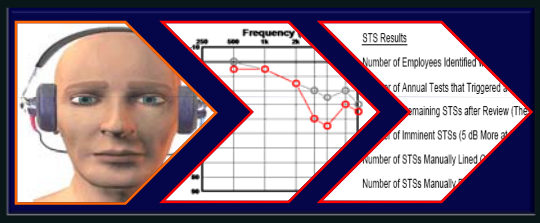
How Can I Use Audiometric Data Effectively?

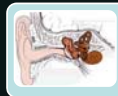
What Tools, Resources and Evidence Exist?



DICK DANIELSON, Ph.D.
National Space Biomedical Research Institute
Baylor College of Medicine, Houston TX

Objectives

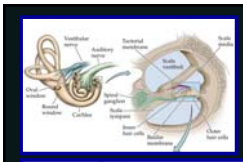
- Review basics of audiometry and NIHL
- Describe roles of Professional Supervisors
- Identify critical steps involved in referrals
- Describe, and apply, practical protocols for determining work-related hearing loss.
- Recognize hearing conservation data management tools



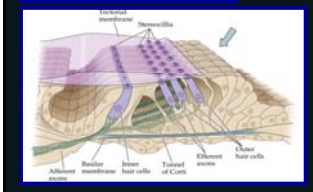
AUDITORY DAMAGE

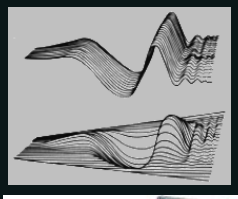
- Anatomical
- Audiometric

3

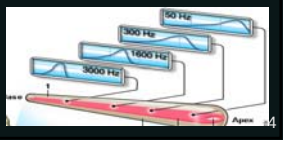


Site of lesion: COCHLEA





Cochlea is organized tonotopically



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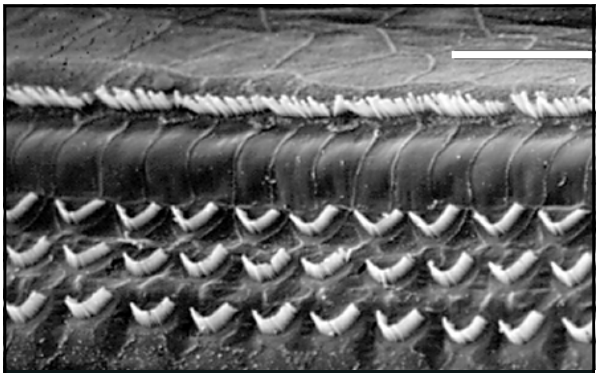
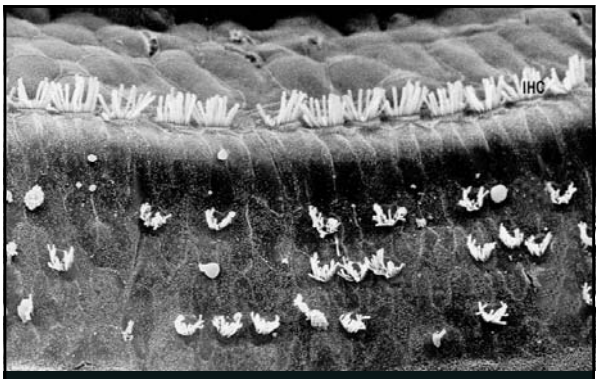


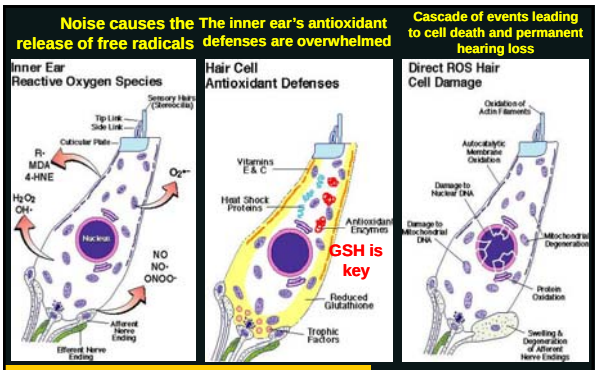
Hearing Hair Cells (Normal)

Hearing Hair Cells (Temporary Damage)



Hearing Hair Cells (Damaged By Noise)

Outer hair cells damaged, not inner hair cells



ROS and free radical damage Increase inner ear antioxidants (GSH)

Kopke and Danielson (2003) CAOHC Update

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Cochlear Damage Reduces Speech Understanding

BUT… Auditory success involves MORE than just hearing beeps!

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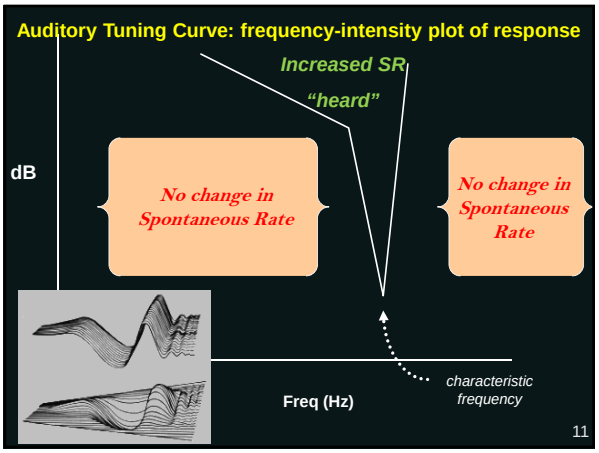
Auditory Tuning Curve: frequency-intensity plot of response



