



Occupational Health Clinics
for Ontario Workers Inc.



Practical Ways of Meeting Noise Regulation Changes

ESAO's 8th Annual Conference - Safety: Not Just Compliance

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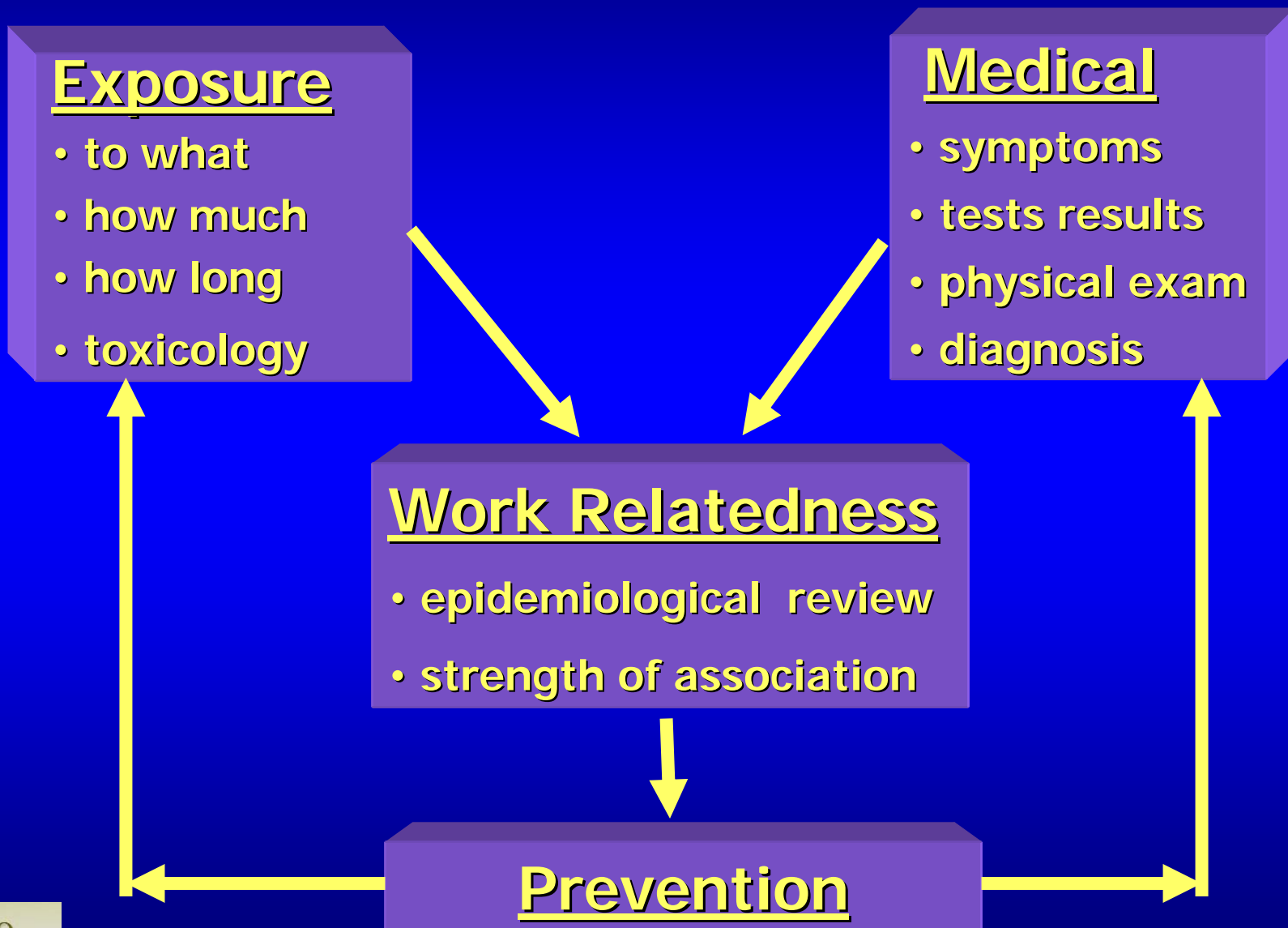


Occupational Health Clinics for Ontario Workers

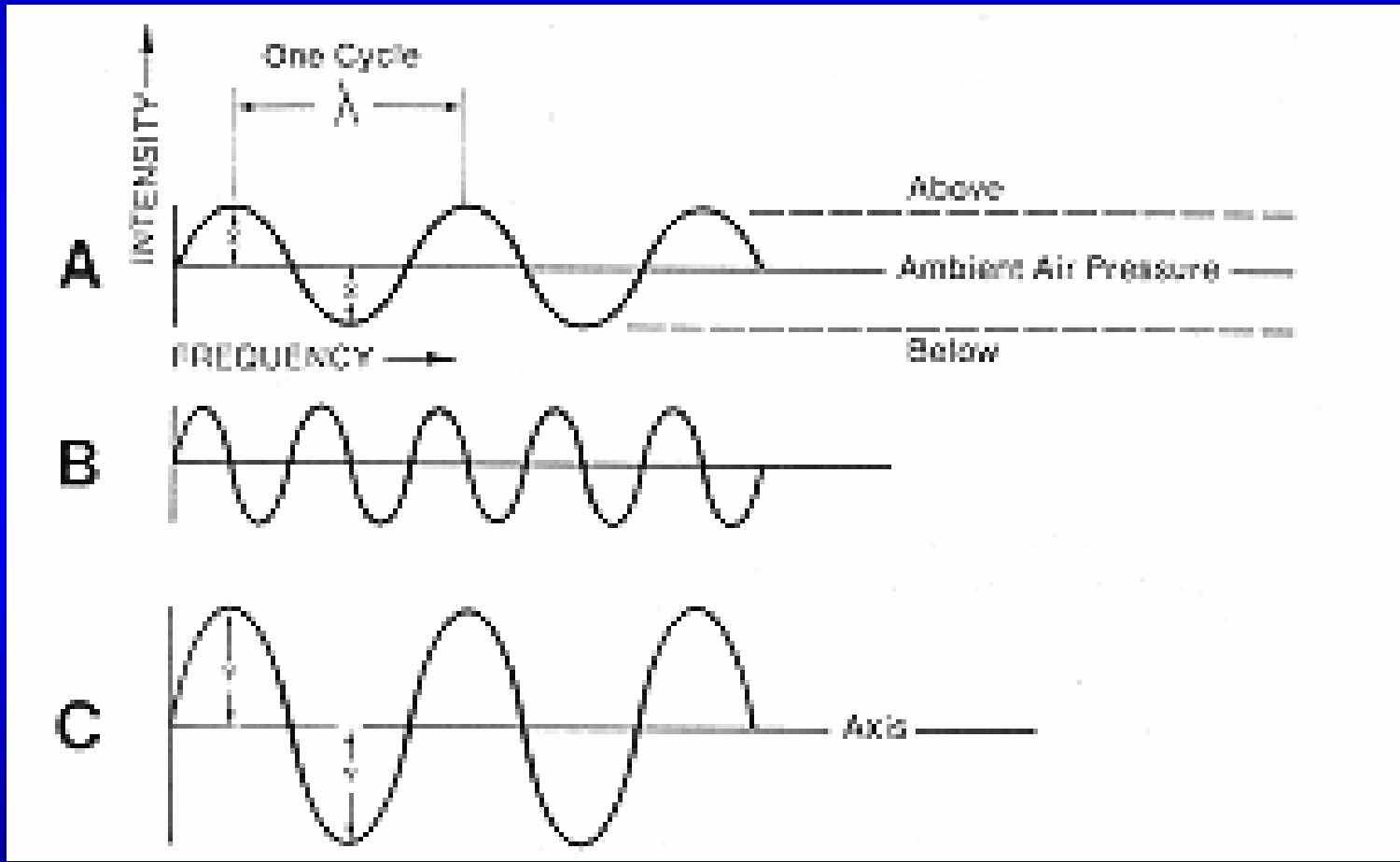
- Inter-disciplinary occ. health team:
 - occupational physicians
 - occupational health nurses
 - ergonomists
 - hygienists
- funded by WSIB Prevention Services
- Board of Directors has organized labour representatives



What OHCOW does:



obligatory frequency diagram:



