

SCC and the Working Environment

- results from the SCC-Consortium



Co-operation between:

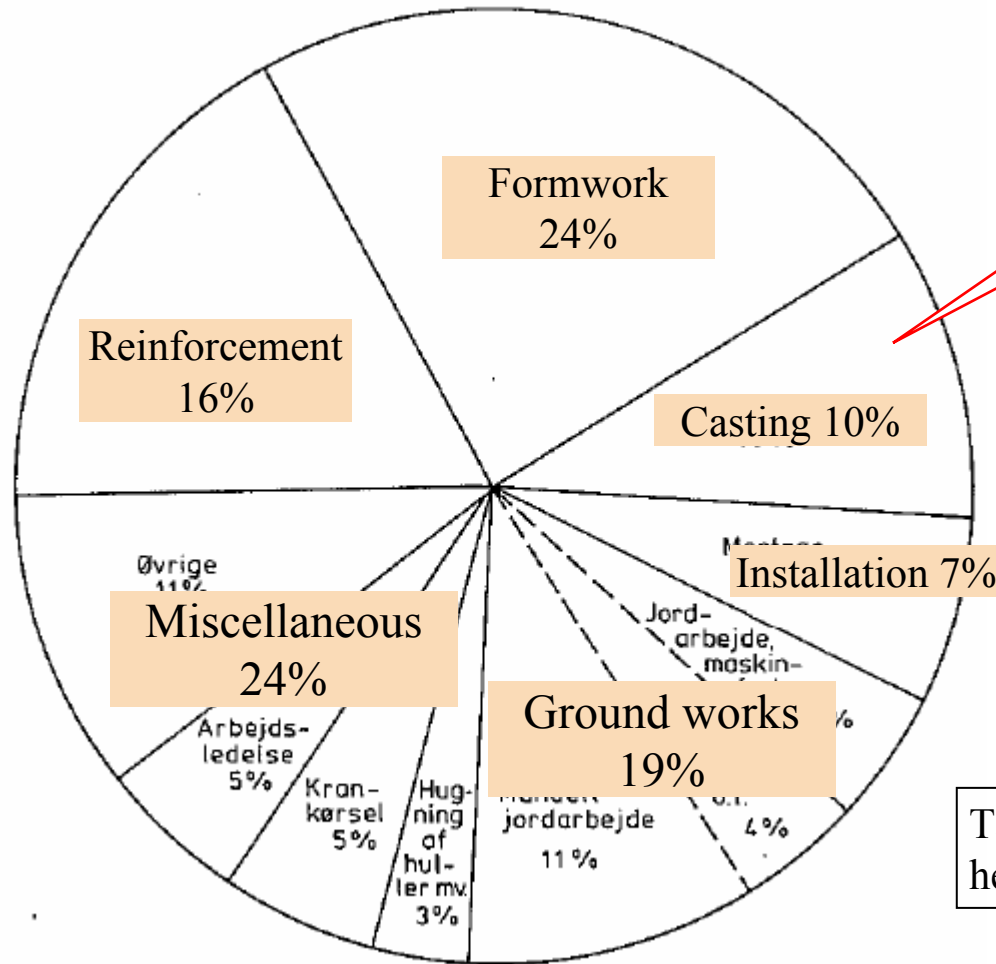
- Danish Technological Institute
- Danish Centre for the Working Environment
- MT Højgaard A/S

What are the impacts of SCC on the working environment?

- **Vibrations are reduced (most significant on the building site)**
- **Noise level is reduced (most significant in the precast plant)**
- **Fewer unhealthy working positions and better ergonomics (most significant on the building site in connection with vertical casts)**
- **Chemicals and dangerous substances**

- **Background:**
 - **Brite EuRam "Rational Production...SCC", 1997-2000**
 - **Brite EuRam "TESCOP", 1997-2000**
 - **Danish investigation of health and safety in the construction industry, DTU, 1979-1981**