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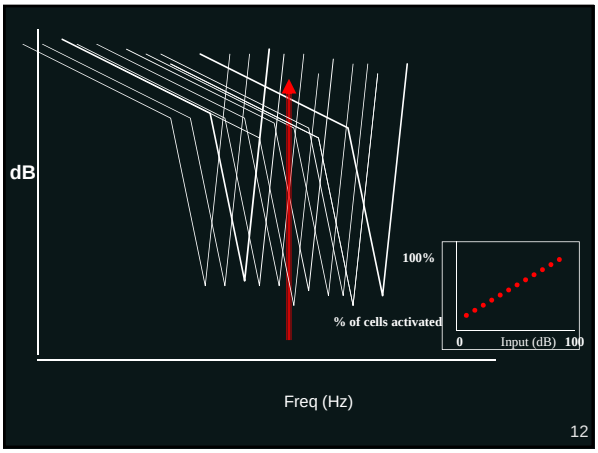

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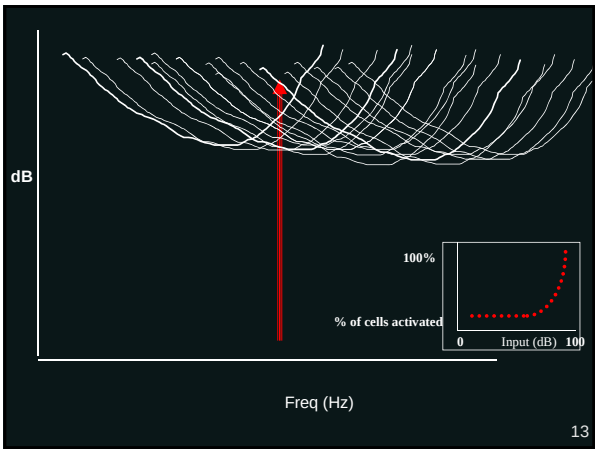

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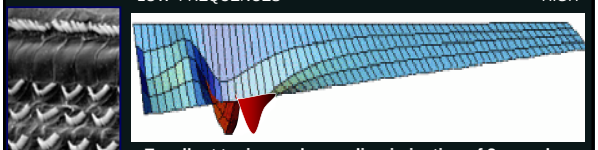
Effects of Noise on Hearing (shown in Anatomical Damage) in terms of Cochlear Tuning

LOW FREQUENCES ---------- HIGH



Excellent tuning and easy discrimination of 2 sounds

Poor cochlear tuning, require 2 sounds to be more separated, in order to discriminate one from another; have difficulty understanding speech in noise, and can't tolerate sounds that others can tolerate

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Acoustic Trauma

- Considered ***occupational injury***
- Single exposure, obvious history, including identifiable chronology
- Can be tied to specific event's date/time

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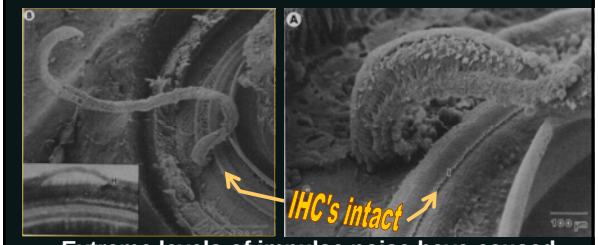
Inner ear damage (animals)



Extreme levels of impulse noise have caused organ of Corti (with Outer Hair Cells) to separate from basilar membrane

Roberto, Hamernik Turrentine. Ann Otol Rhin Laryng (1988)

16

Noise-Induced Hearing Loss

- Considered ***occupational illness***
- Caused by a exposure to toxin (noise)
- Currently being monitored by audiometry
  - *Baseline*
  - *Annual*
  - *Termination*

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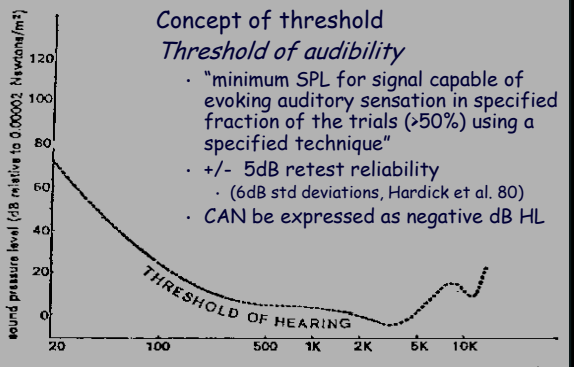
Conventional Metric: Pure tone audiometry

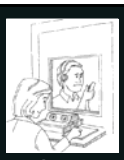
Pure tone audiometry



Concept of threshold

Threshold of audibility

- "minimum SPL for signal capable of evoking auditory sensation in specified fraction of the trials (>50%) using a specified technique"
- +/- 5dB retest reliability
  - (6dB std deviations, Hardick et al. 80)
- CAN be expressed as negative dB HL



What's really measured in audiometry?