[exit to frequency audio file](#)

wavelength of noise

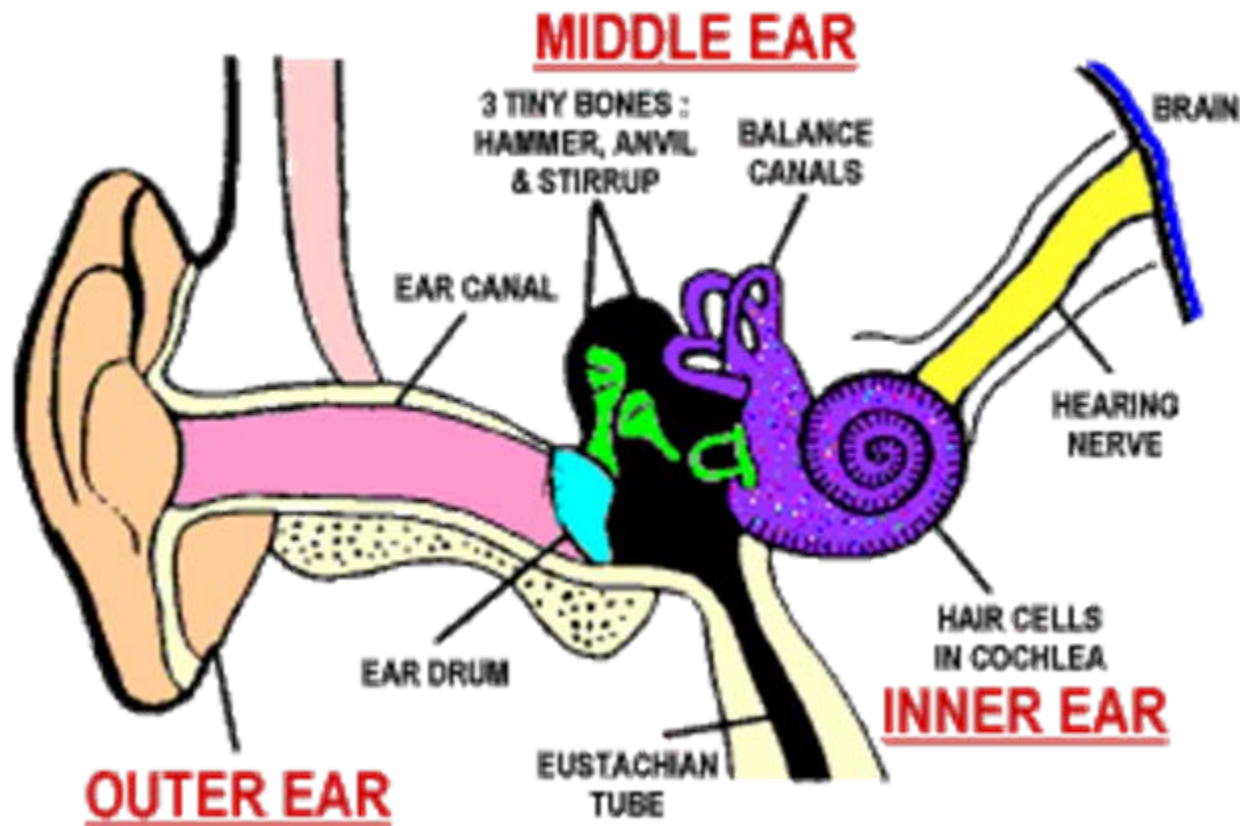
Speed of Sound - 1100 feet per sec at room temp
(or 750 mph or 1200 km/hr).

As frequency (pitch) goes higher, wavelength gets smaller (more cycles per second).

- at 100 hertz wavelength is ~ 10 feet
- at 1000 hertz wavelength is ~ 1 foot
- at 10,000 hertz (10 kHz) wavelength is ~ 1 inch

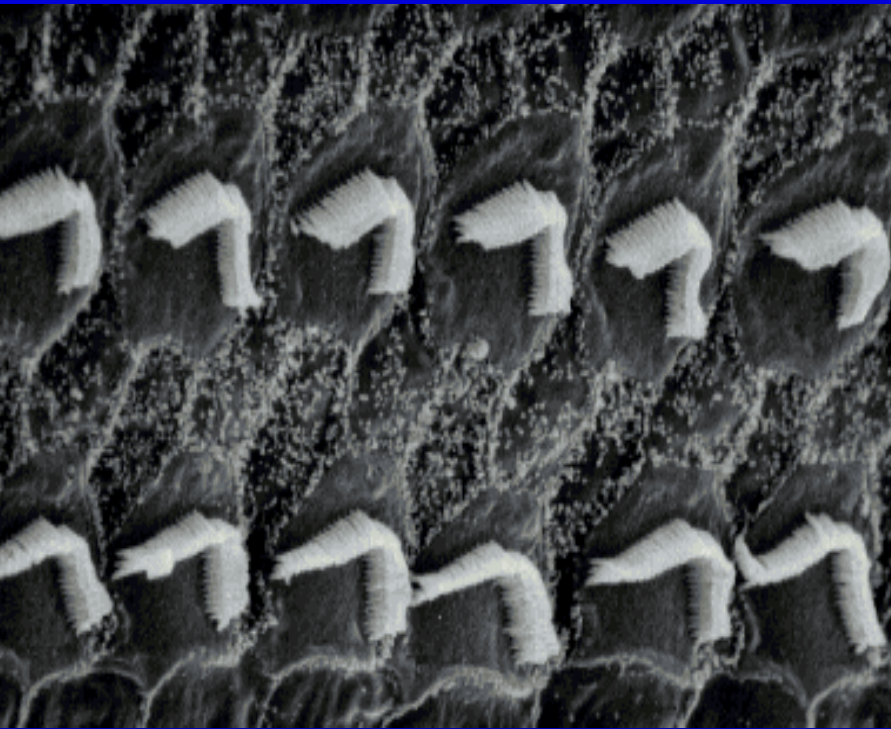


obligatory diagram of the ear:

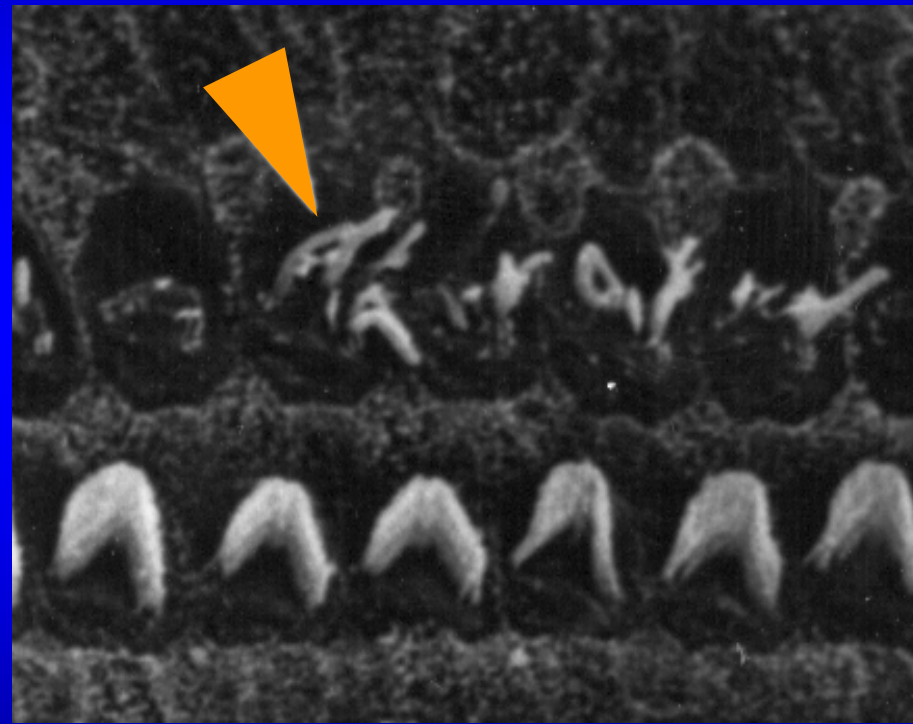


<http://www.tinnitus.asn.au/ear1.htm>

....what we're trying to prevent ...

