

IMPROVEMENT OF THE SAFETY CULTURE AT ESTONIAN ENTERPRISES

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The working conditions in textile and wood processing industries have been investigated using a simple risk assessment method and questionnaires worked out for the purpose.

A simple/flexible risk assessment method (beginning with a two-stage model that could be enlarged into a six-stage model) is worked out by the authors (Tint & Kiivet) and the implementation possibilities are presented. It is necessary to increase interest from the side of employers for using the method and analysing the work environment with the aim of improvement implementations.

The main complaints in textile industry are high temperature in the workroom, bad ventilation, intense work and the dependence of workers' work results from the others. The main risk factors in wood processing industry are hazardous tools and equipment, also heavy physical load, noise, wood dust and odours of chemicals originating from polishes.

KEYWORDS: safety culture, risk assessment, working conditions, textile industry, wood-processing industry

INTRODUCTION

A simple model of safety culture contains three interacting elements: risk controls, attitudes and behaviour[5]. Each element has a value in its own right but cannot be treated independently of the others.

The level of safety culture in Estonia is nowadays defined by the quality of risk assessment carried out at enterprises.

The existing risk assessment models (on the basis of BS 8800)[1] contain the need to determine the probability of the occurrence and the severity of consequences of the influence of hazardous factors on workers. The determination of the probabilities causes some complications to employers of different level of education (inc. not technical). Therefore a simple risk assessment method has been worked out at Tallinn University of Technology, Chair of Work Environment and Safety.

Safety culture as a term was first used in connection with the investigation of causes of the Tshernobyl disaster. The equipment was supposed to be safe, but there was still an accident. The lesson we learned from Tshernobyl was that system safety could not be ensured only by the way of technical means and norms. The way, in which people understand risks, their attitudes towards safety and taking the responsibility of safety of the person himself and the others are important factors in good safety culture. Safety activities at companies could be integrated into management activities within the introduction of quality system.

Nowadays more and more people at workplaces in Estonia are aware of the need to improve their work conditions and have courage to demand the risk assessment from the management of the company. Textile and wood processing are the branches of industry spread largely in the Estonian industrial market.

Risk assessment in work environment has been a topic for the Estonian researchers in work safety and health from 1996, when the EU document "Guidance of risk assessment at work"[2] became accessible. The Estonian Occupational Health and Safety Act (on the basis of EU Directive 89/391), which demands risk assessment at every workplace, was adopted in Estonia in 1999. In this context the main problem for managers has been finding a suitable risk assessment method. Labour inspectors are not satisfied with the majority of risk assessments carried out by employers, but they cannot improve the situation, as they have no better proposals. Determination of the risk level has been regarded as the most difficult part in the whole risk assessment process.

OBJECTIVES

Determine the safety level at Estonian enterprises, carrying out risk assessment at a textile and wood processing firms.

MATERIALS AND METHODS

For risk management in the work environment the following activities are recommended[1,2]:

1. Compile a list of hazards. Mechanical, physical, chemical, physiological, psychological etc. hazards could be identified;
2. Present short information on each hazard;
3. Measure the hazards in the work environment. For this purpose the services of accredited measuring laboratories could be used or the hazards could also be measured by the employer with calibrated measuring equipment;
4. Assess the magnitude of the risk;
5. Rank the hazards by magnitude (starting from the greatest risk), add the cost of reduction methods, the person responsible for the reduction methods and the deadline for reduction;
6. Complete implementation of reduction methods;
7. Perform new risk assessment (the frequency depends on the hazardousness of the activity).

Compared the end of 1999 with the year of 1996, the situation in Estonian economy changed so that risk assessment in the office environment became as important as in industrial activities. As many as 80% of Estonian offices are supplied with computers and 90% of them have Internet connection. Considering this situation in Estonian labour market, a necessity for two different types of risk assessment methods arose, one for industrial activities and the other for office rooms. It seems that the latter might be easier but in

this field also different new hazards have arisen, such as electromagnetic fields from mobile-phones, video displays and other video equipment or odours from chemical materials used nowadays in offices, schools or hotels (hostels) by cleaners.