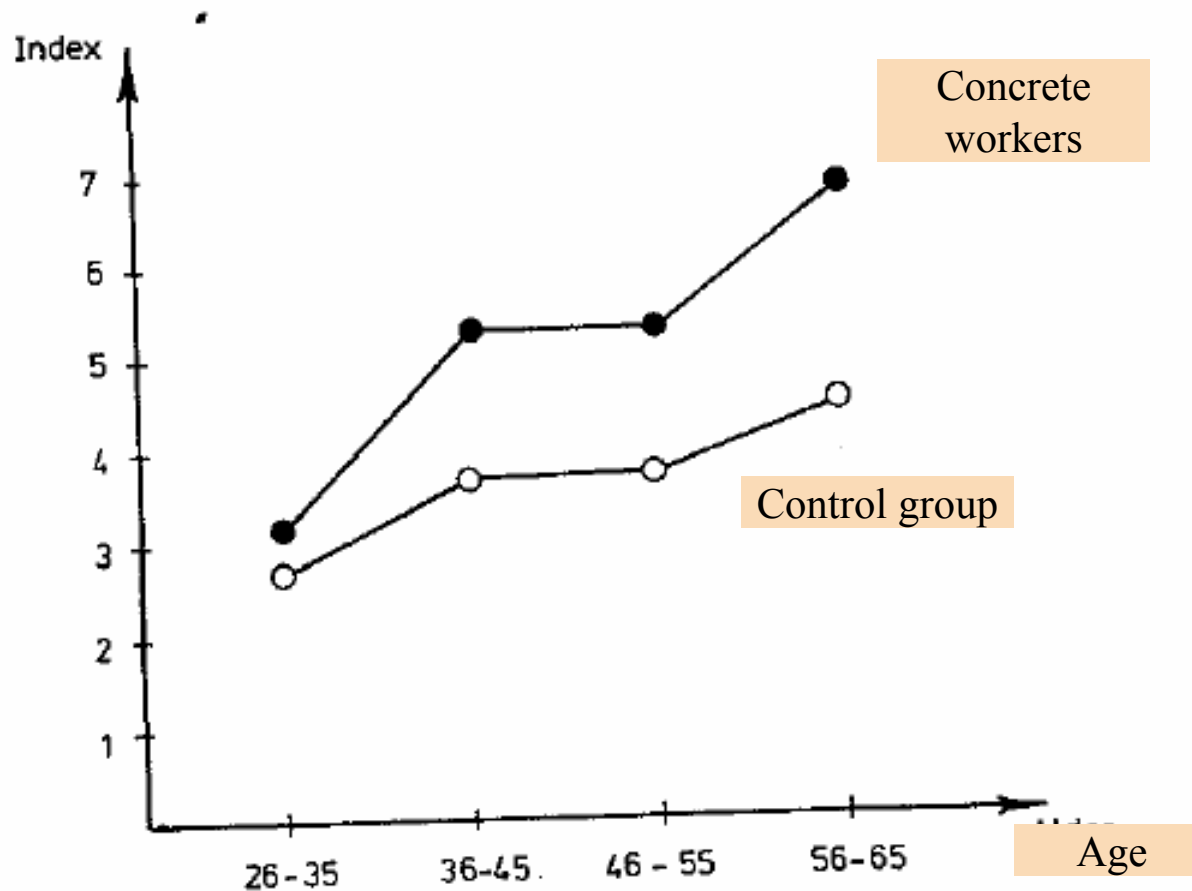
Concrete workers average occupation



SCC has impact on this part

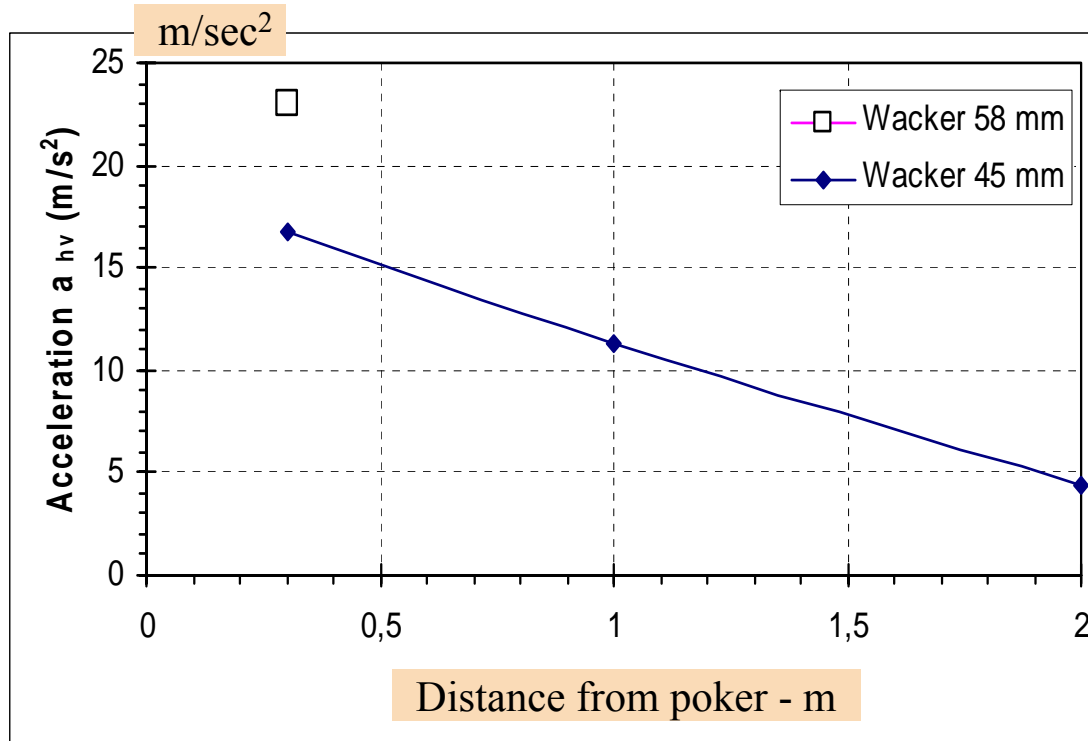
