

# **NOISE INSIDE WORKPLACES**

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## 1 – NOISE EFFECTS

### Effects on hearing

Adaptation phase

Hearing Fatigue

Acoustic trauma

Deafness

### Other effects

On the sense of balance and of movement

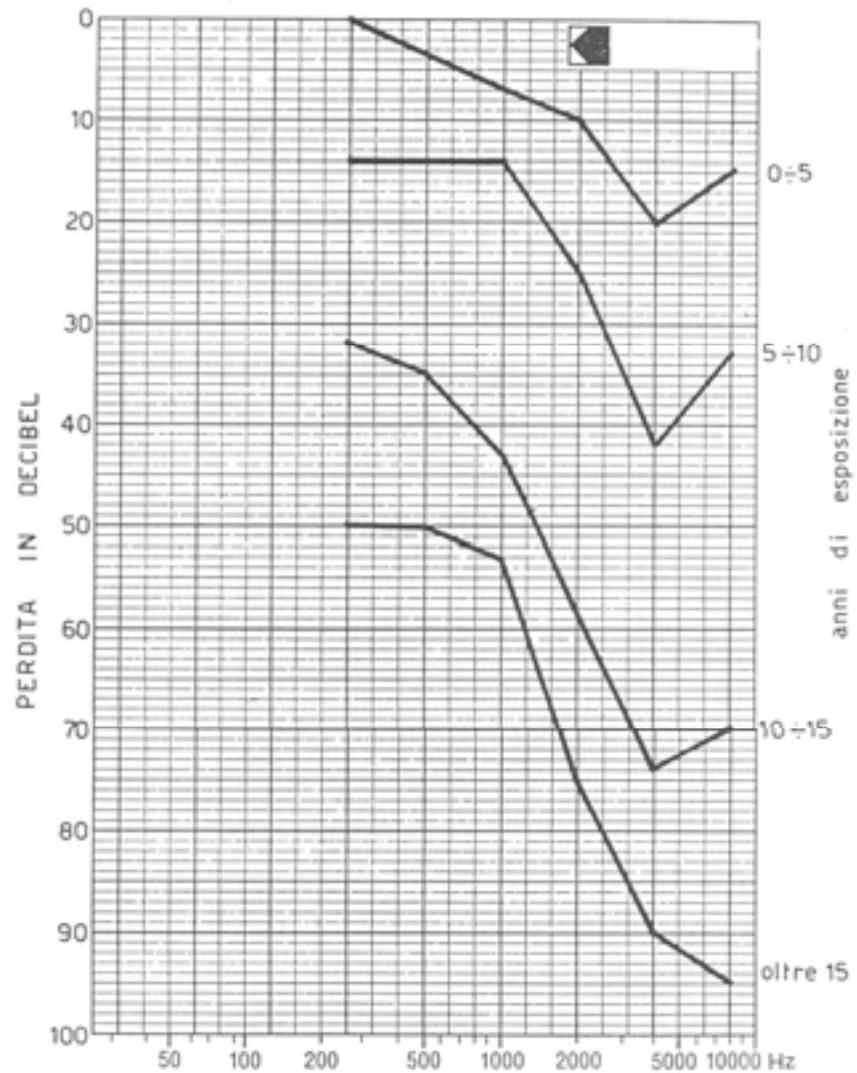
On the sense of attention and of concentration

On the eyesight

On the nervous system, on the character, on the behavior

On the digestive, respiratory, circulatory and vascular systems

Audiometric curves  
of 1200 workers of  
mechanical industry



## 2 – Decree n.195/2006

“Putting into effect of the Directive 2003/10/CE related to workers exposure to the risks deriving from physical agents (noise)”

The limit values of exposure and the action values, respectively referred to daily exposure level  $e$  to the peak of acoustic pressure, are:

- a) Limit values of exposure :  $LEX_{8h} = 87 \text{ dB(A)}$  e  $p_{peak} = 200 \text{ Pa}$  (140 dB(C));
- b) Top action values:  $LEX_{8h} = 85 \text{ dB(A)}$  e  $p_{peak} = 140 \text{ Pa}$  (137 dB(C));
- c) Lower action values:  $LEX_{8h} = 80 \text{ dB(A)}$  e  $p_{peak} = 112 \text{ Pa}$  (135 dB(C)).

