دکتر حمیدرضا صابری

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The Audiogram

Measurement of Hearing and Audiogram Interpretation

Introduction

- How we measure hearing
- How those measurements can be recorded
- What the audiogram can tell us

Purposes of audiometric testing

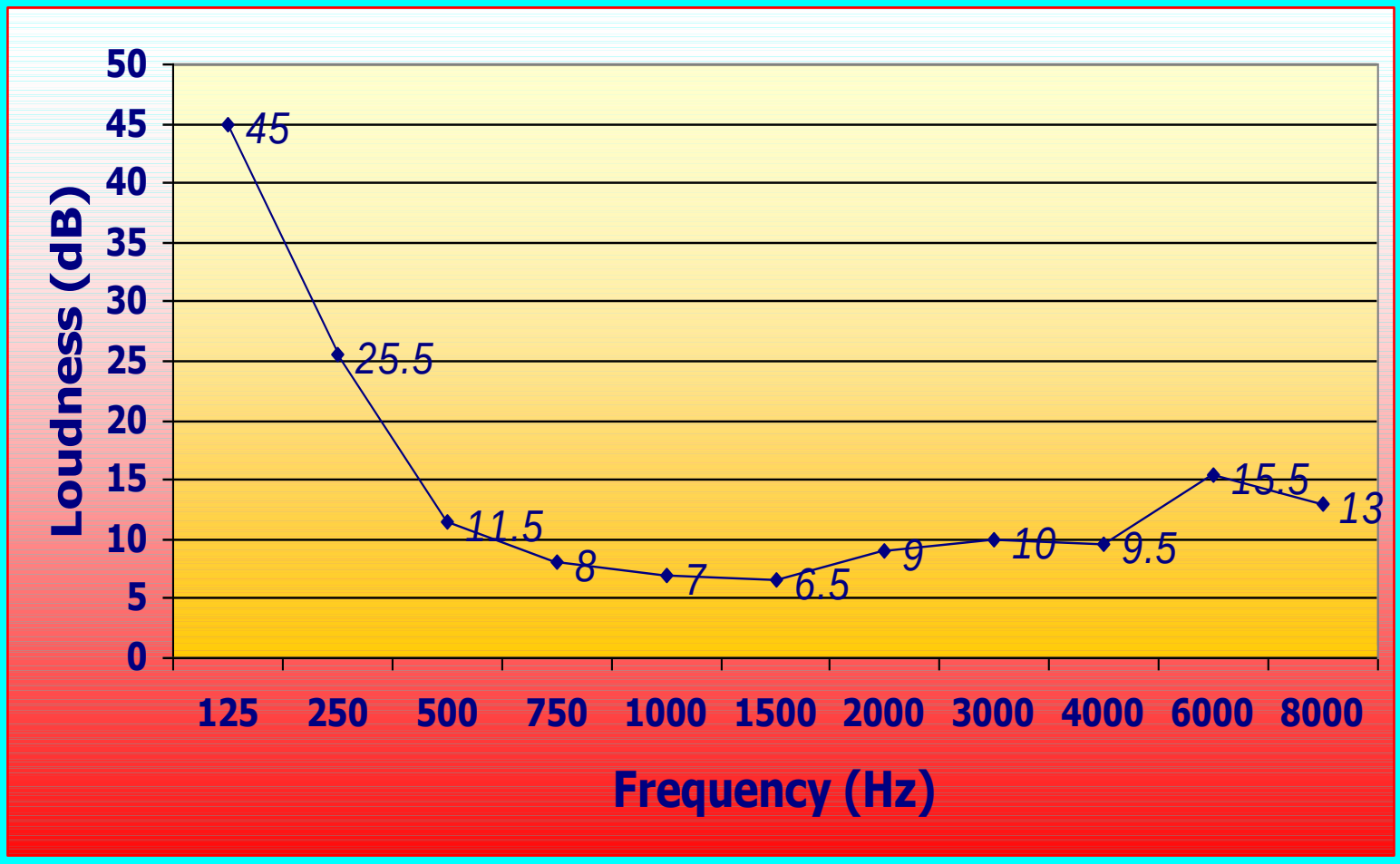
- Monitor the effectiveness of the hearing conservation program
- Identify significant threshold shift
- Establish readiness and fitness for duty
- Ensure proper referral and diagnosis

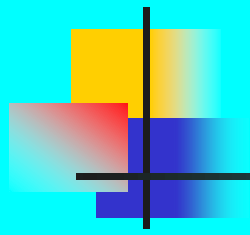
Vocabulary

- Audiogram - A record of a person's pure-tone hearing threshold levels
- Threshold – A level of sound that a person can detect 50% of the time or more
- Audiometric Zero – sensitivity of normal, young adults

Audiometric Zero (Ref ANSI S3.6 1996, TDH-39 earphones)

0 dB Hearing Level at 1000 Hz = 7 dB SPL





- **Does 0 dB HL mean the absence of sound?**

- **What is the intensity of a 0 dB HL pure-tone at 1000 Hz?**

Output Limits of the DOEHRS-HC Audiometer

-10 to 100 dB HL

Serial Audiogram

- Thresholds recorded to the nearest

  5 dB

- Used on DD Forms 2215 and 2216, entrance physicals and physical exam forms (SF 88 and DD 2808)

Serial Audiogram

		Left Ear					
		500	1000	2000	3000	4000	6000
Baseline	1983/06/01	*5*	*10*	*25*	*20*	*35*	*25*
Annual	1999/07/24	*10*	*10*	*15*	*20*	*15*	*35*

