbox"/> Attenuation needed & NRR value of device<input type="checkbox"/> Advantages & disadvantages of device<input type="checkbox"/> Communication needs<input type="checkbox"/> Safety needs<input type="checkbox"/> Personal choice & comfort
-----------------------	--

SELECTION CONSIDERATIONS FOR HPD

There are many types of HPD and regulations mandate a reasonable number of choices be available to the employee.

What information or criteria should be considered in selecting the best HPD?

INSTRUCTOR TIP: Ask students for possible selection criteria **BEFORE** showing slide information.

(CLICK)

1. Work environment -- inside/outside, clean/dirty surroundings, humidity, continuous/intermittent noise
2. Job requirements (pilot vs mechanic) - continuous/impulse noise, communication critical to job or not
3. Attenuation needed and NRR value of device - NRR means Noise Reduction Rating - different jobs would have different needs due to low or high noise levels, e.g. carrier flight line vs. engineer in the engine room
4. Advantages and disadvantages of device - ease of use, durability, effective noise reduction, comfortable, cost

(CLICK)

5. Communication needs - combat, pilot, flight deck worker, shipyard worker
6. Safety needs - enough attenuation to protect hearing but not endanger user from not hearing warning signals

7. Personal choice and comfort
 - a. individual size and sensitivity to HPD shapes, sizes and materials
 - b. command must provide reasonable options for personnel -- normally 2-3 choices, such as hand-formed "Foamies", Quattros, and/or earmuffs.

REMEMBER, THE MOST EFFECTIVE HEARING PROTECTION IS THE TYPE THAT WILL BE WORN CONSISTENTLY AND PROPERLY.

(NEW SLIDE)

<u>SLIDE 6</u>	<p style="text-align: center;"><u>Other Selection Considerations</u></p> <ul style="list-style-type: none"><input type="checkbox"/> Double protection needs Not additive Second HPD provides only 5-6 dB additional attenuation Don't overprotect (safety threat)<input type="checkbox"/> Cost effectiveness for purpose of use<input type="checkbox"/> Administrative controls required when HPDs cannot reduce noise below 85dBA 
-----------------------	--

OTHER SELECTION CONSIDERATIONS

Other HPD selection considerations include

1. The need for double protection to get maximum attenuation of the noise

(CLICK)

2. However, NRR (Noise Reduction Rating) values CAN NOT be added when using two (2) types of HPD. They are **NOT additive**.
 - a. second HPD provides only 5 to 6 additional decibels of protection/attenuation.
 - b. remember that too much protection/attenuation can be a safety threat – so don't encourage wearing double hearing protection when noise levels are between 85 – 96 dBA.

(CLICK)

3. Cost effectiveness of a particular HPD for the purpose it is used.
 - a. Example: handformed "foamies" might be cheaper (less than 10 cents a pair) but should be used only once.
 - b. hearing protection is only needed intermittently when a employee uses a particular piece of equipment.
 - c. if the worker uses 10 pairs of Foamies throughout the work day, that is 50 pairs a week or 2600 pairs a year.
 - d. a pair of noise muffs hanging near the equipment to use during operation is more practical and more cost effective.

e. noise muffs may cost more initially but in the long term will save the command money.

4. HPDs can only reduce the noise level to half of the advertised NRR.

a. even with an additional 5-6 dB of protection obtained by doubling HPDs, maximum attenuation achieved will be 20-30 dB.

b. hazardous noise levels exceeding 110 dB will likely NOT be able to reduce the individual's exposure to less than 85 dBA.

5. Therefore, administrative controls are required to control noise exposure time >>> workers must be rotated in and out of high intensity noise areas.

(NEW SLIDE)

<u>SLIDE 7</u>	<p style="text-align: center;"><u>Approved Types of HPDs</u> <i>Any HPD tested by DoD or NMCPHC approved lab is acceptable</i></p> <ul style="list-style-type: none">➤ Earplugs Pre-formed Hand-formed➤ Noise Muffs – all authorized (w/o radios)➤ Ear Canal Caps➤ Helmets
-----------------------	--

APPROVED TYPES OF HPDS

Here is a list of the major types of Hearing Protection Devices that are approved by the Navy.

Keep in mind that any HPD that has been tested and approved in a DoD or NMCPHC lab is acceptable for individual use.

1. Earplugs: Pre-formed and Hand-formed
2. Noise Muffs - all authorized (w/o radios)
3. Ear Canal Caps
4. Helmets

Let's talk about each type in more detail.....

(NEW SLIDE)

SLIDE 8

Pre-formed Earplugs

Single Flange	25 dB	5 color coded ex small to ex large	Tab points to back of ear
Triple Flange	26 dB	3 color coded Small - Med - Large	Stick only should show
Quad Flange	25 dB	Universal fit One size	Stick only should show
Combat Arms	22+ dB steady noise	3 Sizes Small - Med - Large	Inserted color not visible



NRR -- Noise Reduction Rating

PRE-FORMED EARPLUGS

This chart discusses the major types of pre-formed earplugs used in the military (as of 12/2012).

INSTRUCTOR NOTE: Read through slide. Show and pass around examples of each type of pre-formed earplug.

1. Single Flange -- No longer being made, however, many still in military circulation
 - a. NRR is 25 dB
 - b. Sizes – 5 colored coded extra small to extra large
 - c. Proper fit – small plastic tab should point to back of ear when inserted
2. Triple Flange -- Harder polymer and generally less comfortable than Quattros (4)
 - a. NRR is 26 dB
 - b. Sizes – 3 colored coded small, medium, large
 - c. Proper fit – only stick part should show; largest flange should be flush with ear canal opening
3. Quad Flange -- Polymers are softer and usually more comfortable than older triple flange HPDs
 - a. NRR is 25 dB
 - b. Sizes – one size fits all – “universal fit” -- excluding persons with very large ear canals
 - c. Proper fit – depth of insertion dependent upon how small or large ear canals are. Insert as deeply as possible. Ideally, flange nearest patient’s canal diameter should be flush with ear canal opening with only stick part showing
4. Combat Arms
 - a. Used either for intermittent weapons firing or constant noisy situations
 - i. with outside flange closed, functions just like Foamie for constant noise situations, i.e. helicopter ride
 - ii. with outside flange open, communication IS NOT blocked generally
 - iii. when intense noise occurs, i.e. weapons fire or IED explosion, mechanical device closes off preventing entry of noise
 - iv. after intense noise stops, mechanical device immediately opens again allowing communication
 - v. prevents hearing loss and TM perforations

- b. NRR is 22+ dB
- c. Sizes – 3 sizes small, medium, large
- d. Proper fit -- depth of insertion dependent upon how small or large your ear canals are. Insert as deeply as possible.
 - i. if using older double-sided Combat Arms earplugs which are olive green and yellow the use as follows
 - ii. green side out -- camouflage during combat -- means communication essential during intermittent weapons fire
 - iii. yellow side out means combat arm being used like a foamie

(NEW SLIDE)

<u>SLIDE 9</u>	<p><u>Advantages of Pre-Formed Earplugs</u></p> <ul style="list-style-type: none"> 👉 Effective protection 👉 Durable – can be rewashed/reused 👉 Easily carried – earplug carrying case 👉 Inexpensive 👉 Fairly comfortable
-----------------------	--

ADVANTAGES OF PRE-FORMED EARPLUGS

1. Effective protection with proper insertion depth
2. Durable – can be rewashed/reused until cracks or excessive dryness appear
 - Anecdote: Employee used his pre-formed earplug for 3 years. They became dry rotted. He was evaluated for STS due to cracked HPDs!
3. Easily carried – earplug carrying case – may have cord or string attached to hang around neck for inconsistent exposure
 - CAUTION re: cord -- may be choking hazard for those working near mechanical gears or during hand-to-hand combat
4. Inexpensive
5. Fairly comfortable but often takes time and/or use to adapt

(NEW SLIDE)

SLIDE 10

Disadvantages of Pre-formed Earplugs

- 👉 Requires individual medical fitting of both ears
- 👉 Frequent insertion may cause irritation
- 👉 Works loose with jaw movement
- 👉 Improper fit reduces effectiveness

10

DISADVANTAGES OF PRE-FORMED EARPLUGS

1. Requires individual medical fitting of both ears
2. Frequent insertion may cause irritation
3. Works loose with jaw movement, i.e. talking, chewing – can require worker to re-insert earplug often
4. Improper fit reduces effectiveness or attenuation benefit

(NEW SLIDE)

SLIDE 11

Hand-formed Earplugs “foamies”

Sound Guard	29-33 dB	Medium Size	No color should show when viewed directly in front
EAR Classic	29-33 dB	Small Size	
EAR Classic 30	29-33 dB	Small Size	
EAR Classic 33	29-33 dB	Large Size	



11

HAND-FORMED EARPLUGS “FOAMIES”

This chart discusses the major types of handformed earplugs used – commonly called “Foamies”.

INSTRUCTOR NOTE: Read through slide. Show and pass around examples of each type of pre-formed earplug.

1. Sound Guard earplugs or EAR Classic earplugs
 - a. NRR is between 29 and 33 dB – depends on insertion depth -- only 3dB if barely inserted into ear canal
 - b. Size is medium -- which fits 70% of population
 - c. Proper Fit – none of the solid color should be visible when person is viewed from directly in front

2. EAR Classic 30 earplugs

a. NRR is between 29 and 33 dB -- depends on insertion depth – only 3dB if barely inserted into ear canal

b. Size is small – which fits 15% of general population

c. Proper Fit – none of the solid color should be visible when person is viewed from directly in front

3. EAR Classic 33 earplugs

a. NRR is between 29 and 33 dB -- depends on insertion depth – only 3dB if barely inserted into ear canal

b. Size is large -- which fits 15% of general population

c. Proper Fit – none of the solid color should be visible when person is viewed straight on

(NEW SLIDE)

SLIDE 12	<p><u>Advantages of Hand-Formed Earplugs</u></p> <ul style="list-style-type: none"> Effective protection Comfortable -- Universal fit Medical fitting not required One time use – hygienic Good choice when hat or helmet required Least expensive HPD
-----------------	---

ADVANTAGES OF HAND-FORMED EARPLUGS

1. Effective protection when DEEPLY inserted into ear canal

2. Most comfortable -- generally half of employees prefer foamies as HPD.

3. Universal fit – regular size fits 70% of population -- small and large sizes are available for other 30% of population

4. Medical fitting not required

5. One time use – hygienic

6. Good choice when hat or helmet required – nothing sticks out of canal to “catch” the helmet.

7. Least expensive HPD

(NEW SLIDE)

SLIDE 13

Disadvantages of Hand-formed Earplugs

- ❖ **Must be properly molded**
- ❖ **Must be properly inserted**
- ❖ **One-time use**
- ❖ **Should use clean hands**
- ❖ **Do not use in presence of corrosives**

13

DISADVANTAGES OF HAND-FORMED EARPLUGS

1. **Must be properly molded - small smooth cylinder shape - no creases**
2. **Must be properly inserted - total plug material must be inside ear canal**
3. **One-time use - so continual supply is needed; remind employees not to re-use**
4. **Should use clean hands - sometimes big problem in work areas which require use of chemicals and gloves**
5. **Do not use in presence of corrosives - disintegrate and can cause skin damage, hearing loss or dizziness (ototoxicity)**

(NEW SLIDE)

SLIDE 14

Other Approved Types of HPDs

Noise Muffs or Circumaural Headset	25-35 dB	Varies with type	▪ Seal firmly around pinna ▪ Headband worn top of head ▪ Type II allows headband placement top or behind head or under chin
Ear Canal Caps	18 dB	One Size	▪ Inserted tightly into ear canal opening ▪ Headband placed on top or behind head, or under chin
Helmets			For specific operational uses



14

OTHER APPROVED TYPES OF HPDS

Other types of HPDs that are approved for use include noise muffs, ear canal caps, and helmets

INSTRUCTOR NOTE: Read through slide. Show and pass around examples of each type of pre-formed earplug

1. **Noise Muffs or Circumaural Headset**
 - a. **NRR is 25-35 dB**
 - b. **Size varies with design type - headband can adjust to size of head**

- c. Often used in conjunction with hand formed earplugs for double protection – approximately 30dB or greater attenuation
- d. For use with intermittent noisy equipment, can be shared between users
- e. Initially expensive but very cost effective over time
- f. Proper Fit -- must provide firm seal around pinna; placement of the headband may vary with type of noise muffs

2. Ear Canal Caps

- a. NRR is 18 dB but has great variability, dependent upon headband tension
- b. Size – “universal fit” for ear canals but headband may not fit tightly if not pushed inwards
- c. Proper Fit – headband must have adequate tension to keep canal caps inserted into ear canals

3. Helmets – NRR, Size and Fit dependent upon make/model of helmet and attached materials.

(NEXT SLIDE)

<u>SLIDE 15</u>	<p style="text-align: center;"><u>Advantages of Circumaural Noise Muffs</u></p> <ul style="list-style-type: none">  Good attenuation -- protection  Universal fit  Can be worn with earplugs double protection provides 30+ dB of attenuation  Can incorporate other equipment communications equipment Active Noise Reduction (ANR)  Medical fit not required
------------------------	---

ADVANTAGES OF CIRCUMAURAL NOISE MUFFS

- 1. Good attenuation or protection
- 2. Universal fit – assuming headband can adjust
- 3. Can be worn with earplugs

(CLICK)

--- double protection provides 30+ dB of total attenuation (second HPD provides 5-6dB additional protection)

- 4. Can incorporate other equipment

(CLICK)

--- such as communications equipment and/or Active Noise Reduction (ANR) technology

5. Medical fit not required

(NEW SLIDE)

<u>SLIDE 16</u>	<u>Disadvantages of Circumaural Noise Muffs</u> <ul style="list-style-type: none">👉 Most expensive type of HPD👉 Bulky and heavy👉 Uncomfortable in heat and humidity👉 Effectiveness may decrease with hair, eyeglasses and earrings👉 Not easily carried <p style="text-align: right; font-size: small;">16</p>
------------------------	--

DISADVANTAGES OF CIRCUMAURAL NOISE MUFFS

1. Most expensive type of HPD
2. Bulky and heavy
3. Uncomfortable in heat and humidity
4. Effectiveness may decrease with interference of hair, eyeglasses and earrings
5. Not easily carried

(NEW SLIDE)

<u>SLIDE 17</u>	<u>Advantages of Ear Canal Caps</u> <ul style="list-style-type: none">👉 Quickly inserted without soiling👉 Medical fit not required👉 Easily carried, light weight👉 Universal fit – one size fits all👉 Best for intermittent noise of moderate intensity (95 dBHL or less) <div style="display: flex; justify-content: center; align-items: center;"></div> <p style="text-align: right; font-size: small;">17</p>
------------------------	---

ADVANTAGES OF EAR CANAL CAPS

1. Quickly inserted without soiling
2. Medical fit not required

3. Easily carried, light weight
4. Universal fit - one size fits all
5. Best for intermittent noise of moderate intensity (95 dBHL or less)

(NEW SLIDE)

SLIDE 18	<p><u>Disadvantages of Ear Canal Caps</u></p> <ul style="list-style-type: none"> ❖ More expensive than earplugs ❖ Uncomfortable during extended use ❖ Very limited attenuation ❖ Poor headband tension easily reduces attenuation
-----------------	--

DISADVANTAGES OF EAR CANAL CAPS

1. More expensive than earplugs
2. Uncomfortable during extended use
3. Very limited attenuation
4. Poor headband tension reduces effective attenuation

(NEW SLIDE)

SLIDE 19	<p><u>Helmets</u> Integrated and Specialized HPD's</p> <ul style="list-style-type: none"> • Aviators, Aviation Crew • Flight & Well Deck Personnel • Tank Crews • Amphibious Assault Vehicle Crew Members <div style="text-align: right; margin-top: 10px;">  </div>
-----------------	---

HELMETS Integrated and Specialized HPD's

1. Here are examples of two types of the newer cranial headsets incorporating ear and eye protection with communication capabilities.