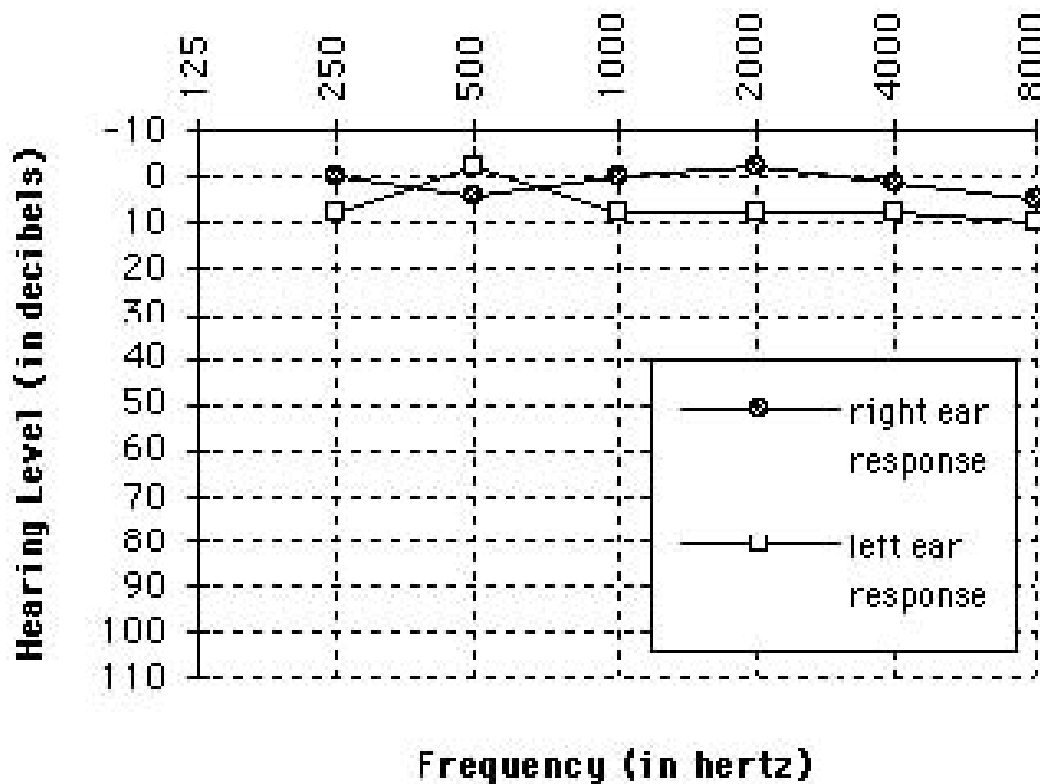


normal hearing cells

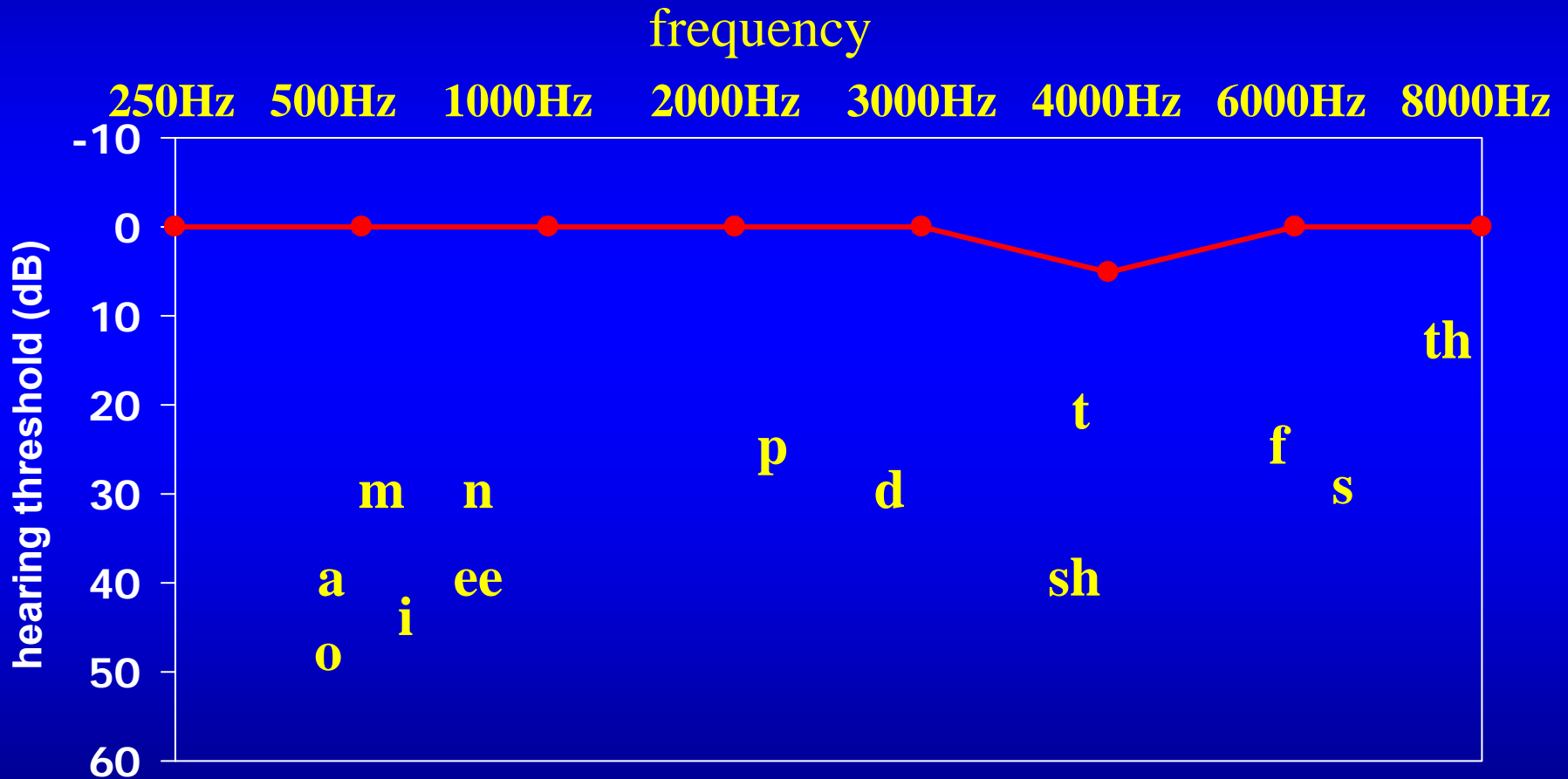


damaged hearing cells

how its measured



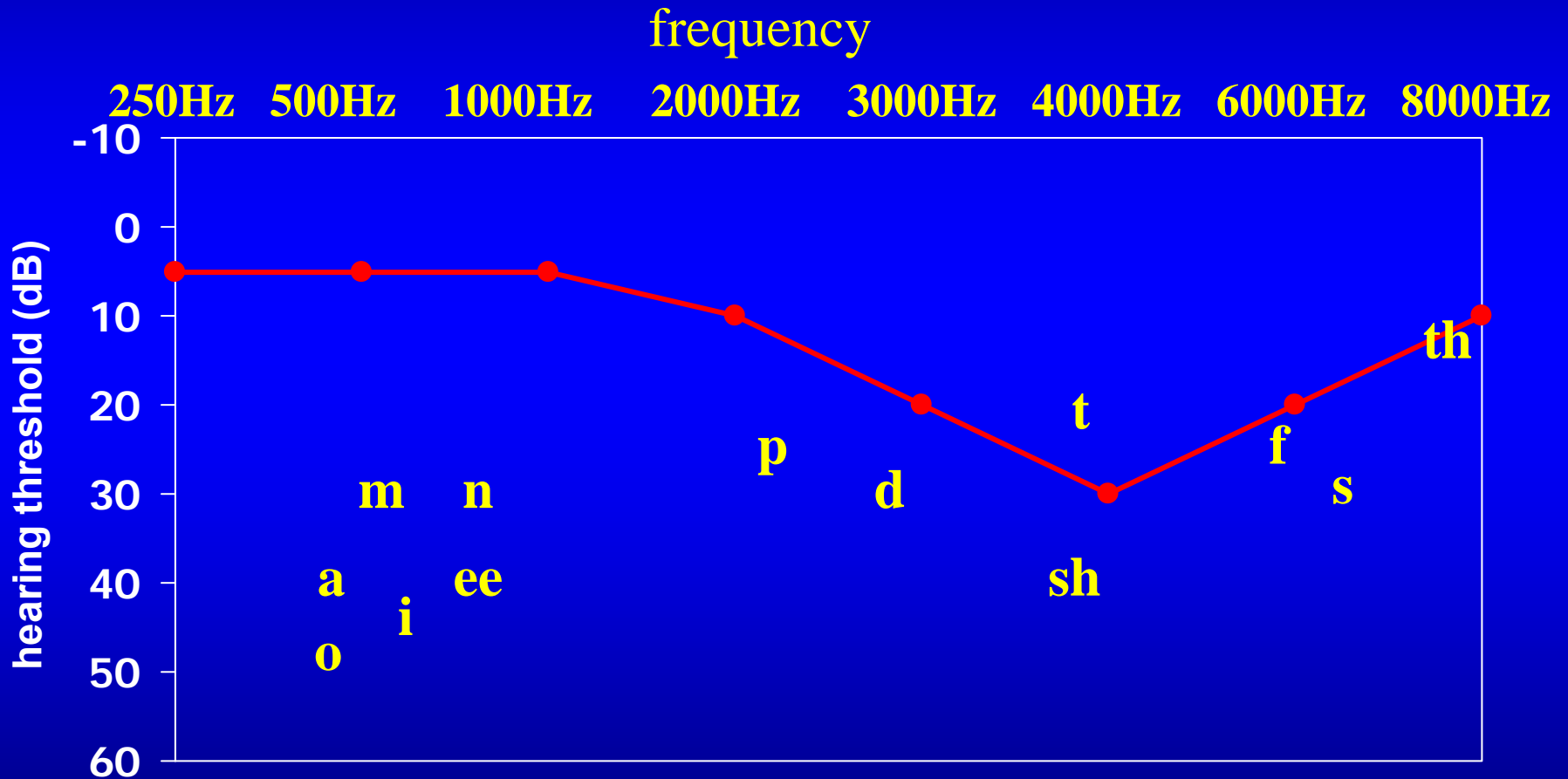
progression of NIHL (noise induced hearing loss)