Since 2000 the importance of industrial activities has risen again. Everybody involved (employers, Centre of Occupational Health of Estonia, National Labour Inspectorate of Estonia) uses its own version of BS 8800. So, in autumn of 2000 it became quite obvious that a new method, sufficiently simple, corresponding to demands of different parties would be highly needed.

Estonia has paid much attention to risk assessment peculiarities in a post-socialist country[6,7,8]. Tallinn University of Technology has also made various proposals for creating Estonian own risk assessment terminology.

The employer can carry out the risk assessment by himself or use the help of occupational health services. The exposure limits are still the main keywords for employers with regard to occupational health and safety (OHS). Therefore, a risk assessment method understandable for employers has to be connected with the exposure limits of hazards in the work environment.

The existing risk assessment models (on the basis of BS 8800) contain the need to determine the probability of the occurrence and the severity of consequences of the influence of hazardous factors on worker. The determination of the probabilities is too complicated even to engineers of occupational health services. Also some attempts have been made to bind the risk level determination (based on BS 8800) with hazards originating from chemicals[3]. The results are presented in Table 1[3].

Table 1 contains risk phrases (R20, R21, R65 etc.). The risk phrases (like R20-harmful in contact with skin) characterize the hazardous effect of chemicals on workers' health in EU and Estonian legislation.

A SIMPLE/FLEXIBLE RISK ASSESSMENT METHOD

The authors of the current article have developed a simple risk assessment method that does not contain the probabilities. The method is based on a two-step model that could be enlarged.

In the case of the assessment of the magnitude of risk a simple (flexible) risk assessment scheme is presented (Figure 1).

The two-step model is clear, understandable, argumented and simple for the user. The model has one boundary line (red on the coloured scheme), which is a stable, largely spread number such as a norm or standard. The no/yes principle is used or corresponds to the norms/does not correspond to the norms or justified/unjustified risk. The model also suits small enterprises and to these that have not a complicated combination of hazards or have rather inexperienced personnel (also in work safety).

In the case of the three-step model (version 1, Figure 2) one step is added to the right side, the boundary is a dotted line (green in the case of coloured scheme). In practice, such a scheme is rarely used. The scheme suits the firms where the state of the work

Table 1. Determination of risk level for hazardous chemicals in workplace air

Consequences ↓→	**Slightly harmful** uncomfortable, irritable feeling, overcoming illnesses R20, 21, 36, 37, 38	**Harmful** burning, skin diseases, long-lasting severe damage, permanent slight disorders R23, 24, 25, 33, 34, 40, 43, 48, 62, 63, 64	**Extremely harmful** poisonings, occupational cancer, asthma, permanent severe damage, illnesses dangerous to health R26, 27, 35, 39, 41, 42, 45, 49, 60,61, 65
Probability			
Highly unlikely severe damage from <10% of the limits, other 10–50% of the limits	**trivial risk** no risk reduction measures needed	**Tolerable risk** follow-up of risks	**moderate risk** risk reduction measures needed
Unlikely severe damage from 10–50% of the limits, other 50–100% of the limits	**tolerable risk** follow-up of risks	**Moderate risk** risk reduction measures needed	**substantial risk** risk reduction measures inevitable
Likely severe damage from 50–100% of the limits, other over limits	**moderate risk** risk reduction measures needed	**Substantial risk** risk reduction measures inevitable	**intolerable risk** risk reduction measures to be implemented at once

environment is comparatively good, the level of danger is not very high and the enterprise has a desire and possibilities of improving the working conditions.

Also a second version of the three-step model is possible (Figure 3).