Typically used by

2. Aviators and Aviation Crew
3. Ship -- Flight and Well deck personnel
4. Tank Crew
5. Amphibious Assault Vehicle Crew Members

(NEW SLIDE)

<u>SLIDE 20</u>	<u>Care and Maintenance of HPDs</u>
	<ul style="list-style-type: none">• Clean after each use with warm soapy water• Rinse & dry completely before re-use• Avoid inserting with soiled hands• Get new pair when condition no longer provides good fit• Made for one time use• Avoid inserting with soiled hands• Never use if contaminated with metal filings or corrosives

CARE AND MAINTENANCE OF HPDS

1. Pre-formed Earplugs – single to multiple flange
 - a. Clean after each use with warm soapy water
 - b. Rinse and dry completely before re-use
 - c. Avoid inserting with soiled hands
 - d. Get new pair when condition no longer provides good fit
2. Hand-Fomed Earplugs – “foamies”
 - a. Made for one time use
 - b. Avoid inserting with soiled hands
 - c. Never use if contaminated with metal filings or corrosives

(NEW SLIDE)

<u>SLIDE 21</u>	<u>Care and Maintenance of HPDs cont....</u>
	<ul style="list-style-type: none">• Wipe down ear cups with alcohol-free cloth• Check for ear cup defects/deformities• Replace cushions when cracked or broken• Check headband tension• Modification of muffs is prohibited• Clean similarly to preformed HPD• Check headband tension• Replace when ear tips become hard

CARE AND MAINTENANCE OF HPDS CONT....

1. Noise Muffs
 - a. Wipe down ear cups with alcohol-free cloth
 - b. Check for ear cup defects or deformities
 - c. Replace cushions when cracked or broken
 - d. Check headband tension – ear cushions should touch each other
 - e. Modification of muffs is prohibited i.e. holes drilled into muffs to allow for personal listening devices

2. Ear Canal Cups
 - a. Clean similarly to pre-formed HPD – clean after each use with warm, soapy water, rinse and dry thoroughly before re-use
 - b. Check headband tension to ensure a tight insertion in ear canals
 - c. Replace when ear tips become hard

(NEW SLIDE)

<u>SLIDE 22</u>	<p><u>Noise Reduction Ratings and Proper Fitting Techniques</u></p> 
------------------------	--

NOISE REDUCTION RATINGS AND PROPER FITTING TECHNIQUES

Mental Break --- Instructor Tip: Conduct a mini quiz on

1. Types of HPDs

2. Advantages and disadvantages

3. What selection criteria should be considered for each type of employee below?
 - a. civilian electrician
 - b. administration employee who is consulting with a supervisor inside hanger
 - c. ship galley worker
 - d. helicopter pilot
 - e. Aviation boatswain's mate handler (ABH)

4. Let's talk about NRR and adequate insertion depth for the next few slides.
 - a. What does the advertised NRR mean?
 - b. Does one really get that much attenuation?
 - c. How deeply should one wear his/her HPDs?

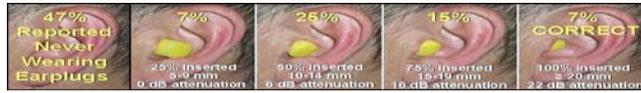
(NEW SLIDE)

SLIDE 23

Real-World Hearing Protection

Interviewed 300 Flight Deck Crews from
4 CVN and 2 LHD / East and West Coast

79% Received an estimated **0 - 6 dB noise attenuation** due to either shallow earplug insertion or NOT wearing earplugs at all



NAVAIR 14MAR06

REAL-WORLD HEARING PROTECTION

1. In 2006, a study was conducted aboard four (4) Air Craft Carriers and two (2) LHD vessels – 300 crew members were interviewed.
 - a. Results indicated that 79% (237) of the Flight Deck Crew received only 0-6dB of hearing protection (attenuation).
 - b. This inadequate protection was from a) not wearing HPD at all or b) wearing them incorrectly.
2. Only 7% -- only 21-- of the 300 workers interviewed wore their HPD correctly.
3. Analogy: Think about a worker who incorrectly wears protective eyewear on the brim of his nose.
 - a. As he welds, shards of metal and sparks shoot from the material.
 - b. How many of you think the person is receiving the maximum benefit from the protective eyewear?
4. It is the same concept with hearing protection.
5. If the worker does NOT insert the earplugs as DEEPLY as possible, then he or she will not receive the required protection or benefit.
6. A good practical rule is that if you have the HPDs inserted correctly, then you should NOT be able to see any color sticking out of the ear canal when you look straight in a mirror (or your shipmate directly facing you should see no color).

**** Noise Reduction Ratings from earplug insertion depth study completed by the Air Force Research Laboratory using American National Standard S12.6-1997 (R2002) Methods for Measuring the Real-Ear Attenuation of Hearing Protectors, Method A (Experimenter Supervised / Verbally Coach), mean minus two standard deviations.**

(NEXT SLIDE)

SLIDE 24

What is a Good Earplug Fitting?

- ☛ **Voices sound muffled**
- ☛ **No difference in sound when cupped hands are placed over ears & removed**
- ☛ **Vacuum effect/feeling**
- ☛ **Comfortable – non-irritating**
- ☛ **Each ear is fit individually**
- ☛ **Majority or all of plug is not visible when directly looking at user**
- ☛ **Single flange tab toward rear of head**

24

WHAT IS A GOOD EARPLUG FITTING?

INSTRUCTOR TIP: Quiz students for ideas or criteria that indicate a good fitting earplug.

What are some ways that you or the employee knows that the earplug is a good fit or inserted properly?

--- Regardless of whether earplug is pre-formed or hand-formed.

(CLICK)

1. **Voices sound muffled**
2. **No difference in sound when cupped hands are placed over ears and removed**
3. **Vacuum effect/feeling when slight tug on stick after insertion**

(CLICK)

4. **Comfortable – non-irritating**
5. **Each ear is fit individually**

(CLICK)

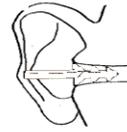
6. **Majority or all of plug is not visible when directly looking at user**
--- stick only for pre-formed, no color or no contrast band of color for hand-formed
7. **Single flange tab toward rear of head OR largest flange that fits the canal is flush against ear canal opening**

(NEW SLIDE)

SLIDE 25

Insertion of Pre-formed Earplug

1. Grasp plug firmly behind largest flange
2. Insert smaller flange in ear canal
3. Push and jiggle toward rear or center of head
4. If a good seal is not obtained, use smaller or larger size
5. Only stick should be seen when looking directly into mirror; last flange should be flush with ear canal



INSERTION OF PRE-FORMED EARPLUG

1. Grasp plug firmly behind largest flange
2. Insert smaller flange in ear canal – grasp ear and pull up/back with opposite hand to open ear canal
3. Push and twist toward rear/center of head
4. If a good seal is not obtained, use smaller or larger size
5. Only stick should be seen when looking directly into mirror; last flange should be flush with ear canal

(NEW SLIDE)

SLIDE 26

Insertion of Hand-formed Earplug

1. Roll earplug between thumb and index finger to make very thin tube
2. Ensure there are no creases in rolled plug
3. Pull up and back on ear
4. Insert earplug as DEEPLY as possible
5. All color should be in ear canal



INSERTION OF HAND-FORMED EARPLUG

1. Roll earplug between thumb and index finger to make very thin tube -- optional method is using 2 hands (between palms or use both thumbs and index fingers together)
2. Ensure there are no creases in rolled plug – smooth dense cylinder
3. Pull up and back on ear with OPPOSITE hand with arm over head
4. Insert earplug as DEEPLY as possible; push deeper 1-2X with fingertip.

5. All color should be in ear canal – if you look directly into mirror or buddy looks face to face at you >>> should see no color.
6. Other practical tips to know if in deep enough
 - a. move index finger from front to back across ear – you should not feel the earplug
 - b. no difference in hearing when you move your hands on and off your ears.

(NEXT SLIDE)

<u>SLIDE 27</u>	<p>Practice #1 – Good or Bad Fit?</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>1</p>  </div> <div style="text-align: center;"> <p>2</p>  </div> </div>
------------------------	---

PRACTICE #1 – GOOD OR BAD FIT?

#1 BAD – pre-formed plug in backwards – stick is inside canal

#2 GOOD -- if there is a vacuum effect.

BAD -- there may be a small space between upper part of flange and ear canal opening – not flush against canal opening

(NEXT SLIDE)

<u>SLIDE 28</u>	<p>Practice #2 – Good or Bad Fit?</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>1</p>  </div> <div style="text-align: center;"> <p>2</p>  </div> </div>
------------------------	---

PRACTICE #2 – GOOD OR BAD FIT?

#1. BAD -- not inserted far enough – too much color/plug showing

#2. BAD – earplug inserted incorrectly – lying horizontally inside concha/bowl of outer ear

(NEXT SLIDE)

SLIDE 29

Practice #3 – Good or Bad Fit?



PRACTICE #3 – GOOD OR BAD FIT?

#1 GOOD – final check would be employee directly into mirror or buddy looking directly at him – no color should show. Also can slide index finger across ear front to back – should not feel any of the earplug or hear no difference when close hands over ears.

#2 BAD -- the tab of the earplug should be going to the back of the ear/head.

(NEXT SLIDE)

SLIDE 30

Practice #4 – Good or Bad Fit?



PRACTICE #4 – GOOD OR BAD FIT?

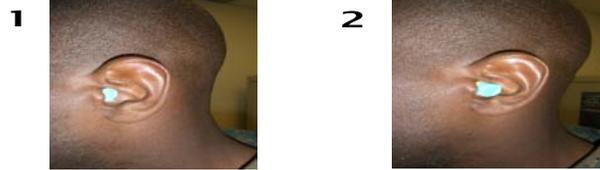
#1 BAD – plug is placed horizontally just inside bowl of ear

#2 BAD – inadequate insertion – almost all of earplug outside of ear canal

(NEXT SLIDE)

SLIDE 31

Practice #5 – Good or Bad Fit?



PRACTICE #5 – GOOD OR BAD FIT?

#1 GOOD – plug is deeply inserted into ear canal

#2 BAD – inadequate insertion – almost all of earplug outside of ear canal

Use the “functional” check : close off your ears with your hands after inserting earplugs. If there is no perceived difference whether your hands are covering your ears or not, then the earplugs are adequately plugging your ears.

(NEXT SLIDE)

SLIDE 32

“But I Can’t Wear My Hearing Protection Because...”

- They hurt or itch my ears!
- My ears will become infected!
- I can’t hear the engine sounds!
- I need to get used to how loud my weapon is!
- I won’t be safe if I can’t hear live fire or my equipment operating!



**Flawed logic! Thinking short-term vs. long-term!
Bottom line: Is your hearing worth protecting?**

BUT I CAN’T WEAR MY HEARING PROTECTION BECAUSE...

These are some of the common excuses for not wearing hearing protection.

1. They hurt or itch my ears!
2. My ears will become infected!
3. I can’t hear the engine sounds!
4. I need to get used to how loud my weapon is!
5. I won’t be safe if I can’t hear live fire or my equipment operating!
6. Some of these excuses are generally false – some of them refer to the need to adapt to noise attenuation.

(CLICK)

7. But most of all, these excuses demonstrate --- Thinking short-term vs. long-term!
8. No matter what argument an employee gives you, it comes down to a personal choice on whether or not they think their hearing is worth protecting.
9. We can only help them by educating and motivating them to enable them to make better choices in the future.

(NEXT SLIDE)

SLIDE 33	<p><u>Effects of HPDs on Hearing Performance</u></p> <p>People will speak at a level that overcomes effects of noise and HPD attenuation</p> <p>Result is good communication over wide range of conditions</p> <p>Effective communication performance requires practice using HPD's consistently</p> <p>Listeners with hearing loss may have problems understanding speech in high levels of noise</p> <p style="text-align: right;"><small>33</small></p>
-----------------	---

EFFECTS OF HPDS ON HEARING PERFORMANCE

1. There are two physical phenomena that occur in noisy communication environments:
 - a. Lombard effect is when people naturally raise the volume of their voices to overcome effects of noise in the area.
 - b. Occlusion effect is when a individual with "plugged" ears will lower the volume of his or her voice because it "echoes" or sounds louder inside the head.
2. In hazardous noise situations, the Lombard Effect will overcome both the Occlusion Effect from the HPDs and the excessive background noise.
3. What remains is good communication over wide range of conditions with the benefit of using hearing protection.

(CLICK)

4. In terms of hearing ability >>>
 - a. It is true that effective communication performance requires practice using HPD's consistently.
 - b. It does take patience and time to adapt to sound's new characteristics reaching your eardrums and to use visual cues to assist understanding.

5. Listeners who have hearing loss may have problems understanding speech in high levels of noise because more of the speech signal is lost to them even before using HPDs.

(NEXT SLIDE)

SLIDE 34	Specialized HPDs ➤ Custom earmolds or earplugs ➤ Musician hearing protection ➤ Communication earplugs & headsets <i>Details following . . .</i> <small>34</small>
-----------------	---

SPECIALIZED HPDS

Hearing Protection Devices that are made for out-of-the-ordinary noise exposure include the following categories:

1. Custom earmolds or earplugs
2. Musician hearing protection
3. Communication earplugs and headsets

Following slides provide more details . . .

(NEXT SLIDE)

SLIDE 35	Custom Earmolds or Plugs  <ul style="list-style-type: none">❖ Made of silicone material❖ Made by audiologist or trained personnel with supervision❖ Hardened mold is sent to lab for final customized molds❖ NRR varies but excellent❖ Expensive❖ Most often used by pilots <small>35</small>
-----------------	--

CUSTOM EARMOLDS OR PLUGS

1. Custom earmolds or earplugs are made to fit the individual's ear.
2. A soft material (silicone) is custom molded to patient's ear canal and allowed to harden (takes 5 minutes)

3. Made by audiologist or trained personnel with supervision
4. Hardened mold is sent to lab for final customized molds
5. NRR varies but excellent
6. Expensive – unless absolutely required for the job, commands do not pay for custom earmolds
7. Most often used by pilots

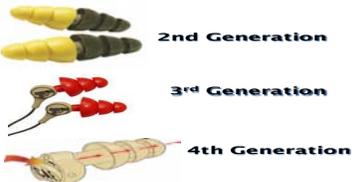
(NEXT SLIDE)

<u>SLIDE 36</u>	<p style="text-align: center;">Musician Hearing Protection</p> <p style="text-align: center;">Devices designed specifically for musicians and sound engineers</p> <p style="text-align: center;">Medically fit</p> <p style="text-align: center;">Custom ear molds made for each individual</p> <p style="text-align: center;">NRR = 15-25 dB</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div>
------------------------	---

MUSICIAN HEARING PROTECTION

1. Devices designed specifically for musicians and sound engineers – this is a growing area for hearing protection
2. Medical fit is required – audiologist must fit correct size or make custom mold
3. Custom ear molds made for each individual
4. NRR = 15-25 dB

(NEXT SLIDE)

<u>SLIDE 37</u>	<p style="text-align: center;">Communication HPD: Combat</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="text-align: center;">Mechanical</p>  </div> <div style="width: 45%;"> <p style="text-align: center;">Electrical</p>  </div> </div>
------------------------	--

COMMUNICATION HPDs: Combat Oriented

- 1. Communication HPDs offer the ability to hear sounds the war fighter needs to hear (approaching footsteps), but affords protection against impulse noise.**
- 2. Communication HPDs come in two varieties: mechanical and electrical.**
- 3. The “Combat Arm Earplug” is an example of a mechanical device. It was developed jointly by the Army and Air Force and is now standard issue for all soldiers in the US Army.**
- 4. Combat Arms earplugs use a mechanical technology that remain open for non-hazardous sounds, allowing for communication to occur, but will briefly close off in impulse noise situations (gunfire, IEDs).**
- 5. The Combat Arms earplug continues to be improved, although older models are still in circulation.**
 - a. Note that for the green and yellow earplug (2nd generation) must be worn with the correct end/color in the ear canal:**
 - b. Yellow side out = HPD like a foamie used when communication is not critical, such as constant noises (helo rides, generators)**
 - c. Green side out = HPD needed during combat when communication is critical.**
- 6. Electrical Communication HPDs, aka Tactical Communication and Protective Systems (TCAPS) work like hearing aids in that they have three (3) major functions or capabilities.**
 - a. First, they amplify soft sounds over long distances to allow the Marine to have a tactical advantage.**
 - b. Second, they allow service members to communicate in between gunfire**
 - c. Third, they protect the user from the intense energy of weapons fire by not amplifying the full sound wave.**
- 7. Three (3) examples include:**
 - a. NACRE Tactical Headsets (Quiet Pro): 1st widely used tactical communication Devices**
 - b. Silynx Communication, Inc. (C4-OPS): waterproof**
 - c. Atlantic Signal Dominator (Dominator): bone conduction and waterproof**