pre-employment: worker starting first job



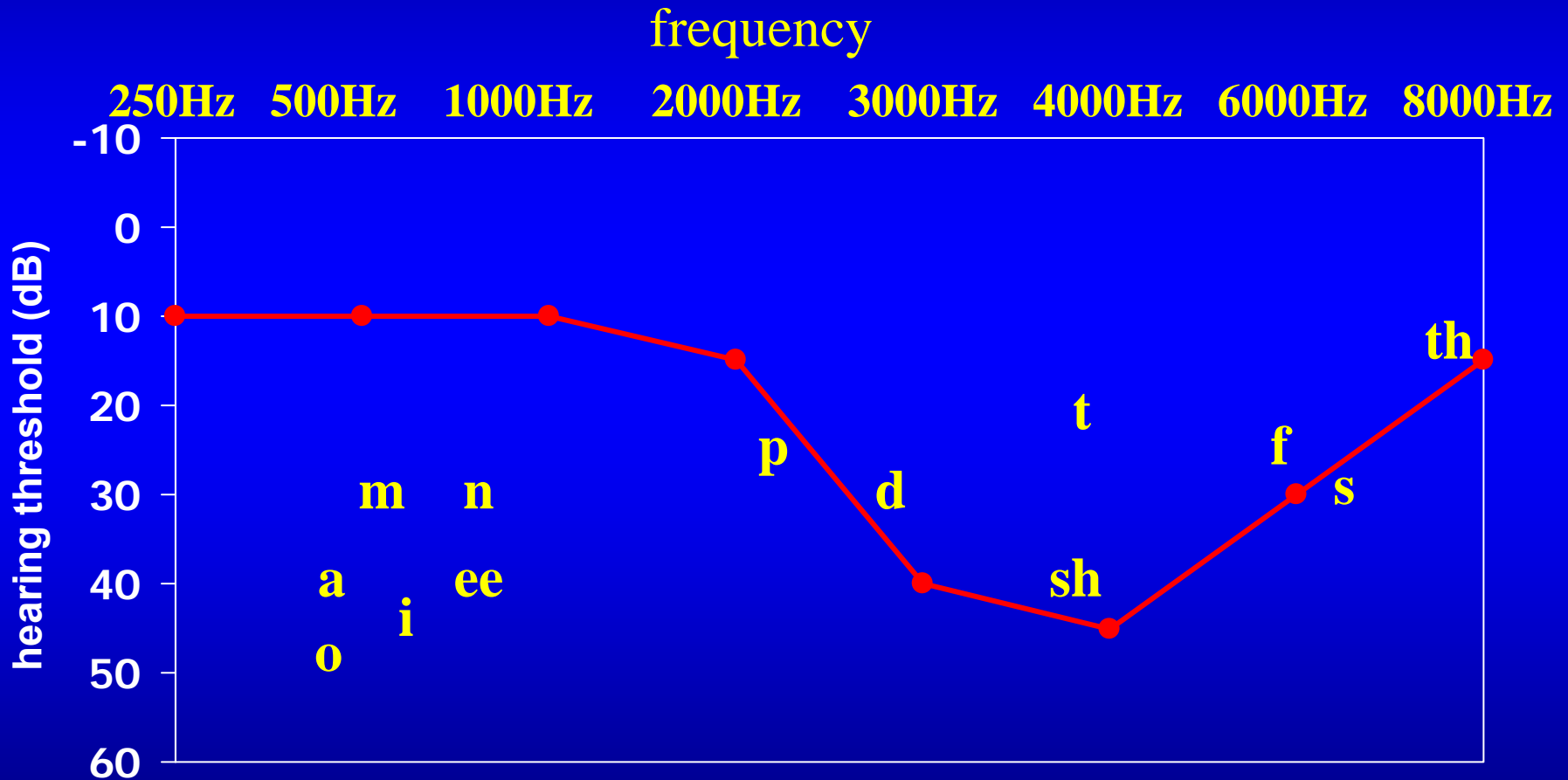
progression of NIHL (noise induced hearing loss)



after 3-5 yrs exposure



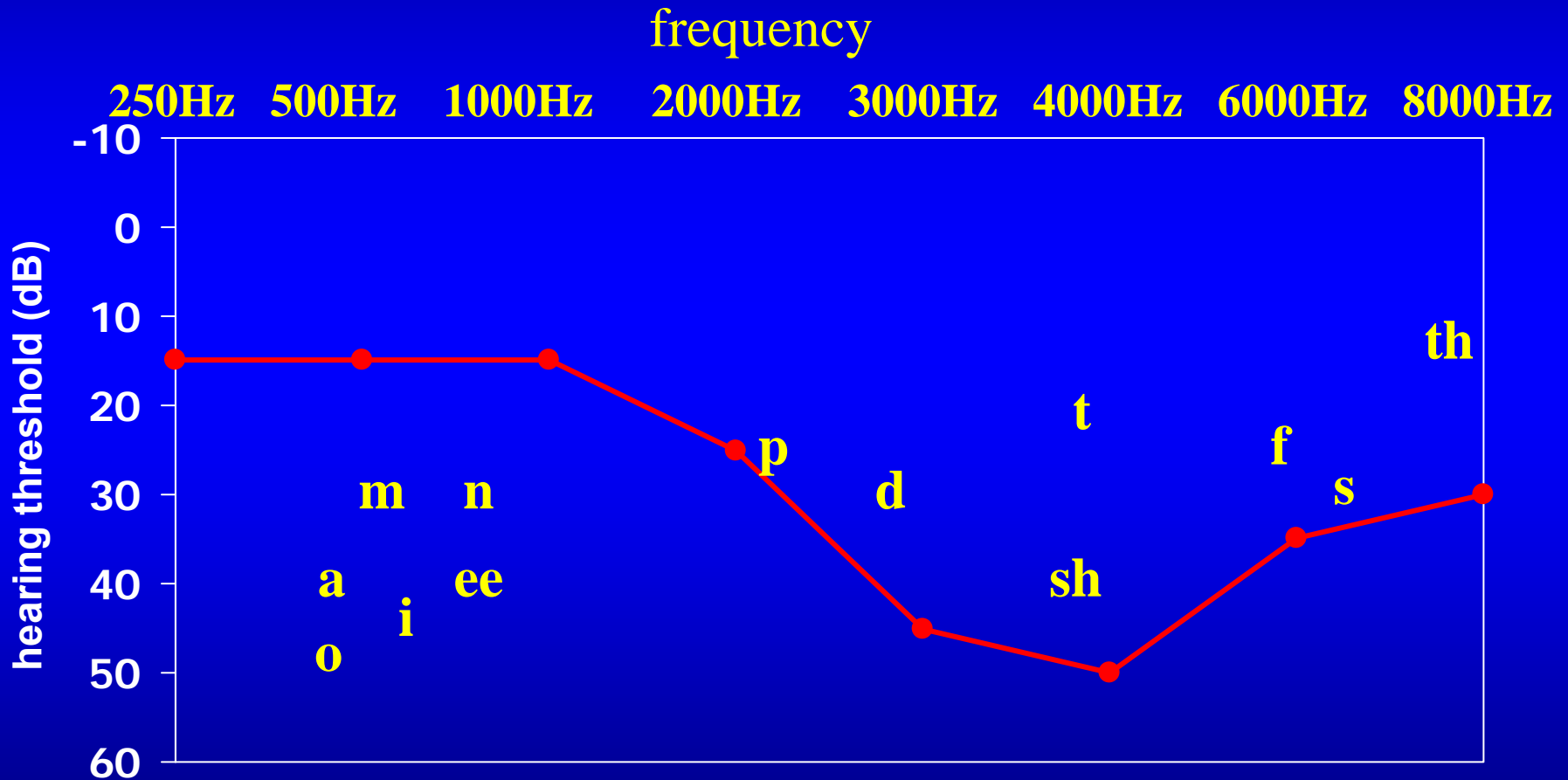
progression of NIHL (noise induced hearing loss)



