

# STRATEGY OF PREVENTION OF THE RISKS associated with exposure to hand arm vibration

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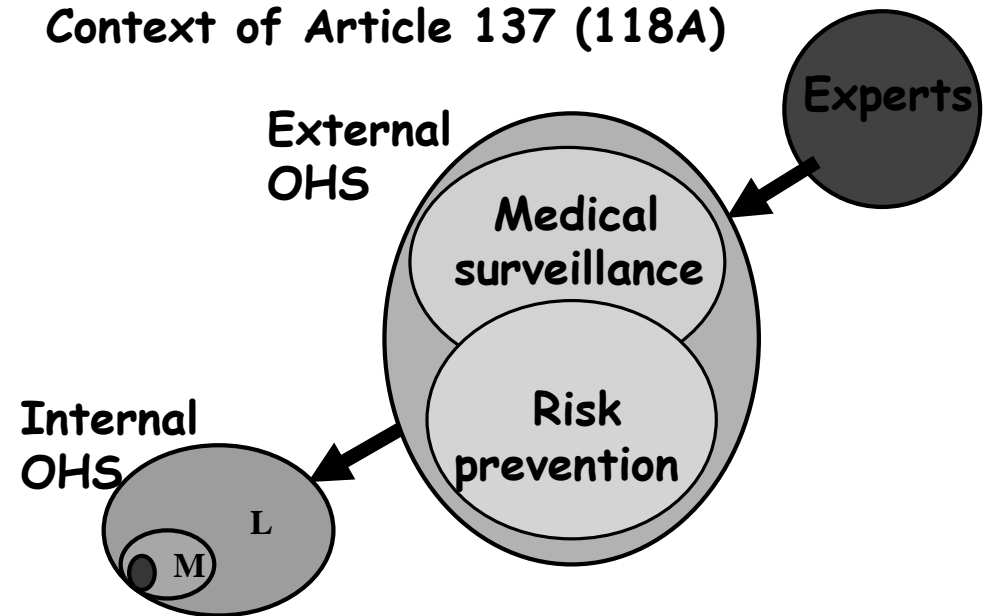
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## Context of Article 137 (118A)



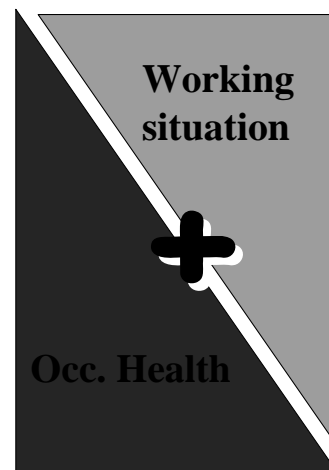
Occupational Health Services structure

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## OH partners

- Employees
- Management
- Safety officers
- Occ. physicians
- Occ. hygienists
- Ergonomists
- Experts



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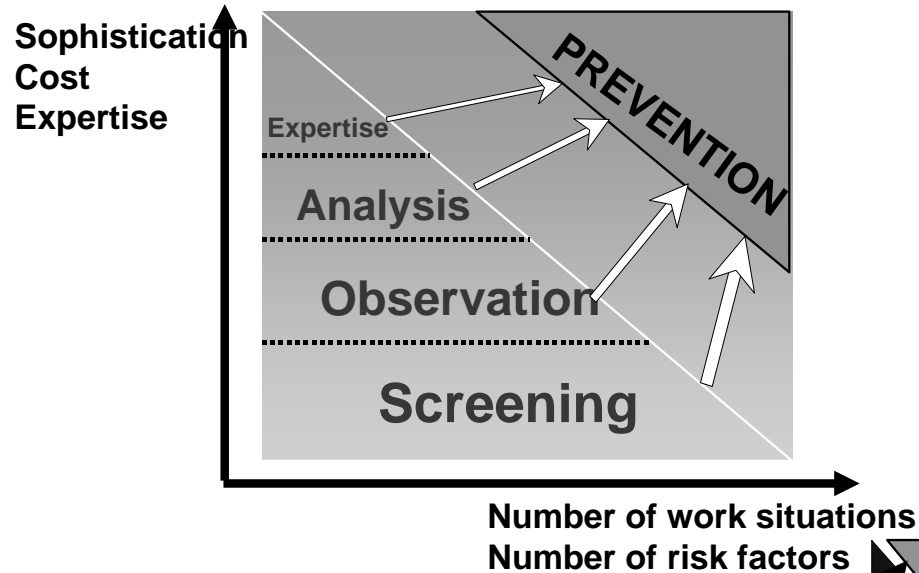
## Objectives