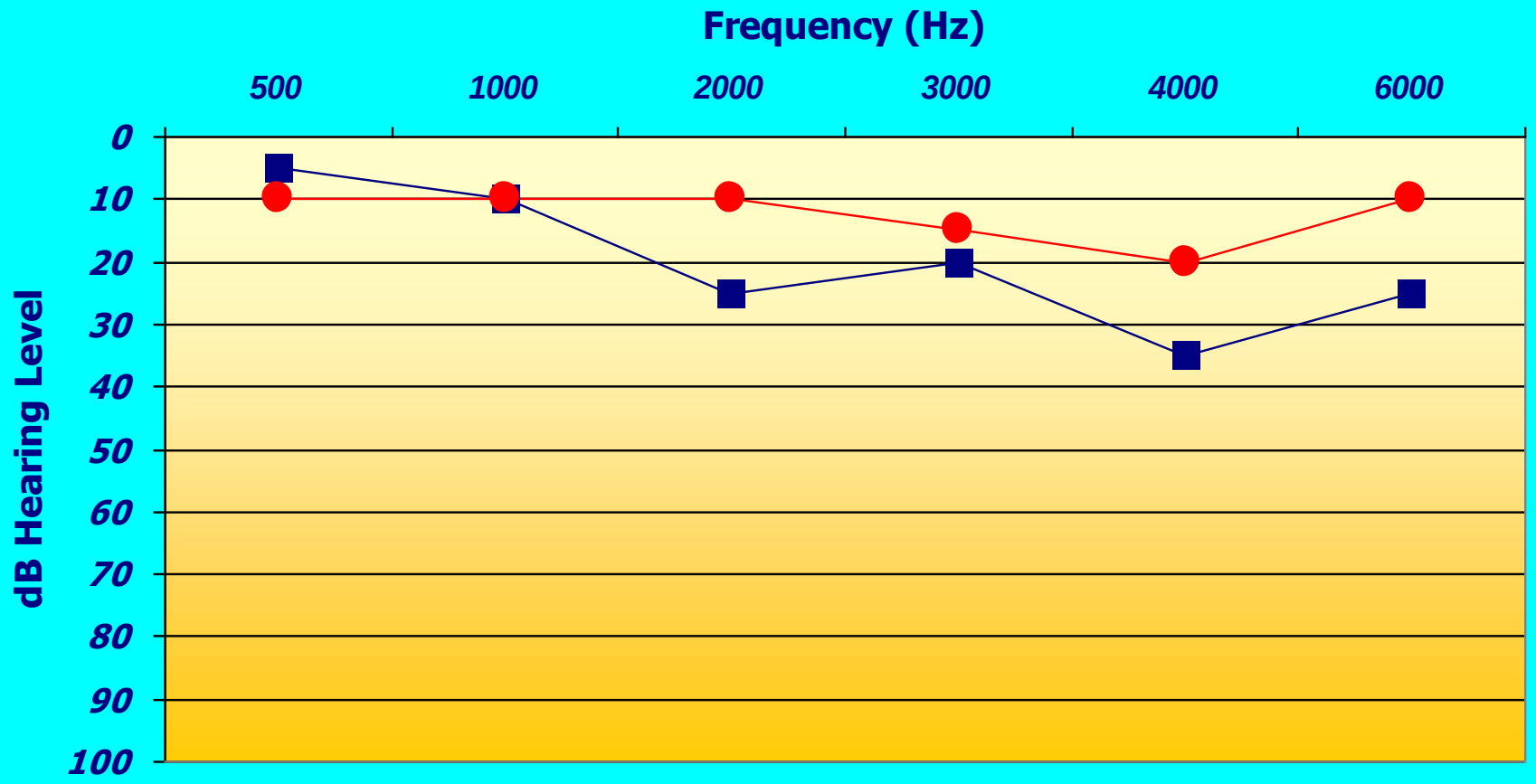
		Right Ear					
		500	1000	2000	3000	4000	6000
Baseline	1983/06/01	*10*	*10*	*10*	*25*	*25*	*10*
Annual	1999/07/24	*10*	*10*	*15*	*20*	*15*	*35*

Mild high-frequency hearing loss at 6000 Hz bilaterally.