Task: **Determines sensitivity for pure-tone stimuli.**
Detect "pure tone" (or beep) at softest level you think you hear the beep

"Hearing Threshold" –
Defined as "*softest tone detected 50% of the time*"

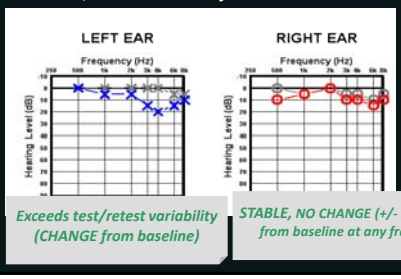
Protocol accommodates "guesses" at soft levels, since procedure brackets (up and down) in region where listener is just barely able to detect tone

Considerations, Air Conduction, Pure-tone Audiometry (Routine Monitoring)

Psychophysical (not objective) technique:

"Bracketing" technique, in 5 dB steps

Test, Re-test variability: +/- 5 dB



Exceeds test/retest variability (CHANGE from baseline)

STABLE, NO CHANGE (+/- 5 dB) from baseline at any freq)

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What is OSHA's position regarding the required "quiet time" before audiometric testing is done?

Baseline must be immediately preceded by 14 hours without workplace noise.

Can an employee's audiometric testing be conducted after the employee has worked a full-shift in a noisy environment, and was wearing hearing protection?

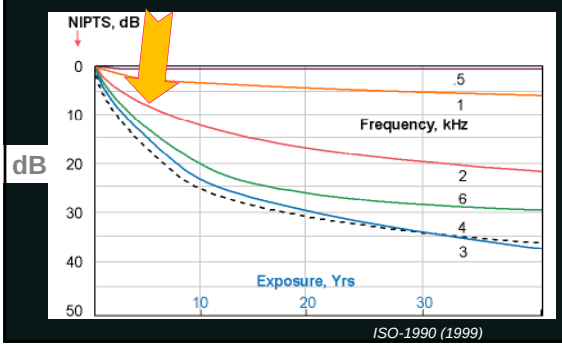
YES

OSHA Ltr: 12/21/2007 - Clarification of OSHA's requirement for 'quiet time' before audiometric testing.

Perform baseline early

- (OSHA: w/in 6 months of first exposure, or within 1 year if mobile van used)
- NASA: Before work assignments in noise, or at least w/in 30 days

Fastest Growth of Noise-Induced Permanent Threshold Shift (NIPTS) Occurs in First Few Years of Exposure (Employment)



ISO-1990 (1999)

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Periodic (Annual) Audiometry

Performed annually, any time during the work shift

NO requirement for noise-free period prior to annual audiograms

- Results of annual compared to baseline
- Since employee is presumed to be wearing hearing protectors, a "shift" could be due to inadequate protection

Q. ***If an employee must be notified of an STS "within 21 days", is that period:***

- 21 days from the date of the audiogram?
- 21 days from the time the company receives the results of the test from the testing service?
- 21 days from the time the company makes its determination that a STS has occurred, (after having received test results)?
- 21 working days or 21 calendar days?

Response: Employees must be notified of their STS within 21 calendar days from the date that the determination is made that their audiometric test showed the STS.

OSHA Standard Interpretation of 06/25/1986 - Time period for notifying employees of a standard threshold shift (STS).

Q. ***What obligation does the successor owner have to retain the medical surveillance records; specifically, hearing tests, from the previous owner?***

Response: *when an employer ceases to do business, that employer is required to transfer all records to the successor employer. The successor employer must retain noise exposure measurement records for 2 years following the date of the exposure measurement. Audiometric test records are required to be retained for the duration of the affected employee's employment with the successor employer. Therefore, the successor owner would be aware of the employees' hearing losses. The act of terminating and re-hiring the employees would not relieve a successor employer of responsibility for the employees' hearing.*

OSHA Standard Interpretation of 04/27/2004 - Retention of exposure and audiometric testing records by successor employers.

Q. ***What obligation does the successor owner have to use existing baselines from the previous owner in hearing conservation management?***

Response: *The successor would normally continue to use the baseline audiograms established by the former employer, **unless there is a good-faith and reasonable basis to question the validity** of these baseline audiograms. When the successor owner continues to use the baseline audiograms established by the former employer, the successor employer also must continue the established annual schedule for future audiograms. In addition, within six months of a new employee's initial exposure, the successor employer must establish a valid baseline audiogram for any new employee who was not employed by the former employer and who is exposed to sound levels in excess of 85 dBA TWA.*

*The employer also may **continue to use recent noise monitoring results from the former employer, as long as workplace conditions and practices that affect noise levels remain relatively similar**, such that noise levels reasonably are not expected to deviate from the old readings to any significant extent.*

OSHA Standard Interpretation of 04/27/2004 - Retention of exposure and audiometric testing records by successor employers

Controversy re: use of age corrections when calculating hearing threshold shifts

OSHA "Allows" age corrections when comparing current to baseline audiogram

NIOSH Does not recommend use of age corrections

- Data derived from outdate data in 60's and 70's (that's now being questioned re: actually being "noise free"),
- Use of non-age-corrected STS encourages early identification of early indicators of hearing loss & increases sensitivity of program

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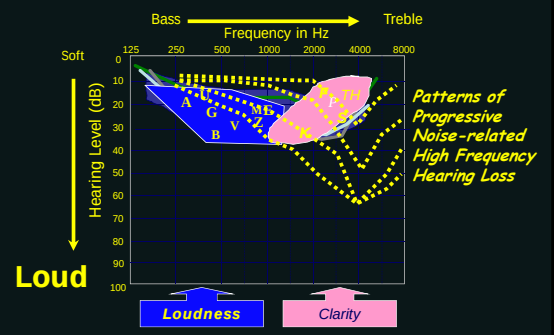
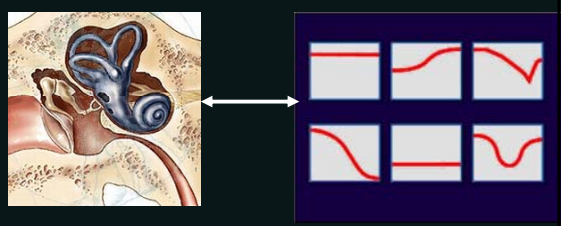
Typical Long-term Effects of Noise on Human Hearing Thresholds



Audiometric Correlates to Auditory Physiology



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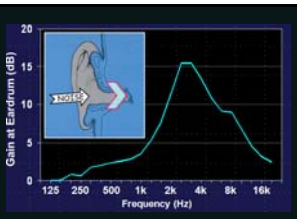
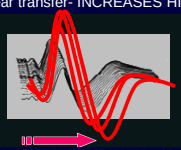
Why 4kHz?