after 15-19 yrs exposure



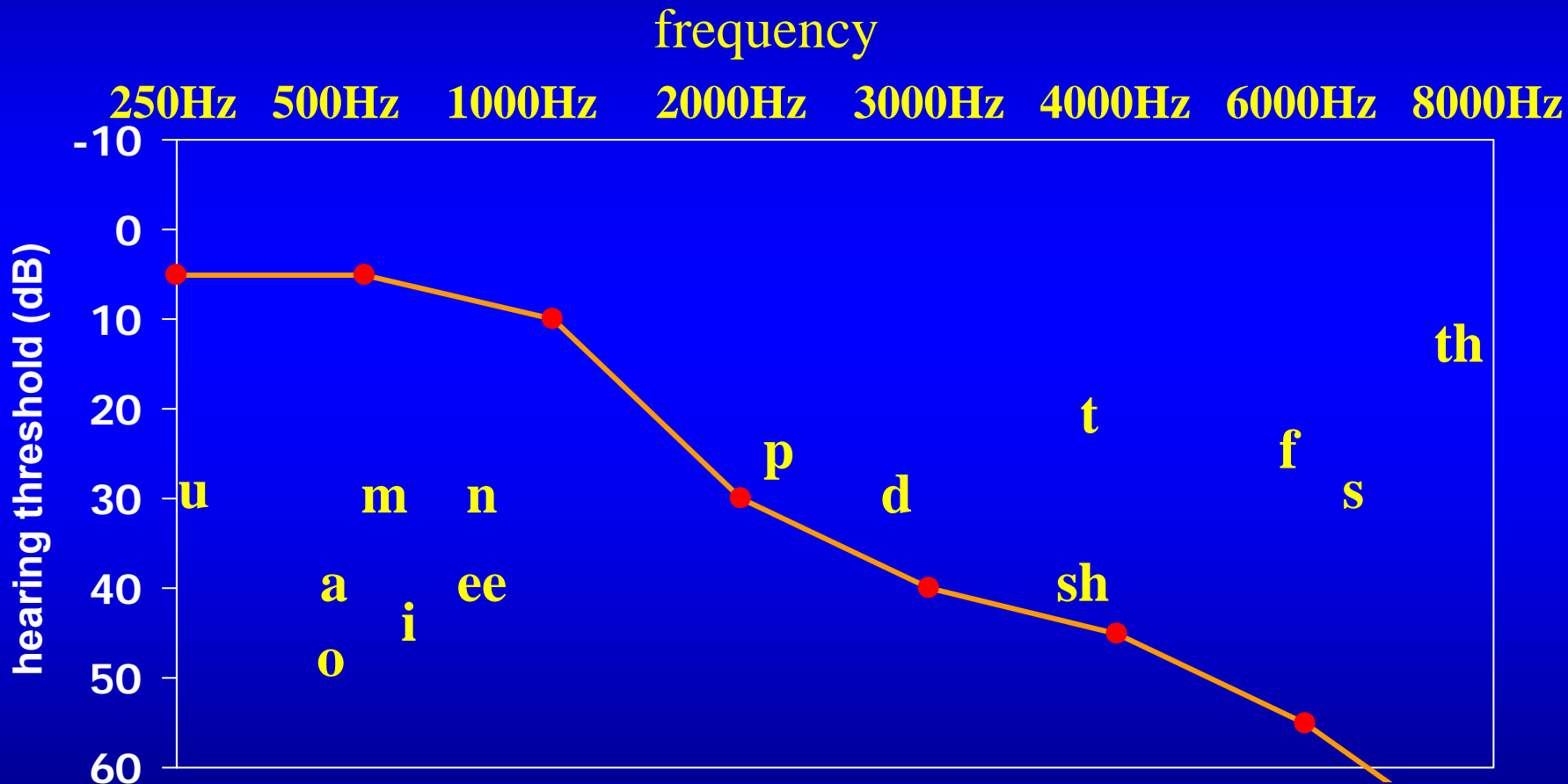
progression of NIHL (noise induced hearing loss)



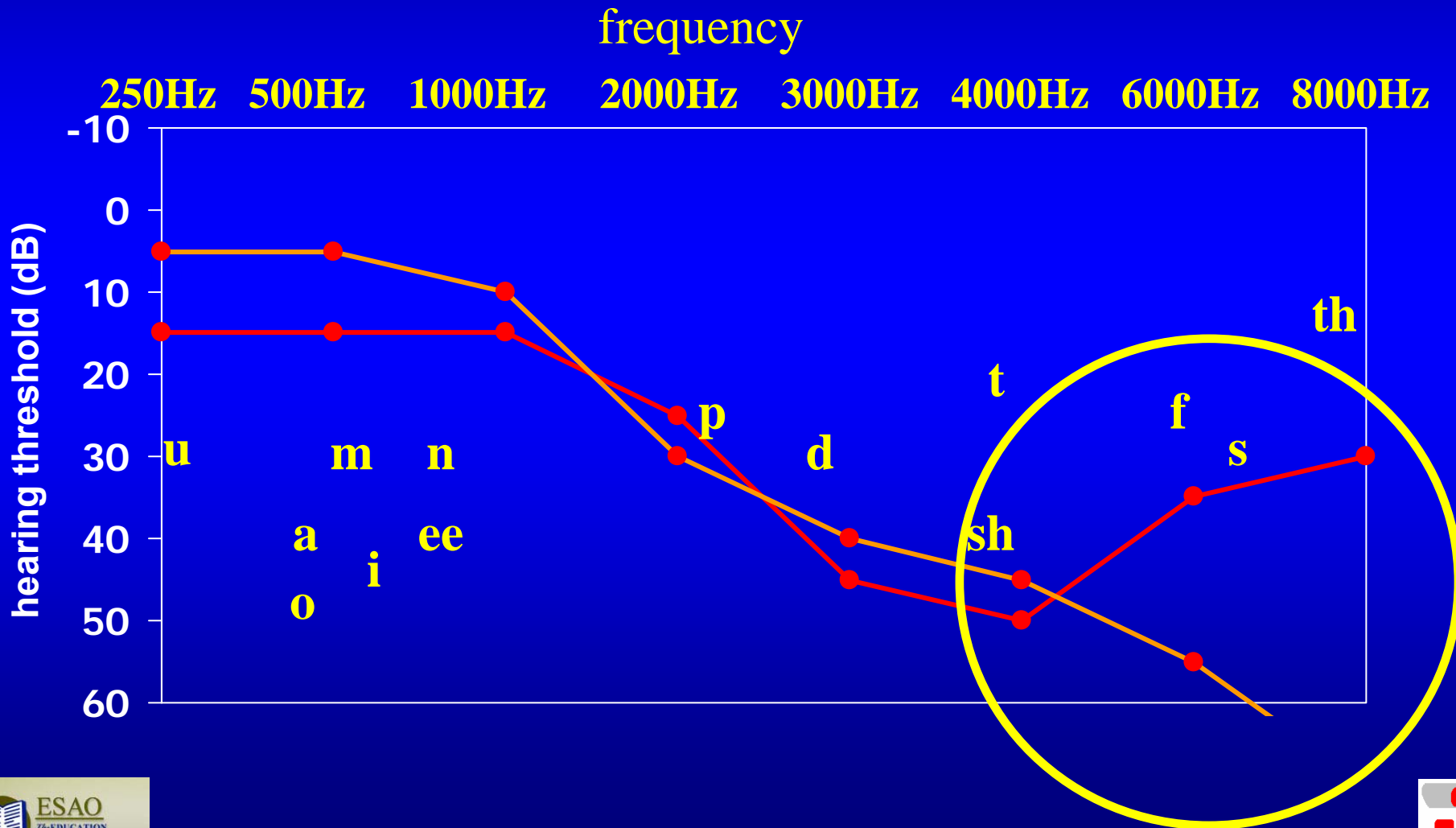
what are the chances?

- depends on the intensity of the noise (how loud it is – measured in decibels (dBA))
- depends on the frequency – high pitch (treble) sounds more damaging than low (bass) sounds
- depends on the length of time exposed (yrs)
- depends on the age (natural hearing loss due to age - presbycusis)

presbycusis (age hearing loss)



presbycusis (age hearing loss)



What are the symptoms of NIHL (noise-induced hearing loss)?

- usually gradual (not noticeable) but can be immediate (if close to an “explosive” noise)
- tinnitus
 - ringing, buzzing, or roaring in the ears or head
 - can be intermittent or continuous
 - extremely annoying and not curable
- screening questions handout

NHANES prevalence of NIHL

- using audiometric data from NHANES (2001-2002) (http://www.cdc.gov/nchs/about/major/nhanes/subsample01_02.htm)
- it is estimated that 45% of males aged 60-69 have a hearing loss exceeding 25 dBA in both ears (as per the WSIB criteria),
- 30% of these have an audiogram that has the signature 3000-4000 Hz “notch” typical of NIHL
- thus **13.7%** of the 2001-2002 US **male** population aged **60-69** have audiometric results which have the NIHL pattern and exceed 25 dB in both ears

How Much Noise is too Much?

