Prevention of work-related musculoskeletal disorders (wMSD) of welders through training

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WELDING AND ERGONOMICS SYMPOSIUM 2014 (WES2014)

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1

Structure of presentation

1. The basic problem: welding usually includes wMSD hazards

2. Proposals for solving the basic problem by training

   2.1. As a part of regular vocational training for welder qualification

   2.2. In the frame of targeted short courses for already qualified welders

   2.3. Proposing a related campaigning and awareness-raising at the European Agency for Safety and Health at Work (EU-OSHA)

1. *The basic problem*

- Industrial welding is usually a strenuous occupation involving work in forced static postures and handling heavy equipment, usually with a high degree of sustained stress to arm and shoulders.
- More specifically welding includes wMSD risks such as:
    - Awkward and/or static body postures for prolonged periods
    - Lifting heavy equipment or materials
    - Performing frequently repeated task-sequences
- The work profile for welder jobs clearly shows these risks.
- Other possible harms – e.g. inhaling metals fumes, eye exposure to welding arc light, foreign objects getting into eyes, burns, noise, etc. – are not considered here.

1. *The basic problem*
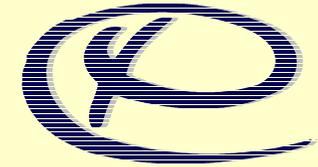
- If, in addition, it is also necessary to frequently change the point of welding the larger part of task execution time is spent for positioning causing the risk of RSI.

- For these cases the Fitts' Law can be applied which models the <u>hand movement time</u> for <u>positioning tasks:</u>

$$T = a + b \log_2 \left(1 + \frac{D}{W} \right)$$

- *T* is the average positioning time to reach the target.
- *a* and *b* are constants to be determined experimentally by fitting a straight line to measured data.
- *D* is the distance from the starting point to the center of the target.
- *W* is the width of the target measured along the motion axis.

1. *The basic problem*

$$T = a + b \log_2 \left(1 + \frac{D}{W} \right)$$

- From the equation, we see a *speed–accuracy* trade-off associated with pointing, whereby targets that are smaller and/or further away require more time to acquire.
- The <u>movement time</u> for a <u>well-rehearsed</u> positioning task
    - increases as the <u>distance</u> to the target increases,
    - decreases as the <u>size</u> of the target increases.
- It follows that for the correct design of such welding activity well-established norm times are crucial (or which is even better, if possible, apply welding automatons instead of humans…).
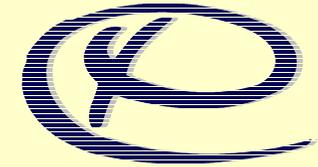
2. Proposals for solving the basic problem by training

In Hungary welder's vocational training is conducted at the following two levels:

• At **technical colleges** (**trade schools**) for youngsters (age 14 – 18 years), typical overall training time:
2 academic years (4 semesters), 2300 hours.

• At **adult training institutions/companies** (for persons above 18 years), typical overall training time: 200 – 450 hours.

None of the above includes wMSD risks!

2. *Proposals for solving the basic problem by training*

2.1. As a part of regular vocational training for welder qualification

- For the **technical colleges** (**trade schools**) we propose developing and free distributing flexible wMSD-related curriculum modules with strong emphasis on appropriate physical jerks/excercises for prevention and compensation of harms.

- These modules have to be worked out together by experienced ergonomist professionals and medical experts.

- The teachers of technical colleges have to be further trained for these modules.

2. *Proposals for solving the basic problem by training*

2.2. In the frame of targeted short courses for already qualified welders

• Before starting a larger scale new job it is necessary – and therefore proposed – to conduct targeted short courses for already qualified welders

• These short practical courses – in addition to or as part of the compulsory labor safety orientation/briefing - should focus on the identified particular wMSD-related risks of that job, including corresponding physical jerks/excercises and also the correct usage of the actual personal protective equipment (special clothing, helmets, goggles, gloves, etc.).8

2. *Proposals for solving the basic problem by training*
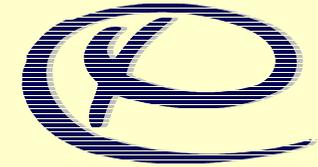
2.3. Proposing a related campaigning and awareness-raising at the EU-OSHA

- In Hungary – in the frame of the Hungarian Ergonomics Society – we are going to launch a campaigning and related curriculum development.
- As the problem has an overall European significance, we also propose campaigning and awareness-raising at the EU-OSHA.

2. *Proposals for solving the basic problem by training*

2.3. Proposing a related campaigning and awareness-raising at the EU-OSHA

- An additional possibility is to create an instructive welding episode for the popular Napo animation series emphasizing the most frequent and most dangerious wMSD-related risks and the proposed prevention/compensation possibilities.