(NEXT SLIDE)

SLIDE 38

Communication HPD: Headsets

Electronic active ear muffs

- good passive reduction
- has microphone
- has small loudspeaker inside the cup



Attenuates constant and impulse noises
Can be attached to radios for distance communication

COMMUNICATION HEADSETS

1. **Electronic active ear muffs**
 - a. good passive reduction of hazardous noise
 - b. has microphone
 - c. has small loudspeaker inside the cup
2. **Attenuates constant and impulse noises**
3. **Can be attached to radios for distance communication**
4. **Used in a variety of situations on shore and on ship, particularly by civilian employees**

(NEXT SLIDE)

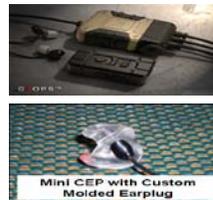
SLIDE 39

Communication HPD: Electrical

Electrical devices provide both communication and protection capability

Earplug designed with small speaker insert

Capable of long range radio communications



COMMUNICATION: ELECTRICAL DEVICES

1. **Electrical devices provide both communication and protection capability. We described their characteristics and use in combat as providing amplification of soft sounds, communication between service members during combat, and reduction or protection from intense weapons fire.**
2. **Quiet Pro, C4 OPS and the Dominator devices have been mentioned previously. It is used in both combat and noncombat situations where communication between users is required or essential.**

3. Earplugs, such as the Mini CEP (Communication Ear Piece) or ACCES Earplug, have a custom molded earplug with a small speaker insert. It is designed primarily for pilot and navigator use.
4. Another characteristic and advantage of electrical communication HPDs that they can be connected to radio systems to allow for long distance communications.
5. Research incorporating Active Noise Reduction (ANR) is currently ongoing by NAVAIR Command.
 - a. ANR electronically cancels low frequency noises (<500Hz frequencies only).
 - b. not effective with jet noise due to its high frequency characteristics

(NEW SLIDE)

SLIDE 40	 <p><u>Funding for HPDs</u></p> <p>Hearing protection must be issued no cost to the employee must be replaced if lost, damaged or poorly fit</p> <p><u>WHO BUYS?</u> AFLOAT Initial HPDs – Ship’s Medical All other HPDs – Department ASHORE – Command Safety</p>
-----------------	--

FUNDING FOR HPDS

1. Hearing protection must be issued at no cost to the employee and must be replaced if lost, damaged or poorly fit
2. Who buys or pays for the HPDs?
 - a. Per AFLOAT Instruction, on a ship, the initial device is issued and paid for by the ship’s medical dept
 - b. subsequent HPDs are issued and obtained from the employee’s department
3. ASHORE, the Command Safety office pays for and provides a reasonable variety of approved devices.
4. Medical clinic, i.e. Occupational Audiology, may fit the initial device, particularly pre-formed earplugs --- however, it is always the command’s responsibility to purchase/supply the HPDs.
5. **PROFESSIONAL EXCEPTION:** If/When an employee sustains an STS, it’s highly recommended that the MTF have a ready supply of HPDs (foamies and quattros) to provide the employee with a free pair while demonstrating proper use/fit.

(NEXT SLIDE)

SLIDE 41



More Funding Details

Personnel in the HCP have the right to choose which type of HPD they prefer to wear

HPD must be among approved selections

Customized ear molds available upon request with adequate funding

41

MORE FUNDING DETAILS

- 1. Regulations state that civilian and active duty personnel enrolled in the HCP have the right to choose, within reason, which type of HPD they prefer to wear.**
- 2. However, the HPD must be among approved selections.**
- 3. Customized earmolds are available upon request and are dependent upon command funding.**

(NEXT SLIDE)

SLIDE 42

QUESTIONS?

42

SUMMARY

Remember ... the best hearing protection is the one that you use consistently and correctly!

It doesn't have to be fancy or expensive - it just needs to be used correctly whenever it is needed.

Any Questions?

(END OF PRESENTATION)

1.11 HC EDUCATION AND MOTIVATION

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>HEARING CONSERVATION HEALTH EDUCATION and MOTIVATION</u></p>   
-----------------------	---

HEARING CONSERVATION HEALTH EDUCATION AND MOTIVATION

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. List HCP Education/Training Instructions2. Identify who requires initial/annual training3. Identify training content requirements and command responsibilities4. List activities to motivate and encourage behavior change for improving compliance5. List education and training resources
-----------------------	--

LEARNING OBJECTIVES

1. List HCP Education/Training Instructions
2. Identify who requires initial/annual training
3. Identify training content requirements and command responsibilities for HCP Training
4. List activities to motivate and encourage behavior change for improving compliance
5. List education and training resources

(NEXT SLIDE)

SLIDE 3

GOAL of the HCP

**Prevent occupationally related
noise-induced hearing loss**

**TO MEET GOAL
Continual education
and training
of noise-exposed personnel**

GOAL OF THE HCP

1. Prevent occupationally related Noise Induced Hearing Loss (NIHL)
 - a. maintain combat readiness
 - b. maintain fitness for duty
 - c. retain job or work specialty
 - d. reduce cost of hearing loss (\$, social)
 - e. promote healthy hearing and quality of life

2. In order to meet this Goal >>> we must provide continual education and training about hearing and hearing conservation to noise-exposed personnel.

(NEXT SLIDE)

SLIDE 4

**HCP Education and Training
Instructions**



HCP EDUCATION AND TRAINING INSTRUCTIONS

1. DoD Instructions 6055.12 and the HCP instructions of each service clearly delineate requirements for HCP education and training to personnel.
 - a. Marines MCO 6260.1 Series
 - b. Navy OPNAV 5100.23 Series and OPNAV 5100.19 Series, NMCPHC Tech Manual 6260.51.99-2
 - c. Army DA PAM 40-501
 - d. Air Force AFI 48-20

2. Local SOP manual for the HCP should provide specific procedures for each command.

(NEXT SLIDE)

SLIDE 5

**Education/Training
Who Needs It & How Often?**

- I. **SHORE BASED Training**
 - A. Initial - supervisors & enrollees
 - B. Annual - supervisors & enrollees
- II. **SHIPBOARD Training**
 - A. Initial - all hands during Indoctrination
 - B. Annual - HCP enrollees



EDUCATION/TRAINING : Who Needs It and How Often?

Shore Based Training and Education: DODI 6055.12 and OPNAVINST 5100.23G

1. Supervisors and HCP enrollees **MUST** receive initial and refresher HC training.
2. “Refresher training can be given by local medical personnel at the time of the annual audiogram”, however, given the length of time needed to cover all aspects of the required training, this option is less than ideal. Training can be augmented by the OHC Tech upon annual testing, however, it is the ultimate responsibility of each command.

Shipboard Training and Education: DODI 6055.12 and OPNAVINST 5100.19E

1. The medical department representative (MDR) **SHALL** conduct training for all hands during indoctrination.
2. The MDR **SHALL** ensure annual, refresher training for the HCP-enrolled personnel is performed.
3. In conjunction with this annual training, the member often receives additional refresher training upon taking the annual audiogram by the OHC Tech.

(NEXT SLIDE)

SLIDE 6

Initial Training Requirements

- I. Elements & rationale for the HCP
- II. Effects of noise on hearing
- III. Proper use and care of HPD
- IV. Command program and individual responsibilities



INITIAL TRAINING REQUIREMENTS

Initial Training Requirements require that the following topic areas be discussed with military and civilian personnel enrolled in the HCP.

1. The elements and rationale for HCP
2. The effects of noise on hearing – both auditory and non-auditory effects
3. Proper use or wearing and the proper care or maintenance of HPDs – of course, this includes an explanation of different types of HPDs that are available within the command
4. Explanation of the responsibilities of the command's HCP program and of the responsibilities of the individual personnel enrolled in the HCP.

Examples: command responsibility for providing adequate choice of HPDs and individual responsibility for showing up for all hearing tests.

(NEXT SLIDE)

<u>SLIDE 7</u>	<p>Initial Training Requirements cont....</p> <p>V. Individual's responsibilities in protecting his or her hearing</p> <p>VI. How hearing loss affects career</p> <p>VII. Off duty practices that prevent HL</p> <p>VIII. Communicating in high-noise environments</p> 
-----------------------	--

INITIAL TRAINING REQUIREMENTS cont....

Initial Training Requirements continued.....

5. Individual's responsibility in protecting their own hearing both during work hours and during off duty hours
6. How hearing loss affects career progression, retention, job performance and mission
7. Off duty practices which will aid in protecting their hearing
8. Communication in high-noise environments, effects of HPD use on communication, etc.

(NEXT SLIDE)

SLIDE 8

Annual Training Requirements

- I. Effects of noise on hearing
- II. Purpose of HPD
- III. Advantages/Disadvantages of HPD
- IV. Instructions on HPD selection, use & care



ANNUAL TRAINING REQUIREMENTS

1. Generally, the only difference between initial and annual training is that initial training requires a discussion about the Elements and Rationale of the Hearing Conservation Program
2. Per DODI 6055.12, all personnel routinely working in designated hazardous noise areas SHALL receive annual training on the nine (9) below training elements. You will notice that this list is repetitive of initial training but a bit more specific.
3. I. The effects of noise on hearing.
4. II. The purpose of hearing protection.
5. III. The advantages, disadvantages, and attenuation of various hearing protectors.
6. IV. Instructions on selection, fit, use, and care of hearing protectors.

(NEXT SLIDE)

SLIDE 9

Annual Training Requirements cont...

- V. Requirements to use HPD and administrative actions for non-compliance
- VI. Purpose of Audiometric Testing
- VII. Explanation of test procedures
- VIII. Explanation that hearing loss will affect job retention/employability
- IX. Encourage HPD use off duty



ANNUAL TRAINING REQUIREMENTS cont...

Annual/Refresher Training Requirements cont.....

1. V. Mandatory requirement of assigned protective equipment, and administrative actions that may follow for failure to wear.

2. VI. The purpose of audiometric testing.
3. VII. An explanation of the audiometric test procedures.
4. VIII. The fact that hearing loss may lead to disqualification from current duties.
5. IX. All personnel shall be encouraged to use hearing protectors when exposed to hazardous noise during off-duty activities.
6. OPNAVINST 5100.23G states that the “Refresher training can be given by local medical personnel at the time of the annual audiogram”, however, given the length of time needed to cover all aspects of the required training, this option is less than ideal. Training can be augmented by the OHC Tech upon annual testing, however, it is the ultimate responsibility of each command.

(NEXT SLIDE)

SLIDE 10	<p>Ship Board HCP Training</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Command Medical</td> <td style="text-align: left;"> <ul style="list-style-type: none"> • Initial and Annual • Stand Downs </td> </tr> <tr> <td style="text-align: center;">OHC TECH</td> <td style="text-align: left;"> <ul style="list-style-type: none"> • Counseling during Hearing Test Results </td> </tr> </table>	Command Medical	<ul style="list-style-type: none"> • Initial and Annual • Stand Downs 	OHC TECH	<ul style="list-style-type: none"> • Counseling during Hearing Test Results
Command Medical	<ul style="list-style-type: none"> • Initial and Annual • Stand Downs 				
OHC TECH	<ul style="list-style-type: none"> • Counseling during Hearing Test Results 				

SHIPBOARD TRAINING AND EDUCATION

1. Who provides it?

(CLICK)

2. OPNAVINST 5100.19E states that “the [shipboard] medical department representative (MDR) shall conduct training for all hands during indoctrination. The MDR SHALL ensure annual, refresher training for the HCP-enrolled personnel is performed”.

(CLICK)

3. When does ship board training occur?
4. The MDR shall ensure that initial and annual (refresher) training is provided for the HCP-enrolled personnel.

5. Initial and annual training sessions can be through Stand Downs.
6. OHC Technicians can provide additional training when counseling during hearing test results. This secondary training is in conjunction to the annual training provided by shipboard MDR. * For larger ships with onboard hearing booths, the AVT or Aviation Medical Technician performs hearing testing and counseling.

(NEXT SLIDE)

SLIDE 11	<p>Shore Based HCP Training</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">COMMAND SAFETY OFFICER</td> <td style="text-align: left;"> <ul style="list-style-type: none"> ➤ Initial and Annual ➤ Stand Downs </td> </tr> <tr> <td style="text-align: center;">OHC TECH</td> <td style="text-align: left;"> <ul style="list-style-type: none"> ➤ Counseling during Hearing Test Results </td> </tr> </table>	COMMAND SAFETY OFFICER	<ul style="list-style-type: none"> ➤ Initial and Annual ➤ Stand Downs 	OHC TECH	<ul style="list-style-type: none"> ➤ Counseling during Hearing Test Results
COMMAND SAFETY OFFICER	<ul style="list-style-type: none"> ➤ Initial and Annual ➤ Stand Downs 				
OHC TECH	<ul style="list-style-type: none"> ➤ Counseling during Hearing Test Results 				

SHORE BASED HCP TRAINING

Shore Based Training and Education regulations state.....
Supervisors and HCP enrollees **MUST** receive initial and refresher hearing conservation training.

OPNAVINST 5100.23G states that the “refresher training can be given by local medical personnel at the time of the annual audiogram”, however, given the length of time needed to cover all aspects of the required training, this option is less than ideal. Training can be augmented by the OHC Tech upon annual testing, however, it is the ultimate responsibility of each command.

1. Who provides it and when does this person provide the training?

(CLICK) (CLICK)

2. The Command Safety Officer has primary responsibility for providing HCP training on shore. Initial and annual/refresher training are provided typically through stand downs.

(CLICK) (CLICK)

3. The OHC Technician can provide additional training when counseling during hearing test results. This secondary training is in conjunction to the annual training provided by each command’s safety.

(NEXT SLIDE)

<u>SLIDE 12</u>	OHC Tech Contributions to Annual Training <ul style="list-style-type: none">👉 Praise normal hearing – no STS👉 Encourage consistent use of HPDs👉 Re-instruct proper insertion of earplugs👉 Encourage awareness of noise levels and HPD use during home and off-duty activities
------------------------	---

OHC TECH CONTRIBUTIONS TO ANNUAL TRAINING

Specific contributions an OHC Technician makes during annual training regardless of working on ship or on shore.

(CLICK)

- 1. Praise normal hearing -- no STS – or praise no further STS**
- 2. Encourage consistent use of HPDs**

(CLICK)

- 3. Re-instruct proper insertion of earplugs - don't hesitate to take 30 seconds to demonstrate or ask patient to demonstrate proper procedures.**
- 4. Encourage awareness of noise levels and HPD use during home and recreational activities**
 - a. Use common sense when listening to personal listening devices**
 - b. Do not use personal listening devices underneath earmuffs when needle gunning onboard ship or in the yards**
- 5. Instructor Tip: Role Play 60-90 second counseling with motivational remarks**

EXAMPLE:

- a. “We see no change from your reference hearing levels and your hearing is still within normal limits.**
- b. You are doing a great job protecting your hearing.**
- c. Remember the tip about putting in your foamies – IF you can look directly into a mirror or have a buddy look at you directly, you should NOT be able to see any color IF the foamies are in deeply enough**
- d. Don't forget to think about noise outside of work. If you are in noise and talking to someone, remember the ARM or 3 Foot Rule. If either one of you have to**

raise your voice to be heard, the noise is at the hazardous level and could be damaging your hearing. Think about using protection or stopping what you are doing. Examples include: Gas powered lawn equipment, NASCAR races, hunting, music events/clubs, weapons firing, construction, etc...