- Coordination of all actors
- « We need valid and useable standards with sufficient scope for practical application »
- « Evaluation » vs « Measurements »
- Cost-effectiveness
- Prevention vs assessment
- Qualitative vs quantitative
- Methods applicable by SMEs

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# Prevention Strategy



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	Stage 1 "Screening"	Stage 2 "Observation"	Stage 3 "Analysis"	Stage 4 "Expertise"
• When?	Systematically	When a "problem" is detected	More complicated Cases	Very complex cases
• How?	Opinions	Qualitative observations	Ordinary measurements	Specialised measurements
• Cost?	Very low	Low	Average	High
• Duration (order of magnitude)	10 min	2 hours	1 day	A few days
• By whom?	Workers + company management	Workers + company management	Same + specialists	Same + specialists + experts
• Knowledge - working conditions - ergonomics	Very high Low	High Average	Average High	Low Specialised

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## How to proceed? (1)

- *Once a problem is detected, people in the field (workers, managerial staff, engineers...)*
  - Observe the work situation in a systematic way;
  - Collect the qualitative information available;
  - Determine whether the problem is real;
  - Determine the prevention measures that can directly be implemented;
  - Estimate whether the residual risk is acceptable or not.

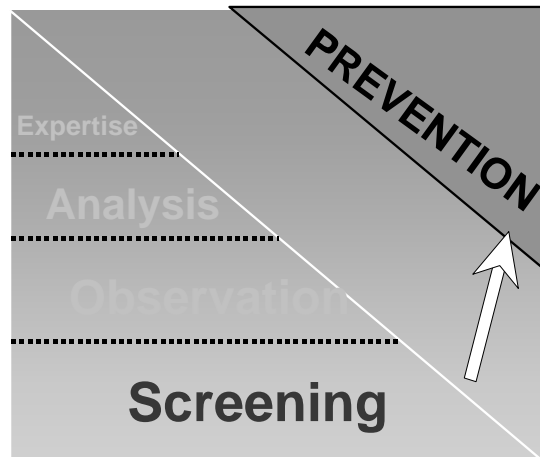
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## How to proceed? (2)

- *If the residual risk is unacceptable, they:*
  - Ask for the assistance of a trained OH specialist;
  - Search together for prevention measures;
  - Estimate again whether the residual risk is acceptable or not.
  - If the residual risk is still unacceptable, the assistance of an expert is necessary.
  - While waiting for technical prevention measures to be taken or if the residual risk is unacceptable.
    - *Individual protection*
    - *Medical supervision*

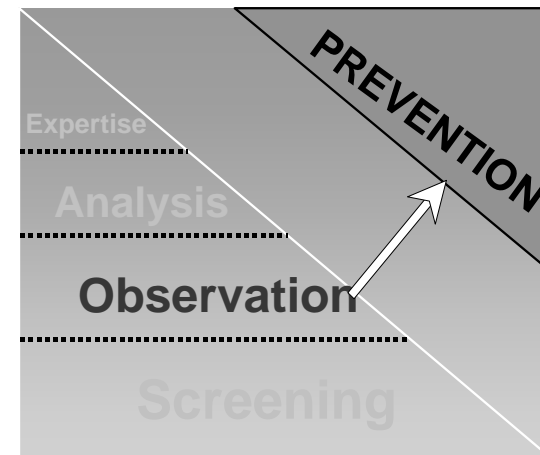
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## Stage 1, screening



**Cross  
factors**

## Stage 2, Observation



## Objectives

- Collect general information on the situation concerning:
  - *the working conditions,*
  - *the sources of hand-arm vibration.*
- Determine immediate technical measures for prevention.
- Determine whether an *Analysis* is necessary:
  - *with what urgency.*
  - *with what objectives.*

## Who?

- People in the company (managerial staff, engineering department, OH specialists) knowing the work situation perfectly.
- In collaboration with the workers.