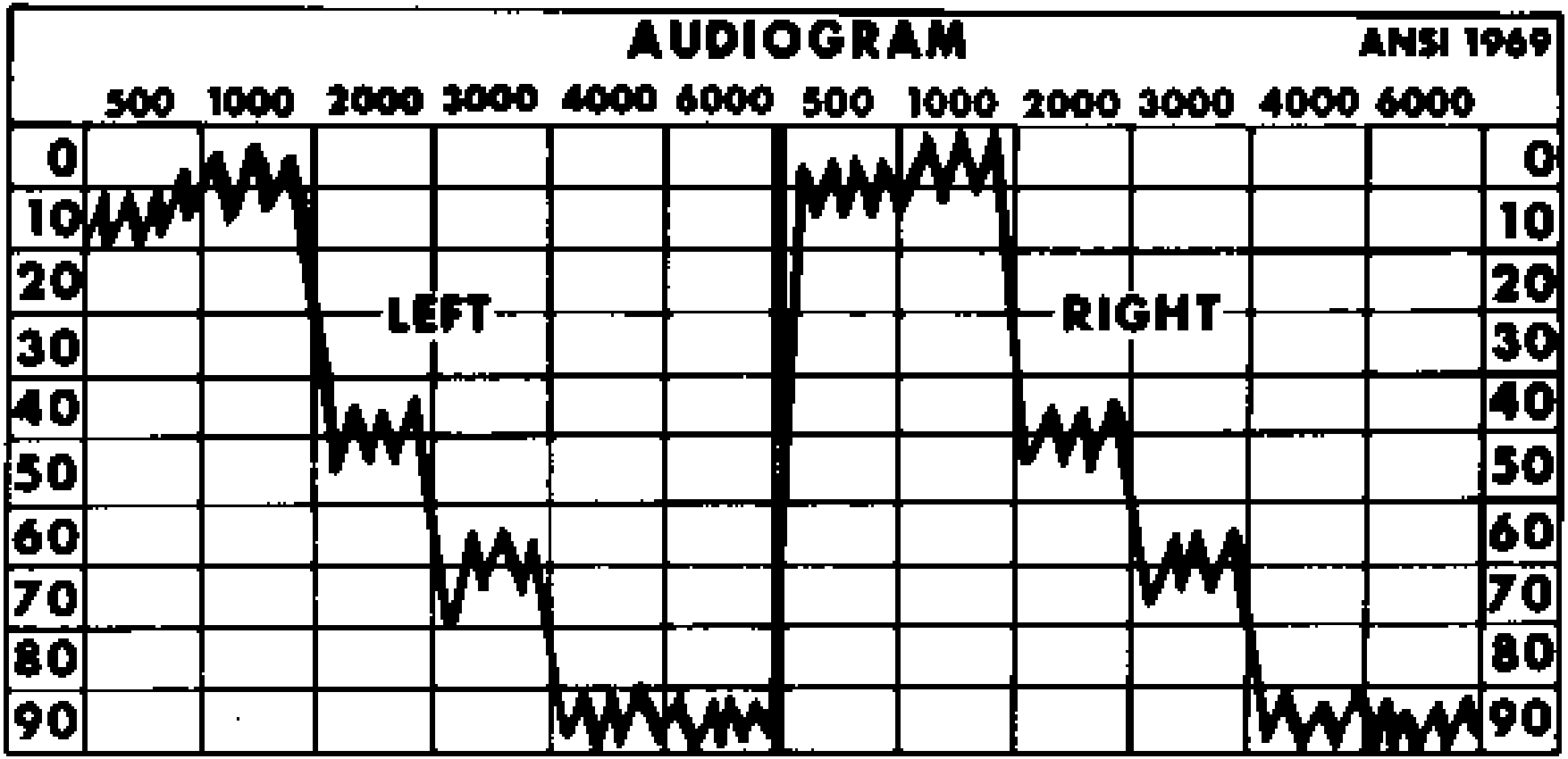
Graphic Audiograms

- Provides a pictorial representation of hearing thresholds as a function of frequency and intensity
- Uses symbols and/or colors to represent right ear, left ear, bone conduction hearing and masking levels