Taken from Danish project on concrete workers health and safety, DTU, 1979-1981.

Concrete workers do wear down more than the public in general



Taken from Danish project on concrete workers health and safety, DTU, 1979-1981.

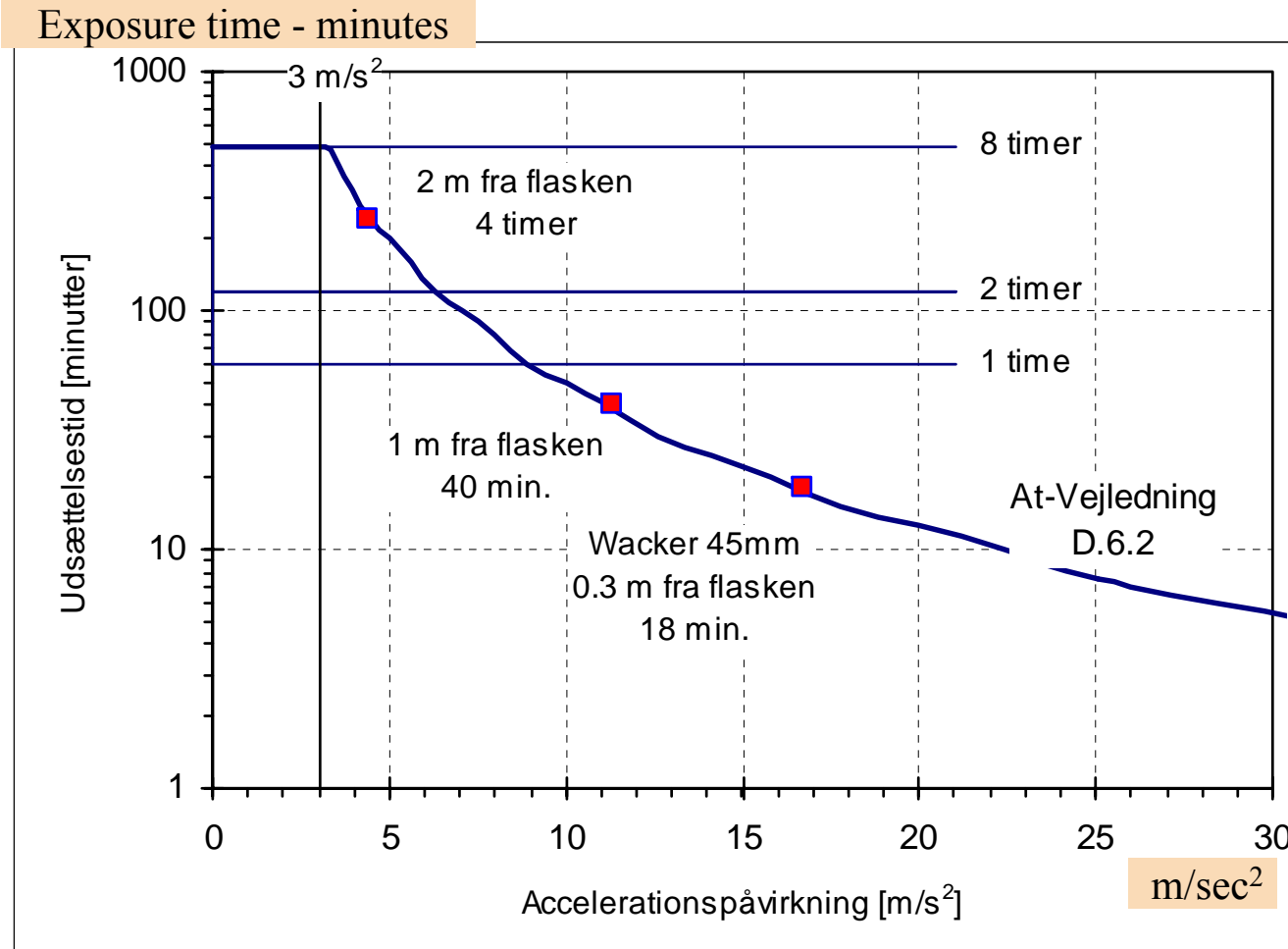
Vibration impact on hand-arm from poker vibration