## Procedure: Collection of information for each machine:

	Tool 1	Tool 2
Machine		
Brand		
Model		
Date of purchase		
Rotation - percussion speed		
Weight		
Electric or pneumatic motor, or gasoline engine		
If pneumatic: direction of the air exhaust.		
Handles		
Number		
Position		
Type		
Tool		
Disc nature diameter		
Description: handheld, suspended, on a stand, on a table ....		
Material worked on (steel, wood, plastic...)		
Date of the last maintenance		
State of the machine		
Balancing		

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## Procedure (2): Activities carried out:

Criteria	Activity 1	Activity 2
Description of the activity		
Vibrating tools used		
Posture and efforts		
Hands positions		
Efforts (gripping and pressure)		
Wrists flexion, extension, deviations		
Arms: above or below the shoulders		
Efforts		
Shoulders: raised...		
Trunk: leaned, twisted...		
Prevention		
Working conditions		
Work surface: variable, fixed (height, distance...)		
Environment		
Work inside or outside		
Cold / normal / hot		
Dust: exhaust system		
Noise: Personal hearing protectors		
Gloves: type		
Training preliminary to the use of the machine		
Perception by the workers		
Vibration		
Postures		
Workers concerned		

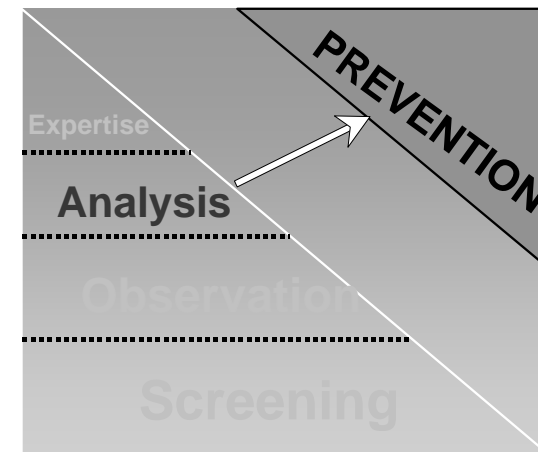
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## Procedure (1)

- **Assessment for each activity:**
  - *Assessment of the current situation:*
    - » Comfort (screwdriver...)
    - » Light discomfort (wood drill...)
    - » Average risk (grinder...)
    - » High risk (percussion drill...)
  - *Assessment of the future situation;*
  - *Need for an Analysis, stage 3, urgency and objectives;*
  - *Assessment of the prevention measures.*

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## Stage 3, Analysis



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## Objectives

- To evaluate, using data tables, the risk related to the hand-arm vibration in the conditions investigated at stage 1, Observation.
- To search further for prevention measures.
- To determine a more adequate work organization
- To determine whether an Expertise, stage 4, is needed.



## Who?

- The people who conducted the stage 2, Observation
- with the assistance of OH specialists having methodological competences.



## How?

- Grouping of the workers with the same exposure (HEG)
- Characterization of the equivalent acceleration in representative working conditions.
- Evaluation of the personal exposure acceleration under these representative conditions.
- Current risk.
- Thorough study of the conditions of use of the vibrating tools.
- Prevention measures.
- Residual risk after prevention.
- Need and urgency of an Expertise (stage 4).
- Short-term measures and possible medical supervision.