- **Anything** above **65 dBA** will eventually wear down your hearing.
- Years of exposure above **80-85 dBA** will lead to a percentage of workers with a hearing **disability** (legally deaf).
- Trying to carry on a conversation over the phone with a background noise level of **60-65 dBA** is very **stressful**.

WSIB Hearing Loss Exposure Equivalencies

The minimum hazardous noise exposure of **90 dB(A)** for 8 hours per day for **5 years** has the following equivalencies*:

84 dB(A) for 40 yrs	89 dB(A) for 7 yrs
85 dB(A) for 28 yrs	91 dB(A) for 3.5 yrs
86 dB(A) for 20 yrs	92 dB(A) for 2.5 yrs
87 dB(A) for 14 yrs	93 dB(A) for 1.8 yrs
88 dB(A) for 10 yrs	94 dB(A) for 1.25 yrs

* ISO 1999-1990. Acoustics – Determination of occupational noise exposure and estimation of noise-induced impairment. Internat. Standard ISO 1990. 2nd ed. Geneva, 1990.



New Noise Regulation

O.Reg. 565/06

- employers must take **all measures reasonably** to protect workers from exposure to hazardous sound levels.
- **protective measures** against noise exposure include engineering controls, work practices and personal protective equipment.
- **assessment of noise levels** must be done without considering any personal protective equipment in use.
- every employer shall ensure that **no worker is exposed to a sound level greater than an equivalent sound exposure level of 85 dBA, $L_{ex,8}$** .



O.Reg. 565/06 (continued)

- the employer shall protect workers from exposure to a sound level greater than 85 dBA, $L_{ex,8}$ **without requiring the use of personal protective equipment.**
- personal protective equipment is **only to be used if** engineering controls,
 - a) do not exist or are not obtainable;
 - b) are not reasonable or not practical to adopt, install or provide because of the duration or frequency of the exposures or because of the nature of the process, operation or work;
 - c) are rendered ineffective because of a temporary breakdown of such controls; or
 - d) are ineffective to prevent, control or limit exposure because of an emergency.



O.Reg. 565/06 (continued)

- if engineering controls can't be used then workers shall wear and use **personal protective equipment** appropriate in the circumstances to protect themselves from exposure to any sound level greater than 85 dBA, $L_{ex,8}$
- a clearly visible **warning sign** shall be posted at every approach to an area in the workplace where the sound level regularly exceeds 85 dBA.

The MOL has published a guideline to help workplaces understand the new regulation



old table:

Column 1	Column 2
Sound Level — in Decibels	Duration — Hours per 24 hour day
90	8
92	6
95	4
97	3
100	2
102	1½
105	1
110	½
115	¼ or less
Over 115	No exposure

new table:

$$L_{ex,8} = 10 \text{ Log}_{10} \left(\frac{\left[\sum_{i=1}^n (t_i \times 10^{0.1 \text{ SPL}_i}) \right]}{8} \right)$$

This means the area under the curve of a sound exposure graph!

solution: on-line calculator ...



Occupational Health
Clinics for Ontario
Workers Inc.

Centres de santé
des travailleurs (ses)
de l'Ontario

Noise Exposure Calculator: This table calculates the 8 hour equivalent sound exposure level as per the equation in O.Reg 565/06. To use this table, enter the measured noise level (in dB(A)) and the amount of time and press ENTER.

Noise Level (in dB(A))	Exposure Time		8 hr Equivalent Exposure Level ($L_{ex,8}$) (in dB(A))
	(hrs)	(min)	
87	6	30	86.1

$L_{ex,8}$

<80 dB(A)

minimal risk of noise induced hearing loss

80-85 dB(A)

some risk of noise induced hearing loss

85+ dB(A)

significant risk of noise induced hearing loss



Sound Level (in db(A))	Duration (85 dBA L_{ex,8}) (hrs/24 hr day)	Duration (80 dBA L_{ex,8}) (hrs/24 hr day)
80¼	24	7½
81½	18	5⅔
82	16	5
83¼	12	3¾
84	10	3¼
85	8	2½
86¼	6	2
88	4	1¼
89¼	3	1
91	2	40 min
92¼	1½	30 min
94	1	20 min
97	30 min	10 min
100	15 min	5 min
101¾	10 min	3 min
104¾	5 min	1½ min
111¾	1 min	20 sec
114¾	30 sec	10 sec

Low Frequency “noise”

- Frequencies below what are considered normal audio ranges have an impact on hearing loss and the human body
- These low frequency vibrations LFV consist of rumbling, clearly perceptible room surface vibrations and feelings of nausea or headaches caused by indeterminate sources



Low Frequency Noise (LFN) Criteria (UK)

“Proposed criteria for the
assessment of low frequency
noise disturbance”

by Dr. A. Moorhouse,
Dr. D. Waddington,
Dr. M. Adams (2005)

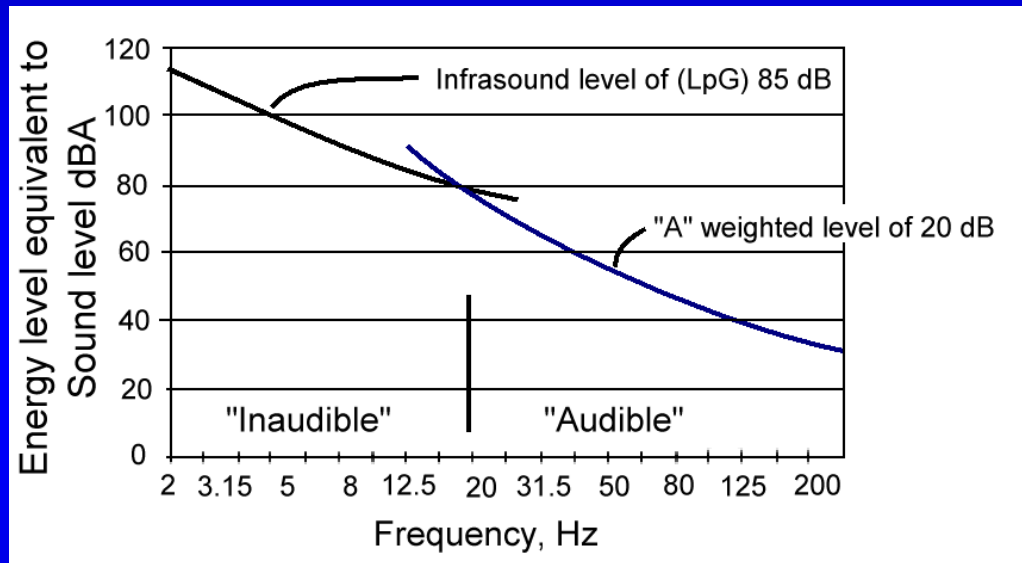
*add 5 dB for steady state noise

*add 5 dB for daytime noise

Hz	dB, Leq*
10	92
12.5	87
16	83
20	74
25	64
31.5	56
40	49
50	43
63	42
80	40
100	38
125	36
160	34



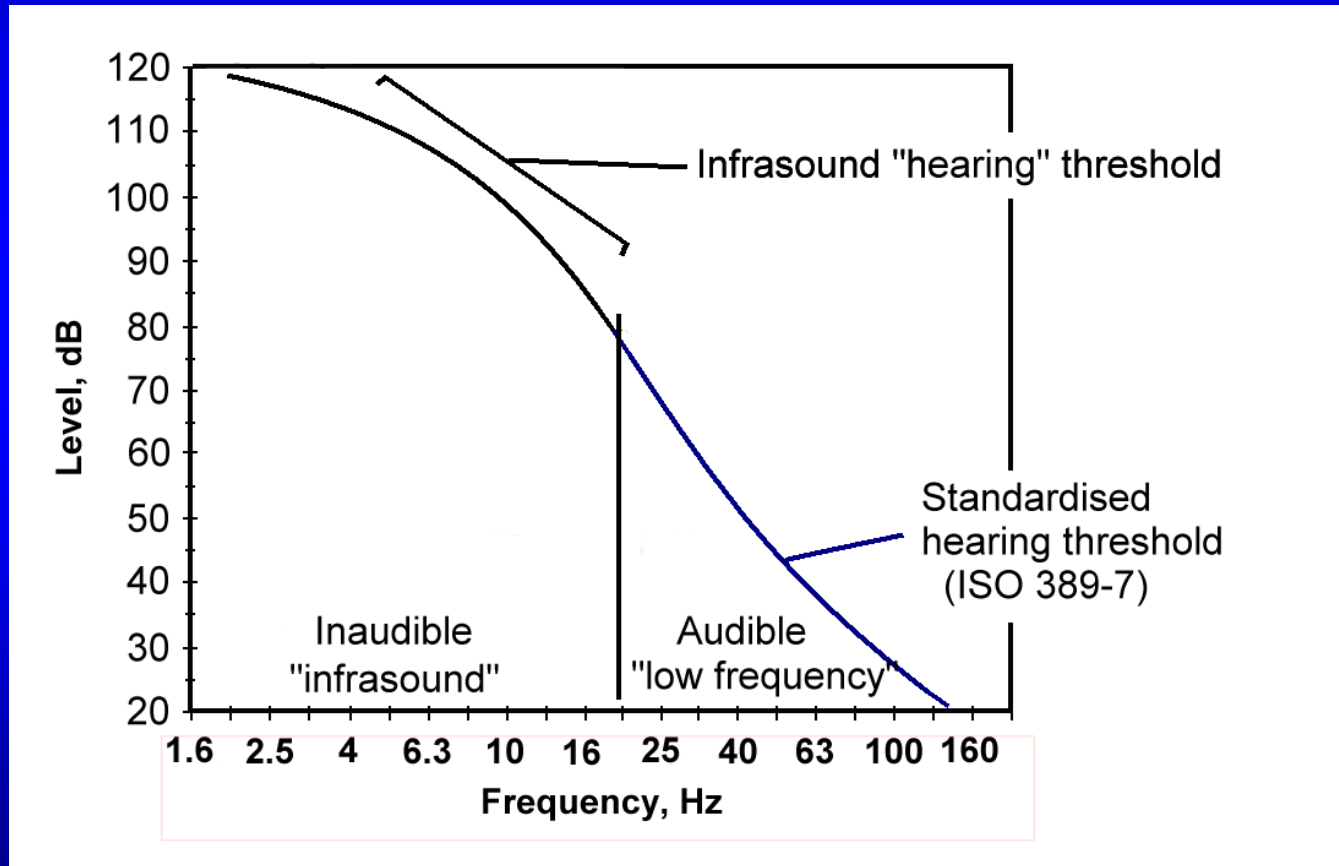
"Sound" levels of giving equivalent "sound" level forces