Graphic Audiograms



Self-recording Audiogram

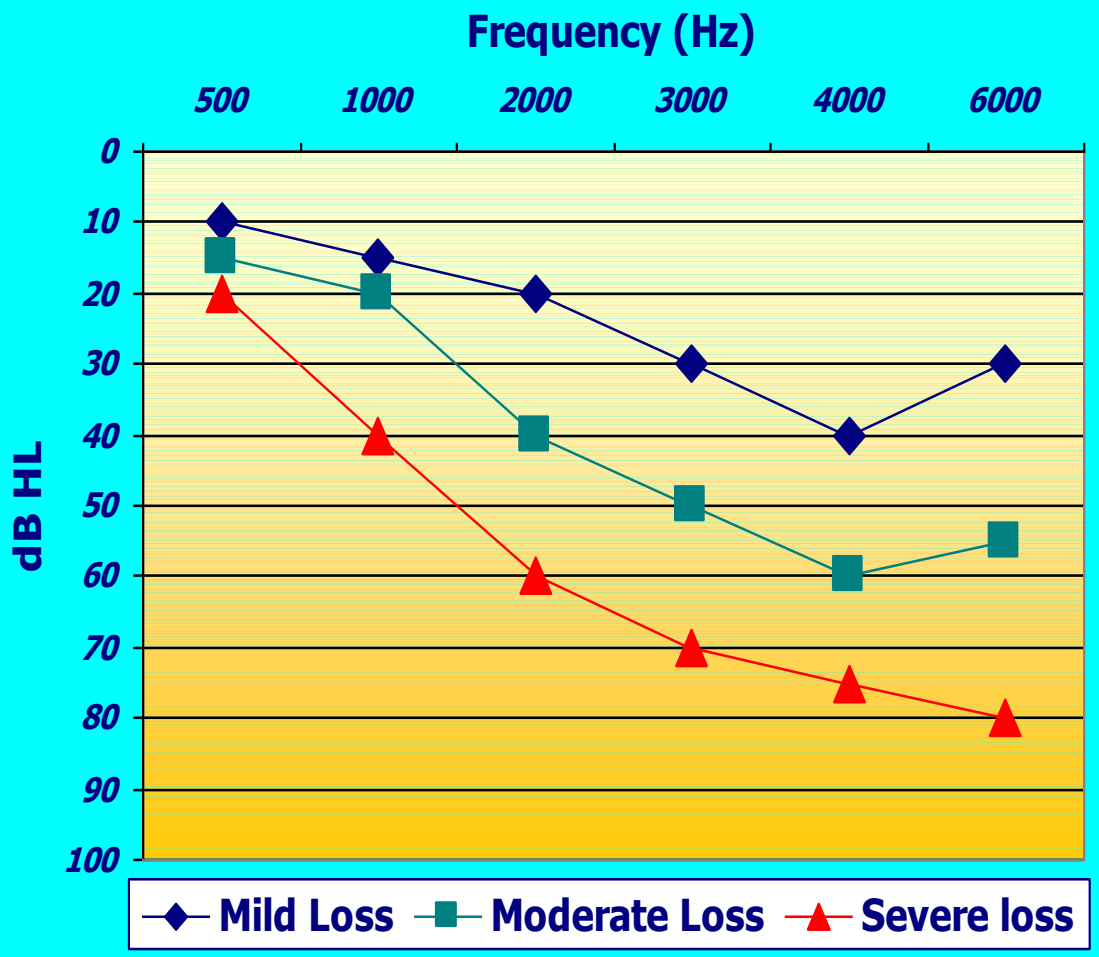


Degrees of Hearing Loss

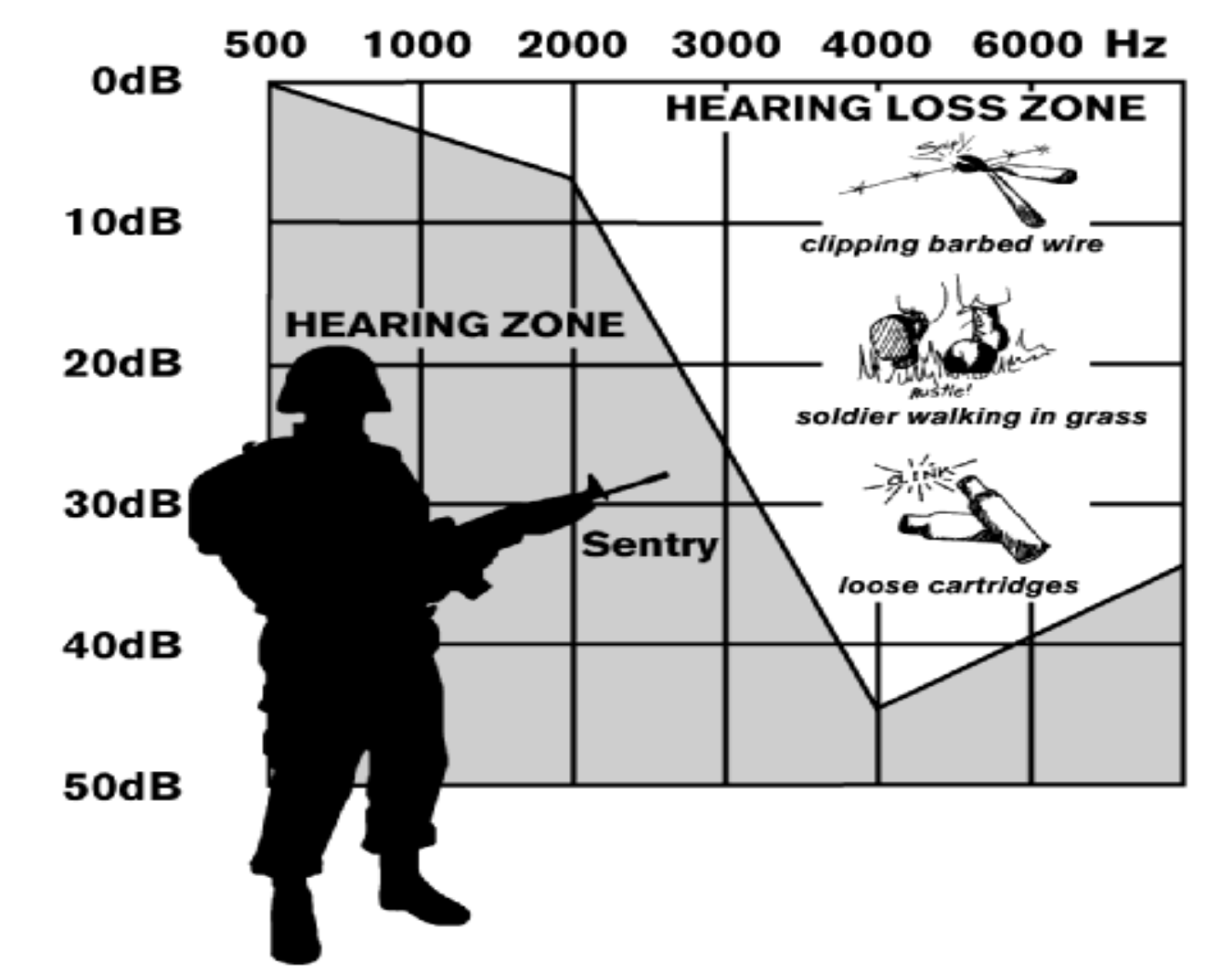
Normal Hearing	-10 - 25 dB HL
Mild Hearing Loss	30 - 45 dB HL
Moderate Hearing Loss	50 - 65 dB HL
Severe Hearing Loss	70 - 85 dB HL
Profound Hearing Loss	> 90 dB HL

Audiogram Configurations:

