Hearing Loss in the Workplace

A Review of Hearing Loss Compensation Claims

IN LIGHT of ADVANCED STATISTICAL ANALYSIS TECHNIQUES

OHSS
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CALIFORNIA INDUSTRIAL HYGIENE COUNCIL

R BRAUCH, OHSS INC., 2017

Hearing Loss Compensation Claims Review

Millions of Workers are at-risk for developing Occupational Noise-Induced Hearing Loss…

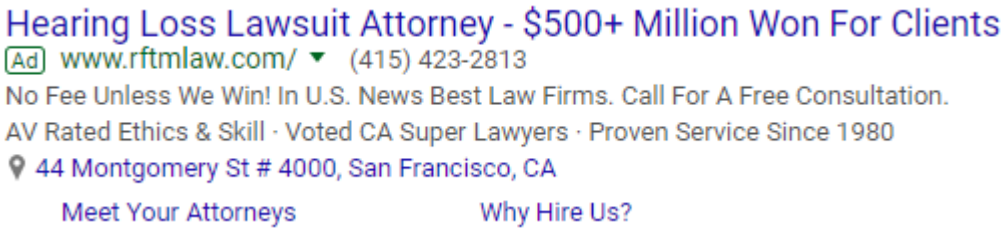
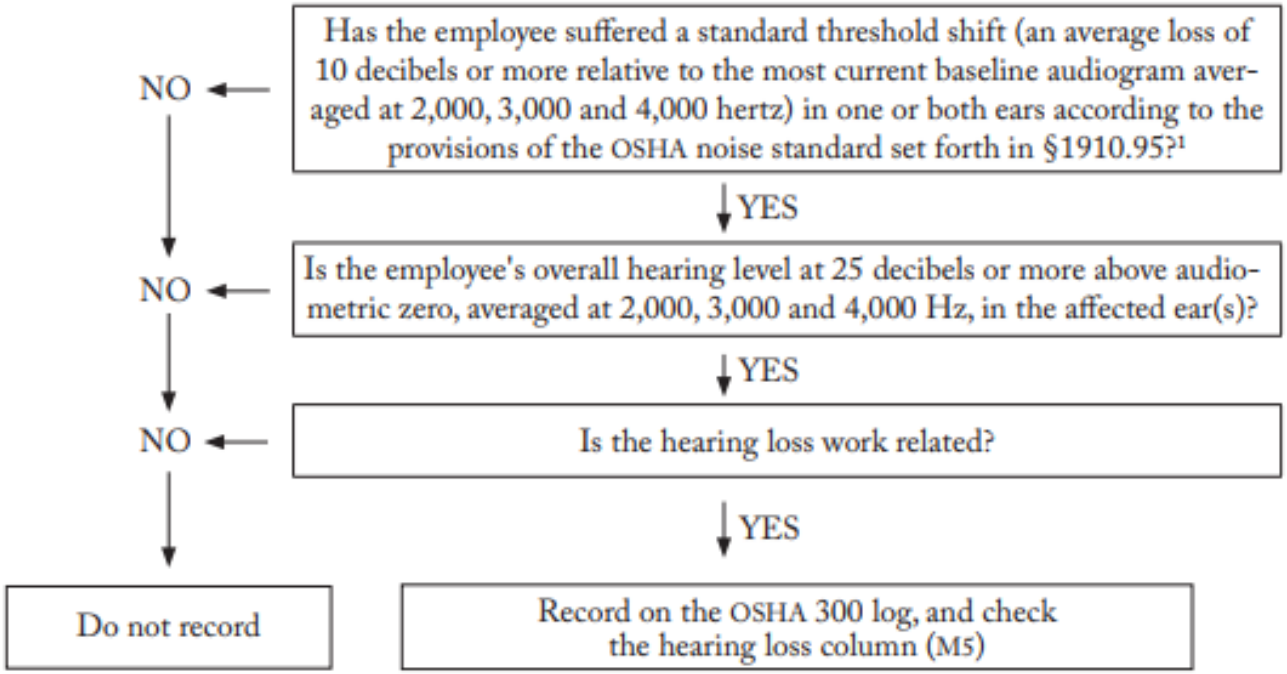


Chart 1. Decision tree for hearing loss recordability

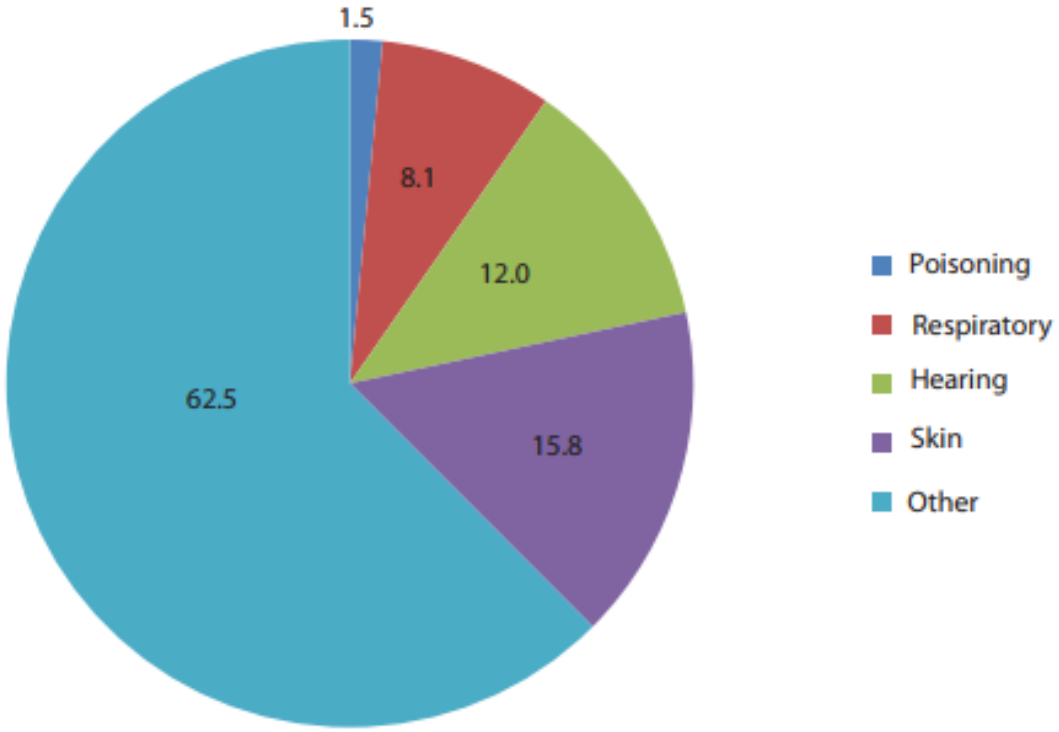


[1] The audiogram may be adjusted for presbycusis (aging) as set out in §1910.95.

NOTE: In all cases, to determine recordability, use the most current baseline in the same manner as you would to calculate a standard threshold shift under the hearing conservation provisions of the noise standard set forth in §1910.95. If a standard threshold shift occurs in only one ear, you may revise the baseline audiogram for that ear only.