## Exposure of the workers: current state (1)

- Grouping of the workers having the same exposure (homogeneous groups)
- For each machine used by a homogeneous group of workers, estimation of the equivalent acceleration  $A_{weq,i}$  (average value and range)
- Correction factor function of the conditions of work
  - *poor state of the machine*
  - *tool badly centred or unbalanced*
  - *very hard material*
  - *presence of shocks.*
- Corrected equivalent acceleration  $A_{weq,i}$



## Exposure of the workers: current state (2)

- Exposure of the workers: current state (2)
- Estimation of the average exposure time per week for each machine:  $H_i$
- Calculation of the partial personal exposure acceleration  $A_{EP,i}$  by dividing the corrected  $A_{weq,i}$  by

$$k = \sqrt{40 \text{ h or } 2400 \text{ min}/H_i}$$

Duration	5'	30'	45'	1h	2h	4h'	8h'	10h	15h	20h	25h	30h	40h
k	22	9.0	7.3	6.3	4.5	3.2	2.2	2.0	1.6	1.4	1.3	1.2	1



## Exposure of the workers: current state (2)

- Calculation of the personal exposure acceleration  $A_{EP}$  by:

$$A_{eq,8} = \sqrt{\sum A_{eq,i}^2}$$

- Current risk
  - (Threshold:  $1 \text{ ms}^{-2}$ )
  - Action level:  $2.5 \text{ ms}^{-2}$
  - Ceiling value:  $5 \text{ ms}^{-2}$ .



## Control measures (1)

- *Modification of the process with elimination of the vibrating machine*
- *Less vibrating machine*
  - Machine better adapted to the task
  - Electric vs pneumatic
  - Adjustment of the air pressure of the pneumatic machines for the same effectiveness
  - New machine (with piston, air cushion...)
  - Antivibration suspension system.



## Control measures (2)

- *Improvement of the tools (disc, graver, wick...)*
  - Tool better adapted to the material
  - Regular replacement of the tool.
- *Improvement of the maintenance*
  - Maintenance file, periodicity
  - Accessories
  - Sharpening of the tool
  - Replacement of the antivibration elements
  - Balancing of the revolving parts.



## *Control measures (3)*

- *Improvement of the handles*
  - *Antivibration handles*
  - *Adequate material for the handles (non metal).*
- *Improvement of postures and reduction of the efforts*
  - *Support of the machine by counterweights*
  - *Adaptation of the height of the work surface*
  - *Training to the use of the machine*
  - *Reduction of the grip strength*
  - *Reduction of the compressive forces*
  - *Blocking of the objects to be machined.*



## *Control measures (4)*

- *Improvement of the work organization*
  - *Reduction in the daily exposure duration*
  - *Increase in the number of pauses*
  - *Days without vibration*
  - *Scheduling of work without vibration exposure.*



## *Conclusion of the Analysis*

- *Exposure of the workers: anticipated state in the future*
  - Estimate the new equivalent exposure acceleration  $A_{\text{weq},i}$ .
  - Estimate the new mean durations of exposure per week  $H_i$
  - Estimate the anticipated partial personal exposure accelerations  $A_{\text{EP},i}$ .
  - Estimate the anticipated personal exposure acceleration  $A_{\text{EP}}$ .
  - Estimate the residual risk.

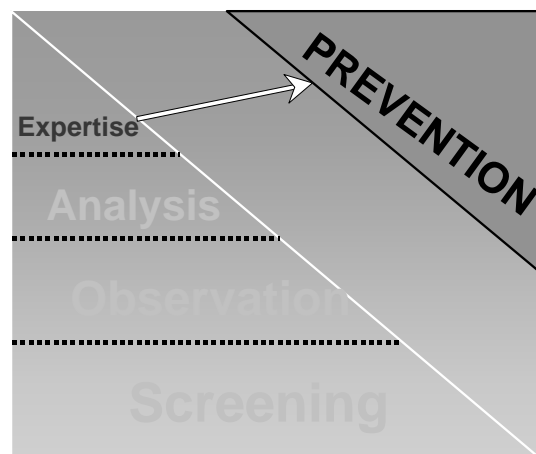


## *Synthesis*

- *List of the prevention measures considered.*
- *Who does what and when by priority.*
- *Need for a stage 4, Expertise.*
  - *What urgency?*
  - *What objectives?*
  - *What vibrating machines?*
- *Personal Protection.*
- *Medical supervision*
  - *Criteria of recruiting personnel*