- Accelerometer measurements
- Vibrator hanging from scaffold
- Resulting acceleration calculated from x, y and z components
- Wacker declare that acceleration impact is 4 m/s²

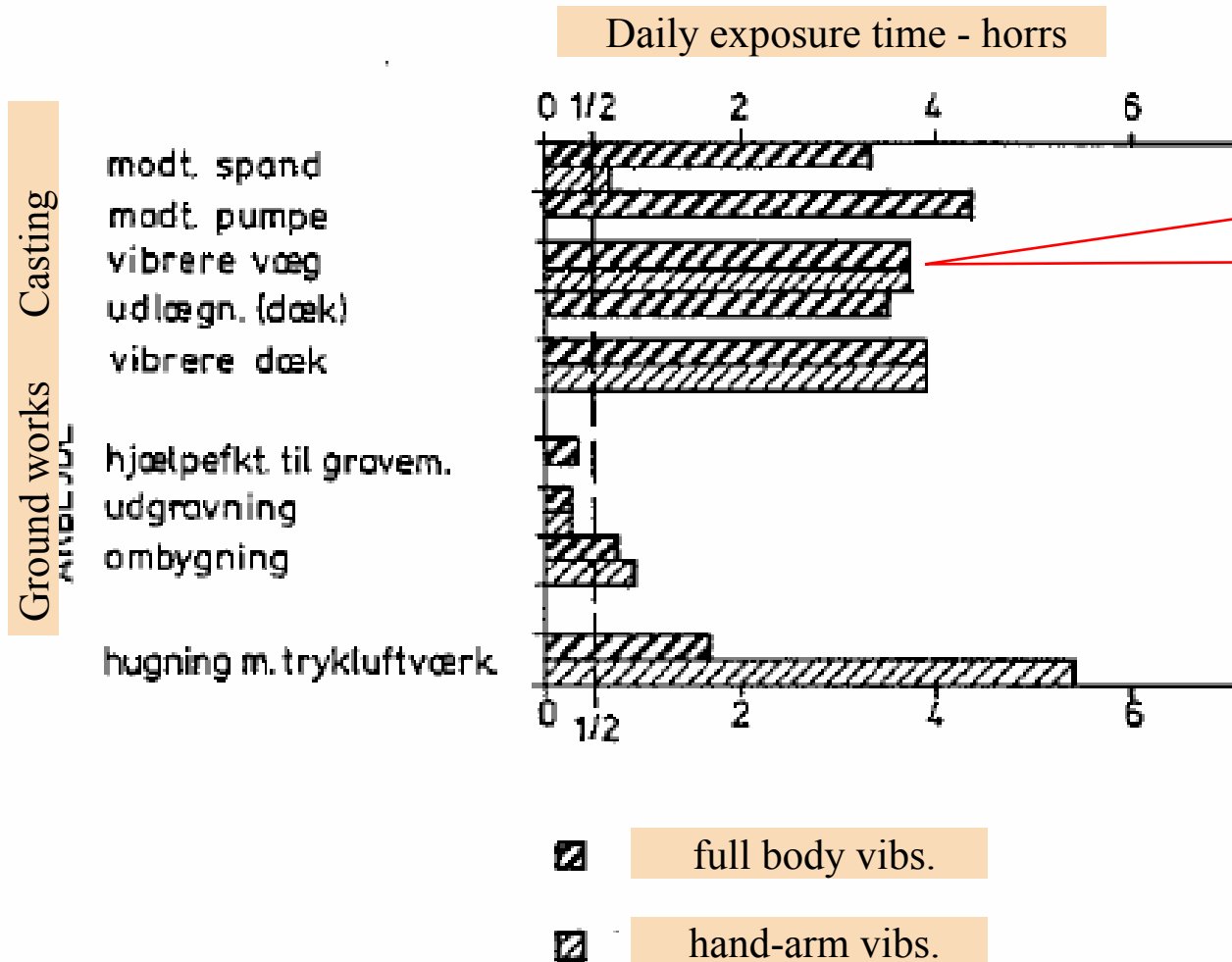
Vibration