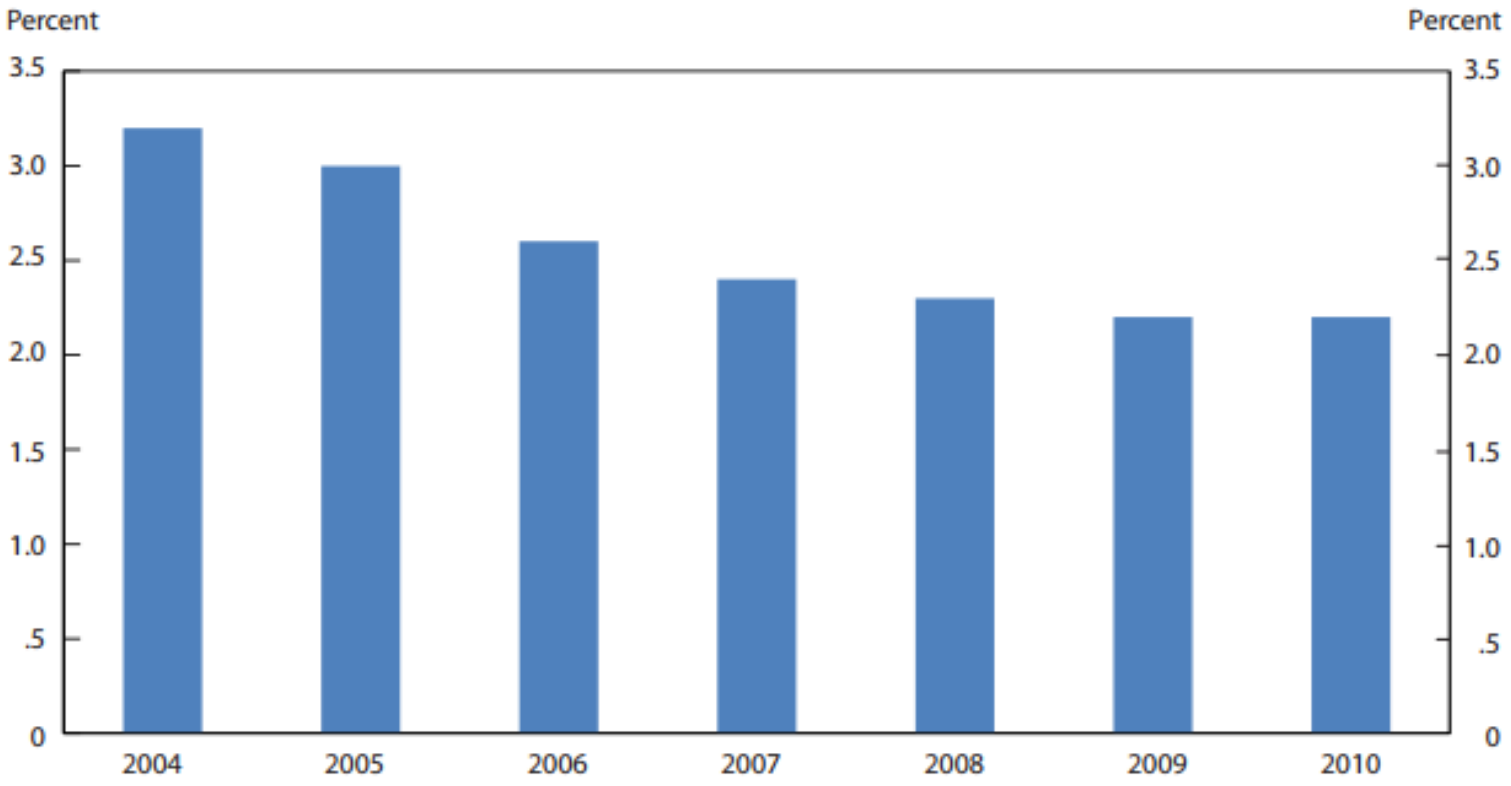
SOURCE: *OSHA Recordkeeping Handbook*, §1904.10 (U.S. Department of Labor, 2005), **http://www.osha.gov/recordkeeping/handbook/index.html#1904.10**.

Chart 2. **Percent distribution of recorded illnesses, private sector, 2010**



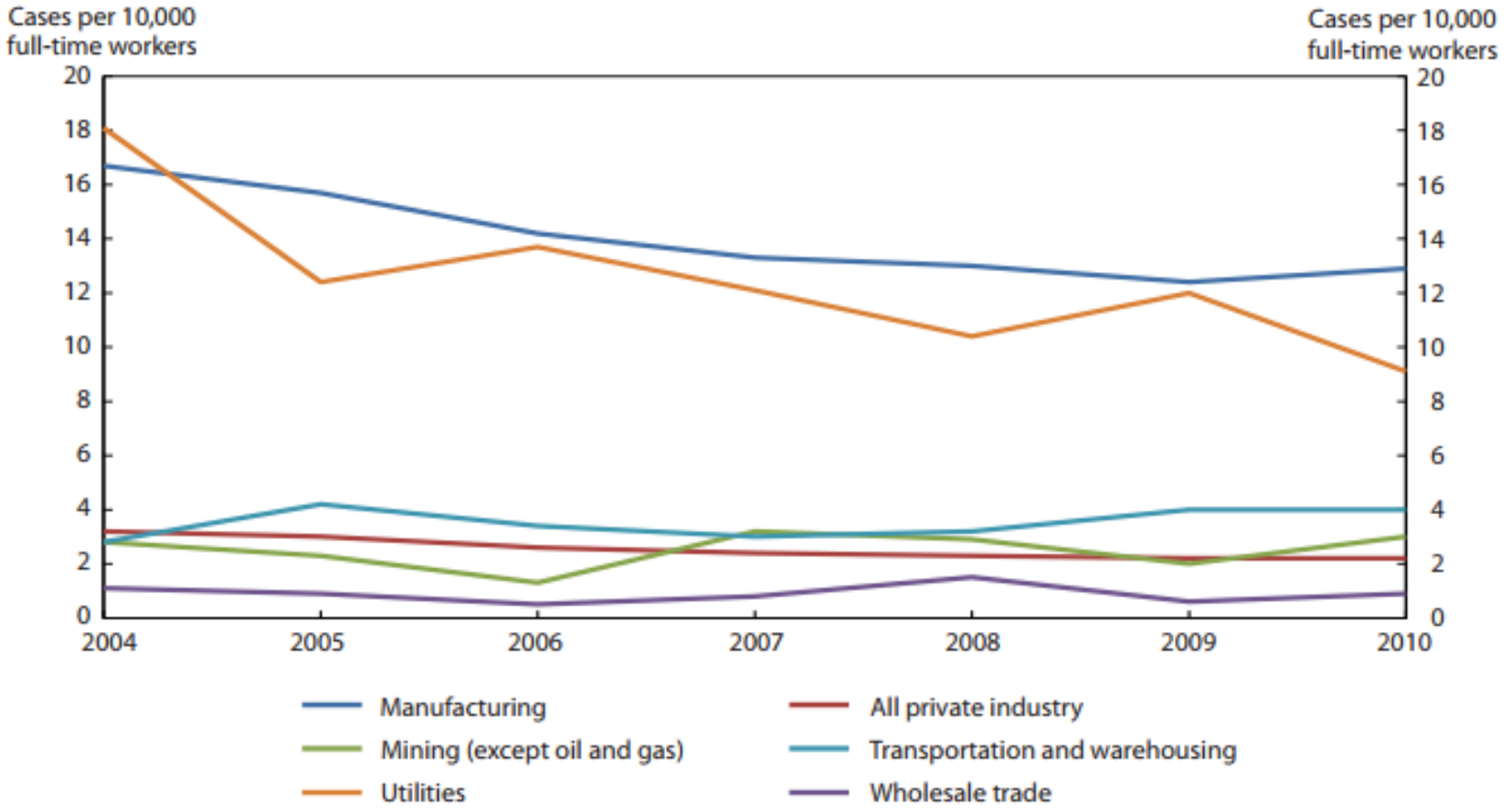
SOURCE: U.S. Bureau of Labor Statistics.

Chart 3. **Hearing loss rate, private industry, 2004–2010**



SOURCE: U.S. Bureau of Labor Statistics.

Chart 4. **Hearing loss rates, selected industries and all private industry, 2004–2010**



SOURCE: U.S. Bureau of Labor Statistics.

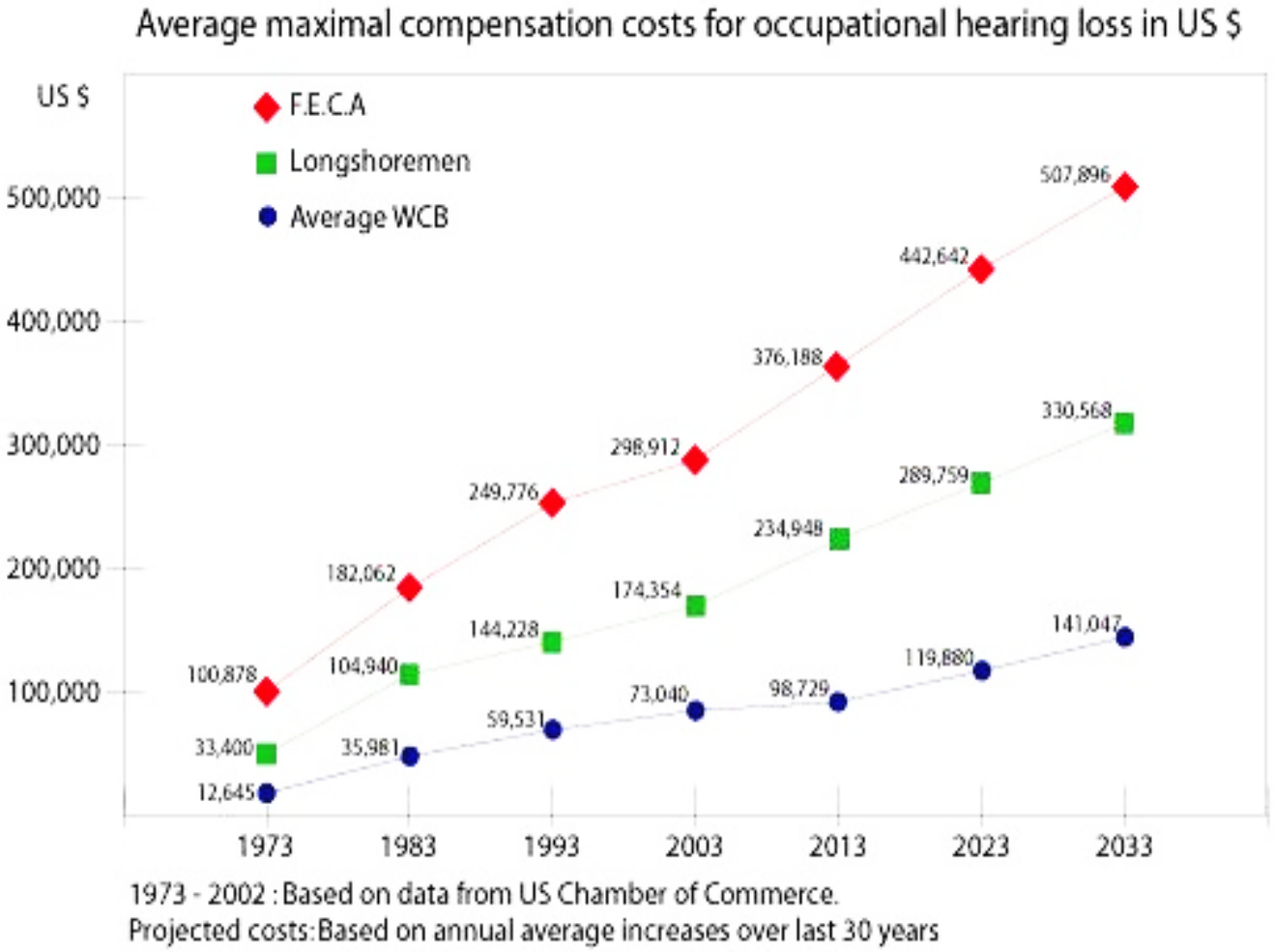
Table 1. Selected industries with high hearing loss rates, 2004–2010