Forces are referenced to a force (sound pressure) of 20 μ Pascals the basis for determining 0 dB for dBA sound levels

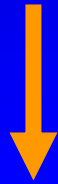
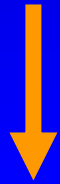


Sensing Threshold



Prevention Opportunities

Best Good Temporary



check on
effectiveness
of controls

source > path > exposure > target > disease

too late!!



Hierarchy of Controls:

1. at the source ⇒ BEST

- eliminate, enclose, silencers, fix, specify

2. along the path ⇒ GOOD

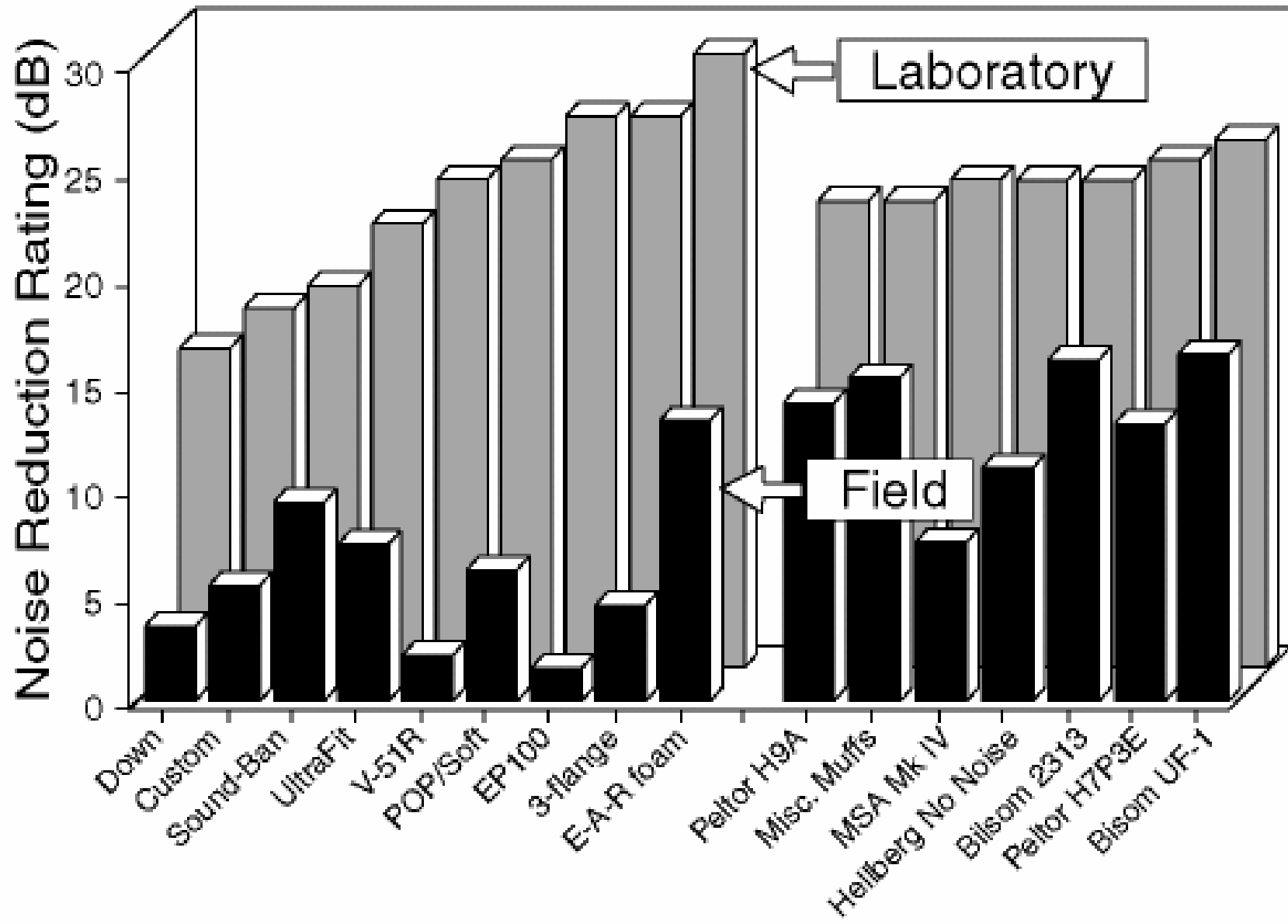
- barriers, curtains, absorbers

3. at the worker ⇒ TEMPORARY

- PPE, audiometry, rotating exposures



effectiveness of hearing protectors



Preventing noise

- purchasing policy (new machinery <75 dBA)
- vibration control (isolators, damping)
- quiet materials for conveyors, bins (noiseless steel, plastic coatings, etc.)
- silencers, mufflers, specially designed compressed air nozzles
- balancing rotating parts, avoiding harmonic frequencies, etc.
- avoiding impacts in process flow (slide instead of drop)
- enclosures, barriers, curtains
- sound absorbing acoustic wall/ceiling treatment
- increasing distance from source
- OHCOW worksheet "Doing something about noise"



Noise Assessment Worksheet

1. WHERE IS IT COMING FROM?

diagram:

(draw a layout of the work area and locate noise sources and exposure workers)



2



1

Noise Assessment Worksheet






2. WHAT TYPE OF NOISE IS IT?

type of noise: (check all appropriate)

- constant
- fluctuating
- periodic
- impact noise
- pure tone
- resonance
- vibration transmission
- room reverberation (echo)






Noise Assessment Worksheet

3. HOW LOUD IS IT?

voice level	noise level (in dB(A))	perception
normal	50	
loud	70	
very loud	85	
shouting	90	
max shouting	100	

Noise Assessment Worksheet

4. HOW HAZARDOUS IS IT?

voice level	noise level	HAZARD LEVEL	
normal	50	slight distraction	
loud	70	annoying/unpleasant	
very loud	85	some risk of hearing loss	
shouting	90	medium risk of hearing loss	
max shouting	100	high risk of hearing loss	



Do we need to do something right away?

- is the **hazard** enough to warrant immediate use of hearing protection?
- remember, personal hearing protection is not very effective (often not worn properly, bad fit, or not worn long enough)
- personal protective equipment is a short-term “band-aid” until a permanent solution can be implemented

Noise Assessment Worksheet

7. SELECT A
NOISE CONTROL STRATEGY:

8. WHO WILL MAKE SURE
IT GETS DONE?

- make a list in order of priority of what can be done to reduce the noise:
 - post area & use hearing protection until we get noise under control (temporary)
 - put compressor outside (or better yet in a closed room with no workers in it)
 - specify that all replacement jack-hammers will meet an 80 dBA criteria (or as close to it as possible)
 - use different way of opening up concrete (backhoe?)
- assign responsibility and set a target date



Noise Assessment Worksheet

9. DO WE NEED EXTRA HELP?

10. WHEN SHALL WE REVIEW
OUR PROGRESS?

- will it help convince workers/powers-that-be if we get some detailed measurements:
 - might be useful to justify spending money on controls
 - make sure results are stated in terms of risk of hearing loss (e.g. exposure is 87 dBA which means 15% of exposed workers will have NIHL by age 60 if exposed for 30 yrs)
 - ensure noise measurements also address noise control options
 - may need acoustical engineer for tough control problems
- set a date when you'll review progress (e.g. 6 months – to make sure things don't get bogged down)



What about the Costs?