In specific conditions, it is possible to use the weekly exposure level but it don't have to exceed the 87 dB(A) and appropriate protective action must be adopted to reduce exposure risks for workers

Where:

Peak of acoustic pressure: the maximum value of the instantaneous acoustic pressure on frequency C;

Daily level of noise exposure ( $L_{ex,8}$ ): medium value of noise exposure levels based on a working day of 8 hours;

Weekly level of noise exposure ( $L_{ex,8}$ ): medium value of noise exposure levels based on a week of 5 days of 8 working hours each.

## 3 – Risk assessment

It is based on:

- a) level, time and duration of the exposure;
- b) exposure limits and action values;
- c) all the effects on health and safety for workers particularly sensitive to noise;
- d) all the effects on health and safety deriving from interaction between noise and toxic agents for the ear in the work activity or between noise and vibration
- e) all indirect effects on health and safety deriving from interaction between noise and acoustic alarms existing in work places to avoid risk of accident;
- f) information on equipment noise emissions given by producers;
- g) existing of other equipment with less noise emissions
- h) the possibility to extend the work time over 8 hours;
- i) data on health surveillance deriving also by scientific literature
- l) availability of protective device

When the overcoming of the lower action values has been assessed, the employer must measure the real noise levels inside the workplace to which the workers are exposed.

When the overcoming of the top action values has been verified, the employer must put into effect a program of technical and organizational actions for reducing noise exposure.

Assessment and measurements must be repeated at least every four years or when relevant changes in work activities or equipments are actuated or when the health surveillance suggest the need.

## 4 - Mitigation actions

In any case, the employer must guarantee the respect of the exposure limits by:

- a) Adoption of different working procedure that help to reduce noise exposure
- b) Choice of adequate equipment with less noise emission;
- c) Designing of structure and workplaces aimed to reduce the exposure conditions;
- d) Information and training for each worker regarding the correct use of the equipments;
- e) Adoption of technical solutions for containing :
  - 1) the noise transmitted by air, i.e. screens wrappings or covering realized by absorbent materials;
  - 2) the structural noise, i.e. anti-vibrations or insulating systems;
- f) Specific maintaining programs for equipments and systems on workplaces;
- g) Modification of the working organization by reduction of the duration and the intensity of the exposure choosing adequate working time

- The areas where the top action values could be overcome must be defined by specific signs and the access must be restricted, whenever possible.
- The employer must consign personal protective device when the lower action values could be overcome.
- He obliges the workers to use the above devices when the top values could be overcome.

When the exposure limits could be overcome, the employer must immediately adopt solutions to reduce the level under the above limits, individuate the causes of the excessive exposures, modify mitigation solution to avoid the repeating of the situations.

## 5 - Protective devices



Devices on-ear

Devices off-ear



## 6 - Protective devices reduction effects

Frequency (Hz)	125	250	500	1000	2000	4000	8000
Reduction (dBA)	21	23	27	30	32	38	39

The reduction with put on device can be assessed following the below methods:

**1) Octave band method (APV)** (complete): it's necessary to know the octave band levels;

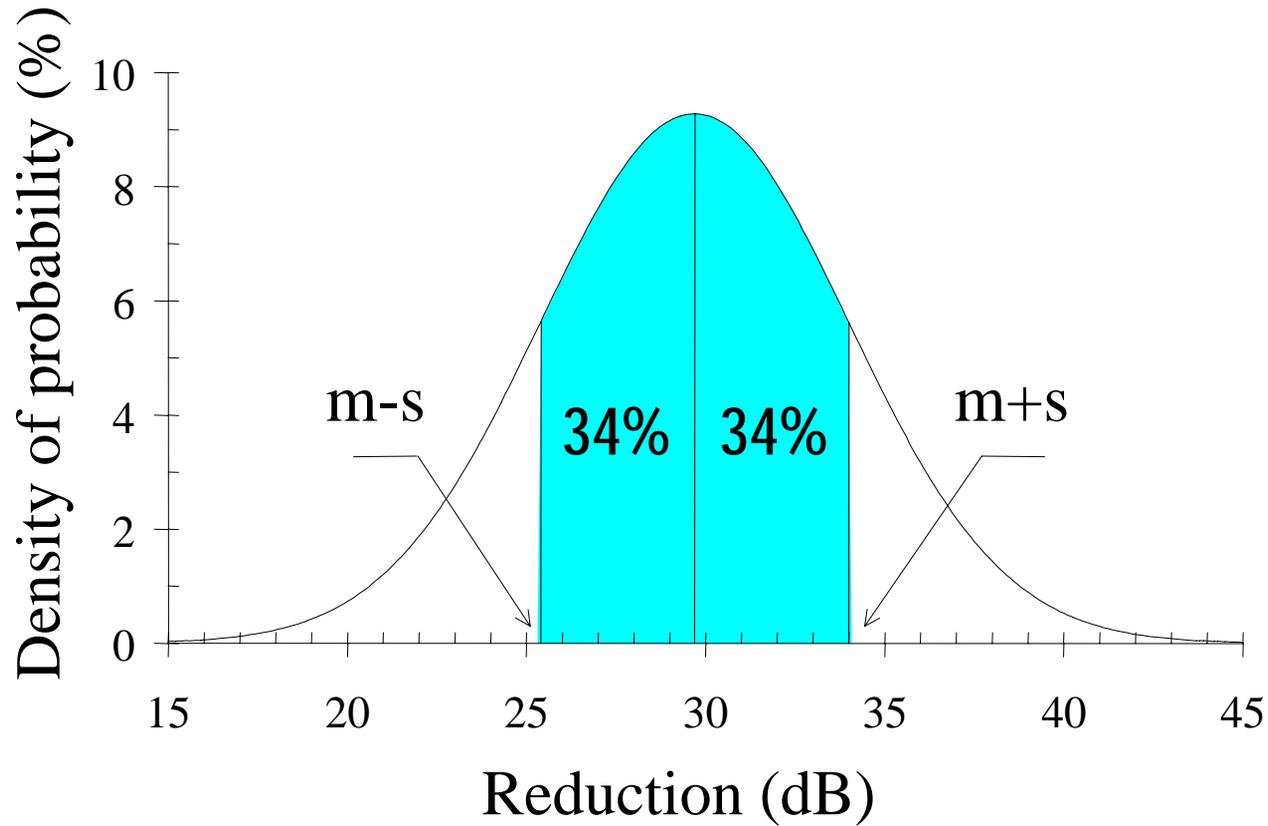
**2) HML Method** (simplified): it's necessary to know **C** and **A** weighted levels

**3) SNR Method** (very simplified): it's necessary only to know **C** weighted level

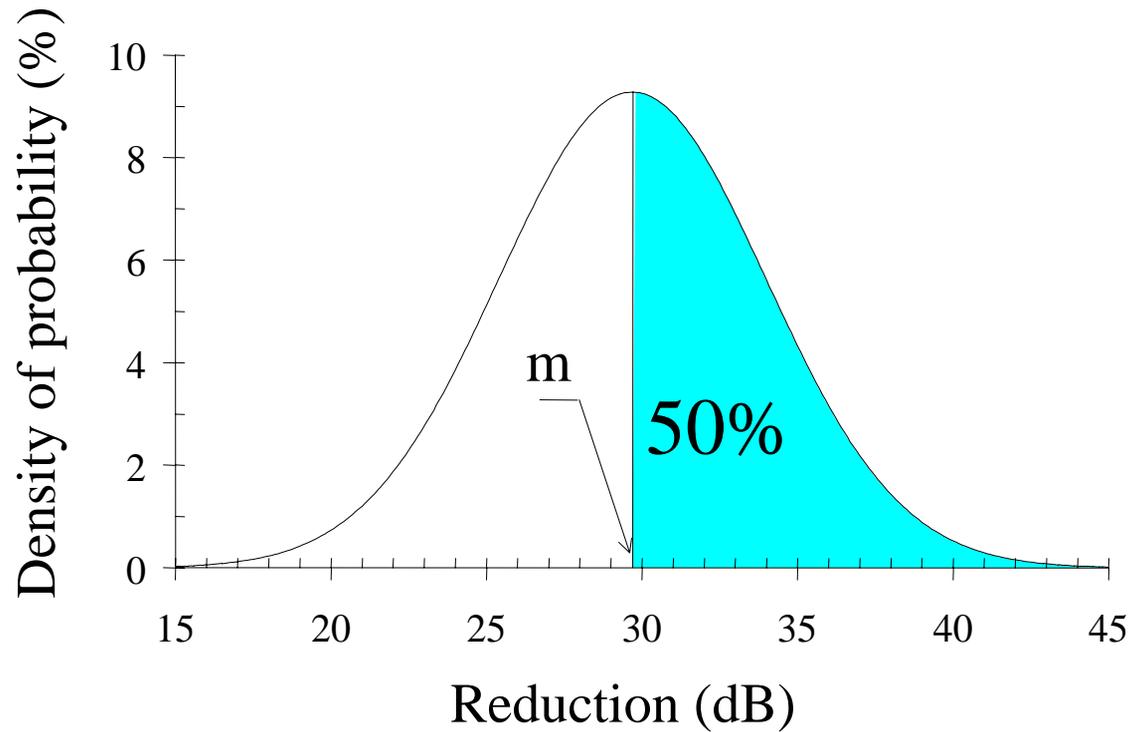
The reduction is not the same for each person but it follows a probabilistic law because it depends on the internal shape of the ear.