Allowable exposure times



Vibration

Allowable exposure times



**Observation for wall casting:
Approx. 2 hours exposure**

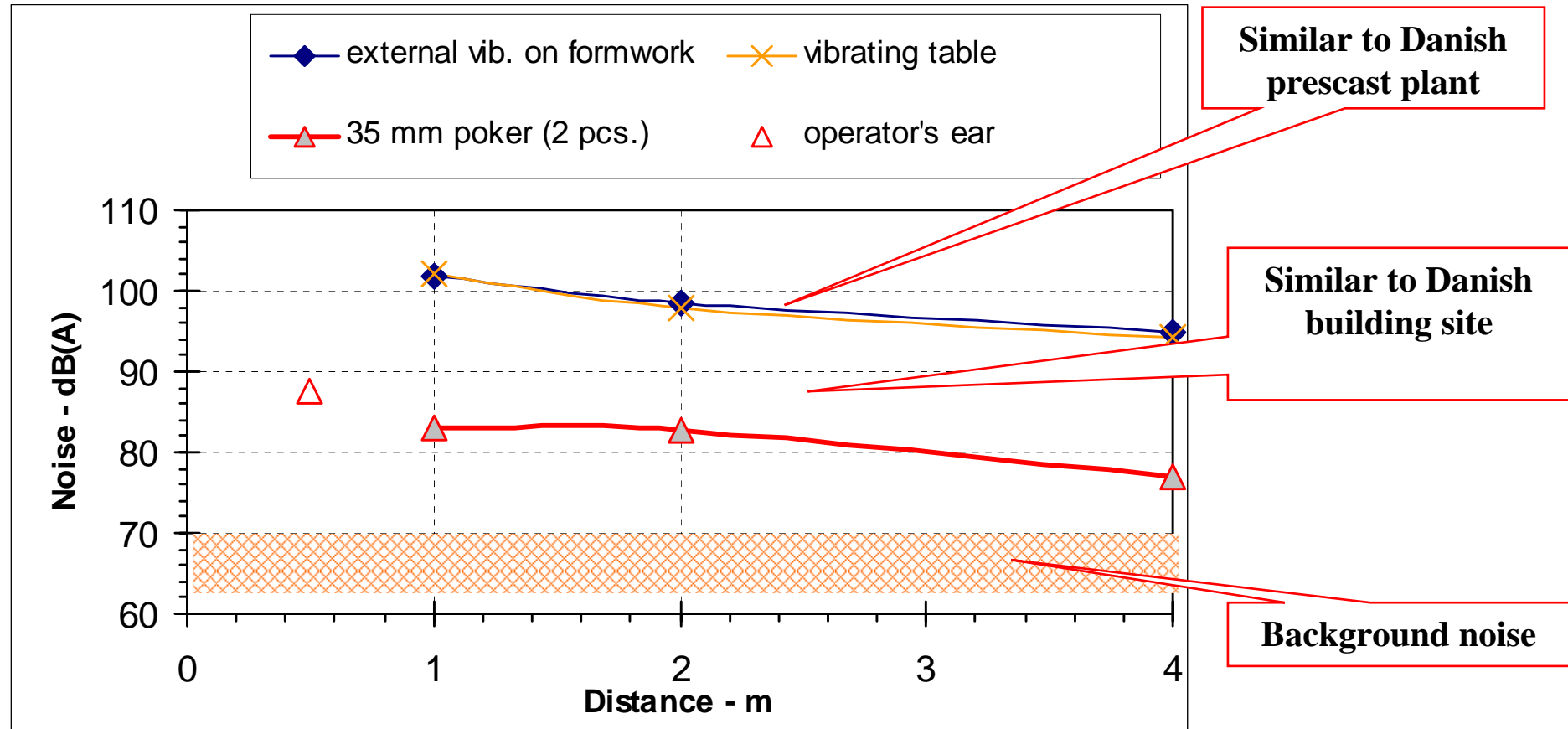
Taken from Danish project on concrete workers health and safety, DTU, 1979-1981.