Barriers to Prevention:






- **Complacency:** it's always been that way, things will never change ...
- **Expertise:** we need an expert with one of those fancy noise meters to come in and measure the noise ...
- **Expense:** noise control is just too expensive!
- **Shift the Blame:** they should have worn their ear plugs ...

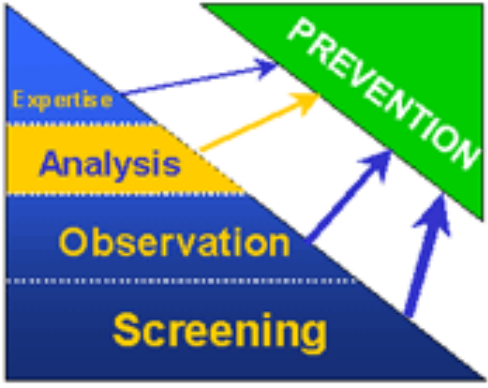
Measuring noise:

- **no measurement** – everyone agrees its too noisy and let's do something about it
- **communication scale** – do you have to raise your voice at an arm's length away – if so probably over 80-85 dBA
- \$50-100 **type III sound meter** (Radio Shack @ Liquidation World) – can work well for area measurements (but no guarantee – calibration needed)
- **dosimeter** \$1000-4000, does datalogging and acts as a sound level meter (usually downloadable) – measure individual exposures averaging over time
- **octave band analyzer** \$3000-12,000, gives you noise frequency analysis usually used for acoustics and noise control engineering



Voice effort noise assessment:

voice level: (1 meter away)	normal	loud	very loud	shouting	maximum shouting
noise level: (in dB(A))	50	70	85	90	100
perception:					
hazard level:	slight distraction	annoying, unpleasant	some risk of hearing loss	medium risk of hearing loss	high risk of hearing loss



Analysis:

- the “specialist”:

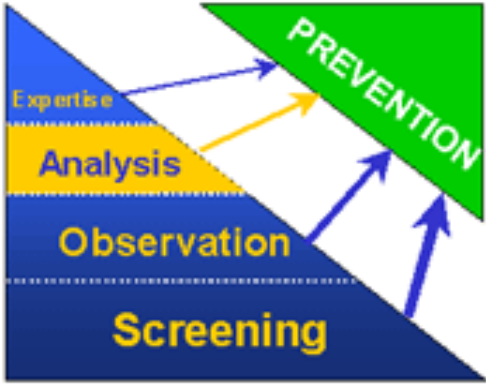
if you get stuck;

- can't lower the noise anymore,
- can't get those with the \$ to spend,
- can't get people to recognize the problem (hazard)

then a specialist might help but have them build on what you've already accomplished and towards your goals.

... remember, you laid the foundation,
... work with them to keep it on target!



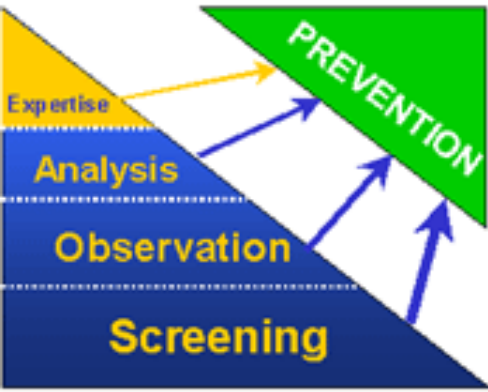


Analysis:

- measurements should be related to **health impact** not just legal compliance.
- the outcome we're trying to avoid is hearing degradation and impairment.
- use ISO calculation website (www.measure.demon.co.uk/Acoustics_Software/h_loss.html) to assign **risk of hearing loss** in exposure report.

... report as: 35 years exposed to 87 dBA implies a 6% risk of hearing 25 dB impairment for 55 year old worker

(not as: 3 dBA under the allowable level ...)



Expertise:

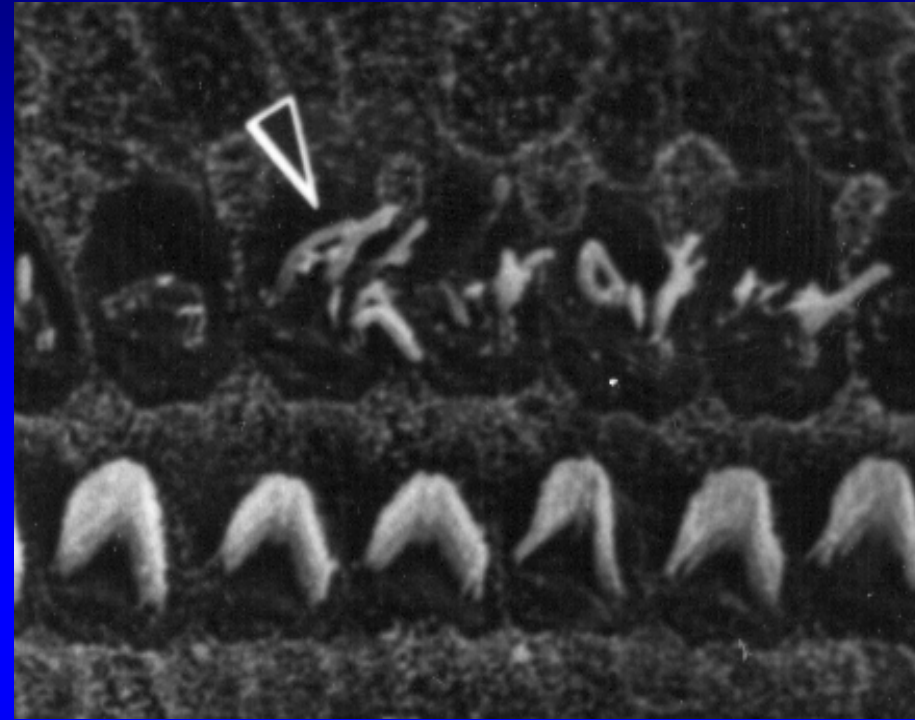
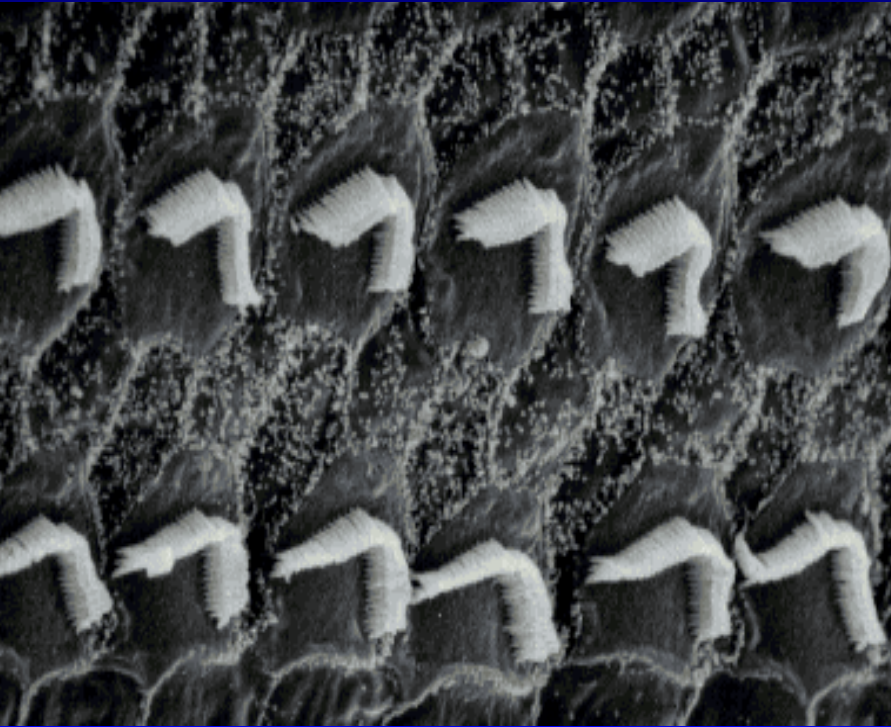
- When the specialists can't solve your problem or accomplish your goal, send for the experts.
- Give them what you've got so far and make sure they keep building on your base.

... keep involved, you know things about the workplace they don't ...

... so, what can we do? ...

- 1) identify noise sources
- 2) evaluate the risks
- 3) recommend controls for each
- 4) get policy noise cap for new equipment
- 5) get hearing tested
- 6) look after your hearing
- 7) get WSIB recognition for NIHL
- 8) **KEEP AT IT!!**





This is your ear.

This is your ear on noise.

Any questions? ...