External ear transfer- INCREASES HIGHS



Middle Ear Muscles and Acoustic Reflex
DECREASE LOWS
(what might happen if no AR?)

Basilar Membrane Dampens Apical End
SHIFTS DAMAGE, 1 to ½ OCTAVE

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CAOHC Occupational Hearing Conservationist Certification

Council for Accreditation in Occupation Hearing Conservation (CAOHC):

Recognized by OSHA, required by MSHA and NASA, recommended by NIOSH

- **9 organizations represented on CAOHC Council**
- **Ensures uniform standards of practice for your audiometric monitoring program**
- **Certification after attendance at 20-hour CAOHC-approved course**

(recertification every 5 years)

ALL TESTERS MUST BE RESPONSIBLE TO A PROFESSIONAL SUPERVISOR

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WHAT'S A "PROFESSIONAL SUPERVISOR (of the audiometric monitoring program) ?

"a technician who performs audiometric tests…….must be responsible to an audiologist, otolaryngologist or physician…(who) shall review problem audiograms….determine whether there is a need for further evaluation……revise audiometric baselines ……(and) supervise and be responsible for the training and competence of the OHC"

OSHA Hearing Conservation Amendment 29 CFR 1910.95(g)(3)

Don't these terms refer to the same person?

Supervisor *(of the HC Program)*	***Professional Supervisor*** *(of the audiometric monitoring program)*
Usually safety, human resources or other administrator	*Has responsibility for the overall audiometric test program and to ensure that the tests conducted by the technicians are conducted properly)*
Responsible for overall management and effectiveness of hearing conservation program	
May also be the direct administrative supervisor of the OHC	

What are Roles of a Professional Supervisor ?

1. Supervises the training and competence of the Occupational Hearing Conservationist
2. Reviews problem audiograms
3. Determines if further evaluation and referral are needed
4. Verifies an STS and determines if it is "work-related"
5. Revises baselines, if warranted (using criteria)

** Must be physician or audiologist*

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Please define "problem audiograms" in the context of the hearing conservation standard

A. Examples of problems audiograms are: Audiograms that show large differences in hearing thresholds between the two ears, audiograms that show unusual hearing loss configurations that are atypical of noise induced hearing loss, and audiograms with thresholds that are not repeatable.

See http://www.osha-slc.gov/OshDoc/Interp_data/I19940509A.html

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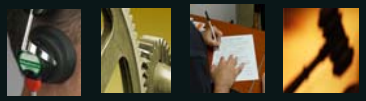
What's involved in Determining Work-Related Hearing Loss?

Model described by Rabinowitz, PM. (2005). Determination of work relatedness. CAOHC Update



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Why is Work-relatedness Determination Important?

- Identifies unacceptable noise exposures, can lead to noise reduction and prevention
- Identifies problems with hearing conservation program
- If not work-related, important to determine other causes of hearing loss and arrange for necessary treatment

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1. Is the Audiometric Test Valid?

Rabinowitz, PM. (2005). Determination of work relatedness. CAOHC Update

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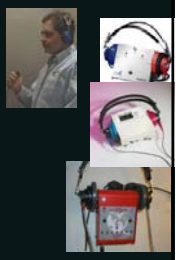
Is the test environment adequate?

Methods of calibration

1. Functional Check, Each day of use

- BIOLOGICAL LISTENING CHECKS
  - Test *same* subject
- BIO-ACOUSTIC SIMULATORS
  - Checks audiometer output
  - Does not eliminate need for listening check or annual cal
  - Might measure background noise in test room



2. Acoustic Calibration

Annual - Measures output and checks linearity

Is the test environment adequate?

Less than maximum allowable ambient noise levels? (NASA NPR 1800.1c)

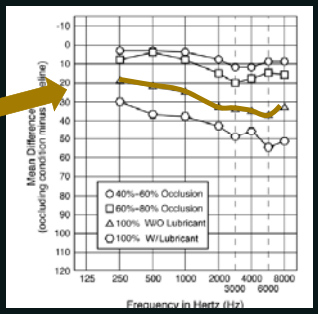
Per ANSI S3.1 1999

Hz	500	1000	2000	4000	8000
dB SPL	21	26	34	37	37

Was the ear canal obstructed?

> 60% occlusion

shown to affects thresholds



Roeser et al. (2005) J Am Acad Audiology 16:740-746

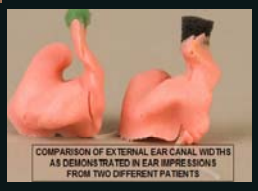
Cerumen Impaction Increases with Age

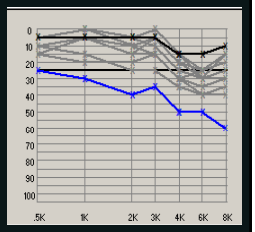
Age Range (In Years)	Impaction Percentage
26-44	5%
45-54	15%
55-64	25%
65-75	34%
75-84	22%

Ballachandra (1995) The Human Ear Canal

Was the ear canal obstructed?

