

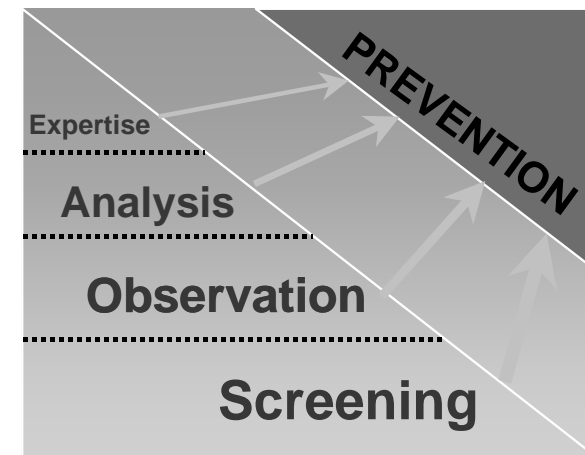
Strategy for management of the risk due to noise

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Prevention Strategy



Stage 2, Observation



Stage 2, Observation: Objectives

- **Collect general information on**
 - Noise sources
 - Noise exposure conditions.
- **Determine immediate technical measures**
- **Determine if a detailed Analysis is necessary**
 - What priority
 - What objectives.



Stage 2, Observation: Who?

- **People inside the company**
 - Who know perfectly the working conditions
 - Ideally, the workers + technical staff
- **Characteristics**
 - Simple vocabulary and words
 - Work situation characterized in all circumstances
 - Not at a given time.
 - No measurement.



Stage 2, Observation: Procedure

1. Characterization of the noise sources

- Identification of the main noise sources
- Location of the work places and the workers
 - With respect to the sources
 - On a map of the area.



Stage 2, Observation: Procedure

2. Risk in the present situation

- Voice level spontaneously adopted
- Order of magnitude of the noise level
- Severity of the risk

Voice level	Normal	Loud	Very loud	Shouting	Maximum shouting
Level (dB(A))	50	70	85	90	100
Interpretation	Light discom fort	High discom fort	Low risk	Medium risk	High risk
Of hearing loss					



Stage 2, Observation: Procedure

Workplace	Before			After			Need for an Analysis
	Voice level	Noise level	Risk	Voice level	Noise level	Risk	



Stage 2, Observation: Procedure

3. Noise control

- Look for straightforward solutions

Items to consider	Possible solutions
Vibrations of parts or panels:	Tighten parts or panels Cover them with a rubbery material
Vibrating ground:	Install silent blocks
Impacts of parts on a hard surface:	Tilt the plate on which the parts are falling Cover it directly or in sandwich with a rubbery material
Mechanical noise:	Use helicoidal gears Use plastic materials Equilibrate rotating parts
Aerodynamic noise:	Avoid discontinuities (elbows,...) Or sharp edges in the air stream Use silencers in ducts

Stage 2, Observation: Procedure

3. Noise control

Air jets:	Use exhaust mufflers for decompression air jet Use special air guns Reduce the air velocity of the jet Avoid the impact of the air jet on a sharp edge or perpendicular to a surface
Acoustical enclosure on the machine:	Use hermetic enclosure covered with rubbery materials Install absorbing materials inside
Pure tones:	Equilibrate rotating parts Dampen the blade on power saws Use rubbery materials on resonating parts
Relocation of the source:	Move the source away from the workers Install a screen between sources and workers.
Acoustical treatment of the room:	Add some absorbing materials near the source if the room is highly reverberant Check noise transmission from adjacent rooms or from the outside

Stage 2, Observation: Procedure

4. Residual risk after implementation of control measures

Workplace	Before			After			Need for an Analysis
	Voice level	Noise level	Risk	Voice level	Noise level	Risk	

Stage 2, Observation: Procedure

5. Conclusions:

- **Need for a detailed Analysis (stage 3)**
 - For what sources?
 - To reach what level of risk?
- **Short-term measures**
 - What personal protection
 - Carried by whom
 - When and how long.

Stage 2, Observation: Conclusions

Noise sources Or activities	Actions			
	What?	Who?	When?	Priority



Stage 3, Analysis



Stage 3, Analysis: Objectives

For the problems not solved satisfactorily at Observation

- Deepen the research for prevention measures
- Ordinary measurements
- Estimate the exposure of the workers.
- Search for more sophisticated prevention measures.
- Organise the HCP.
- Estimate if a more detailed Expertise is needed



Stage 3, Analysis: Who?

- The people who performed the stage 1, Observation
- Assistance of an OH specialist trained in HCP
- **Characteristics**
 - Concepts used more rigorously.
 - Noise exposure levels measured
 - Simple instruments.



Stage 3, Analysis: Procedure

1. Exposure of the workers: present situation

- Groups of workers with same exposure (HEG).
- Stationarity interval
- Times and duration for measurement:
 - Work phases, representative dates and hours.
- Appropriate measuring techniques.
- $L_{Aeq,i}$ for each work phase i.
- Exposure duration per day or week for each $L_{Aeq,i}$.