3 digit NAICS code	NAICS description	2004	2005	2006	2007	2008	2009	2010
331	Primary metal manufacturing	40.1	48.5	36.9	29.1	29.7	40.6	33.8
481	Air transportation	11.4	20.5	17.1	15.8	16.4	24.7	24.7
311	Food manufacturing	30.3	23.8	23.4	24.2	19.4	20.3	22.9
322	Paper manufacturing	15.5	20.1	20.5	18.2	26.7	16.2	19.1
332	Fabricated metal product manufacturing	18.2	18.0	15.3	14.1	14.4	13.8	16.5
336	Transportation materials manufacturing	25.6	22.3	20.7	19.5	17.9	15.5	15.3
313	Textile mills	19.0	30.3	24.1	20.0	16.6	18.7	12.7
337	Furniture and related product manufacturing	24.5	20.7	13.0	12.5	13.7	13.2	12.4
326	Plastics and rubber products manufacturing	16.8	14.8	17.0	11.1	14.4	13.9	11.3

SOURCE: U.S. Bureau of Labor Statistics.

Figure 1 – Maximum compensation of ONIHL in the United States for various States, federal employees and Longshoremen for a 30-year period.

	1973	1983	1993	2003
No. of states	**47**	**44**	**41**	**38**
Average maximum costs US$	**12,645**	**35,981**	**59,531**	**73,040**
Federal employees US$	**100,878**	**182,062**	**249,776**	**298,912**
Longshoremen US$	**33,400**	**104,940**	**144,228**	**174,040**



Hearing Loss Compensation Claims Review

Sometimes, comp claims are submitted for Noise-Induced Hearing Loss (NIHL) but they are not actually Occupational in origin…yet many are still paid out and not properly challenged by employers or their carriers

Hearing Loss Compensation Claims Review

There are many reasons that these claims can and should be challenged, and we will discuss the dynamics of this process, and illustrate some examples of claims which were eliminated or awards reduced with just cause

Hearing Loss Compensation Claims Review

AUDIOMETRIC PATTERN – NOISE INDUCED HEARING LOSS

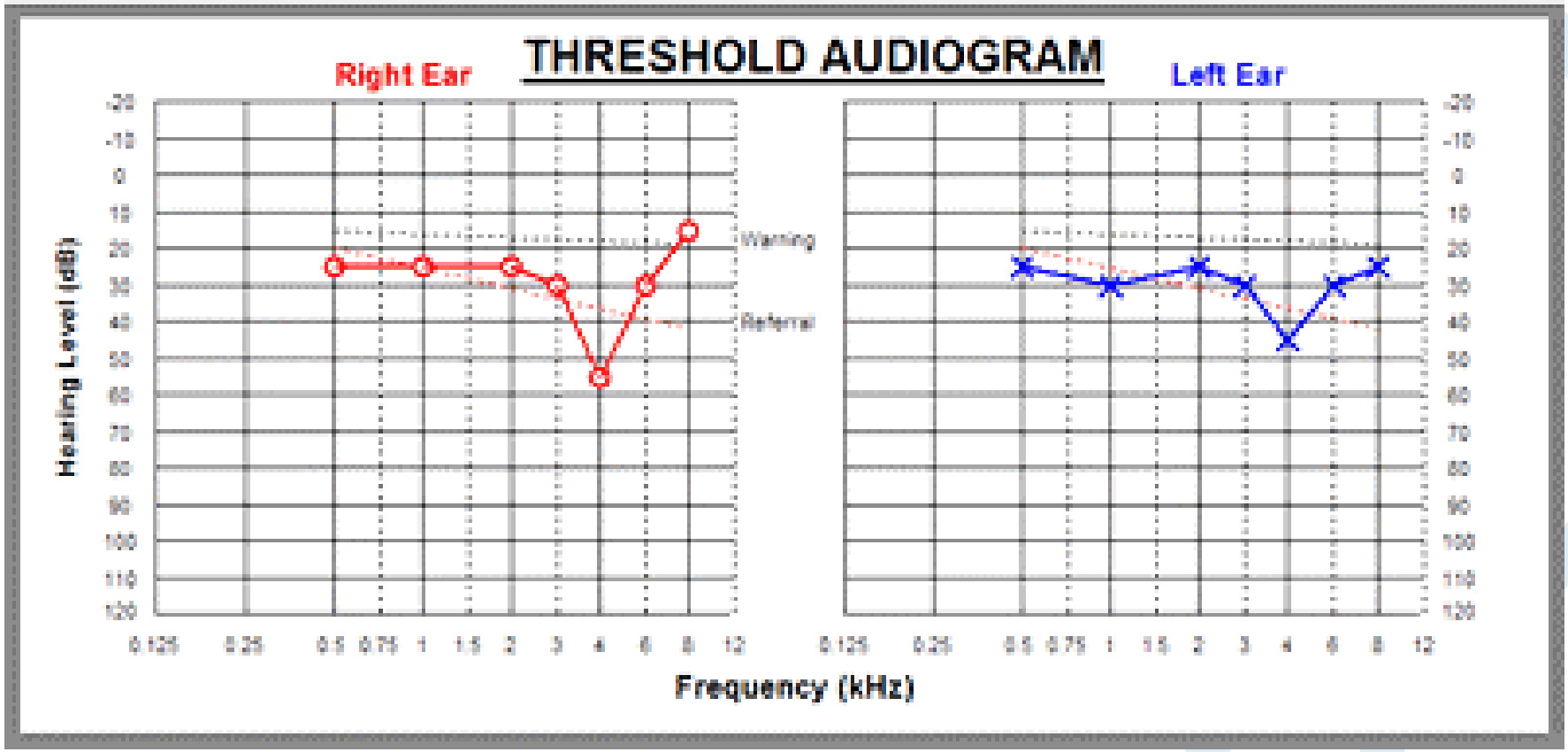
NIHL has a typical pattern with a notch attributed at 3, 4 or 6 kHz as compared to the 8 kHz.

However, other patterns can be encountered, such as a flat audiogram, ascending curve, or low frequency hearing loss.

In the presence of a low frequency audiometric pattern, this is not compatible with NIHL. This requires a medical judgement/decision.

Hearing Loss Compensation Claims Review

NIHL AUDIOMETRIC PATTERN – ‘CLASSIC‘ NOTCH



Hearing Loss Compensation Claims Review

"NON WORK-RELATED" DEFINITION IN TITLE 8 SECTION 14300.5

Are there situations where an injury or illness occurs in the work environment and is not considered work-related?

Yes. An injury or illness occurring in the work environment that falls under one of the following exceptions is not work-related, and therefore is not recordable:

(A) At the time of the injury or illness, the employee was present in the work environment as a member of the general public rather than as an employee.

(B) The injury or illness involves signs or symptoms that surface at work but result solely from a non-work-related event or exposure that occurs outside the work environment.