(NEXT SLIDE)

SLIDE 13	<p style="text-align: center;">Employee Motivation Ideas</p> <p style="text-align: center;">KEY: Behavior must change to improve compliance using HPDs</p> <p style="text-align: center;"><u>ASHORE - Medical Clinics</u></p> <p>OHC Tech Attitude:</p> <ul style="list-style-type: none">✓ respect and concern for hearing✓ enthusiasm in explaining results <p>Demonstrate excellent patient care and "customer service"</p> <p>Use positive reinforcement</p> 
-----------------	--

EMPLOYEE MOTIVATION IDEAS

1. **KEY: Behavior must change to improve compliance using HPDs**
2. **When the OHC Technician works Ashore in a medical clinic or MOHCAT van, motivating and encouraging employees to preserve their hearing is through the counseling time after a hearing test.**
3. **The OHC Technician motivates a patient through his or her attitude toward taking the hearing test seriously and enthusiastically explaining test results and answering questions. His or her professionalism reflected in appearance, interest and helpfulness toward the patient indicates "Hearing is critical to your life"**
4. **The technician motivates by demonstrating good patient care and customer service. This includes listening, problem solving, and verifying referral appointments and any other "promise" made to a patient or command personnel who calls for information.**
5. **Remember to use positive reinforcement whenever a patient has maintained hearing status and consistently used hearing protection. Everyone enjoys being praised for what they do.**

(NEXT SLIDE)

SLIDE 14

Employee Motivation Ideas #2

AFLOAT and RURAL COMMANDS

OHC Technician may assist Safety Officer or Unit Supervisors in educational & motivational activities

- Perform “walk-throughs” to monitor compliance
- Give positive reinforcement for consistent HPD use in the presence of co-workers
- Provide personalized training for workers having difficulty using HPDs
- Reinforce fact that Significant HL can mean a job change or Loss of Employment

EMPLOYEE MOTIVATION IDEAS

1. For Afloat and Rural Command assignments , the OHC Technician may assist the Safety Officer or unit supervisors in more direct educational and motivational activities.
2. Perform “walk-throughs” to monitor compliance and correct use of HPDs
3. Give positive reinforcement for consistent HPD use in the presence of co-workers.
4. Provide personalized training for workers having difficulty using HPDs
 - a. Is it inability to insert/place them properly?
 - b. Is the HPD uncomfortable? Is there a more comfortable fit and/or type unavailable?
 - c. Is there a lack of understanding/recognition of the hazards of noise?
 - d. Is there a “social” reason re: communication difficulty or “I’ve got tough ears!” mentality?
5. Reinforce fact that significant hearing loss can mean a job change due to an unfavorable Fitness for Duty. Recommendations by the audiologist may include restriction from noise hazardous work, placement in a different, non-noise hazardous job, possibly loss of career or employment.

(NEXT SLIDE)

SLIDE 15

Employee Motivation Ideas #3

“You must be the change you want to see in the world” Gandhi

- Supervisors must be HCP role models # 1
- Develop creative competitions
- Recognize units or work centers who have
 - lowest STS rates
 - highest HPD compliance
 - highest annual testing compliance
- Use videos, speakers with hearing loss Highest HCP compliance

EMPLOYEE MOTIVATION IDEAS #2

“You must be the change you want to see in the world” Gandhi

1. Supervisors must be HCP role models – they must comply with regulations, use HPDs appropriately and develop creative competitions to motivate their employees.

With the assistance of their regional MTF/Occupational Audiologist, they can:

- 2. Recognize units or work centers who have**
 - a. lowest STS rates**
 - b. highest HPD compliance**
 - c. highest annual testing compliance**
- 3. Use videos and speakers from the community who have hearing loss**

(NEXT SLIDE)

SLIDE 16	Documentation Annual hearing conservation training ✓ employee training records ✓ DD2216 during annual hearing testing Sign-in rosters of annual group training ✓ kept on file with the unit or shop ✓ a minimum of 5 years Copies of training rosters ✓ forward to Safety Officer
-----------------	---

DOCUMENTATION

1. Annual hearing conservation training

(CLICK)

- a. employee training records**
- b. DD2216 audiogram will state if annual hearing testing also provided HC training**

2. Sign-in rosters of annual group training

(CLICK)

- a. kept on file with the unit or shop**
- b. a minimum of 5 years**

(CLICK)

3. The command Safety Officer will need to keep signed rosters of the annual HCP training

(NEXT SLIDE)

SLIDE 17	Educational Resources <ul style="list-style-type: none">➤ Regional Occupational Audiologists!➤ Student workbook –materials & resources list➤ Navy & Marine Corps Public Health Center➤ Internet sources: Safety, OSHA, CDC, universities, audiology/medical sites➤ Guest Speakers with hearing loss
-----------------	---

EDUCATIONAL RESOURCES

1. Regional Occupational Audiologists! This is their job – use them!
2. Student workbook and training PowerPoint slides – see materials and resources list in manual
3. Navy and Marine Corps Public Health Center (formerly NEHC) – website has many resources, including the training PowerPoint slides
4. Internet sources: Safety, OSHA, CDC, universities, audiology/medical sites, hearing conservation and noise related businesses/organizations (i.e. E-A-R)
5. Guest Speakers with hearing loss – use local resources
 - a. active military and veterans with hearing loss to speak
 - b. industrial hygienists and safety specialists
 - c. physicians - ENT
 - d. musicians who have hearing loss
 - e. motorcyclists, hunters , etc.

(NEXT SLIDE)

SLIDE 18	SUMMARY <i>Four of the Five Elements of the HCP can be outstanding But... IF personnel are not educated or motivated to conserve their hearing through appropriate behaviors, WE have failed in our mission readiness.</i>	
-----------------	--	--

SUMMARY

**Four of the Five Elements of the HCP can be outstanding
(i.e. hazardous noise evaluation, engineering controls, hearing protection devices, audiometric monitoring)**

BUT...

IF personnel are not educated or motivated to conserve their hearing through appropriate behaviors,

then WE have failed in our mission readiness.

USE APPROVED HEARING PROTECTION DEVICES PROPERLY!!!

(NEXT SLIDE)

<u>SLIDE 19</u>	<p style="text-align: center;">QUESTIONS???</p> <div style="display: flex; justify-content: space-around;"></div>
------------------------	---

QUESTIONS???

(END OF PRESENTATION)

1.12 RECORDKEEPING and HCP EVALUATION

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>RECORDKEEPING and HC PROGRAM EVALUATION</u></p> <div style="display: flex; justify-content: space-around; align-items: center;"></div>
-----------------------	--

RECORDKEEPING and HC PROGRAM EVALUATION

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>Learning Objectives</p> <ol style="list-style-type: none">1. Explain the timelines for maintaining records for test equipment, noise surveys, and personnel in the HCP.2. Explain regulations related to OHC technician training and certification.3. Describe the STS reporting procedures for military and civilian personnel. <p style="text-align: right;">2</p>
-----------------------	--

LEARNING OBJECTIVES

1. Explain the timelines for maintaining records for test equipment, noise surveys, and personnel in the HCP
2. Explain regulations related to OHC technician training and certification
3. Describe the STS reporting procedures for military and civilian personnel

(NEXT SLIDE)

SLIDE 3

Recordkeeping

Critical Responsibility

- ↔ Required by law
- ↔ Required by military instructions and guidelines

Medical-Legal information

- Invalid or inaccurate data**
- ↔ Unjust compensation awards

RECORDKEEPING

Recordkeeping is often the least favorite task but it is a critical responsibility.

- 1. First, accurate recordkeeping is required by federal and state laws**
- 2. Second, accurate recordkeeping is required by military instructions and guidelines.**
- 3. Audiograms and any associated paperwork, such as referral forms, are medical legal information and must be treated with care and confidentiality.**
- 4. Hearing test data that are invalid or inaccurate can result in unjust compensation awards**
 - a. technician could prevent a patient from receiving correct evaluation of hearing and tinnitus disability**
 - b. incorrect evaluation could result in an award that is either too much or too little**

(NEXT SLIDE)

SLIDE 4

← KEYS to RECORDKEEPING →

KEYS to RECORDKEEPING

The keys to effective records are

(CLICK)

1. Accuracy of data – not only test results, date of test and other patient information but also accurate recording of the technician, certification and equipment information.

(CLICK)

2. Thoroughness – ALL information should be included, e.g. who, what, when, and disposition

(CLICK)

3. Organization – the most accurate and thorough records are not useful/effective if information is not easily accessible/found.

(CLICK)

4. Legibility – even in the age of computers, handwritten notations and signatures are necessary

- a. illegible writing is NOT useful and has high risk for producing errors**
- b. computer legibility means typing and proofreading – DOEHRs-HC does not automatically spell check!**

(CLICK)

5. Retrievability - effective records must be accessible

- a. the DOEHRs-DR is a web based data repository; however, computers can still crash and data can still get corrupted.**
- b. necessary for everyone to upload to the DR before any hearing data can be retrieved.**
- c. written medical records must be available for reference because audiology testing sites still are too variable in their use of medical record software (both DOEHRs and patient encounter software).**

6. So effective records are accurate, thorough, organized, legible, and are easily retrievable.

(NEXT SLIDE)

SLIDE 5

HIPAA Requirements

***Health Insurance Portability and
Accountability Act of 1996***

**Ensures medical information
is private and protected**

**Sets rules to limit who can view
and receive health information**

**Auditory privacy often not possible
in HC group testing situations**

HIPAA REQUIREMENTS

We should all be familiar with HIPAA regulations as health care workers and as patients.

1. HIPAA stands for the Health Insurance Portability and Accountability Act of 1996 and concerns the privacy of medical information of individuals.
--- It is federal law and has high penalties for non-compliance.
2. HIPAA ensures medical information is kept private and protected
3. The Act defines rules which limit who has the right to receive and can view an individual's health information.
4. In Occupational Hearing testing situations, auditory privacy is not always possible.
 - a. Group testing situations limit total privacy in discussing hearing concerns and test results
 - b. However, the OHC technician should respect any individual patient who requests communication privacy.
 - c. In addition, the HCP audiology testing area should have a sign posted that states that auditory privacy is not always possible.

(NEXT SLIDE)

SLIDE 6

List of Records

MAINTAIN FIVE YEARS:

- Sound Booth Certification
- Audiometer Electroacoustic Calibration
- Daily Biological Calibration Check DD 2217
- Technician Training Certificates

DURATION OF EMPLOYMENT + 5 YEARS

- DD2215/2216 (if unable to upload to DR)

Details following ...

LIST OF RECORDS (that are) OHC TECHNICIAN RESPONSIBILITY

Instructions specify which types of records must be maintained for five years in the audiology test area.

(INSTRUCTOR: Read through the list - next slides go into details for each item)

1. **Sound booth certification**
2. **Audiometer electroacoustic calibration**
3. **Daily biological calibration check DD Form 2217**
4. **Technician training certificates**
5. **There are a few installations or situations that DOEHRS-HC is not being used or uploading to the DR is not available----**
6. **Therefore a local copy of the DD Forms 2215 and 2216 for each employee should be maintained for the duration of employment PLUS five (5) years.**
7. **Each of these responsibilities has been discussed in previous training units.**
 --- However, we will review them from the perspective of generating and maintaining records.

(NEXT SLIDE)

<u>SLIDE 7</u>	<p style="text-align: center;"><u>Sound Booth Certification</u></p> <p>Certification valid for 365 days (one year) Documentation posted on booth - clearly visible Re-certification annually Industrial Hygienist/Tech Audiologist Booth certification guide on NMCPHC website</p> 
-----------------------	--

SOUND BOOTH CERTIFICATION

1. **Test sound booth must be tested and certified annually or whenever the booth has been moved.**
2. **For Ships, booth certification must be performed pier side AND underway.**
3. **Documentation of the certification must be posted on an exterior wall of the booth where it will be clearly visible.**
4. **An Industrial Hygienist, an IH Technician or an Audiologist must re-certify sound booth annually. The OHC Technician cannot perform this task.**
5. **For reference, there is a booth certification guide posted on the Navy and Marine Corps Public Health Center (NMCPHC) website.**

(NEXT SLIDE)

SLIDE 8

Audiometer Electroacoustic Calibration

Calibration valid for 365 days (one year)
DOEHRS-HC software notifies user
upcoming renewal date
stops functioning past renewal date
Sticker label on each audiometer
states date of last calibration
states due date of next calibration
Store certificate of calibration with equipment or file

AUDIOMETER ELECTROACOUSTIC CALIBRATION

1. Each audiometer used must have an electroacoustic calibration completed and recorded at least once a year (every 365 days).

(CLICK)

2. DOEHRS-HC software will begin to notify the user that calibration due date is approaching 90 days in advance. This gives time to schedule the calibration with the NMCPHC Calibration Lab.

a. calibration must be completed by professional prior to that due date, DOEHRS-HC will not operate after that renewal date.

b. after calibration, a sticker label is placed on each audiometer

3. Sticker label will state the date of the last calibration (the one just completed) and the due date for the next calibration (one year).

4. The certificate of calibration for each audiometer used in the sound booth must be stored with the equipment or in a record file.

(NEXT SLIDE)

SLIDE 9

Daily Biological Calibration Check DD Form 2217

DD Form 2217 must be established
after electroacoustic calibration
after re-calibration for any reason
for each audiometer and artificial ear combo
for each human listener, if used
every day before beginning to test patients



DD 2217 documented within DOEHRS-HC
print and file monthly log
ATG/INSERV/Joint Com/MEDIG inspection item

DAILY BIOLOGICAL CALIBRATION CHECK DD FORM 2217

1. A daily biological calibration check will generate a DD Form 2217 record.

(INSTRUCTOR TIP: Before clicking the details , quiz students about when Form 2217 must be established.)

2. As discussed previously in the Audiometer and Test Environment unit, a daily biological calibration check **MUST** be completed for the following reasons:

(CLICK)

- a. immediately after audiometer electroacoustic calibration .
- b. immediately after electroacoustic re-calibration occurs for any reason, e.g. after repair of audiometer.
- c. completed for each audiometer, earphone and artificial ear (Bio-Joe) combination used in the booth.
- d. established for each human listener, if used instead of or in addition to the artificial ear (Bio-Joe).
- e. every day before beginning to test patients – DOEHRS-HC will not function without recording a daily calibration check.

3. DOEHRS-HC documents and stores the daily biological calibration checks.

4. Approximately 3 days before the last day of a month, DOEHRS will notify you that a monthly print out of Form 2217 should be done.

(CLICK)

5. OHC Technician should print a complete month's 2217 records for each audiometer.

6. Maintain a record file or notebook of these monthly reports that is easily accessible. These printed records are a review item during inspection of certifying agencies, i.e. ATG, INSERV, Joint Commission and MEDIG

(NEXT SLIDE)

<u>SLIDE 10</u>	<p><u>Technician Training Certificates</u></p> <p>OHC certification valid for 5 years with annual audiologist evaluations re-certification course required</p> <p>Post certificates in hearing test area in clear view of patient</p> <p style="text-align: right; font-size: small;">10</p>
------------------------	---

TECHNICIAN TRAINING CERTIFICATES

1. Your OHC Technician certification is valid for five (5) years .

- a. WITH annual evaluations by your regional occupational audiologist (HCP Manager).
 - b. Certification can be renewed after attending a one (1) day re-certification course and successfully passing a written exam.
2. A copy of the OHC Technician certificate should be posted in the test area for every technician working that site.
- a. certificate should be located in an area clearly visible to patients.
 - b. second copy of the certificate should be maintained in a file or notebook kept in the test area.

(NEXT SLIDE)

<u>SLIDE 11</u>	<p><u>Organization of Hearing Tests within Medical Records</u></p>
------------------------	---

ORGANIZATION OF HEARING TESTS WITH THE MEDICAL RECORD

1. Original forms must be permanently retained in the patient’s medical record.
2. Audiograms should never be removed from a patient’s medical record.
3. If the information on an audiogram is invalid, or a reference audiogram is superseded by a new one after the follow-up process
 - a. draw a diagonal line across the form
 - b. write “invalid” or “see revised reference audiogram dated ___”, as applicable.
4. The US Navy medical record is organized with “Preventive Medicine and Occupational Health” Information filed on the left (inside front cover-Section I).
5. All DD 2215 and 2216 audiograms should be filed together in the following order in a top down order.
 - a. Most current DD 2215 Reference audiogram on top
 - b. Older invalidated DD 2215 Reference audiograms in reverse chronological order (oldest on bottom)
 - c. All 2216 Annual audiograms in reverse chronological order (most recent on top OR oldest on bottom)

ADDITIONAL NOTE: Check your local SOP about the filing of any NonHCP Audiograms

(NEXT SLIDE)

<u>SLIDE 12</u>	<p><u>Other Records and Data Management</u></p> <p><u>Maintain for 40 years</u></p> <ul style="list-style-type: none"><input type="checkbox"/> Noise Survey Data <p><u>Maintain for 5 years</u></p> <ul style="list-style-type: none"><input type="checkbox"/> Rosters of Noise-Exposed Personnel<input type="checkbox"/> Hearing Conservation Education/Training<input type="checkbox"/> Hearing Injuries of patients with PTS <p style="text-align: right;"><small>12</small></p>
------------------------	--

OTHER RECORDS AND DATA MANAGEMENT

These records are not the responsibility of the OHC Technician typically but you need to know these regulations.