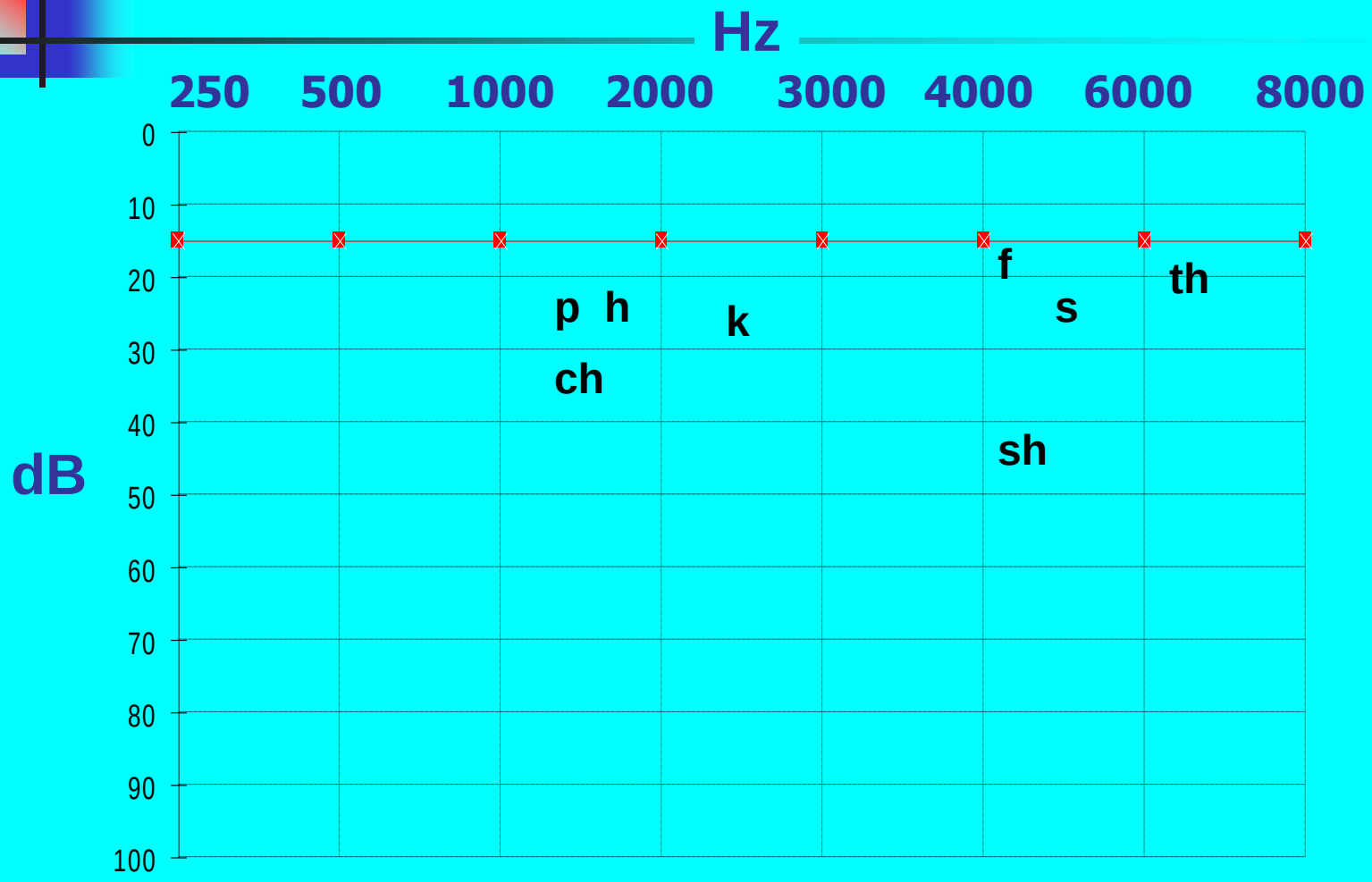
Progressive noise-induced hearing loss



Hearing Loss Zones



Speech Sounds



Audiogram Configurations:
Gundecking

Left Ear					
500	1000	2000	3000	4000	6000
0	*0*	*0*	*0*	*0*	*0*

Right Ear					
0	*0*	*0*	*0*	*0*	*0*

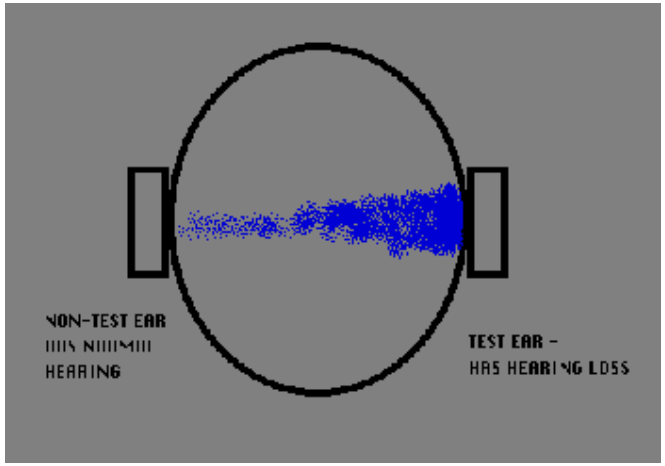
Audiogram Configurations:
Background Noise

Left Ear					
500	**1000**	**2000**	**3000**	**4000**	**6000**
30	***5***	***0***	***5***	***0***	***0***