I Like my ‘Day Job’…

…but I LOVE my Other Job…

Occupational Noise-Induced Hearing Loss (ONIHL)

ONIHL is subject to compensation based on the following criteria:

1. A medical diagnosis of ONIHL
2. Evaluation of the degree of ONIHL as determined by pure tone audiometric tests
3. Evaluation of the degree of debilitation based on the legislated standards of a specific jurisdiction

Individual Factors for Hearing Loss

Intrinsic	**Extrinsic**
1. Genetic	1. Noise exposure:
2. Otological diseases	• Occupational
3. Systemic diseases	• Non-occupational
4. Presbyacousis	2. Physical Trauma
	3. Ototoxic agents
	4. Other agents

Hearing Loss Compensation Claims Review

AUDIOMETRIC PATTERN

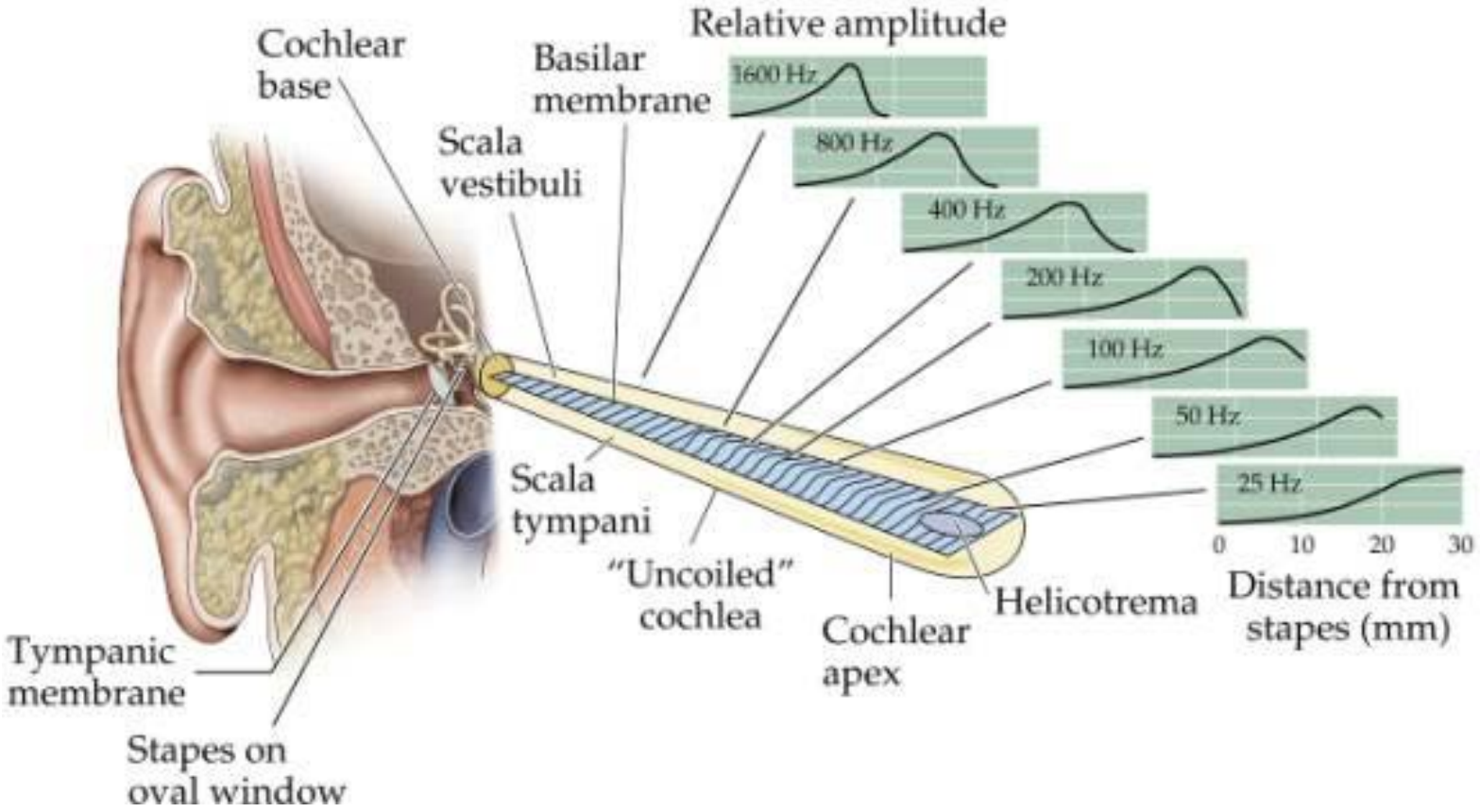
Regardless of the type of pattern exhibited, the actual cause of the 'recordable' hearing loss is always related to the health and medical condition of the worker, either otologically or systemically.

It is not unusual to find workers who will show an unexpected significant change in Hearing Threshold Levels even though their noise exposure model has not changed, their HPDs are being worn (correctly, even) and they are not having any additional exposures outside the workplace!

This is because the ear has many components that can be affected by noise and other factors...

Hearing Loss Compensation Claims Review

AUDIOMETRIC PATTERNS REFLECT FREQUENCY RESPONSE



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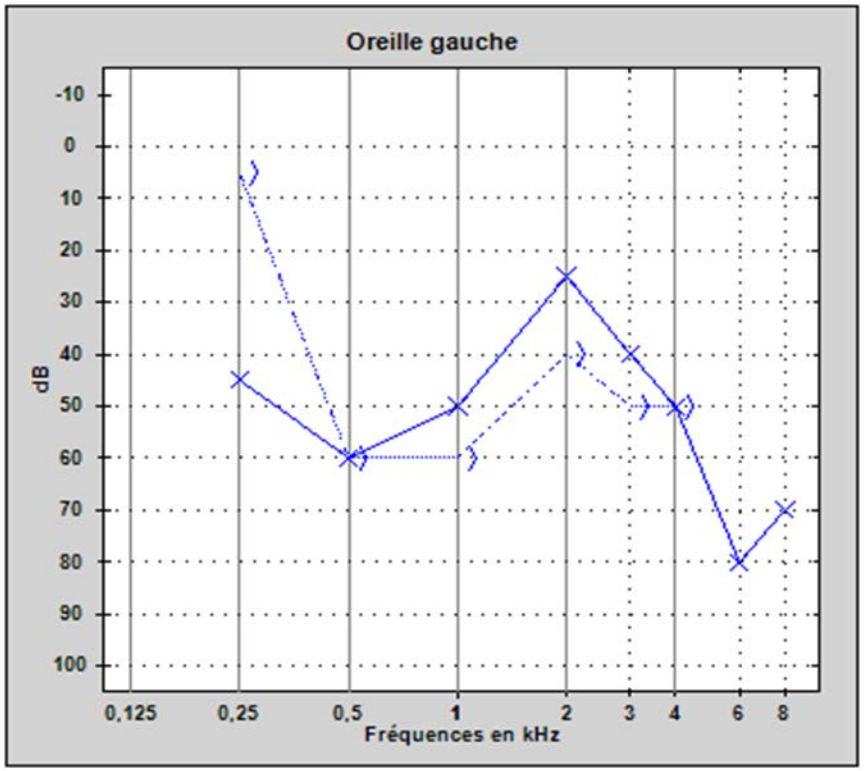
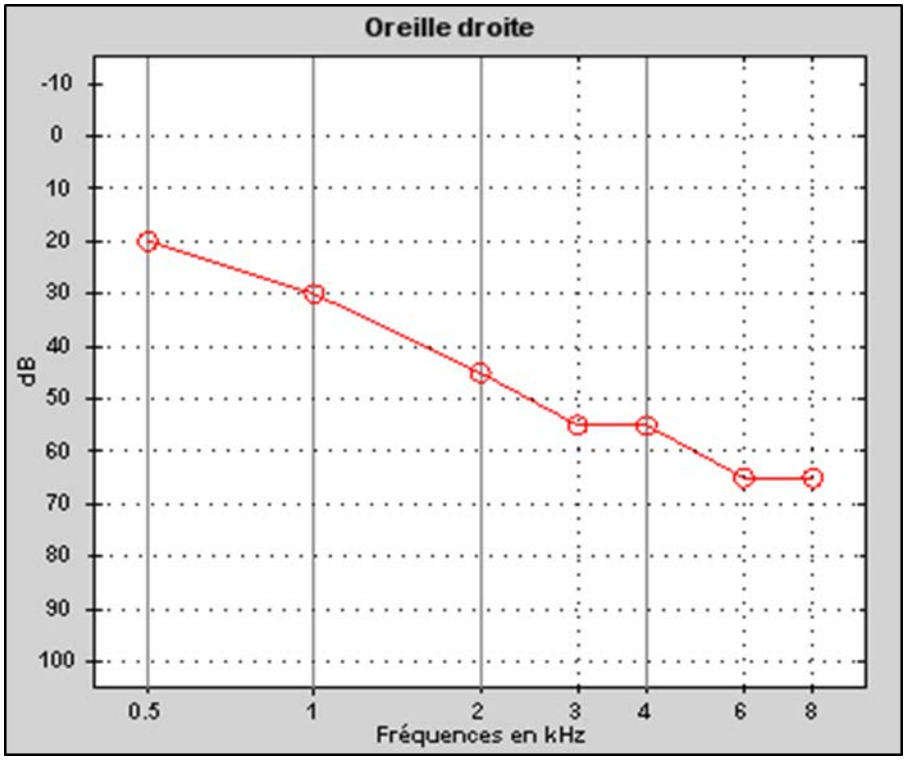
OTHER AUDIOMETRIC PATTERNS OBSERVED: STRIAL