1. Noise Survey Data are kept for forty (40) years by Industrial Hygiene Dept and Command.
2. Records maintained for five (5) years include ...

(CLICK)

3. Rosters of noise-exposed personnel or employees that are enrolled in the HCP.
4. Attendance rosters and summaries of Hearing Conservation Education and Training activities.
5. Lists of patients with verified hearing injuries or PTS (permanent threshold shifts); DOEHRs-HC maintains these records.
6. Again, the OHC Technician is not primarily responsible but may need to know how to access these records.

So we will review them briefly ...

(NEXT SLIDE)

SLIDE 13

Noise Survey Data

Work Areas	Individual Personnel
Noise survey data stored on DD Form 2214 or equivalent	Documentation of personal noise exposure history in DOEHRS-IH
IH & Command retain surveys locally for 40 yrs	Permanently maintained in medical record
Available from IH or Safety officer	

NOISE SURVEY DATA

1. Noise survey data is collected for the Work Area and for Individual Personnel working within that work area.

(CLICK)

2. Data collected for the work area is stored on a DD Form 2214.

3. Industrial Hygienist and the Command retain these surveys for forty (40) years

4. So if the technician is requested to obtain noise survey data, he or she can contact the Industrial Hygiene department/professional or the Safety officer assigned to that work area.

(CLICK)

5. Documentation about individual employees and their history of noise exposure is stored within the DOEHRS-IH (industrial hygiene) software or the IH Offices.

a. This documentation includes TWA – time weighted average – exposure to noise data collected on the individual, typically through dosimeter measurements.

b. These records should be maintained in the individual employee’s medical record

(Additional discussion item: Why or for what purpose(s) would an OHC technician need to obtain Noise Survey Data?)

(NEXT SLIDE)

SLIDE 14

Enrollment Rosters for HCP

WHO MUST BE ENROLLED IN HCP?

All personnel whose TWA is ≥ 85 dBA

All personnel routinely exposed to potentially hazardous noise when IH Noise Survey is unavailable

WHO CREATES & MAINTAINS HCP ROSTERS?

Command Safety

- creates and maintains HCP Roster per IH Noise Survey recommendations
- provides supporting MTF with total number of personnel on the HCP semi-annually



14

ENROLLMENT ROSTERS FOR HCP

Who Must Be Enrolled In HCP?

(CLICK)

1. All personnel routinely exposed to noise ≥ 85 dBA – based on 8 hour average TWA of ≥ 85 dBA -- must be enrolled in the Hearing Conservation Program. This includes those employees that are “At Risk” -- defined as being “routinely” exposed to hazardous noise more than 2 days/month re: 8 hr ave TWA definition.
2. In the absence of an IH Survey, All Personnel routinely working around potentially hazardous noises shall be enrolled in the HCP until an IH Survey can be obtained.
3. Who creates and maintains HCP rosters?

(CLICK)

4. Per IH survey recommendations, enrollment is accomplished by the worker’s command (usually Safety)
 - a. Command Safety creates and maintains HCP enrollment roster
 - b. provides the supporting Medical Treatment Facility with a total number of personnel on the HCP, semi-annually.

(NEXT SLIDE)

SLIDE 15

Enrollment Rosters for HCP #2

Command Responsibilities

Sends Workers for HC Testing

Sends Feedback about Patients Tested

- Y Command Safety Officer or DIVO (Afloat)
- Y Pass or need to follow-up

15

ENROLLMENT ROSTERS FOR HCP #2

1. **Command responsibilities differ for ashore and afloat situations.**
 - a. **Ashore, it is the Command Safety Officer that ensures workers in the HCP show up for their annual hearing tests.**
 - b. **Afloat, the DIVO (Division Officer) is responsible for ensuring the workers are sent for testing, in coordination with the ship's IDC.**
2. **Typically, OHC technicians see HCP patients on a walk-in basis in medical clinics.**
--- **However, appointments are needed for full hearing evaluations by audiologists.**

Both Ashore and Afloat -

3. **After completion of unit testing (or periodically), feedback from medical (memo, rosters of members tested) must be communicated to the sponsoring unit's Safety Officer or DIVO (AFLOAT).**
 - a. **Feedback should indicate "Pass" or the need for follow-up testing.**
 - b. **DOEHRS-HC and/or DOEHRS-DR facilitates production of feedback to command safety/DIVO**

(NEXT SLIDE)

SLIDE 16

Hearing Conservation Education/Training

**Initial/Annual Training by each Command
training logs kept by unit's command**

**Annual Training by Medical Dept (OHC Technician)
documents annual training as a remarks
entry on DD 2216
training done in conjunction with
counseling audiogram results**

16

HEARING CONSERVATION EDUCATION/TRAINING

1. **Training Responsibilities differ depending on Ashore or Afloat commands (refer to appropriate Instruction).**
 - a. **it is the CO's responsibility that training is accomplished, (ultimately).**

b. training logs and rosters are kept by the unit's command (occasionally by medical so refer to Instructions).

2. When annual training is augmented by the Medical Treatment Facility--- typically by the OHC Technician

(CLICK)

a. the training is documented as a remarks entry on the patient's DD Form 2216 audiogram.

b. this is the extra training done by the OHC Technician as the audiogram results are discussed with the patient.

c. it is very important that the OHC Technician use these few minutes to reinforce HC behaviors and encourage better compliance because it may be the only HC training the patient receives that year.

(NEXT SLIDE)

SLIDE 17	<u>Patients with STS and PTS</u>
OHC TECHNICIAN <ul style="list-style-type: none">• DOEHS-HC generates remarks entry• Patient signs test acknowledging reduced hearing levels (STS)• Permanently placed in patient's medical record	AUDIOLOGIST or OCCUPATIONAL PHYSICIAN <ul style="list-style-type: none">• OSHA & DoD require written notification of PTS to patient & supervisor• PTS data sent to local Safety Office who reports: military --Navy Safety Center civilians -- OSHA 300 log

PATIENTS WITH STS AND PTS

Recordkeeping for patients with an STS and PTS involves the OHC Technician and Occupational Professional - the Audiologist or Medical Staff.

(CLICK)

1. OHC Technician is responsible for ...

- a. typing appropriate remarks on the patient DD Form 2216
- b. obtaining patient's signature on the DD Form 2216 acknowledging the significant threshold shift (STS)
- c. placing the audiogram in the proper order inside the patient's medical record

(CLICK)

2. After verification that the STS is a Permanent Threshold Shift (PTS) - (either OSHA reportable PTS or a non-reportable PTS), the Audiologist or Occupational Physician is

responsible for sending a letter, memo or e-mail to the patient and his/her supervisor notifying them of the hearing injury.

--- Once PTS is confirmed by Audiologist, maximum time for reporting to OSHA/Navy Safety Center is 21 days

3. Feedback is provided by Audiologist/Occupational Physician to the local Safety Office who then report...

- a. active Duty to the Navy Safety Center via the WESS-II electronic reporting system
- b. civilians to OSHA: OSHA 300 log via WESS-II system.

(NEXT SLIDE)

SLIDE 18	<p style="text-align: right; font-size: small;">Patients with STS & PTS cont....</p> <p style="text-align: center;"><u>"OSHA REPORTABLE" PATIENTS*</u></p> <p style="text-align: center;">Command Safety reports on OSHA 300 Log if all 4 criteria met</p> <ol style="list-style-type: none">1. Permanent hearing loss2. Occupationally related3. STS \geq 10dB at 2000, 3000 and 4000Hz4. Average thresholds \geq 25dB at 2000, 3000 and 4000Hz <p style="text-align: right; font-size: x-small;"><i>*civilians</i></p> <p style="text-align: right; font-size: x-small;">18</p>
-----------------	---

"OSHA REPORTABLE PATIENTS"

1. Command Safety reports hearing injuries for civilians on an OSHA 300 Log per regulations.
2. OSHA regulations state that an "OSHA Reportable" PTS must meet four (4) criteria.
 - a. the hearing loss must be permanent
 - b. occupationally related
 - c. there must have a positive STS present with an average shift of >10 dB at 2000, 3000, and 4000 Hz in either ear.
 - d. hearing thresholds must show an average of 25 dB or greater at 2000, 3000 and 4000 Hz for the shifted ear.
3. If the average threshold is less than 25 dB, it is not recordable because hearing is still considered to be within normal limits.
4. Once a patient has sustained one OSHA recordable PTS, any PTS the patient incurs after that will also be recordable,
 - a. it will already have met the criteria of > 25 dB average threshold at 2-4 KHz.

(NEXT SLIDE)

SLIDE 19

Evaluation of HCP Effectiveness

*Good HCP compliance
does not ensure
good employee hearing acuity*

Program effectiveness
must be
evaluated continually
to determine
WHERE and HOW
improvements
can be made

**Top Analysis
Metrics**
✓ Compliance
✓ STS Rate
✓ TTS Rate
✓ PTS Rate
(audiologist responsible)

EVALUATION OF HCP EFFECTIVENESS

1. It is critical to realize that “Good HCP compliance does NOT ensure good employee hearing acuity.”
2. Remember that there are many elements and many team members involved in the HC Program ---
 - a. Elements: accurate hazardous noise data, engineering controls, audiometric monitoring, education/training and proper use of hearing protection devices (HPDs)
 - b. Team members: professionals, command officers, technicians, active duty and civilian employees exposed to hazardous noises

(CLICK)

3. HC Program effectiveness must be evaluated continually to determine WHERE and HOW improvements can be made.

(CLICK)

4. Occupational Audiologists are responsible for analyzing HC data related to compliance rates, STS, TTS and PTS rates .
5. Audiologists consult with other HCP team professionals and command personnel to improve efforts toward meeting the HCP goals of prevention of hearing injuries and ensuring mission readiness.

(NEXT SLIDE)

SLIDE 20

Audiology Workload

Requirements for reporting workload
may vary between commands

- CHCS/AHLTA used to capture information
- patients seen, clinic site, provider (OHC Tech)
 - type of appointment/hearing test
 - symptoms, test procedures, disposition

- OHC Technicians provided with MEPRS FBN-codes
- reports medical surveillance workload

DOEHRS-HC captures daily workload information

20

AUDIOLOGY WORKLOAD

1. Workload refers to recording patient encounters.
2. Requirements and software programs may vary between commands and branch services.
3. CHCS or AHLTA are two types of patient database software programs. OHC Technicians must type and code information about individual patients tested.

(CLICK)

- a. patients seen, clinic site, provider (OHC Tech)
- b. type of appointment/hearing test
- c. symptoms, test procedures, disposition

4. OHC Technicians provided with MEPRS FBN-codes to report medical surveillance workload.
5. DOEHRS-HC captures daily workload information re: individual patient, type of hearing test, UIC.

(NEXT SLIDE)

SLIDE 21



THE KEYS to RECORDKEEPING

- ↖ Accuracy
- ↖ Thoroughness
- ↖ Organization
- ↖ Legibility
- ↖ Retrievability

23

SUMMARY and QUESTIONS

1. In summary, we have discussed the required recordkeeping regulations and procedures and who is responsible.
 2. For everyone in the HCP, the KEYS to effective recordkeeping are
- a. Accuracy
 - b. Thoroughness
 - c. Organization
 - d. Legibility
 - e. Retrievability (accessibility)

(END OF PRESENTATION)

1.13 REGULATIONS AND COMPENSATION

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>REGULATIONS and COMPENSATION</u></p>   <p>Occupational Safety and Health Administration www.osha.gov</p> 
-----------------------	---

REGULATIONS and COMPENSATION

(NEXT SLIDE)

<u>SLIDE 2</u>	<p>LEARNING OBJECTIVES</p> <ol style="list-style-type: none">1. Recognize the federal legislation and agencies regulating hearing conservation.2. Identify the regulations that contain HCP instructions for DoD employees.3. Name who to notify for hearing injuries (PTS) for military and civilian personnel.4. Locate the website resources for military regulations and instructions for HCP.5. Discuss general concepts related to compensation awards. <p style="text-align: right;">2</p>
-----------------------	---

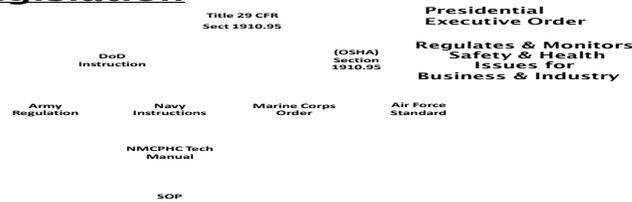
LEARNING OBJECTIVES

1. **Recognize the federal legislation and agencies regulating hearing conservation.**
2. **Identify the regulations that contain HCP instructions for DoD employees.**
3. **Name who to notify for hearing injuries (PTS) for military and civilian personnel.**
4. **Locate the website resources for military regulations and instructions for HCP.**
5. **Discuss general concepts related to compensation awards.**

(NEXT SLIDE)

SLIDE 3

Legislation



LEGISLATION

- 1. Title 29, Code of Federal Regulations (CFR), Section 1910.95 is the Occupational Noise Exposure law – April 1983.**
- 2. OSHA: Created the federal agency called Occupational Safety and Health Administration (OSHA) which is responsible for regulating and monitoring safety and health issues for business and industry.**
 - a. Section 1910.95 contains the regulation regarding hearing conservation.**
 - b. all hearing conservation programs for workers must meet OSHA guidelines at a minimum**
- 3. DoD Instruction 6055.12 describes the DoD Hearing Conservation Program which applies to tri-service secretariat level.**
 - a. mandates that each service meet minimum guidelines and develop service-specific regulations.**
 - b. these guidelines are more stringent-tougher-than OSHA minimum guidelines.**
- 4. Army-Navy-Marine Corps-Air Force: The four (4) major service branches have developed Hearing Conservation regulations/instructions meeting or exceeding DoDI guidelines. (Coast Guard currently under Dept of Homeland Security).**
- 5. NMCPHC Tech Manual: The Navy Instructions for its HCP are found in the NMCPHC Technical Manual, TM 6260.51.99-2.**
 - further explanation of responsibilities and protocols are found in local command Standard Operating Procedures (SOP) manuals.**

(NEXT SLIDE)

SLIDE 4

OSHA Guidelines

All programs must meet or exceed OSHA standards



1. Monitor hearing of workers exposed to noise levels ≥ 85 dBA
2. HPDs required when noise levels are ≥ 90 dBA TWA
 ≥ 85 dBA TWA for documented PTS
3. HPDs must be available for any worker exposed to noise levels ≥ 85 dBA

OSHA GUIDELINES

1. All OHC programs in business and industry must meet or exceed OSHA standards.

The major standards are

2. Workers' hearing must be monitored when workers are regularly exposed to noise levels greater than or equal (\geq) 85 dBA.
3. HPDs required when noise levels are ...
 - a. greater than or equal to ≥ 90 dBA TWA
 - b. greater than or equal to ≥ 85 dBA TWA if an STS has been documented
4. HPDs must be available for any worker exposed to noise levels greater than or equal to > 85 dBA.

(NEXT SLIDE)

SLIDE 5

Title 29, Code of Federal Regulations Part 1904 Occupational Injury and Illness

Recording and Reporting Requirements

PTS Identified
Average loss at
2, 3, 4k Hz > 25 dB

Recorded in
medical record

Verified PTS sent to
Command's
Safety Officer
Civilian: OSHA 300 Log
Active Duty: Navy
Safety Center

TITLE 29, CODE OF FEDERAL REGULATIONS PART 1904 OCCUPATIONAL INJURY AND ILLNESS

1. In 2004, this federal regulation was added, mandating requirements for recording and reporting hearing loss.
2. It mandates that when specific hearing loss criteria identifies a PTS, the injury must be recorded in the medical record.
3. That criteria is an average threshold of greater than 25 dB at 2000, 3000 and 4000 Hz in either ear; or said another way, greater than or equal to 30dB.

(CLICK)

4. In the military, all civilian workers who are identified as having a PTS
 - a. (verified hearing injury greater than 25dB average @ 2, 3 and 4000 Hz),
 - b. must be reported to their safety officer in order to record them on the “OSHA 300 Log”.
5. active military workers identified with a PTS, regardless of thresholds --being within normal range or greater -- are reported to their Safety Officer.