So the producer specifies for each device and for each frequency the reduction and the standard deviation

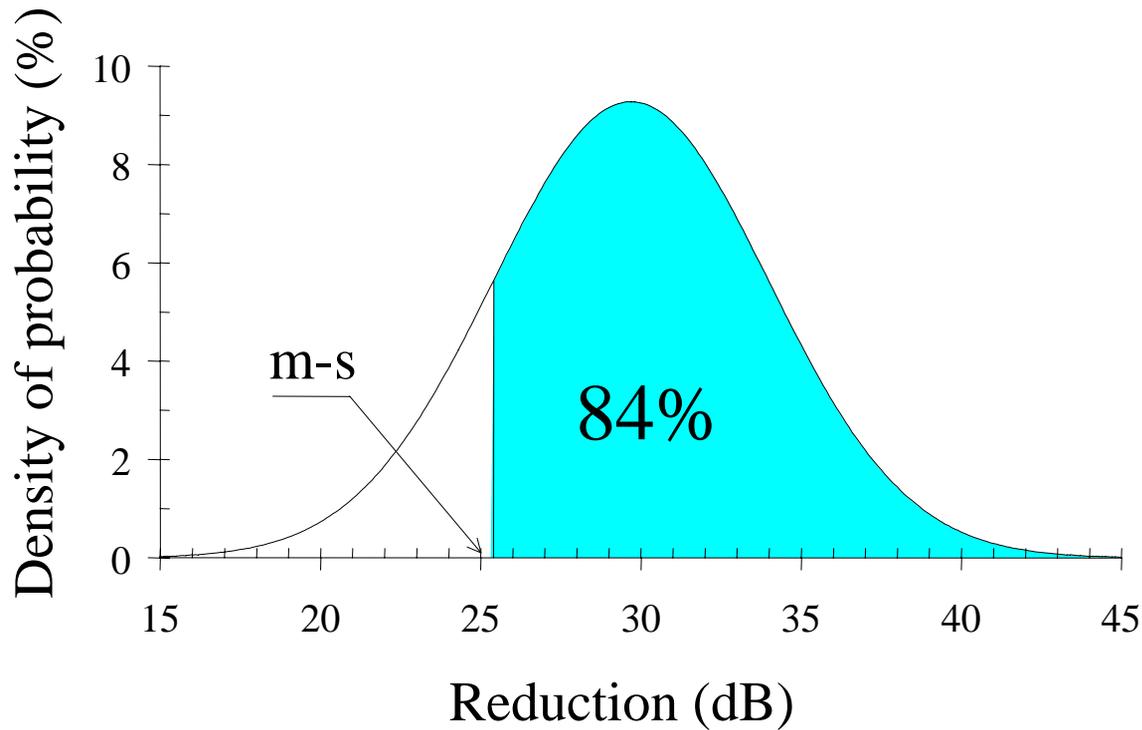
<i>Frequenza (Hz)</i>	<i>125</i>	<i>250</i>	<i>500</i>	<i>1000</i>	<i>2000</i>	<i>4000</i>	<i>8000</i>
Medium Reduction (dB)	21.0	23.3	26.9	29.7	32.4	38.4	38.7
Standard Deviation (dB)	4.7	4.4	4.8	4.3	3.9	4.2	5.1