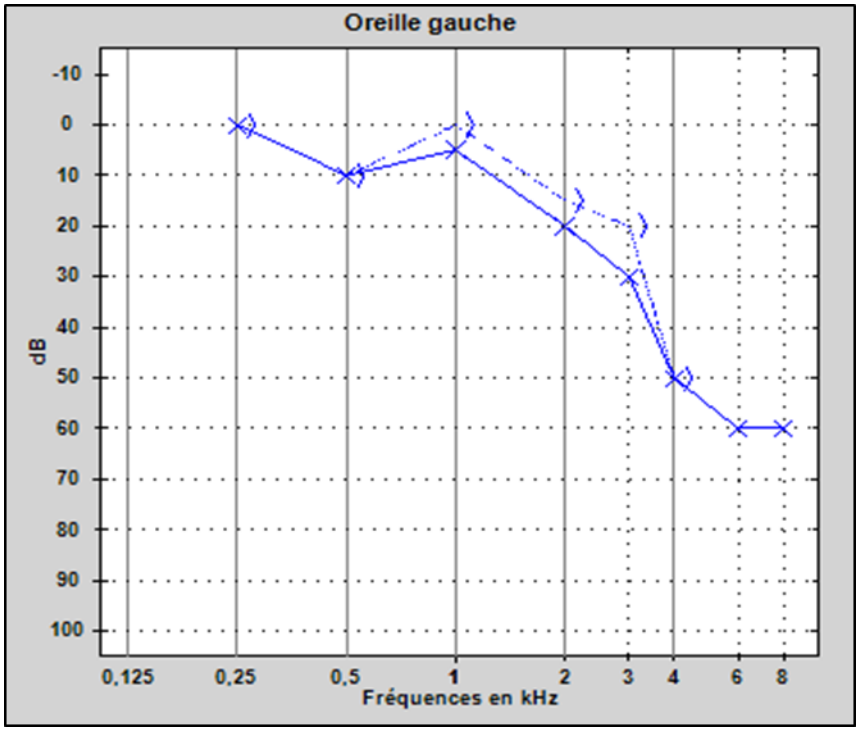
Hearing Loss Compensation Claims Review

OTHER AUDIOMETRIC PATTERNS OBSERVED: LOW SLOPING

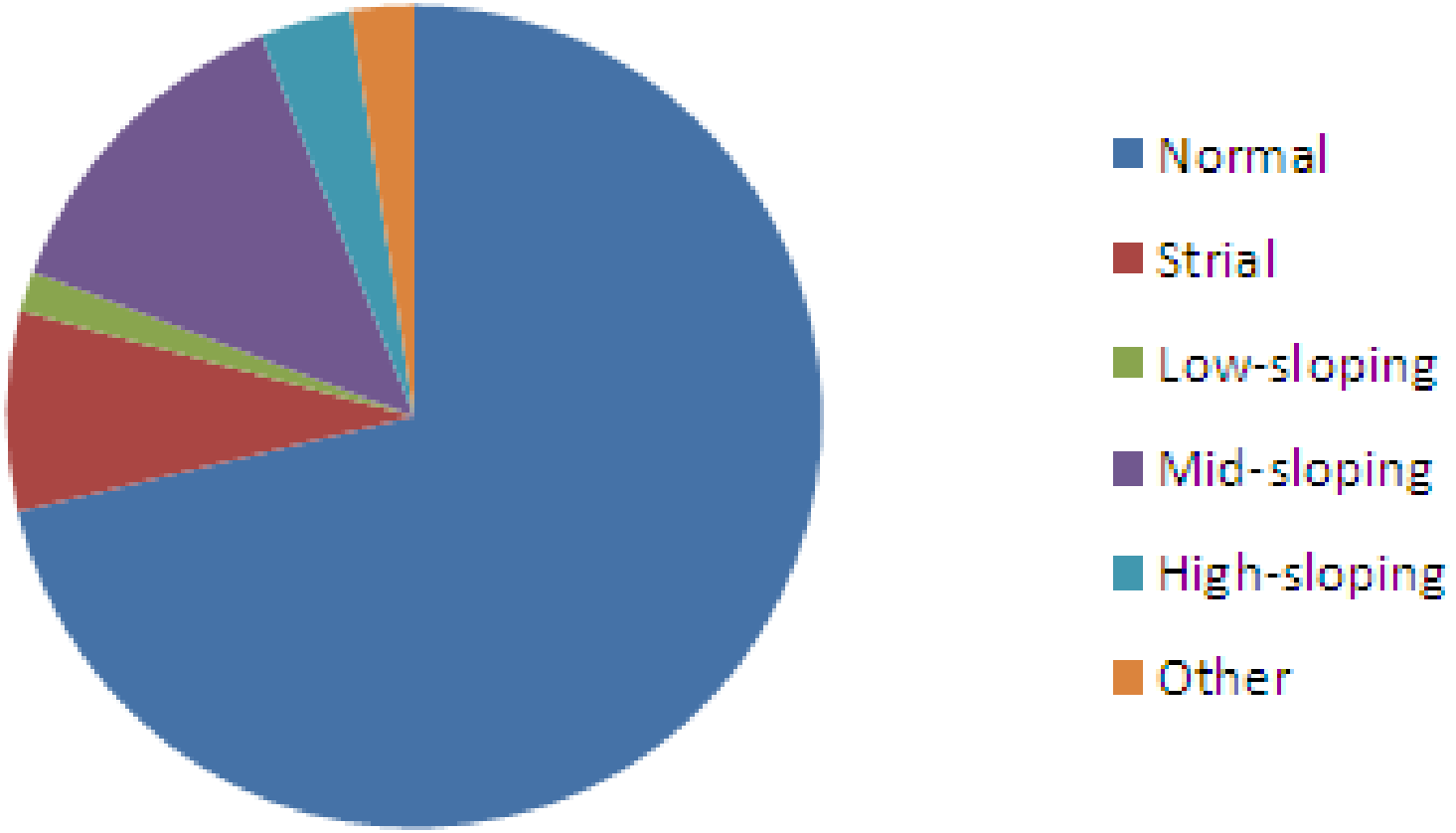


Hearing Loss Compensation Claims Review

OTHER AUDIOMETRIC PATTERNS OBSERVED: MID-SLOPING



Global Analysis
(based on last audiogram)



Medical considerations

The first consideration is to determine whether the factors involved are of an intrinsic or extrinsic nature and whether there are otologic or systemic diseases present that could have modified the HTLs shown on the Audiogram

Can Advanced Data Analysis improve HCP Performance?

What are the limitations and challenges involved?

“Successful people do what less successful people are not willing to do. Even if it is uncomfortable or goes against ‘the norm’…”

Reasons why an HCP may not be effective in preventing recordable Hearing Loss

Is your Exposure Model sound?

Are the correct HPDs being fitted, fit-tested and worn?

Are there other causes such as oto-toxins, off-site expsoures, etc?

The Most Successful Hearing Conservation Programs are Metrics Driven.

The question is, what metrics are important?

Are the indicators Leading or Lagging?

What do they offer in terms of actionable information?

The Role of Advanced Predictive Analytics

Certain intrinsic or extrinsic causes other than exposure to noise may accelerate worsening of HTLs in a short period of time.

Analyzing the Trajectories or Trends in HTLs is a very useful tool in identifying abnormal progressions in hearing degradation over time, regardless of whether it is due to noise exposure or other causes…

Silos get in the way of big data analysis. Whether in data sources or organizational structures, silos lead to complicated analytics and lackluster results

Real Ear Exposure Levels (REEL)

Developed by

Bertrand-Johnson Acoustics Inc.

REEL Software

- A method to estimate the Real Ear Exposure Level (REEL) to which an employee is exposed to regardless of hearing protection devices worn, time and manner in which it is worn.

(19) **United States**

(12) **Patent Application Publication**

BERTRAND et al.

(10) **Pub. No.: US 2017/0300631 A1**

(43) **Pub. Date: Oct. 19, 2017**

(54) **METHOD TO ESTIMATE REAL NOISE EXPOSURE LEVELS**

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(73) Assignee: **Bertrand Johnson Acoustique Inc.**, MONTREAL (CA)

(21) Appl. No.: **15/486,286**

(22) Filed: **Apr. 12, 2017**

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Publication Classification

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A61B 5/12	(2006.01)
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G06F 19/00	(2011.01)

(52) **U.S. Cl.**

CPC ***G06F 19/322*** (2013.01); ***G06F 19/3437*** (2013.01); ***A61B 5/125*** (2013.01); ***A61B 5/7275*** (2013.01)

(57) **ABSTRACT**

There is provided a method for determining a noise exposure level associated as the cause of an observed evolution of hearing acuity of an individual of known gender. The method comprises the following steps: 1) providing a first audiogram of the individual measured at age X and a second audiogram of the individual measured at age Y; 2) inputting the individual's gender, age X, and a time period equal to Y−X in a statistical hearing threshold levels evolution prediction formula; 3) calculating projected hearing loss audiograms specific to each of a plurality of possible noise level exposure values, using the prediction formula; 4) comparing a pattern of each calculated projected audiogram with a pattern the second audiogram; 5) selecting the projected audiogram that best fits the second audiogram; and 6) assuming that the noise exposure level value associated with the selected projected audiogram is the noise exposure value that caused the evolution of hearing acuity observed between the first and the second audiograms. There is also provided systems for performing the method and methods for providing services to clients or enabling users regarding determination of real ear noise exposure values.