Right Ear					
30	***0***	***5***	***0***	***0***	***0***

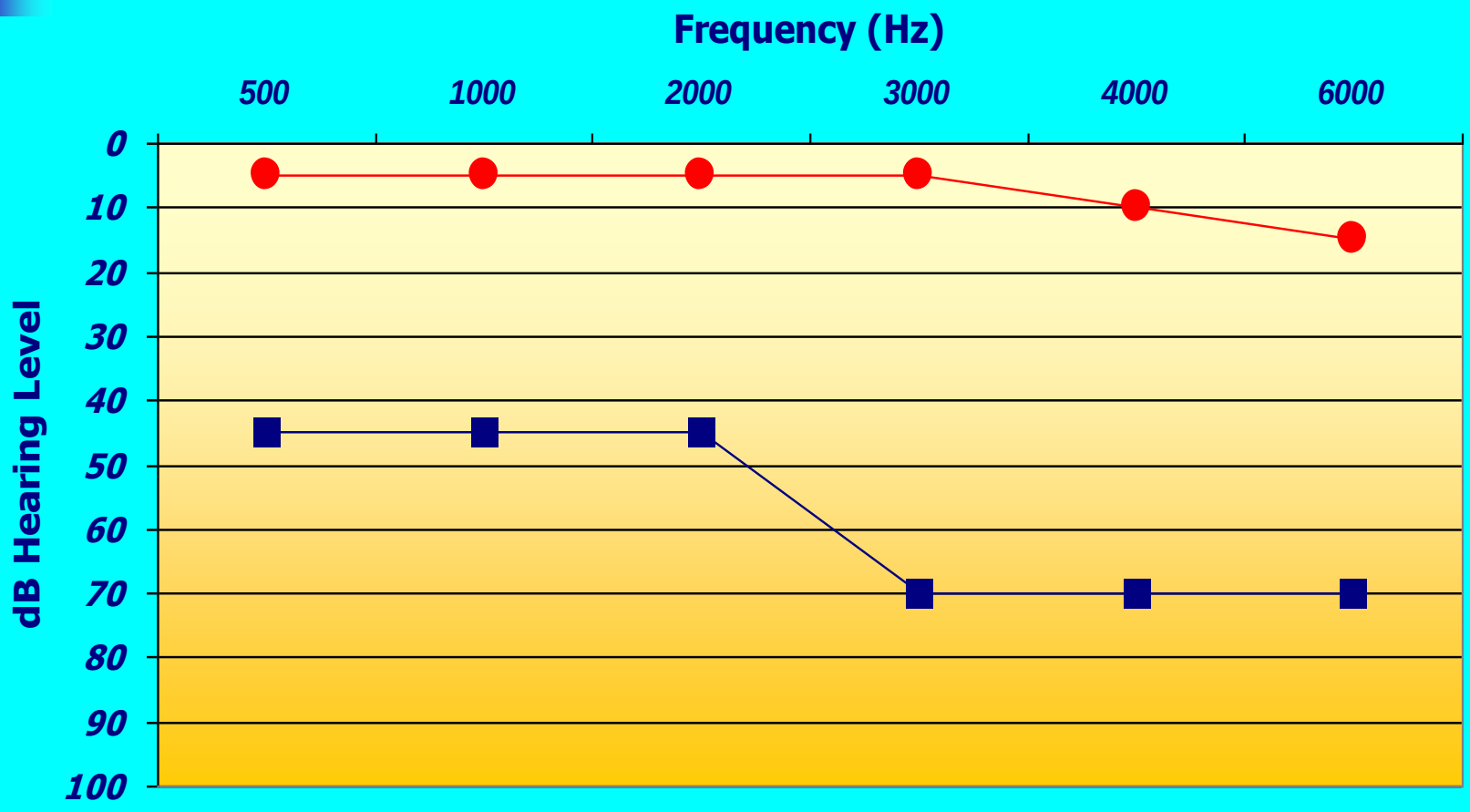
Cross-over

- **One ear hears much better than the other**
- **The sound presented to the test ear crosses through the skull and stimulates the hair cells of the cochlea of the non-test ear**
- **The non-test ear is the one actually responding to the tone**



- **Differences of $\geq$ 40 dB at the same frequency between ears are suspicious**

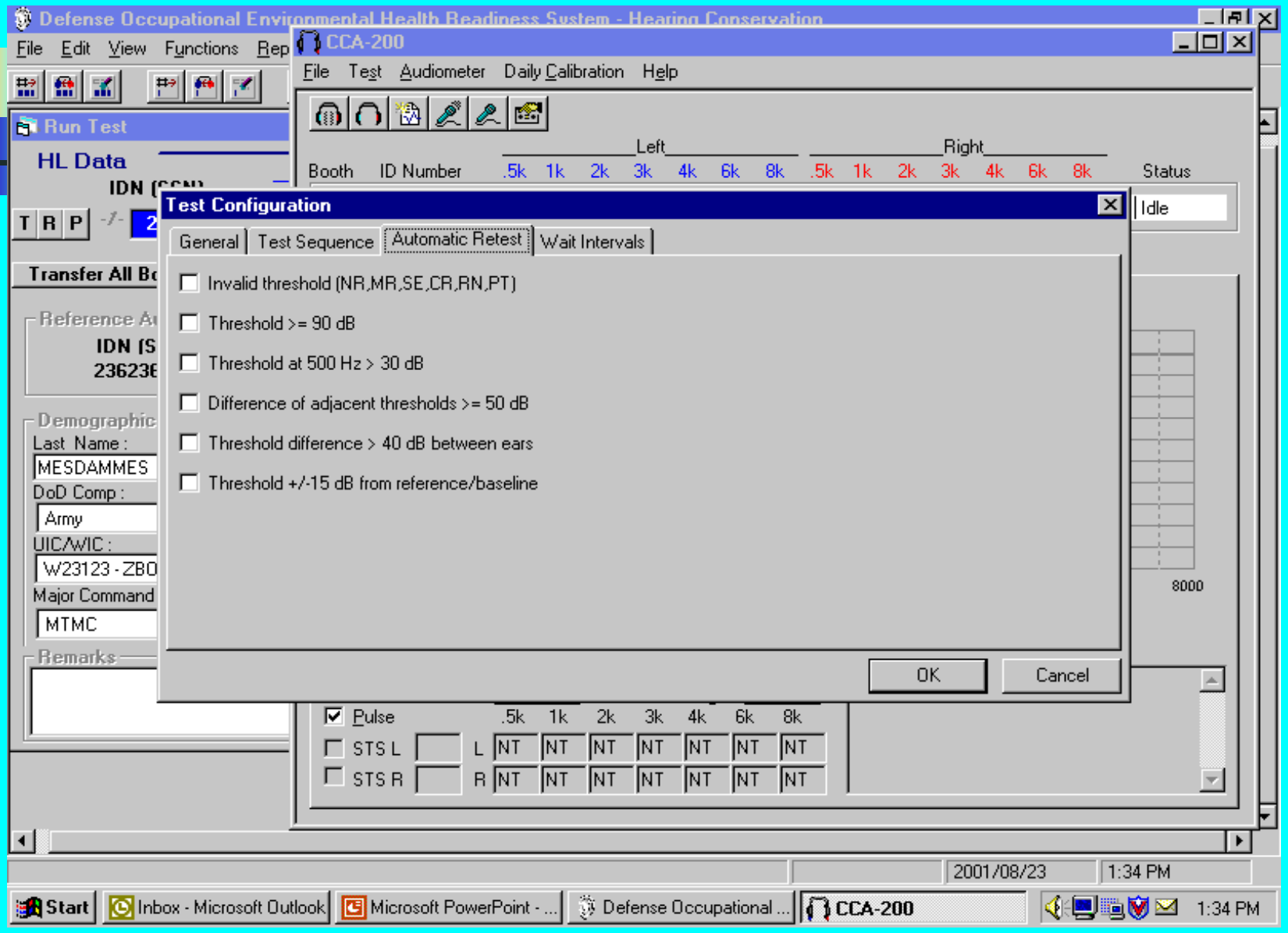
Cross-over


Frequency (Hz)
500
1000
2000
3000
4000
6000
dB Hearing Level
0
10
20
30
40
50
60
70
80
90
100