(NEXT SLIDE)

SLIDE 6	  Examples of Similarities & Differences SIMILARITIES BETWEEN OSHA & DoD Definition of STS HCP Action noise level is ≥ 85 dB A HC Education and training requirements Hazardous noise signs posted DIFFERENCES BETWEEN OSHA & DoD OHC Technician certification Decibel allowance for biologic calib of audiometers Age correction for STS Use of HPDs for 14 hr auditory rest
----------------	--

EXAMPLES OF SIMILARITIES AND DIFFERENCES

Here are a few examples of the *SIMILARITIES* between OSHA federal guidelines and DoD instructions . . .

1. Definition of a Significant Threshold Shift (STS) is the same.
2. Noise level that requires HCP Action is same -- equal or greater than 85dB A.
3. HC education and training requirements are similar.
4. Both require hazardous noise signs to be posted properly .

Here are just a few of the *DIFFERENCES* between OSHA federal guidelines and DoD instructions . . .

5. DoD requires that OHC technicians be certified --- OSHA does not.
6. DoD allows a smaller variation (+/- 5dB) from the baseline (2215) levels during biologic calibration of audiometers -- OSHA allows +/- 10dB .
--- OSHA also allows more background noise during testing (42-62 dB HL) than DoD (27-41 dB)

7. DoD does NOT allow for any threshold corrections due to age when determining STS – OSHA does use age correction factors.

8. DoD does not allow the use of HPDs in a noisy environment to count as 14 hrs of auditory rest (noise free) before a follow up hearing test -- OSHA does allow use of HPDs.

Clearly DoD requirements are more strict!

(NEXT SLIDE)

<u>SLIDE 7</u>	<p>DoD Instruction 6055.12 Hearing Conservation Program</p>  <p>Each department must....</p> <ul style="list-style-type: none">▶ protect personnel from occupational hearing loss▶ use comprehensive HCPs▶ applies to tri-service secretariat level▶ applies to all military and civilian personnel and operations world-wide
-----------------------	--

DOD INSTRUCTION 6055.12 HEARING CONSERVATION PROGRAM

Again, the major directives of the DoDI 6055.12 are the following....

1. Goal of a Hearing Conservation Program must be to protect military and federal personnel from occupational hearing loss.
2. To meet this goal -- comprehensive hearing conservation programs (HCPs) must be used.

(CLICK)

3. Applies to three (3) major branches of military service – Army, Air Force and Navy (includes Marine Corps and Coast Guard).
4. “Secretariat level” refers to national Pentagon leaders which indicates the regulation applies to all military and civilian employees worldwide.

(NEXT SLIDE)

SLIDE 8

DoD Instruction 6055.12 **Hearing Conservation Program #2**



Provides basic suggestions for program elements

BUT does not provide specifics.

Mandates that each Service must -

1. develop service-specific procedures
2. meet these minimum instructions

DOD INSTRUCTION 6055.12 HEARING CONSERVATION PROGRAM #2

1. DoD Instruction 6055.12 --- It does provide basic suggestions for program elements.
2. BUT does NOT provide specifics.
3. It mandates that each service develop and implement a comprehensive HCP.
 - a. must develop and implement instructions specific to that service's operations/activities
 - b. must meet or exceed minimum guidelines

(NEXT SLIDE)

SLIDE 9

Procedures **to Achieve HCP Elements**

Must be discussed by each Military Service Instructions

- ✓ Overview of HCP
 - ✓ Roles and Responsibilities
 - ✓ Fitness for Duty issues
 - ✓ Forms and Protocols
 - ✓ Evaluation of Statistics to determine HCP Effectiveness
- USA USAF USN USMC USCG

INSTRUCTIONS OF EACH SERVICE DISCUSS PROCEDURES TO ACHIEVE HCP ELEMENTS

1. This section describes regulations/instructions of all military services for Hearing Conservation Programs
2. Each instruction must describe HCP Programs according to following elements
 - a. Overview of HCP
 - b. Roles and responsibilities
 - c. Fitness for Duty issues
 - d. Forms and protocol
 - e. Evaluation of statistics to determine HCP effectiveness

(NEXT SLIDE)

SLIDE 10



Army Hearing Conservation Regulations



DA PAM 40-501

- ▶ Specific to soldiers and civilian employees on Army installations and during operations
- ▶ Program manager location – United States Army Public Health Command, Aberdeen, MD
- ▶ Differences – command hierarchy/titles, Fitness for Duty (FFD) ratings
- ▶ Similarities – Procedures and protocols, forms
- ▶ All Army personnel now enrolled in “Hearing Conservation Program”

10

ARMY HEARING CONSERVATION REGULATIONS

1. Army’s HC Regulations are DAPAM 40-501
2. Specific to soldiers and civilian employees on Army installations and during operations.
3. Program manager location -- United States Army Public Health Command (USAPHC), Aberdeen, MD.
4. Differences with other military service HCPs
 - a. command hierarchy/titles
 - b. Fitness for Duty ratings
5. Similarities with other military service HCPs
 - a. procedures and protocols
 - b. forms used
6. All US Army personnel now enrolled in the “Hearing Conservation Program”. Civilians’ enrollment is dependent upon IH recommendations.

(NEXT SLIDE)

SLIDE 11



Air Force Hearing Conservation Regulations



AFOSH Standard 48-20

- ▶ Specific to airmen and civilian employees on Air Force installations and during USAF activities
- ▶ Program manager location– School of Aerospace Medicine, Wright-Patterson AFB, Dayton, OH
- ▶ Differences – command hierarchy/titles, Fitness for Duty ratings
- ▶ Similarities – enrollment requirements, procedures and protocols, forms

11

AIR FORCE HEARING CONSERVATION REGULATIONS

1. Air Force HC Regulations are AFOSH Standard 43-20.

2. Specific to airmen and civilian employees on Air Force installations and during operations.
3. Program manager location -- USAF School of Aerospace Medicine, Wright-Patterson AFB in Dayton, OH.
4. Differences with other military service HCPs
 - a. command hierarchy/titles
 - b. Fitness for Duty ratings
 - c. forms used
5. similarities with other military service hcps
 - a. requirements of enrollment in hcp
 - b. procedures and protocols

(NEXT SLIDE)

SLIDE 12	<div style="display: flex; justify-content: space-between; align-items: center;">  <div style="text-align: center;"> <p>Marine Corps Hearing Conservation Program</p> <p>MCO 6260.1</p> <ul style="list-style-type: none"> ▶ Marine Corp Order implements the HCP for Marines and civilians at training installations and during operations ▶ Program manager location: Washington DC ▶ Different from other HCPs ▶ Every Marine now enrolled in HCP </div>  </div>
-----------------	---

MARINE CORPS HEARING CONSERVATION PROGRAM

1. Marine Corps HC Regulations are MCO 6260.1.
2. Specific to marines and civilian employees on Marine Corp training installations.
3. Program manager location - Safety Division, Washington, DC.
4. Critical difference with other military service HCPs, particularly Navy's NAVOSH 5100.23 Ashore regulation.
 - a. HCP enrollment = 100% of active duty Marines, regardless of MOS
 - b. Navy and Air Force enrollment based on noise exposure or TWA results

Note: When motivating Marines or any military personnel to comply with HCP requirements, be ready to refer to that particular military branch's regulations.

(NEXT SLIDE)

SLIDE 13



Navy Hearing Conservation Regulations



OPNAVINST 5100.23

- ▶ All aspects of Occupational Safety and Health in the workplace **Ashore**
- ▶ Chapter 18 – HCP

OPNAVINST 5100.19

- ▶ All aspects of Occupational Safety and Health for the **Fleet**
- ▶ Chapter B4 – HCP

Program manager location – NMCPHC, Portsmouth, VA

14

NAVY HEARING CONSERVATION REGULATIONS

1. Navy has two (2) regulations regarding hearing conservation.
2. OPNAVINST 5100.23 series
 - a. also referred to as navosh ashore (navy occupational safety and health)
 - b. includes all aspects of occupational health and safety in work environments on shore
3. OPNAVINST 5100.19 series
 - a. also referred to as navosh afloat (navy occupational safety and health)
 - b. includes all aspects of occupational health and safety concerning the fleet
 - c. main difference between 5100.23 and 5100.19 is that the ashore instruction must consider civilians where afloat only considers military personnel.
4. Chapter 18 establishes and describes HCP elements and procedures for on shore installations.
5. Chapter B4 establishes and describes HCP elements and procedures when afloat.
6. HCP manager location for Navy – Navy Marine Corps Public Health Center (NMPCHC) in Portsmouth, VA.

NOTE – No significant differences between 5100.23 and 5100.19 series (Ashore and Afloat).

(NEXT SLIDE)

SLIDE 14

**NMCPHC Technical Manual
6260.51.99 series – 2 (Sept 2008)**



**Navy & MC
Public Health
Center
HCP and
Procedures Manual**

**Detailed guidance for
Medical Dept personnel
to implement
OPNAV Instructions**

**Listed as
major reference in
5100.19, 5100.23,
and
MCO 6260 series**

15

NMCPHC TECHNICAL MANUAL 6260.51.99-2 (SEPT 2008) SERIES

1. Navy and Marine Corps Public Health Center Technical Manual 6260.51.99 series.
2. This is the procedures manual that covers all of public health issues – which includes occupational audiology and hearing conservation.
3. It provides detailed guidance for Medical Department personnel.
 - a. to implement hcp requirements identified in opnav instructions
 - b. replaces previous instructions (BUMEDINST 6260.5 and NEHC 6260.51.99 -1)
4. This technical manual is listed as major reference in other regulations/instructions series.
 - a. OPNAVINST 5100.19 (NAVOSH Afloat)
 - b. OPNAVINST 5100.23 (NAVOSH Ashore)
 - c. MCO 6260

(NEXT SLIDE)

SLIDE 15



**LOCAL COMMANDS
Military Treatment Facilities MTFs**

Local SOP often used to implement HCP

**Evidence and proficiency assurance for
inspection teams...
Joint Commission & MEDIG, INSERVE, ATG**

LOCAL COMMANDS

1. Local commands may have policies to implement HCP.
2. Military Treatment Facilities (MTFs) usually house Occupational Audiology testing sites/facilities.

(CLICK)

3. **May have Standard Operating Procedure (SOP) Manual**
 - a. **specific to that installation/environment**
 - b. **provides guidelines of responsibilities**
 - i. **example – referral guidelines**
 - ii. **example – responsibility for audiology booth certification**
4. **Audiometry manuals and annual update training**
 - a. **specific to situation – example: one-station vs multi-station**
 - b. **specific to population – example: ships only, marines only, tri-service testing**
5. **Inspection and accreditation entities/teams that assess program and patient care, i.e. Joint Commission**
 - a. **look for manuals and guidelines in service/testing areas**
 - b. **look for evidence of OHC technician continuing education and skill proficiency**

(NEXT SLIDE)

SLIDE 16	<p style="text-align: center;"><u>OHC Technician’s Concern with Regulations</u></p> <p>Regulations provide reference to</p> <ol style="list-style-type: none"> a. general HCP information b. procedures c. protocols d. certification requirements <p style="text-align: center;">Required to keep copies in testing area (physical or electronic copies)</p> 
-----------------	--

OHC TECHNICIAN’S CONCERN WITH REGULATIONS

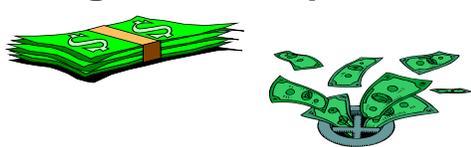
1. **Why should the OHC Technician be concerned or familiar with the OHCP regulations?**
2. **Knowledge of regulations assists you in performing job responsibilities.**
3. **Regulations provide a reference for**

(CLICK)

- a. **HCP general information**
- b. **procedures**
- c. **protocols**
- d. **certification requirements**
4. **Technician is required to keep copies accessible in testing area.**
5. **Reference for technicians, visiting command personnel, inspection teams.**

6. When counseling HCP patients, citing regulations for particular service may increase motivation and compliance.

(NEXT SLIDE)

SLIDE 17	<p>Hearing Loss Compensation</p> 
-----------------	---

HEARING LOSS COMPENSATION

Purpose of HCP is two (2) fold ...

1. Prevent permanent hearing loss of employees.
2. Reduce compensation cost for hearing loss disability >> Prevention directly relates to reduction of medical costs.

(NEXT SLIDE)

SLIDE 18	<p><u>HEARING & TINNITUS</u></p> <p># </p> <p>Top Reason for Military Disability Claims</p> <p>Highest Category of Compensation Costs</p> <p>VA Benefits Report 2010</p> <p style="font-size: small;">19</p>
-----------------	--

HEARING and TINNITUS

1. Hearing Loss and Tinnitus are the top two disabilities that Veterans report for compensation
2. Why Hearing Loss and Tinnitus?
 - a. young workforce who is exposed to multiple work sites, many of which are noisy.
 - b. service members, whether they are ever in combat or not, are paid to be combat ready

c. involves shooting, explosions and other war activities so the tools of the trade are inherently noisy!

(NEXT SLIDE)

SLIDE 19	Hearing Loss Compensation	
	Military	Civilians
	Amounts determined by Veteran's Administration	Amounts determined by OWCP
	Lifetime award – percent hearing loss is percentage of monthly salary for life	One-time award – additional if condition aggravated during employment
	Payments often in form of tax exemption on retirement pay	Prohibits collecting from multiple employers for same loss concurrently (VA & OWCP)

Hearing Loss Compensation

1. General information about compensation
 - a. military – compensation award amounts determined by VA (Veteran's Administration)
 - b. civilians – compensation amounts determined by OWCP (Office of Worker's Compensation Programs)
2. Military – life time award
 - a. based on a percentage (%) of last monthly salary for rest of life
 - b. payments often in form of tax exemption on retirement pay
3. Civilians – one time award,
 - a. although additional award or increase may be given if condition is aggravated during employment
 - b. this prohibits multiple collections for same loss

(NEXT SLIDE)

SLIDE 20	Hearing Loss Compensation cont...	
	Military	Civilians
	Medical Board determines disability & award or disability claim filed upon termination of service	Professional review of each claim:
	Disability rating determined to establish degree of handicap.	Awarded only for work related noise exposure (>84dBA TWA)
	Multiple conditions yield cumulative percentage	Awarded only for noise-induced hearing loss (no other etiology)
		Awarded only for portion of loss incurred during federal employment

HEARING LOSS COMPENSATION ...CONT...

1. Military – Claim is determined by a medical board or with the VA upon termination of service.

2. Civilians – Claim must be reviewed by professional (audiologist, physician, etc).
3. Military – A disability rating is determined in order to establish degree of handicap
4. Military -- Multiple conditions will be added together for a total percentage
5. Civilian – Compensation awarded only for work related noise exposure \geq 85 dBA TWA.
 - a. awarded only for NIHL and not for other ear related disorder/disease
 - b. awarded only for the portion of hearing loss incurred during federal employment

(NEXT SLIDE)

SLIDE 21	Hearing Related Costs for Veterans FY 2010		
	VA Physical C&P Exams	1,364,165	207,608,000
	Hearing Aids	561,212	196,964,000
	Assistive Listening Devices	35,143	4,639,000
	Batteries	44,086,395	5,428,000
	Parts & Accessories	2,372,768	4,380,000
	Hearing Aid Repairs	315,892	14,076,000
	Cochlear Implants	436	4,652,000
	Adjudication & Appeals	Unknown	???
	Lost Production Time	Unknown	???
	TOTAL COST estimate		\$433,095,000
	<small>* rounded to nearest thousand</small>		

HEARING RELATED COSTS FOR VETERANS FY 2010

The next five (5) slides summarize hearing related costs as reported by the VAMC in 2010. This information is NOT in your student work book because of its time-linked details. However, these costs clearly demonstrate the importance of hearing conservation.

1. These are costs reported by the Veterans' Administration that are related to hearing and hearing injury services.
2. These are real costs.

(INSTRUCTOR: Read the chart – type of service, number of patient encounters, number of items, dollar cost)

3. Note that these cost data are rounded to the nearest thousand dollars
4. AND the total is an lower than reality because of the unknown costs

(NEXT SLIDE)

SLIDE 22	<u>Hearing Loss & Tinnitus Compensation Claims FY10</u>		
	Hearing Loss	17%	\$ 1,063,000,000
	Tinnitus	30%	\$ 336,660,000
	TOTAL		\$ 1,399,660,000

HEARING LOSS and TINNITUS COMPENSATION CLAIMS FY10

1. In the Veteran’s Administration Benefits Report 2010, these figures indicated the percentage of major claims for hearing loss and tinnitus, and compensation awards.
2. Hearing Loss was 17% of the total major disability claims for a total compensation cost of \$1,063,000,000 or 1.063 billion dollars.
3. Tinnitus was 30% of the total major disability claims for a total compensation cost of \$336,660,000 or 336.66 million dollars.
4. Total compensation awards for hearing loss and tinnitus in 2010 equaled \$1,399,660,00 - That is 1 billion 399 million 660 thousand dollars.