Vibration

Conclusions - 1

- **Exposure to vibrations from handheld equipment is a health risk for concrete workers.**
- **Increased risk of numbness and poor blood circulation in fingers/hands.**
- **Limit of 3 m/sec² is easily exceeded with poker vibrators.**
- **However, pistol type poker vibrator with handle (for horizontal castings) are less strenuous.**
- **Avoiding compaction with vibrators will improve the working environment significantly.**

Noise measurements



Taken from Brite EuRam SCC project, 1997-2000, Results obtained at University of Paisley.

Conclusions - 2

- **In a precast plant form vibrators generate excessive noise throughout the building.**
- **Level around 95-100 dB(A) under vibration, which means less than one hour daily exposure time allowed.**
- **Omitting vibration reduces noise level from down to around 70-80 dB(A).**
- **Only need for ear protection when noisy equipment are used (electric saw, drilling, grinding, etc.)**
- **Leaving out the noise from vibration improves the working environment significantly in the precast plant.**
- **However, still a short vibration is sometimes used with SCC.**

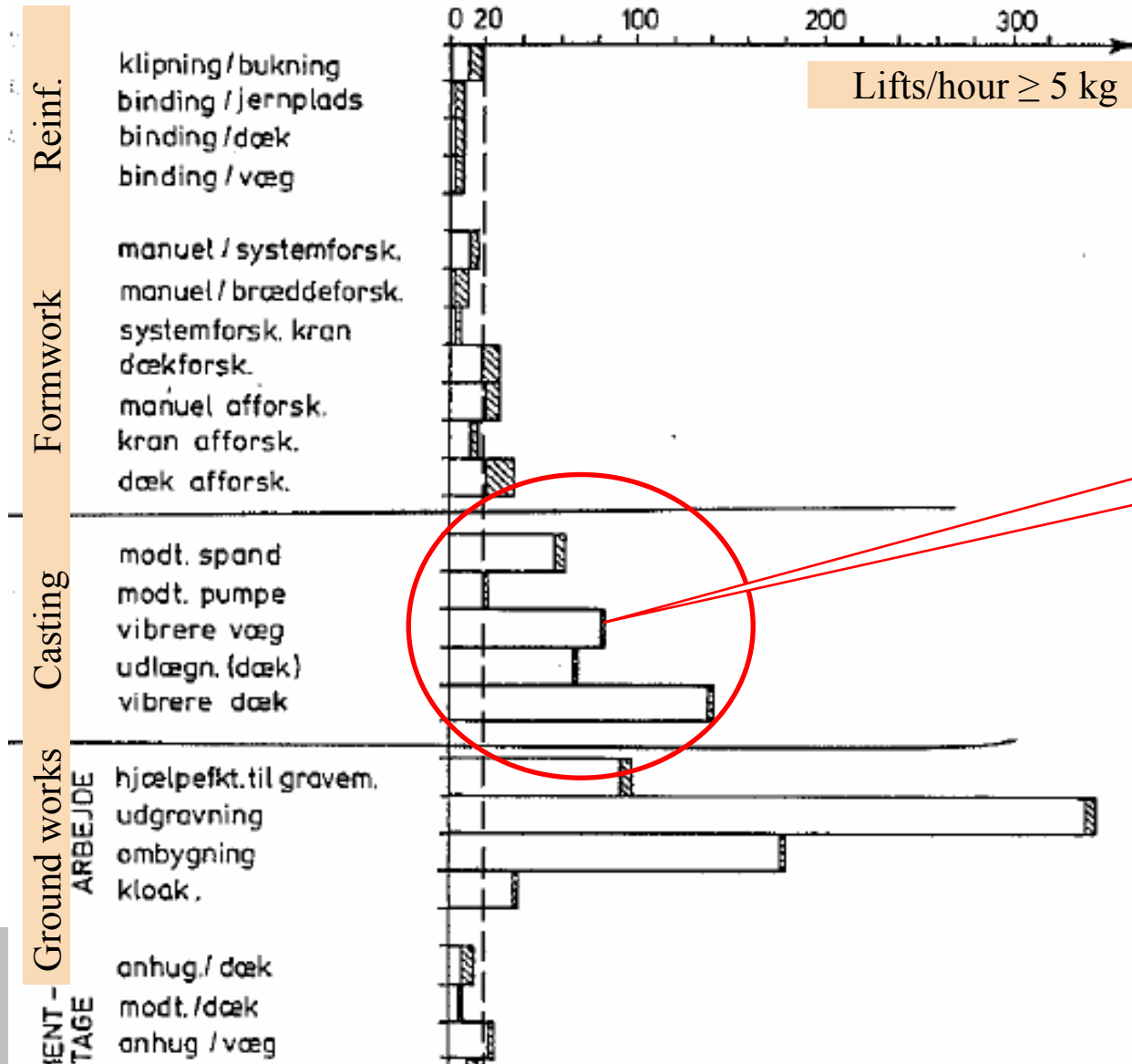
Conclusions - 3

- **At building site the limit of 85 dB(A) is clearly exceeded for all the workers in the vicinity of the casting. Thus, ear protection is mandatory.**
- **Max allowed exposure time is around 2 hours per day.**
- **Omitting vibration at the building site reduces noise level from 90-95 dB(A) to around 85 dB(A). 10 dB(A) increase is felt as a doubling of the sound.**
- **Therefore, avoiding compaction with vibrators will improve the working environment significantly at the building site even though noisy operations are still taking place (heavy machines, pumps, etc.).**

Ergonomics

- **What are the important issues?**
 - heavy lifts of equipment and building materials
 - pushing and pulling (risk of sudden unexpected movements/impacts)
 - many repetitions
 - unhealthy and unpleasant working positions (crouched/hunched)
- **Difficult to measure and quantify**
- **Differs from person to person (not objective)**