Malingering

- Pretending to have a hearing loss by waiting until the sound is quite loud before pressing the response button
- IAW Article 115, Paragraph 194, a person may be charged with malingering if he/she pretends to have a hearing loss that is later found to be non-existent

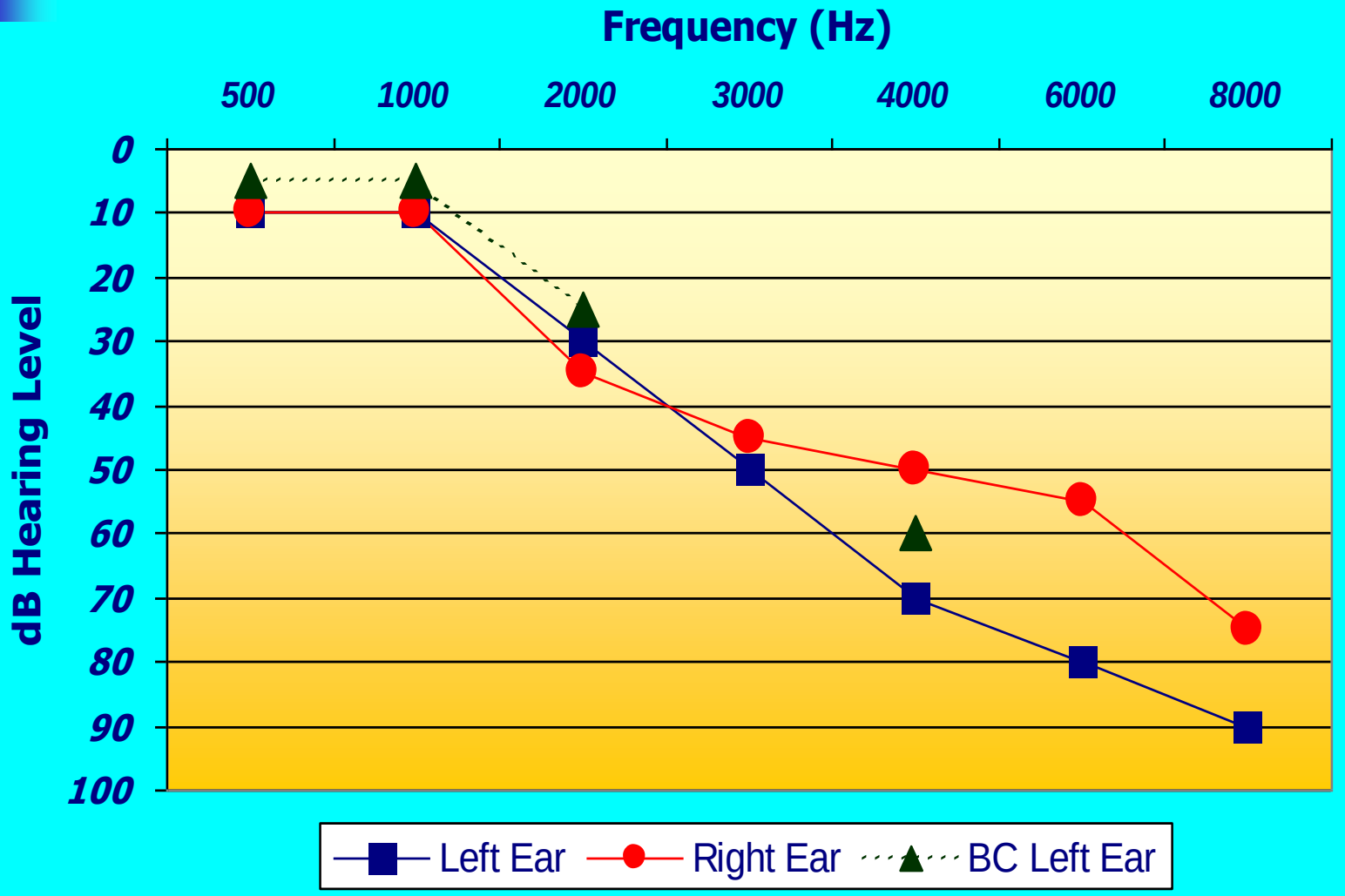
Automatic Rechecks



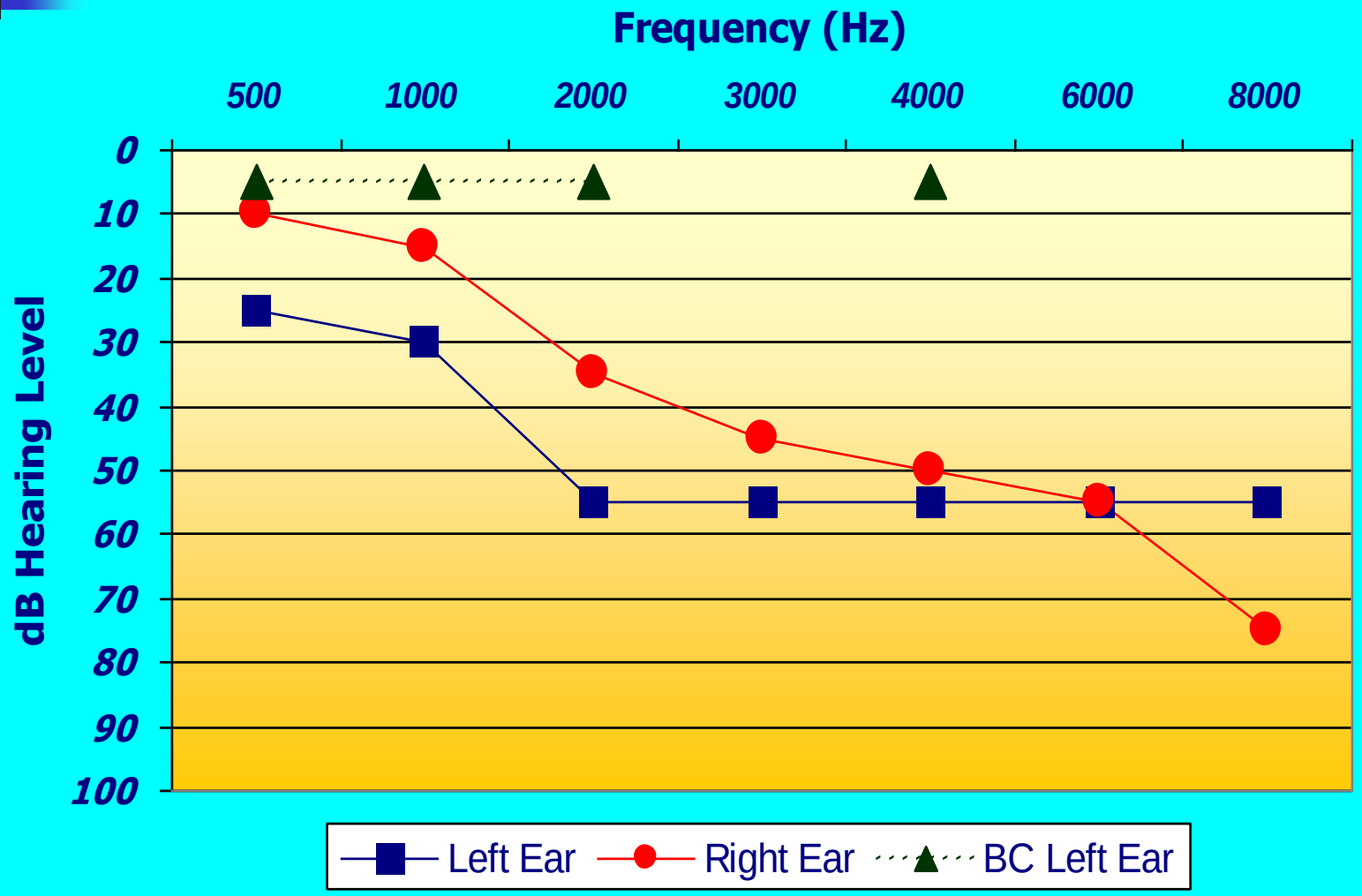
Sensorineural Hearing Loss

- Determined by a complete audiological evaluation
- Compare air-conduction and bone-conduction pure-tone thresholds
- Look at acoustic immittance test results

Sensorineural Hearing Loss



Conductive Hearing Loss



Counseling Patients

"Well, as we thought, it's something gross."

Explain the Test Results

- Provide privacy for explanation
- Both ears tested
- Frequencies tested
- The lower the threshold, the better the hearing
- Review each ear in terms of intensity and frequency

Appropriate Explanations

- Within normal limits
- Loss in the high or low frequencies
- Loss in one or both ears
- Hearing has changed or remained the same

Making Diagnoses

"It could be one of those things that crawl into your ear and lay eggs, and the eggs hatch and burrow into your—nope. It looks fine."

Medical Legal Requirements
Regardless of Type

- Patient's name, SSN, (MOS, SSI, Job Location, and Unit Identification Code)
- Examiner's name, SSN, and certification number
- Date of Test
- Make, model, and serial number of audiometer
- Calibration date of audiometer.

DOEHRS-HC supplies most of the necessary medical legal audiogram information

AUTOMATICALLY

DD Form 2215

Reference Audiogram

- For all military and noise-exposed civilians