Does the Ear Canal Collapse?

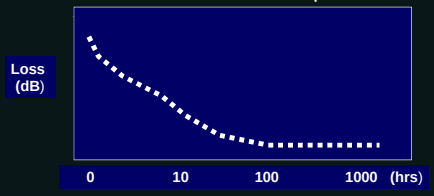




- Numerous Fluctuations in Air Conduction Thresholds
- Condition identified in clinical evals

Is shift permanent, not temporary?

- TTS shows greatest recovery within~12-14 hours
- If loss still present after 30 days, considered PTS
- If no TTS, no PTS expected
- However, no absolute relationships



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Baseline Revision

OSHA: Annual audiogram *may* be substituted for baseline when PS determines that a significant improvement exists or STS is persistent

	Right						Left					
Frequency	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
Current	5	5	10	20	15	15	5	10	10	20	25	20
Baseline	40	35	30	20	15	10	40	40	30	25	20	15
Shift			-20	0	0				-20	-5	5	

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Baseline Revision (NHCA, 2001)

1. *Revision for Improvement*
   If average hearing level at 2k, 3k, and 4k in either shows improvement of 5 dB or more, and improvement persists on next test (either annual or retest), may be flagged for review by PS *(NO age corrections)*
2. *Revision for Persistent OSHA STS*
   If STS persists on next annual test (or next test given 6 months later), may be flagged for review by PS. Unless PS determines for reason to NOT revise, the baseline for that ear should be revised to STS test that shows lower (more sensitive) value for ave of 2k, 3k, 4k Hz.
   No baseline revisions without six-month intervals

See appendix K, CAOHC Manual, 2002

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Q. ***How should baseline audiograms should be revised ?***

(*both ears at same time? each ear separately?)*

Response: *When the professional evaluating the audiogram determines that a baseline revision is appropriate, whether due to a persistent STS or improved thresholds, the baseline must be revised for each ear separately*

OSHA Standard Interpretation of 05/08/2003 - Baseline audiogram revision due to persistent STS or improved thresholds; revision must be made for each ear separately.

Q. What is OSHA's position regarding which audiometric baseline is used for someone who is rehired?

OSHA's response:

Employers may use the original baseline audiogram for rehired employees provided that: (1) the employer has retained the original baseline; and (2) the original baseline was valid.

If the previous audiograms were not retained, then the first valid audiogram obtained from the employee after rehire would become the baseline audiogram.

The decision on whether or not a rehire baseline is appropriate should be made by the audiologist or physician.

Standard Interpretations 02/08/2005
Audiometric baseline revisions in employee rehire situations.

Is there evidence of malingering? "NONorganic"

Suspicion warranted:

- Flat audiogram (50-60dB, all freqs)
- High variability when retesting for thresholds
- Exaggerated response to stimuli
- Behavior not consistent with loss
- Audiological signs:
  - Discrepancies b/w pure tone average (.5-2kHz) and Speech Reception Threshold
  - Atypical responses (e.g., half-word responses)

2. Is the Employee Exposed to Potentially Damaging Noise (or Ototoxic Chemicals) at Work?

Rabinowitz, PM. (2005). Determination of work relatedness. CAOHC Update 52

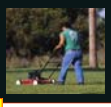
Damage Risk Criteria (DRC)

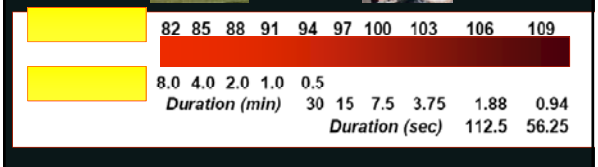
What is the

"Correct" Damage Risk Criteria?

- **HOW MANY ARE YOU WILLING TO PUT AT RISK?**
- **WHAT IS MAX DAILY NOISE EXPOSURE THAT WILL NOT CAUSE MEASURABLE HEARING LOSS OVER A PERIOD OF MANY YEARS?**
- **WHAT DAILY NOISE EXPOSURE WILL CAUSE MEASURABLE HEARING LOSS OVER A PERIOD OF MANY YEARS?**

NASA Hearing Conservation Standard NPR 1800.1c
(Considers levels and duration)





Hearing Protection is recommended for each of these exposure conditions (all contain equal energy)

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Q ***How often would an employee have to be exposed to noise levels in excess of the 85dB TWA before being required to be covered by the company HCP (i.e., one day, ten days, thirty days)?***

One day. ***All employees*** *exposed at or above 85-dB (TWA) must be included. This includes employees who may have only occasional exposures at this level. Thus, for example, the HCP provisions would apply with respect to an engineer or other such employees who visit a facility several times a year and are exposed to TWA noise levels at or above 85 dBA, even though they may not experience any other such exposures during the year.*

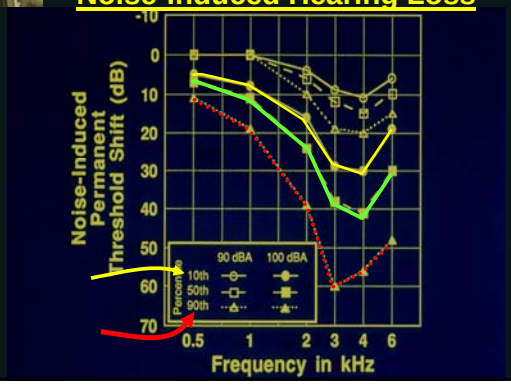
OSHA Standard Interpretation of 02/13/2004 – "Employees with occasional exposure to noise levels in excess of 85 dBA TWA must be included in the company's hearing conservation program"

Q. ***Once in the program, how long does an employee have to go without being exposed to 85 dB to be removed from the program?***

Response: *Employees who have not been exposed to noise levels equal to or exceeding 85 dB (as an 8-hour TWA) for an entire year following their last annual audiogram may be removed from the program.*

OSHA Standard Interpretation of 02/13/2004 - Minimum exposure for inclusion in the hearing conservation program (HCP); removal criteria.