We are not done yet . . .

(NEXT SLIDE)

SLIDE 23	<u>Embedded and Unknown Costs</u>	
	<small>UNKNOWN NUMBER OF VETS</small>	<small>LIFETIME ENTITLEMENTS</small>
	Hearing Loss & Tinnitus awarded compensation as secondary disabilities	Disability awards can change over a lifetime
	Hearing Loss & Tinnitus not compensated BUT rated 0% disability	THEREFORE Compensation amounts can increase as injuries worsen

EMBEDDED AND UNKNOWN COSTS

1. Most Veterans receiving compensation for hearing loss weren't injured directly in combat; MOST hearing injuries were occupationally related.
2. How can OHC Technician and Audiologist make the biggest impact in preventing HL?
 - a. implementing their part of the “ Five (5) Major Elements of HCP”.
 - b. MOST effective way to prevent the injuries before they occur is through ducation and raining.

3. Percentage of veterans receiving compensation for hearing loss secondary to other major disability claims appears to be 83%.

Percentage of veterans receiving compensation for tinnitus secondary to other major disability claims appears to be 70%.

4. Actual number of Veterans awarded compensation for hearing loss and tinnitus is unknown. Why?

a. Hearing loss and tinnitus are disabilities secondary to other major disability, i.e. limb amputation, arthritis, knee problems.

b. Many veterans currently have 0% disability rating and are not receiving any HL/Tinnitus benefits.

5. VA compensations are lifetime entitlements; and can change with time, i.e., compensation awards can increase as member's injuries worsen.

NOTES FOR INSTRUCTORS KNOWLEDGE:

Veterans who have hearing loss lost their hearing due to combat or occupationally related injury. Most veterans receiving disability benefits have never served in combat. There is no requirement under law to have a service connected (SC) HL to receive hearing aids by the VA. To be SC in order to receive disability benefits, a veteran must show (1) they have a current disability, (2) that some event occurred during military service that plausibly caused or aggravated the injury or illness, and (3) a connection or nexus between (1) and (2). The audiogram is usually the basis for deciding the presence of SC hearing loss or significant changes in thresholds consistent with noise injury. In cases where there are no audiograms (often before 1970), other indirect evidence is considered, e.g. MOS, awards and decorations, deployments, etc. In cases of documented combat, the burden of evidence is relaxed.

Because of the importance of obtaining an audiogram at separation (preferably periodically during service), DoD and VA have signed a joint MOU that requires every service member to receive a Separation Health Assessment that must include an audiogram. Service members cannot get a DD214 until this requirement is met. Without an audiogram, VA cannot determine with certainty if a service member suffered hearing loss during service. By law, we must give the benefit of doubt to the veteran.

Most SC disabilities are due to non-combat injuries. VA recognizes that some of the current hearing loss is due to non-military occupationally-related work, or to other intervening causes such as aging. Generally, it is impossible to allocate the relative contributions of these various causes. If any of the current hearing loss is related to military service to a reasonable degree of medical certainty, then the disability is calculated on the basis of all of the current disability hearing loss.

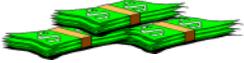
Once SC, veterans can request increases in disability rating if their hearing loss gets worse. Of course, for most veterans, such changes are not due to any further military

noise injury. INCREASES IN DISABILITY CAN BE AWARDED FOR AGE-RELATED CHANGE OR PROGRESSION OF DISEASE.

There are unique features of VA disability compensation not found in other disability systems that embodies America's promise to its veterans to care for them for life and to express the lasting gratitude of the Nation.

Kyle C. Dennis, Ph.D.
Audiology and Speech Pathology National Program Office (10P4RA)
50 Irving Street NW
Washington, DC 20422
Email communication on 03 Jan 2012

(NEXT SLIDE)

SLIDE 24	 \$1,832,755,000 + <small>(that's over a billion dollars in one year - 2010)</small> Hearing Loss Major Disability Claims + Tinnitus Major Disability Claims + Other Hearing Loss Related Costs + Embedded & Unknown Costs
-----------------	---

“ALL THESE FACTORS EQUAL...”

1. So if we add up the known Hearing Loss major disability claims in 2010
+ and the known Tinnitus major disability claims (together \$1,399,660,000 on Slide #24)
+ with the other Hearing Loss Related Costs (4433,095,000 on Slide #23)
2. It equals \$1,832,755,000.
3. HOWEVER it is more than that with the Embedded and Unknown Costs (Slide #25) -

AND...

(CLICK)

4. What about civilian workers claiming hearing injuries while working for the DoD?
--- We don't have ready cost figures for those one-time disability awards.
5. It is difficult to equate that vast sum of money to something we can relate to, so let's look at the next slide...

(NEXT SLIDE)

SLIDE 25

Reality Check



2010 = \$1.8+ Billion buys....

18+ Joint Strike Fighters @ \$100M

OR

450+ M1A1 Abram Tanks @ \$4M

OR

**19+ Years of Employment for
535 Legislative Elected Officials**

REALITY CHECK

1.8 PLUS billion dollars could buy ...

18+ Joint Strike Fighters @ \$100M

OR

450+ M1A1 Abram Tanks @ \$4M

OR

19+ Years of Employment for 535 Legislative Elected Officials

(NEXT SLIDE)

SLIDE 26

DoD Operational Budget

*VA Medical Claims
Misc Veterans Benefits
ALWAYS PAID FIRST*

*Ships, Tanks, Planes
Hospitals, Bases,
Salaries*

27

DoD OPERATIONAL BUDGET

- 1. We've seen news about nation's budget shortfalls.**
- 2. When the DoD makes budget cuts, every dollar matters. Remember that the disability compensation awards continue to be paid as lifetime awards with possible increases.**
- 3. When the DoD has a Reduction in Force (RIF), whose jobs are jeopardized? Can't happen? Following major wars such as the Gulf War and Iraq War, many jobs were lost short of retirement. Also requirements for re-enlistment become stricter.**
- 4. Therefore Healthy Mind, Body, Spirit and EARS = Mission readiness, deployability and employability!**

(NEXT SLIDE)

SLIDE 27



ONLY SOLUTION....

Conserve Hearing and Prevent Rising Costs

**Accurate Hearing Testing
Conscientious Follow-up
Careful Fitting & Re-fitting of HPDs
Effective Counseling
Meaningful Hearing Health Education
Enforced HPD Use
Successful HCP Management**

28

ONLY SOLUTION....

1. Only solution is to conserve hearing for DoD employees AND to prevent the steep rising trend in compensation costs.

>>>> Efficient and Effective Hearing Conservation Program

2. OHC technicians are major component in this solution to conserve hearing and prevent rising costs through ...

(CLICK)

3. Accurate hearing testing with accurate patient demographic data input

4. Conscientious follow-up of STS results and referrals

5. Careful fitting and re-fitting of HPDs coupled with effective instruction in use and care

(CLICK)

6. Effective counseling about current hearing status that encourages individual worker/patient to have good hearing health behaviors on and off the job.

7. Meaningful hearing health education that is realistic and motivational

(CLICK)

8. Enforced HPD use by supervisors, safety officers, command officers

9. Successful HCP management through analysis of statistical data about STSs and PTSs

(NEXT SLIDE)

SLIDE 28

SUMMARY Decreasing Compensation Costs

Effective
engineering
controls &
noise
abatement

Audiometric
monitoring
for early
identification
of hearing
changes

Hearing conservation education
for work & recreational activities

Enforcement
of HPD use
at all
responsibility
levels

Program
Management
statistical
evaluation
of effectiveness

29

SUMMARY: Decreasing Compensation Costs

In Summary for decreasing compensation costs...

1. We need to effectively implement all elements of HCP

(CLICK)

2. Number one (1) solution -- Navy's primary means for noise abatement
>>>> Effective engineering controls to reduce hazardous noise levels in the workplace

(CLICK)

3. Accurate audiometric monitoring for early identification of hearing changes
a. consistent follow-up testing and referral protocols
b. regularly scheduled testing

(CLICK)

4. Enforcement of HPD use at all responsibility levels
a. encouragement of chiefs, officers, supervisors to be excellent role models to protect hearing
b. appropriate personal use of HPDS
c. enforcement and discipline procedures
d. provide appropriate access to effective protection devices for individual workers

(CLICK)

5. Hearing conservation education for both work and recreational activities
a. clear understanding that no one has "tough" ears
b. correct insertion/placement of HPDS

6. For off-work hours, personnel need to consider noise output
a. home and garden equipment and use
b. music playing equipment and use at home and in vehicles
c. recreational activities

(CLICK)

7. Program management -- statistical evaluation of effectiveness of HCP
 - a. Compliance rates - annual tests, follow-up testing, referral audio evaluations
 - b. STS and PTS rates - general and according to categories (job type, commands, duration of exposure, etc.)
 - c. HPD availability and use

(NEXT SLIDE)

<u>SLIDE 29</u>	<p style="text-align: center;">QUESTIONS?</p> 
------------------------	--

QUESTIONS?

END OF PRESENTATION

1.14 OHC TECHNICIAN: ROLE and RESPONSIBILITIES

<u>SLIDE 1</u>	 <p>HEARING CONSERVATION PROGRAM</p> <p><u>THE OCCUPATIONAL HEARING CONSERVATION TECHNICIAN</u></p> <p>ROLE and RESPONSIBILITIES</p>
-----------------------	---

THE OCCUPATIONAL HEARING CONSERVATION TECHNICIAN : ROLE and RESPONSIBILITIES

(INSTRUCTOR: Historically, this unit has been presented after the Overview of the HCP unit. This current version contains terminology and concepts that are presented sequentially in the other units. Therefore, we recommend that this unit be used at the END of the course to review the OHC Technician job and provide a summary of the course.)

(Another idea is to present the Slides 3, 4, and 5 after the Overview unit to introduce the OHC Technician.)

(NEXT SLIDE)

<u>SLIDE 2</u>	<p><u>Learning Objectives</u></p> <ol style="list-style-type: none">1. Identify the role of the OHC Technician as a team member of the Hearing Conservation Program2. Describe the responsibilities of the OHC Technician3. Describe the limitations of the OHC Technician duties
-----------------------	--

LEARNING OBJECTIVES

1. Identify the role of the OHC Technician as a team member of the Hearing Conservation Program
2. Describe the responsibilities of the OHC Technician
3. Describe the limitations of the OHC Technician duties

(NEXT SLIDE)

SLIDE 3	<p>What Are Attributes of an OHC Technician?</p> <table style="width: 100%;"> <tr> <td style="text-align: center;"> <p>Technical competence <i>YES!</i></p> <p>Practical knowledge that can be transferred to workers <i>YES!</i></p> </td> <td style="text-align: center;"> <p>Passion for hearing conservation <i>YES!</i></p> <p>Expertise in Acoustics, Audiology, Noise Control, Anatomy & Physiology <i>NO!</i></p> </td> </tr> </table>	<p>Technical competence <i>YES!</i></p> <p>Practical knowledge that can be transferred to workers <i>YES!</i></p>	<p>Passion for hearing conservation <i>YES!</i></p> <p>Expertise in Acoustics, Audiology, Noise Control, Anatomy & Physiology <i>NO!</i></p>
<p>Technical competence <i>YES!</i></p> <p>Practical knowledge that can be transferred to workers <i>YES!</i></p>	<p>Passion for hearing conservation <i>YES!</i></p> <p>Expertise in Acoustics, Audiology, Noise Control, Anatomy & Physiology <i>NO!</i></p>		

WHAT ARE ATTRIBUTES OF AN OHC TECHNICIAN?

1. Technical competence

(CLICK) YES!

2. Passion for hearing conservation

(CLICK) YES!

3. Practical knowledge that can be transferred to workers

(CLICK) YES!

4. Expertise in Acoustics, Audiology, Noise Control, and/or Anatomy and Physiology

(CLICK) NO!

(NEXT SLIDE)

SLIDE 4	<p>CRITICAL ROLE in Hearing Conservation Program</p> <p>The "FACE" of the HCP</p> <ul style="list-style-type: none"> • See personnel first • Fit HPDs • Educate & motivate • Answer questions
----------------	---

OHC TECHNICIANS

1. OHC Technicians play a critical and absolutely essential role in the Hearing Conservation Program.

- a. Remember the goal of the OHCP is to ensure auditory fitness for duty and to prevent occupationally related hearing loss..
 - b. This goal can be accomplished only with technicians performing accurate air conduction hearing tests and counseling employees about their hearing status and how to preserve/protect it.
2. Purpose of providing annual audiogram tests is to MONITOR people in a hearing conservation program, to ensure that their hearing DOES NOT degrade with time and exposure to noise. Fewer than five (5%) percent of these employees are seen for full audiology evaluations (referrals).
3. These monitoring tests should only be performed on active duty and civilian employees ROUTINELY exposed to hazardous noise as defined by an Industrial Hygienist.
4. These annual HCP tests DO NOT include the Non HCP tests performed for other medical reasons – “prehire” employees, PHAs, non-HCP flight physicals, non HCP fork lift physicals, 2-3 year occupational screenings (truck driver physicals).
5. The OHC Technician administers both HCP and Non-HCP hearing tests.

(CLICK)

6. You as a OHC Technicians are the “FACE” of the HCP.
 - a. You see personnel first and fit HPDs
 - b. You educate and motivate personnel during their routine tests to conserve their hearing by using HPDs properly.
 - c. You answer their questions and refer them to the appropriate professional.
 - d. The majority of Navy employees never see an audiologist except during a training session (Stand Down). Again, Occupational Audiologists see less than 5% of these employees for full audiology evaluations (referrals).
7. The OHC Technician is truly the “FACE” of the Hearing Conservation Program.

(NEXT SLIDE)

SLIDE 5

Responsibilities

- Certification
- Equipment
- Audiometric Hearing Testing
- Follow Up Care and Fit HPDs
- Hearing Conservation Education and Motivation
- Recordkeeping and Data Management
- Professional Behavior and Ethics

RESPONSIBILITIES

1. OHC Technicians have these major responsibilities, which we will discuss in detail in the following slides.
2. Certification as an occupational hearing conservation technician
3. Equipment use, maintenance and troubleshooting problems
4. Audiometric hearing testing for routine and follow up audiograms and related test procedures.
5. Follow Up care which includes counseling patients, fitting HPDs, and referrals
6. Hearing conservation education and motivation
7. Recordkeeping and data management using paper and electronic records
8. Professional behavior and ethics

(NEXT SLIDE)

SLIDE 6

Certification

HCP Certification
Good for 5 years if . . .
Annually evaluated by OHC Audiologist

Working Knowledge and Access to
DOD 6055.12
OPNAVINST 5100.19/23
MCO 6260.1
NMCPHC Tech Manual
Local SOP

RESPONSIBILITIES – CERTIFICATION

1. Every HC Technician must be certified by attending and passing this training course.

(CLICK)

- a. certification is valid for 5 years .
 - b. WITH a positive annual proficiency evaluation (check of professional skills and work habits) by an OHC audiologist.
 - c. after five (5) years, technicians must attend and pass a re-certification class (typically 8 hrs).
2. Each OHC Technician must demonstrate a working knowledge of official instructions for the HCP.
3. These instructions include ----
- a. DOD 6055.12
 - b. OPNAVINST 5100.10/23
 - c. NMCPHC Tech Manual
 - d. Local SOP (Standard Operating Procedures)
4. Copies of these instructions must be kept at each test site for reference and auditing purposes (paper or e-copies).