- Performed before noise-hazardous duties or as soon as possible thereafter
- Noise-free period of at least 14 hours before the test
- No temporary ENT problems the day of test
- Refer for low-frequency or high-frequency hearing loss
- After a permanent STS, re-establish a new baseline

DD Form 2216

Hearing Conservation Data

- Periodic audiogram
- Annual
- 90 - Day
- Termination
- Other

Forms

General Information

- Maintain audiograms for entire period of employment plus 5 years
- Test must be performed by audiologist, physician, persons certified by CAOHC, or one who has received equivalent military training
- Equivalent military training includes this course. The certification from this course and other Army courses is only 5 years

Audiogram Review

Trained personnel must review all audiograms for validity and proper patient disposition.

Who Reviews?

- Initially any Hearing Conservation Technician
- Problem audiograms must be reviewed by an audiologist, otolaryngologist or other physician

Audiograms to Refer

DD 2215's

> 25 dB at 500, 1000, and 2000 Hz

> 55 dB at 3000, 4000, or 6000 Hz

DD 2216's

Significant Threshold Shift (STS) computed from the average of 2000, 3000, & 4000 Hz in either ear in comparison to the baseline or reference hearing test (DD2215)

Factors Affecting Validity

- Poor test environment - audiometric test booth does not meet background noise criteria
- Cross-over hearing
- Uncooperative patients

Review Questions

- Does an audiometric booth need to be perfectly soundproof?
- Excessive noise in an audiometric test booth will probably effect which frequency?
- When hearing levels between ears at the same frequency differ by 50 to 70 dB, what should you suspect is going on?