Individual Susceptibility to Noise-Induced Hearing Loss



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Occupational/Environmental Ototoxins Can Interact Synergistically with Noise Exposure

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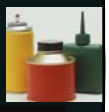
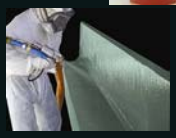
Which Organic Solvents Could Present an Ototoxic Risk?

- ***Styrene*** *(most prevalent, toxic)*
- ***Trichloroethylene*** *(degreaser, dry cleaning agent, "sniffer")*
- ***Carbon Disulfide***
- ***Toluene***





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Do impulse noises place one ear at risk?

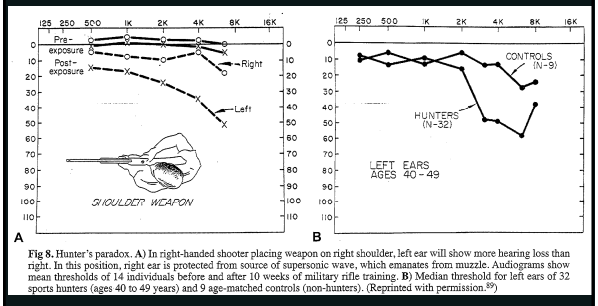

Fig 8. Hunter's paradox. **A)** In right-handed shooter placing weapon on right shoulder, left ear will show more hearing loss than right. In this position, right ear is protected from source of supersonic wave, which emanates from muzzle. Audiograms show mean thresholds of 14 individuals before and after 10 weeks of military rifle training. **B)** Median threshold for left ears of 32 sports hunters (ages 40 to 49 years) and 9 age-matched controls (non-hunters). (Reprinted with permission.[89])

Clifford and Rogers, 2009

3. Is the Hearing Loss Consistent with NIHL, OR is There a Medical Condition Present That Can Completely Explain the Loss?

Rabinowitz, PM. (2005). Determination of work relatedness. CAOHC Update 61

Noise-Induced Hearing Loss Evidence-Based Statement ACOEM, 2002

- Always sensorineural
- Typically bilateral
- Loss usually not greater than 75dB
- Rate greater in first 10-15 years
- No progression when noise exposure stops
- 4kHz " Notch" is typical first sign

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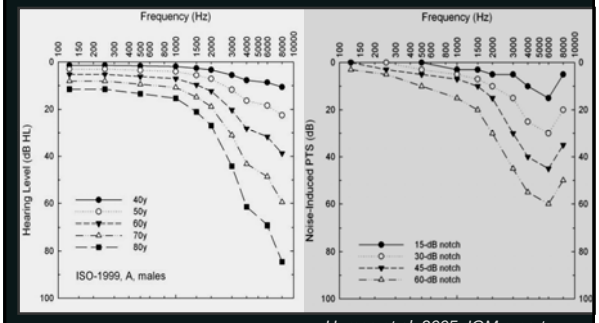
Comparison of Pure Age-Effects and Noise-Effects on Hearing Levels



Humes et al. 2005 IOM report

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REFERRALS TO A CONSULTANT

- **What should your clinic SEND?**
- **What should your clinic EXPECT?**

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Must every STS be referred?

"An *audiogram* is not the sole indicator of a need for a referral. As mentioned above, the professional reviewer would determine if an employee needs to be referred for further testing or examination. "

http://www.osha-slc.gov/OshDoc/Interp_data/I19980602.html

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WHEN SENDING REFERRALS…

1. Referral decision made by PS
2. Notify employee in writing about the decision to refer and why
3. Provide all previous serial audiograms
4. Provide information about noise exposure (and work) history
5. State reason for referral (in writing):
    1. *Invalid test at plant*
    2. *STS*
    3. *Cerumen removal and retest needed*

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IN TURN, REFERRAL SOURCES SHOULD PROVIDE…

1. Pure-tone air and bone conduction thresholds (with 3k and 6k Hz)
2. Other audiological data , including comment re: RELIABILITY
3. ID information
   - Audiometer make, model, SN, cal date
   - Type of earphone used
   - Audiologist's name and title
4. Comments re: nature of hearing loss from audiologist and/or physician

"Please advise… more likely than not caused by noise exposures?"

Q. When is the company responsible for paying for the referral to a physician?

OSHA's response:

"The company must pay for any referrals that are for the purpose of further identifying the effects of occupational noise exposure or any detrimental effects from wearing hearing protectors. Medical pathologies which are clearly not related to the wearing of hearing protectors or an otoscopically abnormal eardrum due to an allergy or cold are not the employer's responsibility."