THEORY

- ISO 1999 (7029) and ANSI S3.44 Standards are used to predict changes in Hearing Thresholds Levels (HTLs) based on:
  - Age
  - Gender
  - Level of exposure
  - Duration of exposure

BASIS OF REEL

Data mining of hundreds of thousands of audiograms and noise exposure records enabled the development of an algorithm based on a retrospective analysis of the expected behavior of HTLs at the .5, 1, 2, 3 4 and 6 kHz

Using: Age, Gender, plus Level and Duration of Exposure, the software can plot expected Evolution of HTLs at the key frequencies

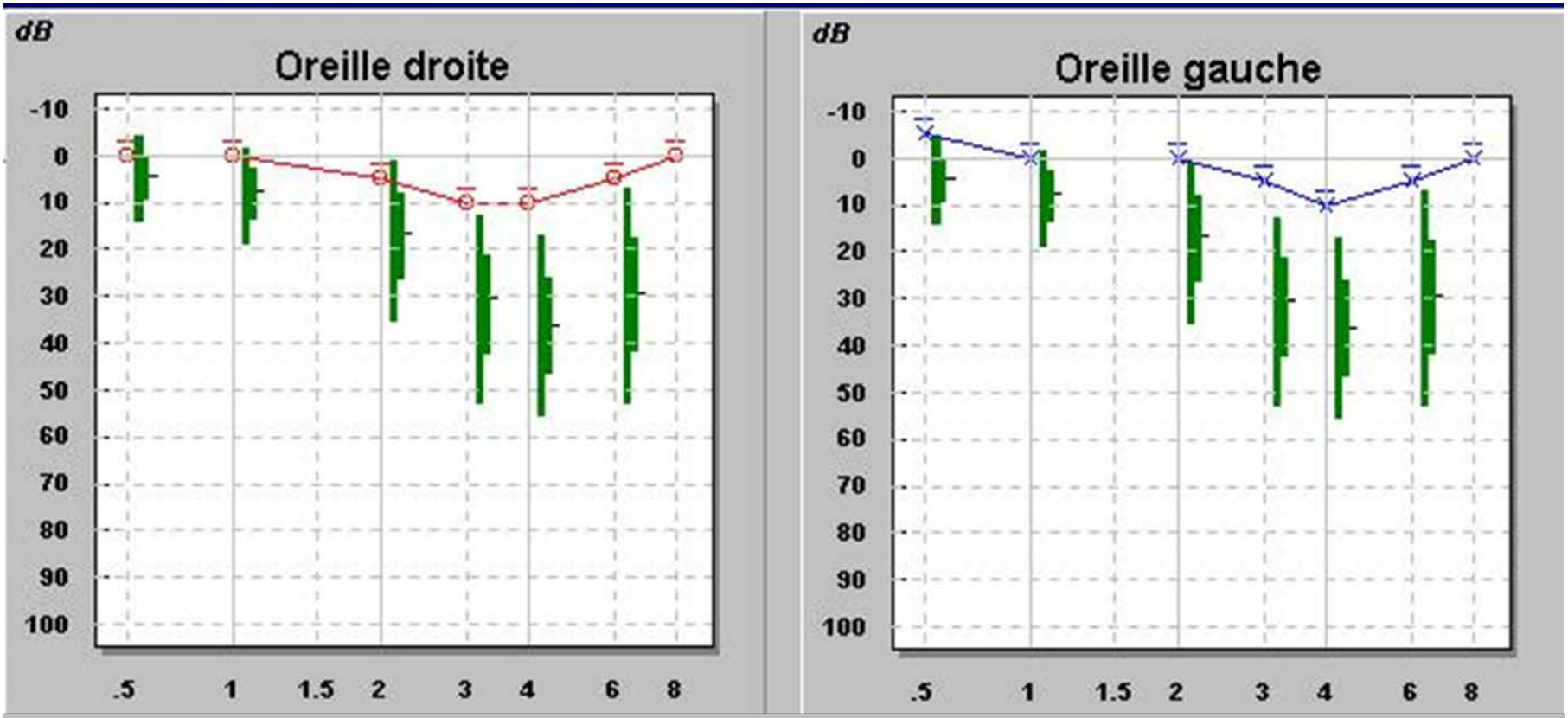
…the REEL procedure estimates the noise level that would have produced the observed evolution of HTLs at each frequency. This has incredible power to uncover root causes of hearing loss

Uses of REEL

- Identify Real Ear Exposure Level based on the evolution of audiometric results of an individual
  - Tracks the evolutions of the HTLs from one audiogram to another in order to estimate the noise level that would have caused such an evolution

- Identifies at-risk employees who are showing effects consistent with unusually high levels of an estimated noise exposure with respect to their actual measured noise environment

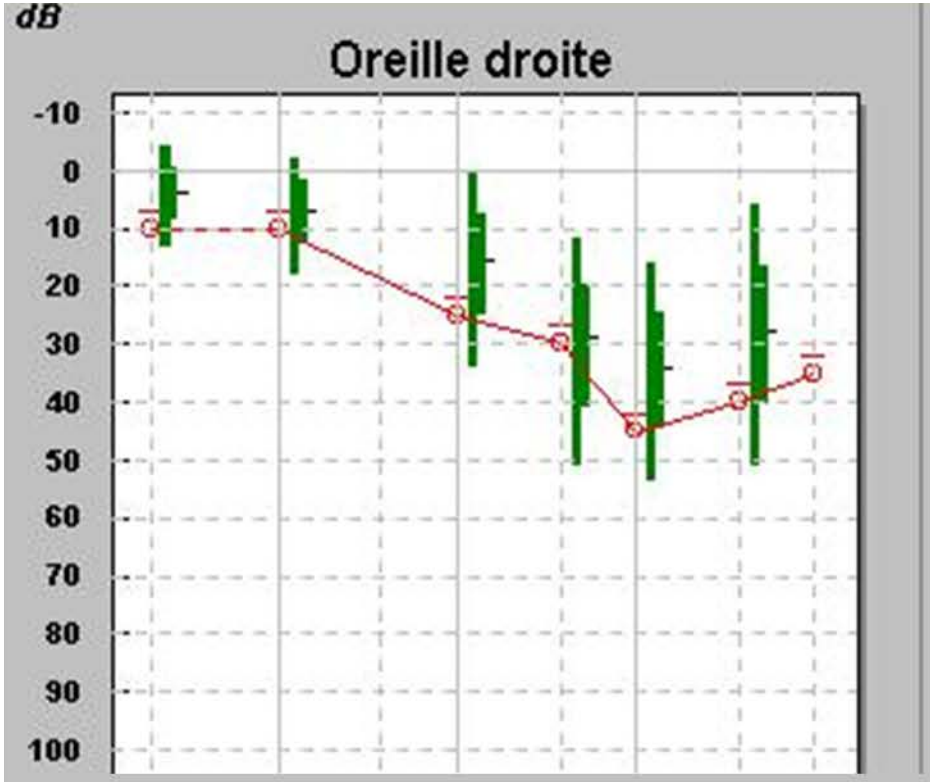
Actual outcome vs predicted HTL change

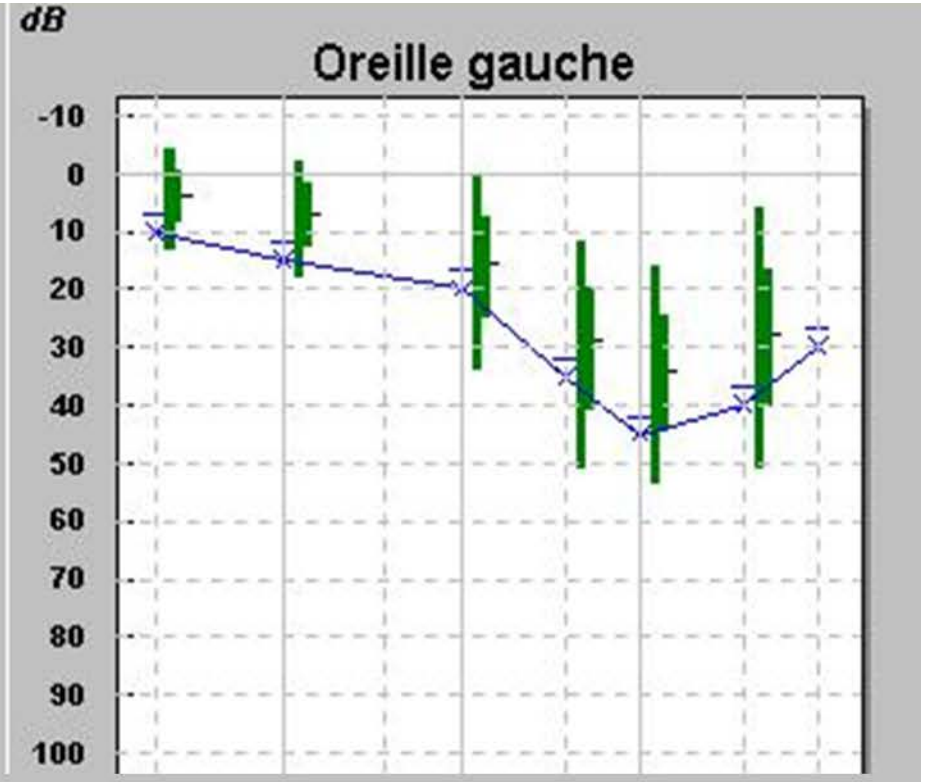


This subject demonstrates thresholds better than the projected HTL's for their personal noise exposure level. This could be the result of:

- Adequate use of HPD's
- More resistant to the effect of noise on hearing
- Inadequate measure of the noise exposure level
- Whatever the cause, it is the kind of result we should aim for in all workers

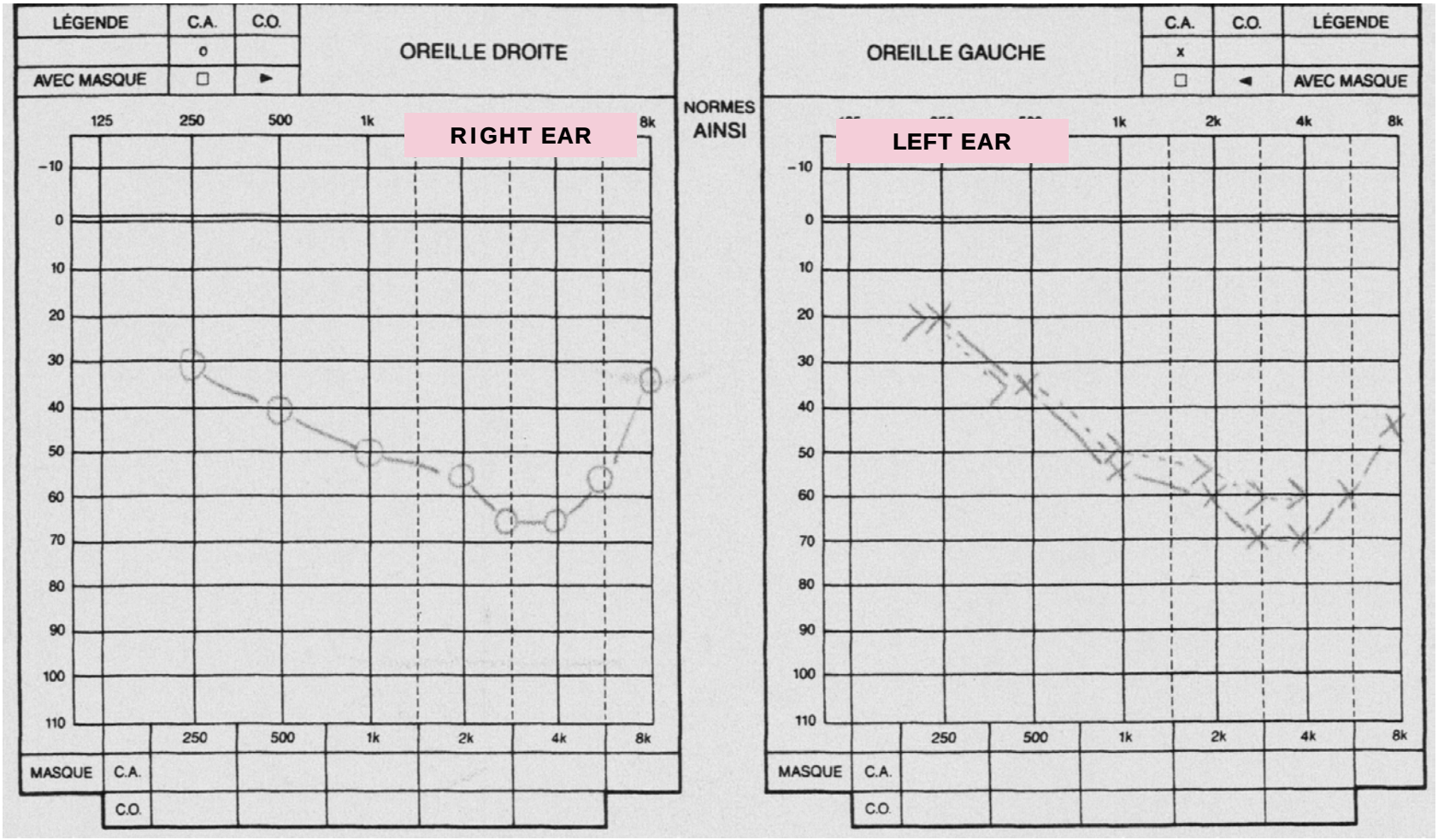
Poor outcome vs predicted HTL change





As shown in this case, we can notice that this subject is slightly below the median projected for this group

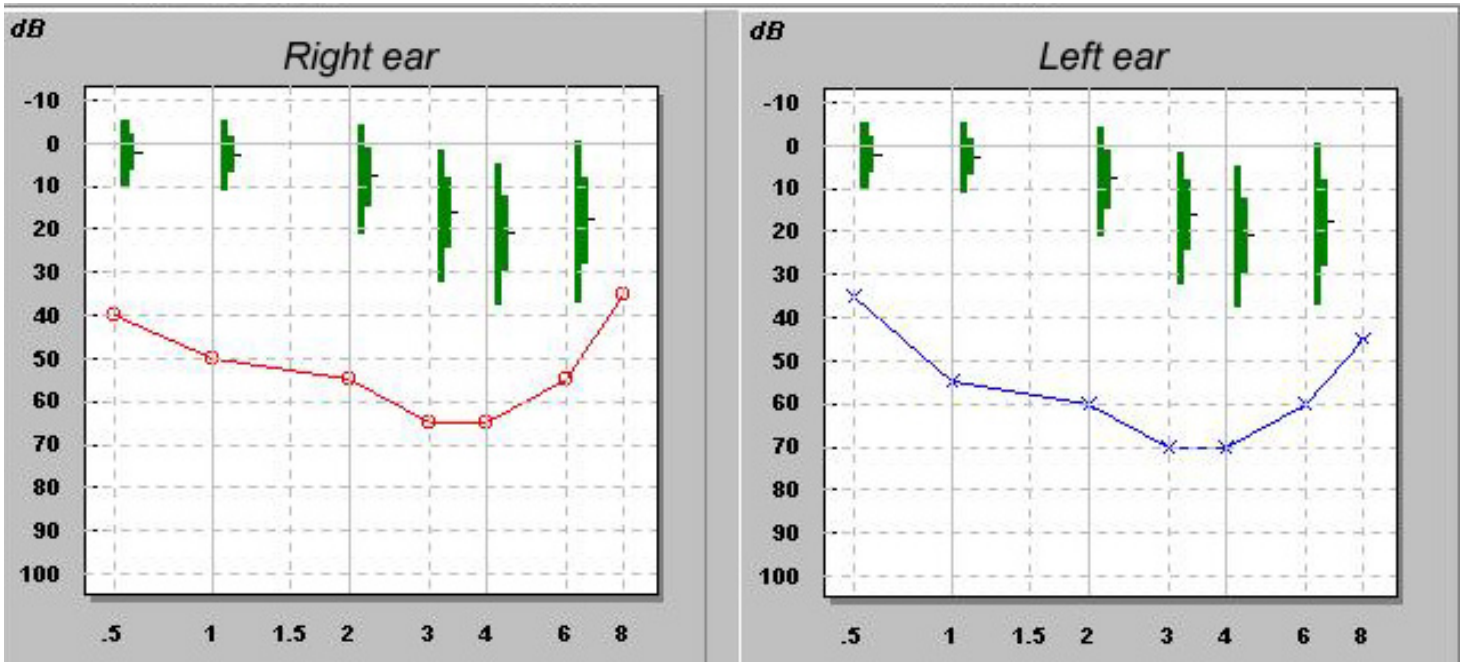
Actual Subject Example #1: Truck driver



Example of non-occupational NIHL

Male, 41 years, truck driver, 15.6 years exposure to 82.2 dBA, 8hrs/day

Conclusion: No relation between HTLs and projections
Review of case: Works as disc jockey on the weekends 12 to 14 hours (typical)
Non-occupational exposure: Average 10hrs/week,100 dBA