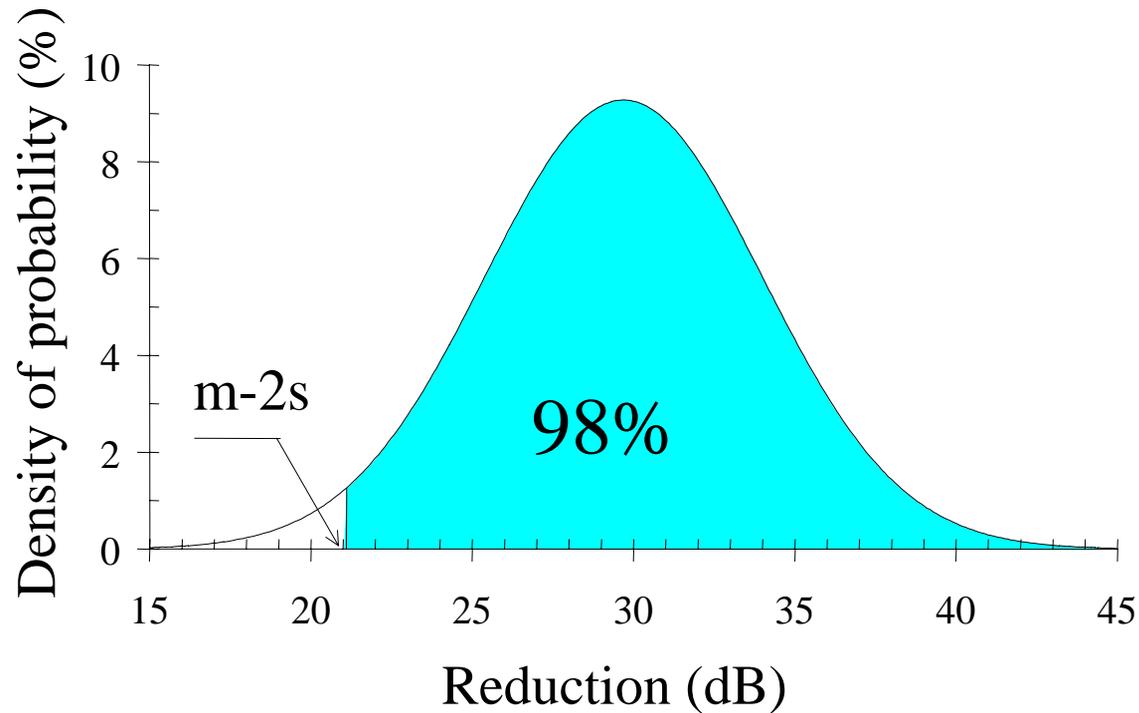
Percentage of workers comprised between m-s and m+s



Reduction for the 50 % of the workers



Reduction for the 84 % of the workers considering only one standard deviation



Reduction for the 98 % of the workers considering two standard deviations

## 7 - Over protection

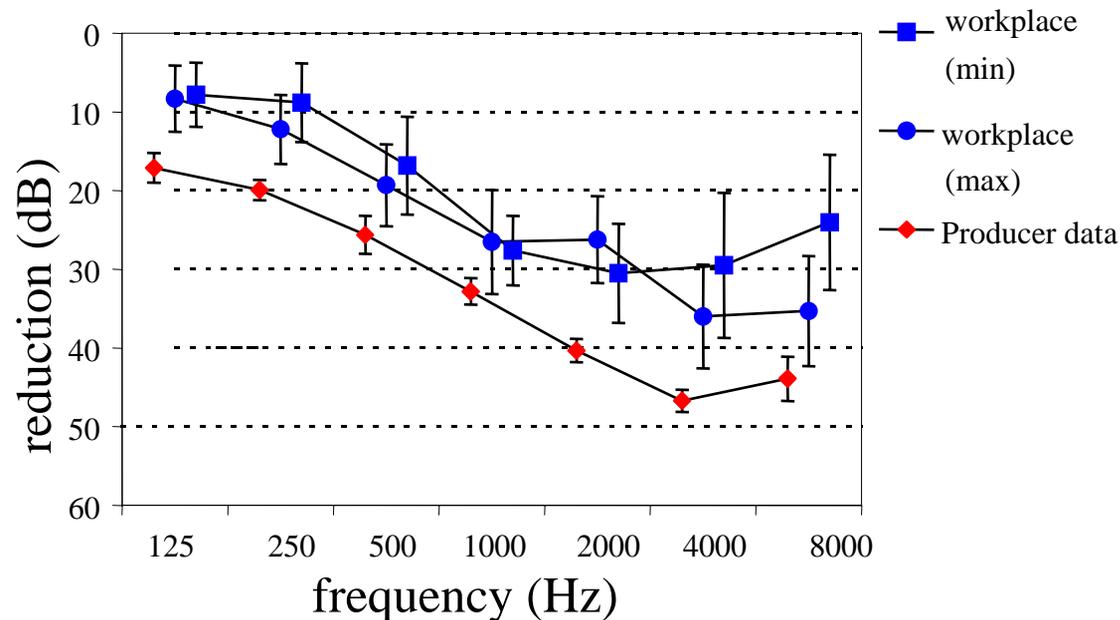
- 1) Low noise perception of the noise generated by the equipment in case of bad operation;
- 2) Bad perception of alarm signs;
- 3) Bad comprehension of verbal communications