(NEXT SLIDE)

<u>SLIDE 7</u>	<p><u>Equipment</u></p> <ul style="list-style-type: none"> ▪ Verify Calibration <ul style="list-style-type: none"> a. audiometer is current b. test booth is current ▪ Perform daily <ul style="list-style-type: none"> a. functional listening check b. audiometer calibration ▪ Troubleshoot routine problems <ul style="list-style-type: none"> a. test equipment b. software
-----------------------	--

EQUIPMENT (Responsibilities)

1. OHC Technician is responsible for assuring test equipment is functional.
- a. must be aware of calibration requirements
 - b. there are Annual requirements and Daily requirements
 - c. DOEHRS will not operate past the annual calibration due date of the audiometer
 - messages will appear warning about the upcoming due date
 - d. calibration of audiometer setup (with headphones) can be done by the NMCPHC on an annual schedule
 - e. calibration of hearing booth is performed by local Industrial Hygienist annually

(CLICK)

2. Daily equipment responsibilities include

- a. functional listening check of each audiometer's headphone, chord, jack and push button
- b. calibrating each audiometer with a Bio-Joe to verify audiometer/headphone combination provide accurate test tones daily.
- c. DOEHS-HC will not operate without transfer of daily calibration data from each audiometer being use.

(CLICK)

- 3. OHC Technician is responsible for knowing how to troubleshoot routine problems with
 - a. test equipment and software
 - b. includes what to do when an audiometer doesn't pass daily calibration, headphones have static, response button doesn't work
 - c. troubleshooting software includes both basic computer use and operation and DOEHS-HC and DR access

(NEXT SLIDE)

<u>SLIDE 8</u>	<p style="text-align: center;"><u>Audiometric Hearing Testing</u></p> <p>Pure Tone Air Conduction Testing</p> <ul style="list-style-type: none"> a. determine type or reason for test b. ensure test accuracy and validity c. enter accurate demographic data <p>Follow-up Tests</p> <ul style="list-style-type: none"> a. determine if STS b. use appropriate referral protocols c. update reference audiograms correctly 
-----------------------	--

AUDIOMETRIC HEARING TESTING (Responsibilities)

- 1. Major duty is to test hearing
 - a. technician uses pure tone air conduction test procedures to establish an employee's hearing thresholds
 - b. although the software uses research based methods to determine thresholds ---- procedure is referred to as audiometric screening
 - c. this means that only an audiologist can verify hearing acuity levels and validity of Significant Threshold Shifts (STS) which then becomes Permanent Threshold Shifts (PTS)

(CLICK)

- 2. Technician is responsible for determining type or reason for test - to meet employee needs and use correct recording form (2215, 2216, NHC).
 - a. reference (baseline) audiogram
 - b. annual HC monitoring,
 - c. pre/post deployment hearing status,

- d. termination from the HCP or separation/retirement from military service
 - e. follow up testing
 - f. non-HCP audiogram (pre-hire eligibility, personnel not enrolled in HCP, commissioning, physicals, etc.)
3. **Ensure Test Accuracy and Validity**
 - a. provides clear understandable instructions
 - b. judges if patient is responding as instructed
 - c. uses correct reference (2215) and other considerations (asymmetry, 270 Rule, health issues) to determine possible STS
 - d. accommodates for external complicating factors (environmental noise, multiple person booth)
 4. **Enter Accurate Demographic Data**
 - a. essential for best patient follow up
 - b. required for accurate reporting of individual employee and HCP results

(CLICK)

5. **Technician administers Follow Up Tests to employees that fail first hearing test.**
 - a. determines if possible STS -- makes decisions about whether employee should be referred to audiologist for full hearing evaluation
 - b. uses appropriate referral protocol – occupational audiologist, medical officer
 - c. knows and applies instructions correctly about when a new reference 2215 should be generated for a particular employee

(NEXT SLIDE)

<u>SLIDE 9</u>	<p><u>Other Tests Administered</u></p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;"> <p>Otoscopic Examination</p>  </td> <td style="text-align: center; width: 50%;"> <p>Tympanometry</p>  </td> </tr> </table>	<p>Otoscopic Examination</p> 	<p>Tympanometry</p> 
<p>Otoscopic Examination</p> 	<p>Tympanometry</p> 		

OTHER TESTS ADMINISTERED (Responsibilities)

1. OHC Technicians are trained to look into the ear with an otoscope or perform otoscopic examination.
2. Observes general/gross signs of problems that may affect hearing – examples: obstructions in canal, red eardrum.

3. Tympanometry can be administered to screen for normal function of the middle ear system.
4. These two tests assist in making appropriate referrals to medical officers.

(NEW SLIDE)

<u>SLIDE 10</u>	<p><u>Follow – Up Care</u></p> <p>Referrals to</p> <ol style="list-style-type: none"> a. audiologists b. medical officers or IDCs <p>Counseling patients toward understanding</p> <ol style="list-style-type: none"> a. hearing test results b. follow up procedures & requirements c. proper fit & use of HPDs d. compliance & behaviors that conserve hearing
------------------------	--

FOLLOW-UP CARE (Responsibilities)

1. OHC Technicians need to know criteria and procedures to refer employees to
 - a. audiologists for a full hearing evaluation because
 - i. a STS sustained through Follow Up testing
 - ii. patient does not meet baseline or Fitness for Duty (FFD) criteria
 - iii. patient complains of serious hearing problems and/or tinnitus
 - b. medical officers if medical condition related to ear and hearing is observed – obstructed ear canal, draining ear, pain, abnormal tympanogram
 - c. being the only medical team member available (isolated region/area, shipboard)

2. Counseling by OHC Technician involves explanation of
 - a. test results – how to read the audiogram, normal hearing range, define STS, impact on understanding speech and safety issues
 - b. follow-up procedures – HCP follow-up requirements to verify thresholds, explain audiology evaluation
 - c. proper fitting and use of HPDs – explain and demonstrate types of HPDs, correct insertion and use (circumstances and hygiene)
 - d. everyday behaviors that protect and conserve hearing -- work and recreational activities

3. OHC Technician must take advantage of “teaching moments” to encourage HCP compliance and behaviors that will protect hearing

These few counseling “moments” may be the only “annual training” the employee receives before getting another hearing test

(NEXT SLIDE)

SLIDE 11

**Hearing Conservation
Education and Motivation**

**DISCUSS
QUALITY OF LIFE
ISSUES**

**POSITIVE
REINFORCEMENT
OF
HCP COMPLIANCE**

**ASSIST
SUPERVISORS
WITH
COMPLIANCE
ACTIVITIES**

HEARING CONSERVATION EDUCATION AND MOTIVATION (Responsibilities)

1. OHC Technicians may provide HC education and motivation in other situations besides during patient counseling and referral procedures.
 - a. they may assist with initial and annual HC education and motivation activities
 - b. particularly true for OHC Techs deployed on ships

To emphasize what has been discussed previously, HC Education and Motivation includes

2. Sharing Noise and Hearing Facts

(CLICK)

3. Quality of Life Issues

(CLICK)

4. Positive Reinforcement of HCP Compliance -- seize opportune "moments" to reinforce HPD use, proper Hazardous Noise signage, showing up for hearing test and any follow up tests, etc.

(CLICK)

5. Assist Supervisors with Compliance Activities – contests, recognition awards, etc.

(CLICK)

6. As we said in the beginning, OHC Technician is typically the POC (Point of Contact) for the HCP
 - a. You are responsible for answering questions within your scope of knowledge and experience
 - b. You need to know when to refer questions/concerns to audiologist and industrial hygienist

(NEXT SLIDE)

SLIDE 12

Additional Duties

Recordkeeping and Data Management

- a. documentation in health records
- b. proper storage of forms and instructions



Monitor effectiveness of HCP

- a. assist HCP manager/audiologist
- b. report observations of compliance, etc

12

ADDITIONAL DUTIES (Responsibilities)

1. Recordkeeping and Data Management includes both physical medical records AND electronic records in DOEHRs.
2. Typically, OHC Tech will also be responsible for inputting patient encounters into a clinic/hospital database (i.e. CSCH, AHLTA).
3. Clinical forms used in everyday practice (i.e. patient demographic form) and equipment records (DoD Form 2217) require organized storage.
4. Copies of DoD and branch service Instructions need to be easily assessable.

(CLICK)

5. OHC Tech provides assistance when requested with monitoring the effectiveness of and compliance with the HCP.
6. They may be requested to report observations of compliance and other events related to HCP.

(NEXT SLIDE)

SLIDE 13

Professionalism

Professional interaction

- a. patients – rights, privacy, satisfaction
- b. HCP team members



High professional standards

- a. integrity
- b. work habits – personal and work area
- c. keep job skills current

13

PROFESSIONALISM (Responsibilities)

1. OHC Technicians are responsible for conducting their duties with a professional attitude and professional behaviors,
2. Diligence concerning patient rights, privacy, and satisfaction should be practiced always.
3. Caution! Repetitive nature of technician's work can result in what may appear as an uncaring "sing song" or robotic delivery of instructions and explanation of test results. Always treat each employee as an individual.
4. OHC Technician is not only the daily representative of HCP to employees but also in medical clinics and work sites.
 - All interaction with clinical staff and other HCP team members should be as professional as possible.
5. Maintain high professional standards
 - Remember integrity is what you do when no one is watching; follow established instructions and procedures.
6. Develop and maintain good professional work habits
 - a. punctuality, dependability, flexibility
 - b. appearance, use of appropriate language
 - c. consideration of fellow workers, clean orderly work areas.
7. Change is inevitable! OHC Techs must stay up to date with changes in regulations, computer software, and local SOP.

(NEXT SLIDE)

SLIDE 14	<p style="text-align: center;"><u>Responsibility Limitations</u></p> <div style="display: flex; align-items: center;">  <p style="font-size: small;">Conduct any type of audiometric testing other than pure tone air conduction testing & screening tympanometry</p> </div> <div style="display: flex; align-items: center;">  <p style="font-size: small;">Interpret hearing test results re: diagnosis of type, cause & treatment of ear disease</p> </div>
-----------------	---

RESPONSIBILITY LIMITATIONS of the OHC TECHNICIAN

1. Critical that OHC Technician does not perform outside of his or her training and responsibilities.
2. Sometimes the situation makes these limitations difficult due to
 - a. requests from personnel and HCP team members
 - b. trying to get patient the help he or she needs

3. **DO NOT** conduct any type of audiometric testing other than pure tone air conduction testing and tympanometry .
4. **DO NOT** interpret hearing test results in terms of
 - a. type of diagnosis – conductive, sensorineural, mixed
 - b. cause of hearing loss
 - c. recommendations or critique of treatment(s)
5. **WHY?**
 - a. you are using test procedures that do **NOT** give you enough information to make these type of decisions.
 - b. job position of OHC Technician does not include this level of authority .
6. **CAUTION:** Otoscopic examination and tympanometry allow you to make general statements of whether there is an indication of outer/middle ear problems (pathology). Regardless of your knowledge, be careful not to diagnosis a specific ear disorder but refer to a Medical Officer

(NEXT SLIDE)

<u>SLIDE 15</u>	<p style="font-size: small; color: gray;">Responsibility Limitations...</p> <div style="display: flex; align-items: center; justify-content: center; gap: 10px;">  <div style="text-align: left;"> <p>Assume role of supervisor of audiometric monitoring</p> <p>Independently train or certify other OHC technicians</p> <p>Conduct noise surveys and analyses</p> </div> </div> <p style="font-size: x-small; color: gray; margin-top: 10px;">15</p>
------------------------	--

RESPONSIBILITY LIMITATIONS of the OHC TECHNICIAN

1. OHC Technicians perform the critical role of performing audiometric testing of hearing levels and determining if a possible STS exists.
2. However, OHC Technicians do **NOT** supervise the monitoring of employees' hearing status
 - a. you do not verify an STS and perform related hearing conservation activities to monitor further changes in an individual employee hearing status.
 - b. audiologists and occupational health medical officers are responsible for supervising employees' hearing status
3. OHC Technicians do **NOT** independently train or certify other OHC technicians. They may assist an OHC Director (audiologist) in training but always under supervision.

4. **OHC Technicians do NOT conduct noise surveys and analyses.**
 - a. **industrial hygienists complete these surveys and reports**
 - b. **it is highly recommended that an OHC Tech knows how to access and understand an IH Noise survey/report in order to answer questions about HCP enrollment for specific UICs, etc.**

(NEXT SLIDE)

<u>SLIDE 16</u>	<p>Responsibility Limitations . . .</p>  <p>Provide engineering or noise control solutions</p> <p>Independently evaluate effectiveness of the HCP</p> <p style="font-size: small;">16</p>
------------------------	--

RESPONSIBILITY LIMITATIONS of the OHC TECHNICIAN

1. **OHC Technicians do NOT provide engineering or noise control solutions.**
 - a. **if you observe a possible need or problem with noise exposure, check with the work site command to see if Industrial Hygiene (IH) has been contacted.**
 - b. **perhaps you can assist in getting the correct POC for the command/supervisor**
2. **Audiologists are responsible for evaluating the effectiveness of HCP**
 - a. **they are responsible for analyzing DOEHRS-HC data and making reports for command decision making.**
 - b. **OHC Technicians assist audiologists by accurately typing demographic data for each employee tested and performing all test procedures/recordkeeping accurately**

→ →→ “DATA INTEGRITY”

(NEXT SLIDE)

SLIDE 17

**Responsibilities
to the Patients**

- Professional concern and interest
- Provide valid/accurate audiograms
- Ensure patient understands test purpose and follow-up results...not only say "You Passed"!
- Demonstrate proper HPD fit on each ear
- Motivate consistent HPD use both on/off duty
- Maintain professional work space
- Protect patient rights

17

RESPONSIBILITIES TO THE PATIENTS

1. Professional concern and interest in each individual patient and the conservation of his or her hearing. Project an attitude of competence, organization and service.
2. Provide valid/accurate audiograms
3. Ensure patient understanding of test purpose, results and follow-up when indicated. It is NOT enough to tell a patient that he or she "Passed".

(CLICK)

4. Demonstrate proper HPD fit on each ear individually.
5. Demonstrate and counsel patients on how to insert plugs properly and how to clean HPD's.
6. Motivate consistent HPD use both on/off duty.
7. Demonstrate professionalism in appearance of work space and your own appearance
8. Protect patient privacy, ensure confidentiality and follow HIPAA rules.

(NEXT SLIDE)

SLIDE 18

**CRITICAL ROLE
in
Hearing
Conservation
Program**

**The "FACE"
of the
HCP**

- See personnel first
- Fit HPDs
- Educate & motivate
- Answer questions

SUMMARY

We return to the beginning.

1. OHC Technicians have an essential critical role in the HCP -- The Program could not exist without technicians

(CLICK)

2. OHC Technicians are the "FACE" of the HCP

3. You see personnel first

4. You fit HPDs

5. You educate and motivate employees to comply with HCP regulations and conserve their hearing

6. You answer questions and make proper referrals

(NEXT SLIDE)

SLIDE 19

**ANY
QUESTIONS?**



ANY QUESTIONS

END OF PRESENTATION

CLINICAL ANECDOTES and EXAMPLES

An OHC Technician with experience was working a new test site with a single person booth. She completed testing a patient and noted that scores indicated thresholds in both ears that were opposite from previous audiograms, i.e. a mid frequency loss in the right ear and a negative STS in the left ear today compared to better hearing in the right ear and worse hearing in the left ear previously. She looked at the patient in the booth and the earphones were placed properly. The patient had remarked that he always failed hearing tests because he had "funky inconsistent" hearing. Well, maybe he has inconsistent conductive issues....but an earlier audio evaluation indicated no air-bone gaps.

Tech starts to counsel, explaining how sometimes allergies, etc can cause temporary problems in the ears.....but it was weird how today's results had reversed ears. He confirmed that the earphones had been on correctly.

Suddenly, tech remembered the Functional Listening Check that morning. The tones had started in the right ear and then the intensity check had been heard in the left ear. She had checked to see if she had placed the earphones on correctly -- Yes, red right. She made a mental note to check if this "new" clinic with relatively new equipment was set up differently. Now sitting with the patient, she stared through the booth window and finally saw that the headphone jacks were reversed. Patient was relieved and happy to redo the test and no STS was found in either ear based on the previous audio evaluation.

When had the jacks been reversed? By the technician? By a patient? Since the audiometer had calibrated just fine that morning, the tech had not had a reason to unplug the earphone jacks. However, the former tech had warned her that cords sometimes were pulled out when a patient sat down/moved around in the chair (audiometer directly behind and above their chair in single person booth).

TAKE HOME MESSAGE -

Do the functional listening check daily. Take time to look at all equipment components. Check out anything odd before seeing patients. Don't depend only on biologic calibration.

(Instructors encouraged to make notes on pertinent anecdotes/examples for ready use and accurate efficiency in class instruction.)