Outcome of non-occupational determination

Example #2 – Machine Operator

Subject: Male - 62 years old

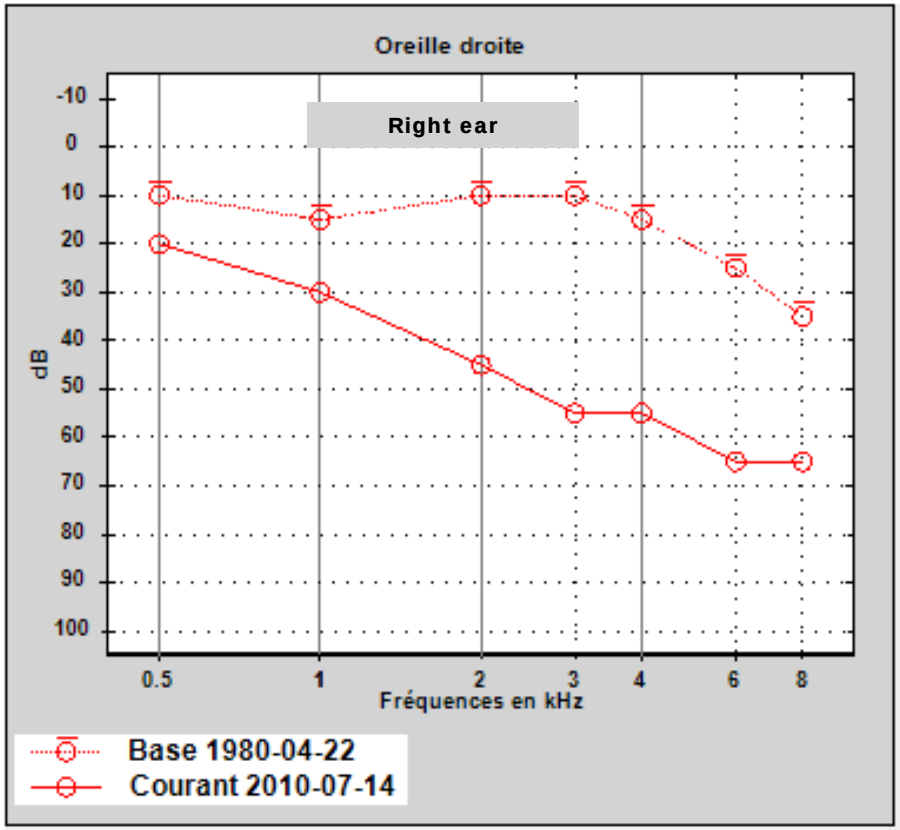
Occupation: Manufacturing

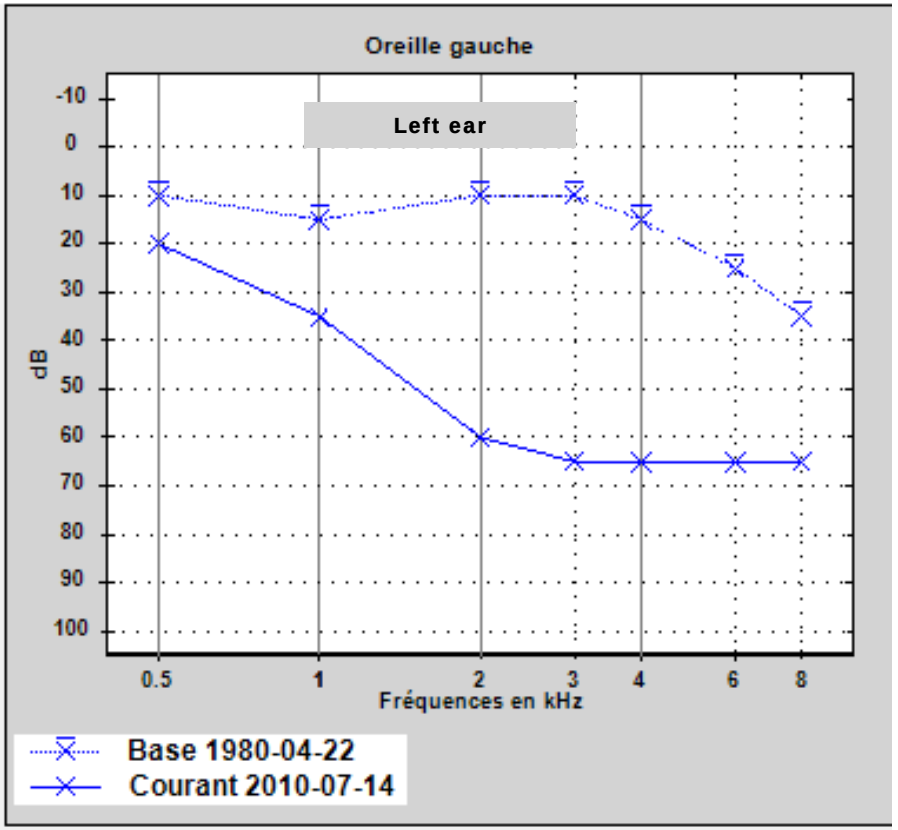
Duration of exposure: 1978 to 2014

Noise exposure levels: 84 dBA

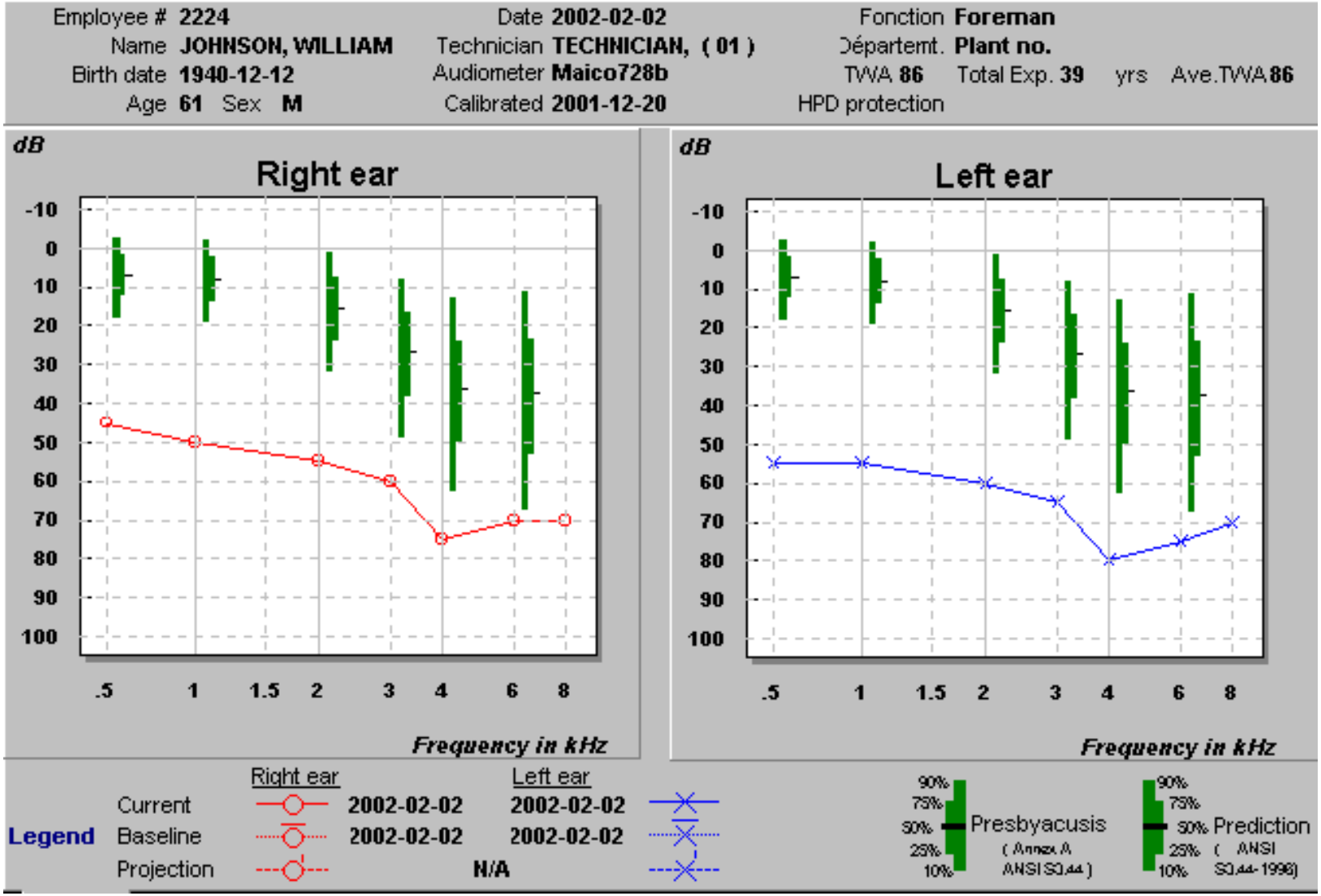
Medical History: Reviewed

Audiogram / Current HTLs to Baseline





Audiogram analysis to predicted outcome



Medical history

1. High cholesterol
2. Hypertension
3. Heart disease
4. Aortic valve/bypass surgery

Remember - Systemic disease with vascular pathologies will very likely affect the auditory system due to decreased oxygenation.

Results

Claim rejected (due to personal pathologies)

Lost in the Noise?

We know that advanced data analytics can be used to identify workers at risk of not only hearing loss but possibly other serious health issues.

It is only a matter of time before application of these techniques are more widely used as best practice in Industrial Hygiene & Audiology

RESEARCH TEAM LEADERS

BERTRAND–JOHNSON ACOUSTICS INC.

Dr. Robert Bertrand (Neuro-Otologist)

Dr. Daniel Johnson (Ret., USAF decd. 2007)

References and related Publications

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Friedland DR, Cederberg C, Tarima S (2009) “Audiometric Pattern as a Predictor of Cardiovascular Status: Development of a Model for Assessment of Risk.” Laryngoscope; 119: 473-86.

California Code of Regulations Title 8, Section 14300.4 and .5


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