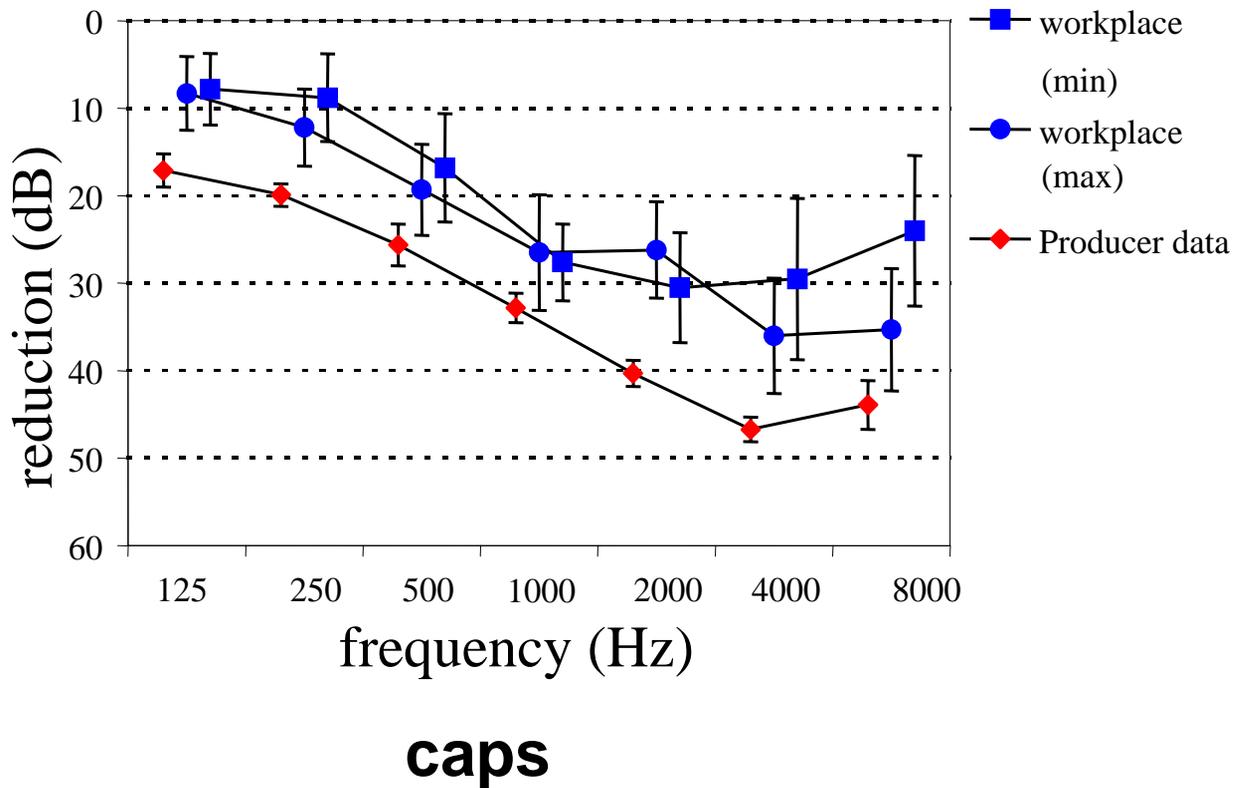
The noise exposure level with devices on ear shouldn't be less than 70 dB(A).