Lift of equipment and materials



Lifts/hour \geq 5 kg

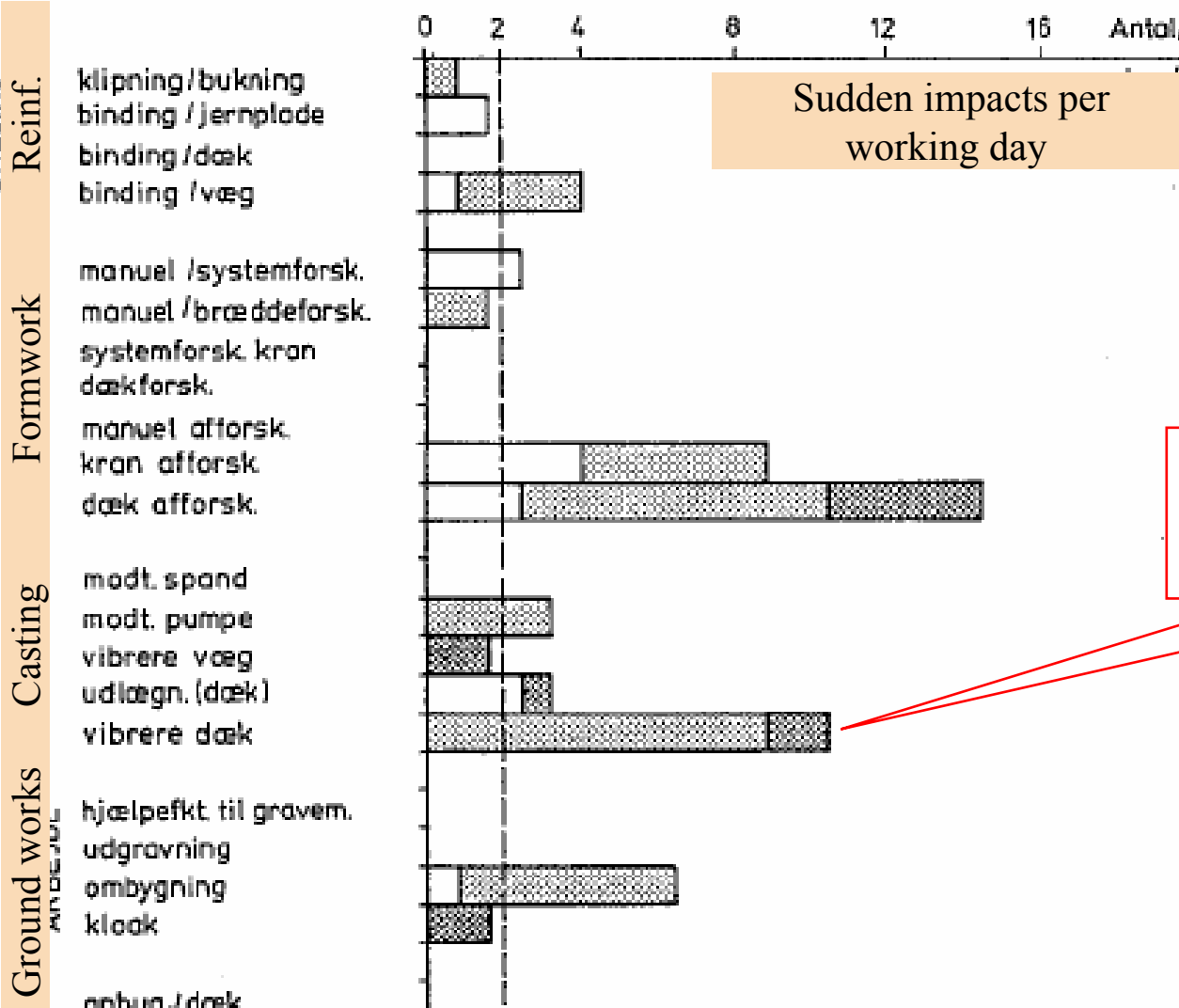
**Observation for wall casting:
Approx. 86 lifts/hour in
connection with vibration**

Taken from Danish project on
concrete workers health and
safety, DTU, 1979-1981.

Ergonomics

DTI, Concrete Centre
Claus Vestergaard Nielsen

Lift of equipment and materials



Sudden impacts per working day

Vibration of floors, where vibrator hose gets stuck.

Taken from Danish project on concrete workers health and safety, DTU, 1979-1981.

Ergonomics

Ergonomics for wall castings with traditional vibration

- Many moderately heavy lifts.
- Bending over and lifting at the same time, resulting in torsion of the back.
- Difficult to obtain good and secure base for your feet.
- All in all very stressful working conditions for the human body.
- Plus vibration and noise impact.

[WVI 0538 pumpe.AVI](#)

[WVI 0540 arb stillinger.AVI](#)



Video from MT Højgaard site at DR-byen, Copenhagen, June 2005.

Conclusions - 4

- **Concreting has large impact on back and joints due to heavy lifts and unhealthy working positions.**
- **SCC reduces the impact and thereby the increased wearing down of concrete workers by leaving out some of the stressful working positions.**
- **The SCC effect on the ergonomic working environment is most pronounced for wall castings.**

More information

- www.SCC-konsortiet.dk
- www.VoSCC.dk (only in Danish)
- www.NordicSCC.net
- Claus.V.Nielsen@Teknologisk.dk



Thank You