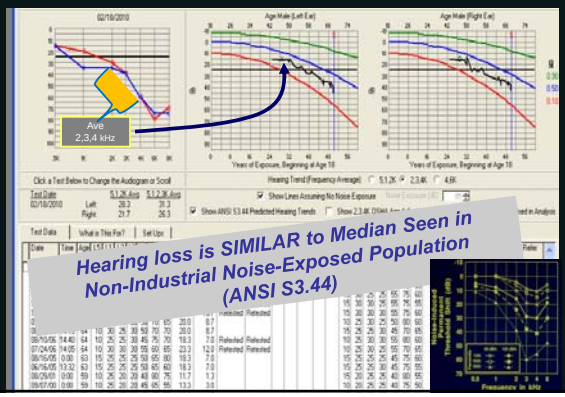
Standard Interpretations *06/02/1998*
Hearing conservation: referrals, financial responsibility, and documentation.

ANSI S3.44-1996, Determination of Occupational Noise Exposure and Estimation of Noise-Induced Hearing Impairment

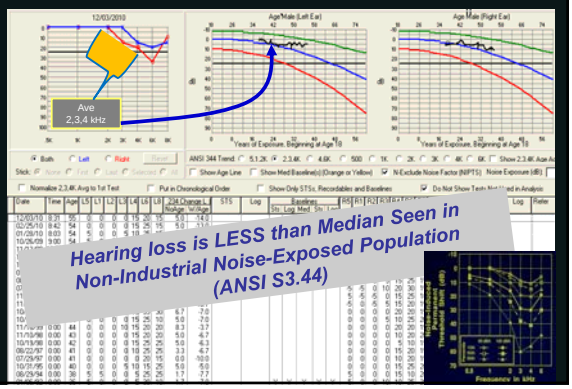
Model includes estimations of hearing loss in:

- ***Non-Industrial Noise-Exposed Population (NINEP***
- ***Workers exposed to noise (without hearing protection) for up to 40 years***

Individual Hearing Trends (example 1)



Individual Hearing Trends (example 2)



Non-occupational Exposures

- Important to document, both for medical legal and prevention purposes
- Cannot attribute all of loss to non-occupational exposure if individual is also noise exposed at work.

Reasons to Consider STS as Not Work-Related

- Documentation that individual not noise-exposed at work
  - *(Caution- excessive peak exposures may cause loss, even if 8 hour TWA less than 85).*
- Documentation of medical reason to completely explain loss.
- Documentation of test error or malingering

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Aids in Work-relatedness Determination

- ACOEM Position Statement on Noise-induced hearing loss
- AAA Position Statement
- Presence of audiometric "notch"
- Audiometric history
- Exposure history, documentation
- Medical history, examination
- Results of audiological evaluation
- Team approach

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Q. ***Can an employer force an employee to take an annual audiometric tests as part of their proactive approach to control occupational or non-occupational hearing loss?***

Response: OSHA's Noise standard requires only that audiometric testing be made available to all employees whose exposures equal or exceed an 8-hour time-weighted average of 85 dBA. On the other hand, the standard does not prohibit an employer from having a company rule that employees submit to audiometric testing.

01/23/1995 - Occupational Noise Exposure Standard when an employee with a history of off-the-job noise exposure

4. Considering Steps 1-3, Did a Work Exposure Either Cause or Contribute to the Hearing Loss, or Significantly Aggravate a Pre-existing Hearing Loss?

Rabinowitz, PM. (2005). Determination of work relatedness. CAOHC Update

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OSHA CFR 1904.5 Work-relatedness

OSHA presumption of work-relatedness applies to all recordkeeping decisions

- If worker in work environment, ALL injuries and illnesses presumed to be work-related
- If one portion of hearing loss is work-related, it is ALL considered work-related

…Unless medically proven to be ALL NOT work-related

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OSHA CFR 1904.5 Work-relatedness

"You must consider an injury or illness to be work-related if an event or exposure in the work environment either caused or contributed to the resulting condition or significantly aggravated a pre-existing condition or illness.

Work-relatedness is presumed for illnesses and injuries resulting from events or exposures occurring in the work environment, unless an exception in 1904.5(b) (2) specifically applies. "

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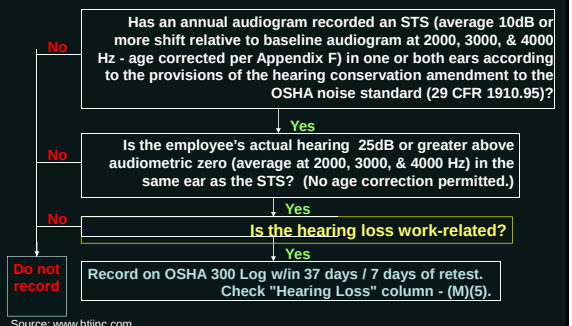
RECORDABILITY GUIDELINES OSHA 29 CFR 1904.10 (2002)



Source: www.htiinc.com

Reasons to Consider STS Not Work-Related

- Documentation that individual not noise-exposed at work (caution- excessive peak exposures may cause loss, even if TWA $_{8\ hr}$ less than 85)
- Documentation of medical reason that explains loss.
- Documentation of test error or malingering

Pitfalls in Work-Relatedness Determinations

- Ascribing hearing loss to non-occupational exposures without adequate documentation
- Assuming individual not noise- exposed because wearing hearing protection.
- *Bending to pressure to "reduce recordables"
- Mismanagement of hearing impaired employees

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Attributing hearing loss to non-occupational exposures

- Caution!!
- To do this, burden of proof is on PS to show that occupational exposures did not contribute, and that non-occupational exposures sufficient to cause loss.
- (Remember OSHA presumption of work-relatedness)

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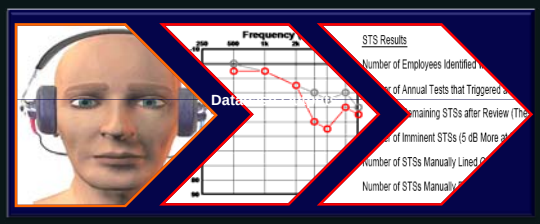
Using Your Database



Professional Supervisor

- Assumes responsibility for tracking population hearing status.
- Needs to understand software capabilities and algorithms
- Should be proactive in data-driven quality assessment and management.