Stage 3, Analysis: Procedure

- Partial personal noise exposure level

$$L_{PE,i} = L_{Aeq,i} - K$$

$$k = 10 \lg \left(\frac{8h \text{ or } 480 \text{ min}}{\text{duration per day}} \right) \quad \text{or} \quad k = 10 \lg \left(\frac{40h \text{ or } 2400 \text{ min}}{\text{duration per week}} \right)$$

Duration/week	5'	25'	50'	100'	150'	225'	5h	7.5h	10h	15h	20h	25h	30h	40h
Duration/day	1'	5'	10'	20'n	30'	45'	1h	1.5h	2h	3h	4h	5h	6h	8h
K dB(A)	27	20	17	14	12	10	9	7	6	4	3	2	1	0



Stage 3, Analysis: Procedure

- Personal noise exposure level L_{PE}

Difference in dB(A) Greatest - smallest	0	1	2	3	4	5	6	7	8	9	10	12
Difference in dB(A) Total - greatest	3	2.5	2.1	1.8	1.4	1.2	1.0	0.8	0.6	0.5	0.4	0.2



Stage 3, Analysis: Procedure

Risk in the present situation:

- Discomfort:

$L_{Aeq,i}$ (dB(A))	50	60	70	80
Voice level	Normal	Raised	Loud	Very loud
Discomfort	Low	Medium	High	Extreme



Stage 3, Analysis: Procedure

Risk in the present situation:

- Hearing impairment: % subjects 55 years old, 35 years exposure to the present noise, average hearing loss > 25 and 50 dB

L _{PE} dB(A)	85	90	92	94	97	98	99	100
50 dB	4	5	7	9	15	18	21	26
25 dB	29	36	40	46	59	65	70	75



Stage 3, Analysis: Procedure

Work phases	Daily exposure duration	L _{Aeq,i} dB(A)	Impact >140 dB	L _{PE,i} dB(A)	Comments	Priority
L _{PE} dB(A) =						
Interpretation: Discomfort Risk of hearing impairment greater than 25 dB: Risk of hearing impairment greater than 50 dB:						



Stage 3, Analysis: Procedure

Synthesis for the present situation	
Evaluation of the exposure and contributions of the different work phases	
Homogenous exposure group	
Representative period	
Measurements:	
Work phases	
Date and time	
Representativeness	
Instruments	



Stage 3, Analysis: Procedure

- Prioritisation of the work phases:
- Work phases with L_{PE,i} > acceptable noise level;
- Main noise sources responsible



Stage 3, Analysis: Procedure

2. Detailed Analysis of the exposure conditions

- Work techniques
 - New technology
 - Less noisy machines.
- Characterization of the noise sources:
 - Causes vs sources of noise
 - Noise level at the sources
 - Directions of emission



Stage 3, Analysis: Procedure

2. Detailed Analysis of the exposure conditions

- Noise reduction
- Noise propagation:
 - + distances sources-workers
 - + directivity of the sources
 - + screens between sources and workers.



Stage 3, Analysis: Procedure

2. Detailed Analysis of the exposure

- Acoustic treatment of the room:
 - + reverberation time
 - + reflecting partitions, ceiling or ground,
 - + absorptive materials
- Acoustic insulation with the neighbours and outside:
 - Tightness of doors and windows, cracks, openings,
 - Heavy gaskets, noise barriers.
- Work reorganisation



Stage 3, Analysis: Procedure

3. Report + who does what when.

Items	Actions			
	What?	Who?	When?	Priority
Work techniques				
Workplaces				
Noise sources				
Noise propagation				
Room acoustics				
Room insulation				
Work organisation				
Work duration				



Stage 3, Analysis: Procedure

4. future situation

- Personal noise exposure level L_{pe} expected
- Residual risk :
 - Discomfort, or hearing impairment
- Need for a Expertise
 - What priority and objectives?
- Short-term protective measures
- Medical surveillance:
 - Audiometric exams, Hearing conservation program.

Stage 3, Analysis: Procedure

Future situation						
Evaluation of the exposure and contributions of the different work phases						
Work phases	Daily exposure duration	$L_{Aeq,j}$ dB(A)	Impact >140 dB	$L_{PE,j}$ dB(A)	Comments	Priority
L_{PE} (dB(A)) =						
Maximum admissible noise exposure level						
Interpretation residual risk: Discomfort: Risk of hearing impairment greater than 25 dB: Risk of hearing impairment greater than 50 dB:						
Need for a stage 4, "Expertise"						
Personal protection what ? By whom ? When ?						
Medical surveillance (audiometric examinations)						

Stage 4, Expertise

Stage 4, Expertise: Objectives

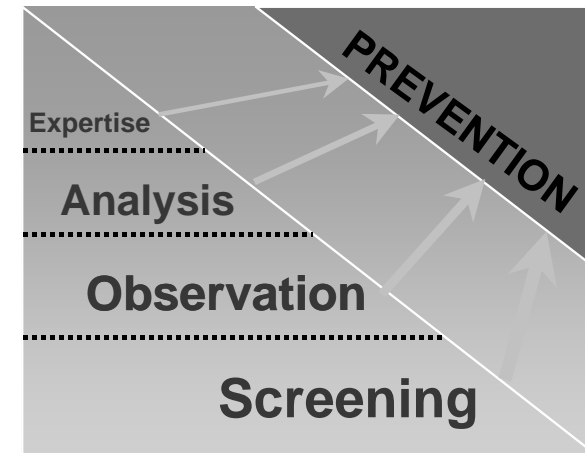
- Better characterize some noise and/or certain acoustic phenomena
- Finer Analysis of activities and noise conditions
- Ultimate prevention/control modifications.

Stage 4, Expertise: Who?

- People of the company
- Assistance of experts with:
 - Specialised measuring equipment
 - Training to use them and interpret the results.
 - Technical Expertise for particular technical solutions.



Prevention Strategy



Thank you