## Stage 4, Expertise



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## Stage 4, Expertise (1)

- *Conducted for a given problem in a given context*
  - *after the Observation and Analysis*
  - *when no satisfactory solution could be found.*
- *Nature and content vary from one case to another*
- *Expert is expected to be able to define the best way*
  - *investigate the remaining problem*
  - *advise the users about the most adequate sophisticated solutions.*

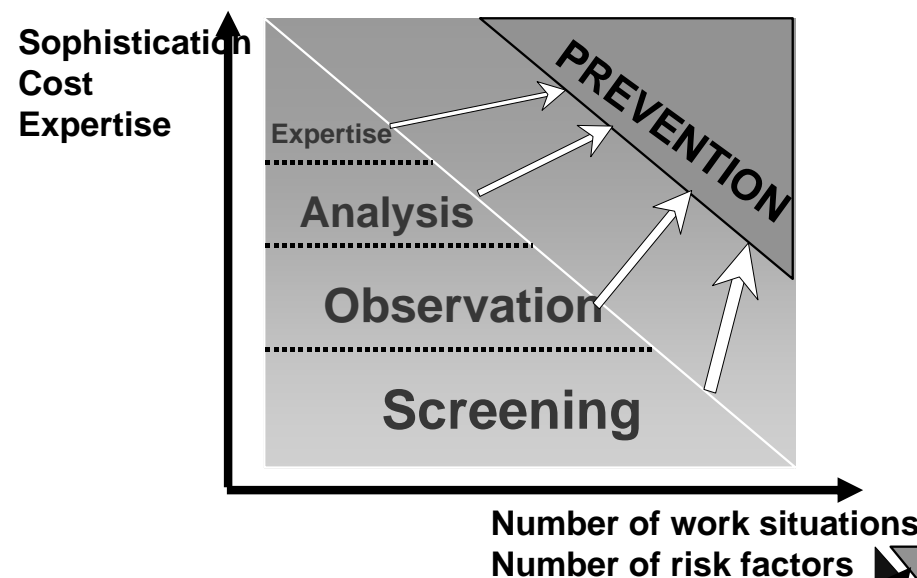
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## Stage 4, Expertise (2)

- *The people who conducted the Observation and Analysis remain responsible for defining:*
  - *The conditions or machines to study*
  - *The representative days*
  - *The sequence of activities*
  - *The homogeneous groups of exposure.*
- *The expert is responsible for*
  - *The measurements to perform*
  - *The equipment used, its characteristics and its calibration*
  - *The measuring techniques: axes, durations, frequency analysis...*

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## Prevention Strategy



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## Conclusions

- **Take advantage of the knowledge and qualifications of the different intervening parties**
  - In sequence, as and when needed
  - To arrive to significant improvements of the working conditions
  - as fast, as effectively and as economically as possible
- **Acknowledge specifically the abilities of the workers and their direct management to determine the appropriate solutions.**

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## Conclusions

- **Coordinate the efforts of**
  - the persons directly concerned
  - the specialists and experts from outside.
- **Deviate deliberately from the common procedure**
  - measurements by qualified people are NOT indispensable
  - to assess the risks
  - to identify the most appropriate solutions.

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## Conclusions

- **Validation... By analogy with other methods( heat, MSDs)**
  - User-friendly, cost effective
  - Generate solutions
  - People return to it
  - Structure the co-operation between partners
- **But:**
  - **People want numbers**
  - **OH specialists want to measure**
  - **Employers want to delay actions**
  - **Resistance to change**

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*Merci de  
votre  
attention...*

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