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What metrics can be reported?

Evaluate the audiometric database

- Annual rate of STS
- Percentage of eligible employees who actually got tested

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Comparison of Early Flags

In a recent study of an audiometric database, Rabinowitz et al. compared 12 different "shift criteria" and then recommended use of

- ***10 dB non–age-corrected STS***

  or

- ***8 dB age-corrected shift at 2, 3, and 4 kHz***

as best predictors of future recordable hearing loss

Rabinowitz et al. (2007) J Occup Environ Med 49:1310-1316

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Annual Rate of STS
*= 100 * [# of STS / (# annual tests)]*

- Age correction allows for comparison of STS rates between two populations with different ages of workers.
- *What is a target rate of STS?*
  - NIOSH analysis of industrial database: 3%
  - Best Practice: Aim for STS rate of non-exposed population

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Aggregate Incidence of STS's and PTS's In Eight-Year Review (2003-2010) Rink, 2011

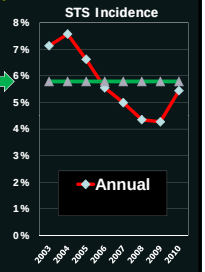
Rink reviewed large database from U.S. industrial sites **(N = 1,088,717)**

Incidence (in ANNUAL TEST):

STS **5.79%**

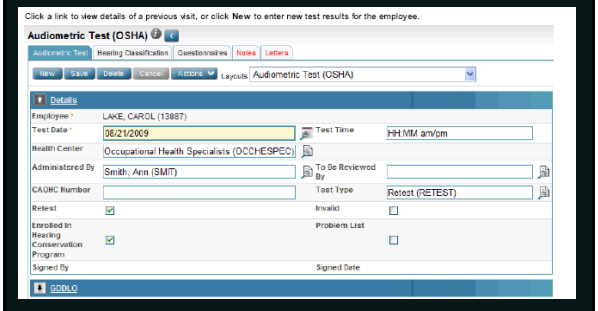
- **OSHA recordable** ***4.24%***
- **Non-recordable** ***1.46%***

Incidence (in RETEST) :

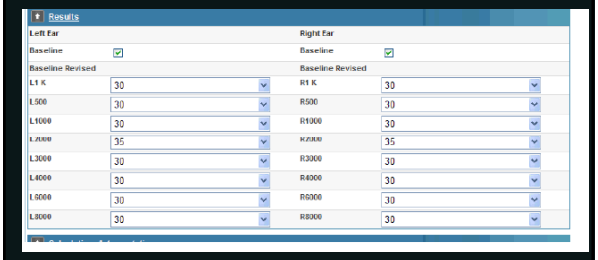


Rink (2011) Eight-Year Review of the Age and Gender Distribution of NIPTS and RNIPTS, NHCA Conference

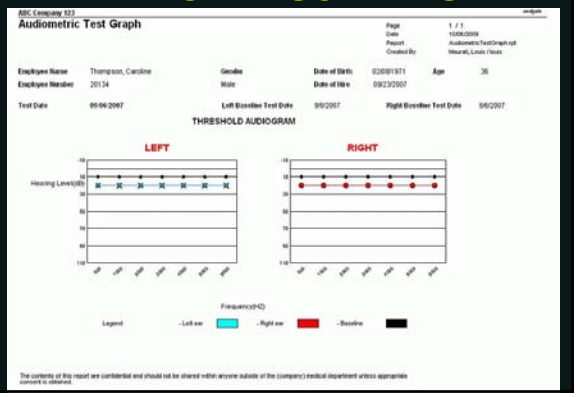
MEDGATE SCREENS



MEDGATE SCREENS
Audiometric data input



MEDGATE SCREENS



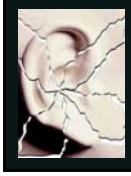
MEDGATE SCREENS

Application software does calculations, determines STS. But STS can be (should be) confirmed by reviewer.

Other Metrics Worth Tracking

Hearing Impairment:

- How many workers have HTL >25dB in average of 500, 1k, 2k, 3 kHz?
  - Useful for gauging extent of workers comp liability as well as need for workplace accommodation, etc.



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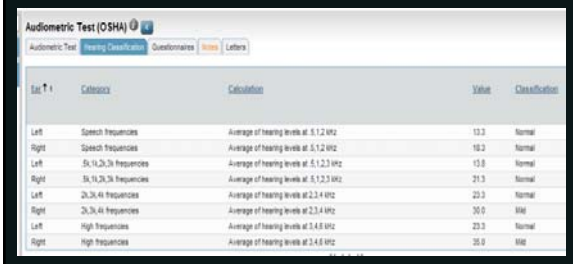
MEDGATE SCREENS
Hearing Classification tab



Today's Focus

Review "best-practice" protocols that may be used when conducting audiometric monitoring, reviewing test results, and making dispositions (including referrals and determinations of work-relatedness)

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