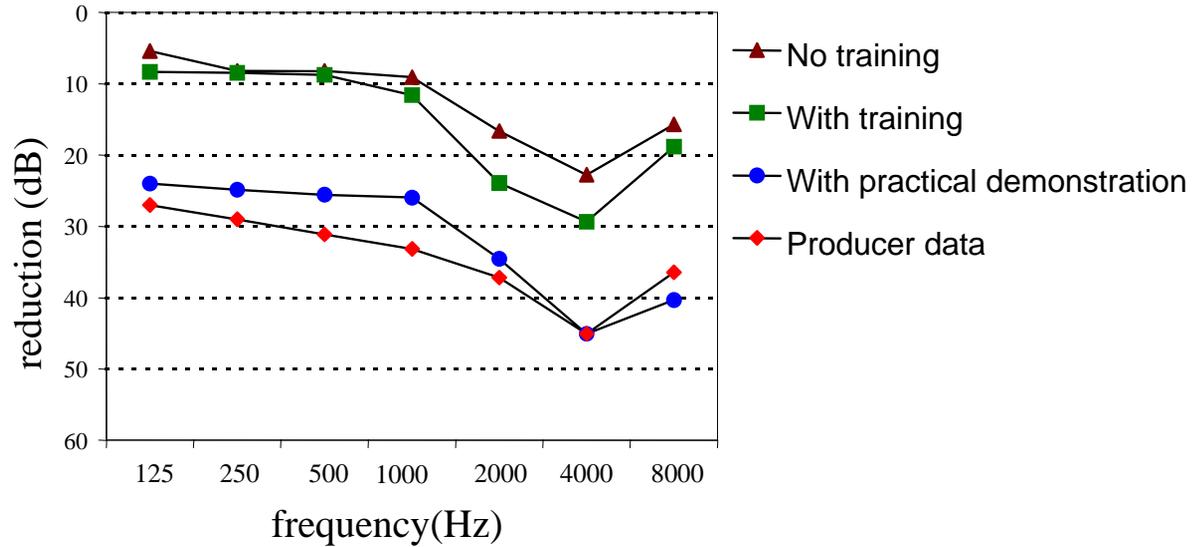
## 8 - Real protection

In the workplaces the protection depends on various factors due to worker and its training, to ambient itself, to operating conditions, to device ecc.

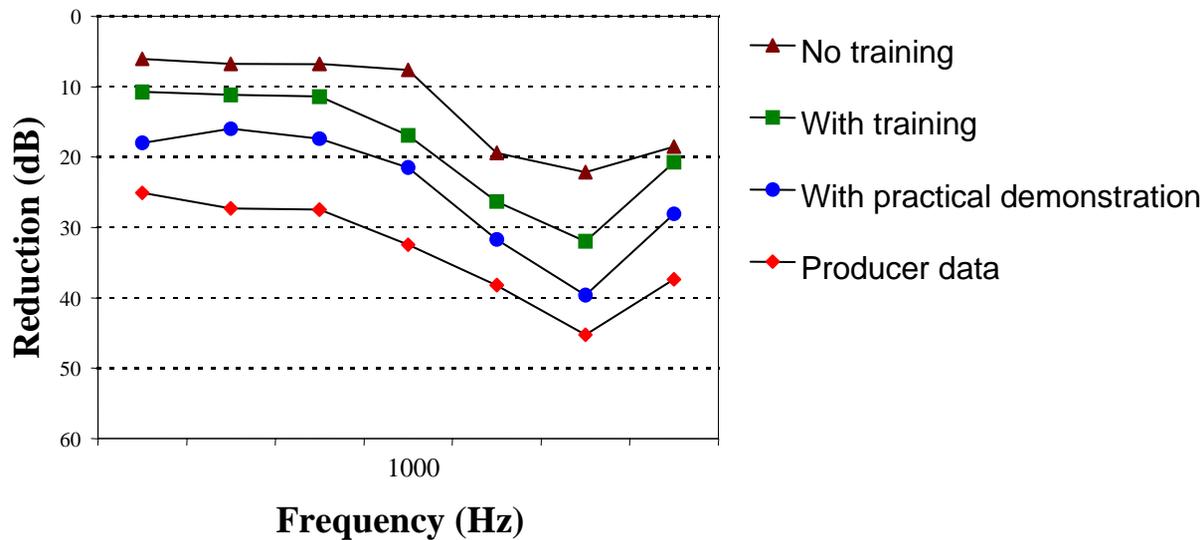
That determines protective conditions different from those estimated by producer; i.e. for headsets:







**Preformed caps**



**Soft caps**

## 9 – Normative references

- European Directive 2003/10/CE on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise).
- Decree n.195/2006  
“Putting into effect of the Directive 2003/10/CE related to workers exposure to the risks deriving from physical agents (noise)”