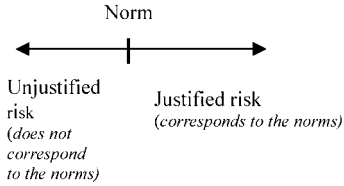

Figure 1. Two-step model

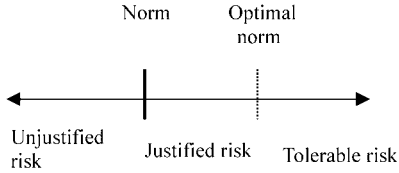

Figure 2. Three-step model (version 1)

In this case one step is added to the left side of the scheme. The boundary line is named conditional risk (red dotted line): in practice it is not fixed. This line needs scientifically argumented statements (investigations) developed in co-operation by scientists in medicine, engineering and economics.

Temporarily, in the emergency case, the boundary line could be fixed as a subjectively argumented agreement. This scheme suits the enterprises that have a desire to improve the work conditions, making them more satisfactory and less dangerous.

As to the content, the four-step model (Figure 4) is nothing more than the result of the summation of the previous schemes. So it is also simple and understandable for the user. The model suits medium-sized enterprises (but not only), where the situation of the work environment is irregular with many different hazards, therefore the level of hazards at workplace varies a large extent and the personnel, having the relevant qualifications are able to orient in the improvement of the work environment. The main target in this activity is the left side of the model, where the risk level is higher.

The scheme (Figure 5) is a development of the previous schemes — an additional step is added to the four-step model to the left (worse) side of the scheme, the boundary line is a double dotted line (red in the case of the coloured scheme).

This scheme is more complicated than the previous ones and it seems that there is no need for that scheme. The simpler (previous) schemes could be used. The desire of some authors to use only complicated multi-stage models is overstrained. If they are used then they could be used in big factories with a complicated mix of hazards and where the personnel are able to manage with one intricate scheme.

Finally, it is possible, but not particularly necessary, to add one stage to the right side of the five-step scheme and develop the six-step scheme (Figure 6), where the

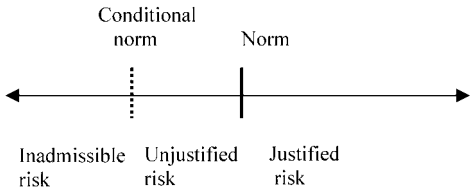

Figure 3. Three-step model (version 2)

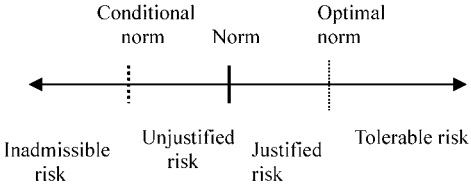

Figure 4. Four-step model

boundary line is a dotted double line (coloured green) that fixes zero-risk or negligible risk. In fact, we can speak of zero risk only when no hazards exist in the work environment.

To conclude, the flexible model presented offers every enterprise an opportunity to choose a suitable and feasible scheme for introduction into practice.

ANALYSIS OF WORKING CONDITIONS IN THE WOOD PROCESSING INDUSTRY

The work environment in a large wood-processing firm (1,000 workers) — in a medium-sized town in Estonia, was analysed. A list of hazards was compiled before the investigation by the work environment specialist of the firm who has worked in this factory over 20 years.

The main risk factors in that kind of industry are hazardous tools and equipment, also heavy physical load (moving the wheelbarrow), noise, wood dust and in some places odours of chemicals (mostly formaldehyde) originating from polishes.

The measurements of the hazards were carried out in the department were polishing and varnishing take place. The following results were obtained:

- temperature of the air — 19.8°C;
- moisture of the air — 42.0%;
- lighting (overall) — 300 lx;

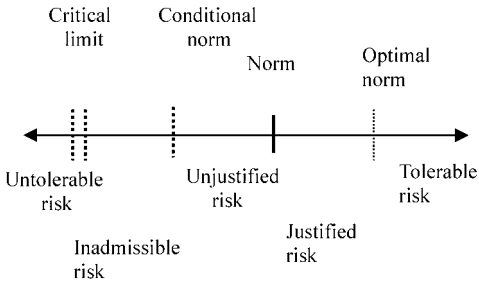

Figure 5. Five-step model

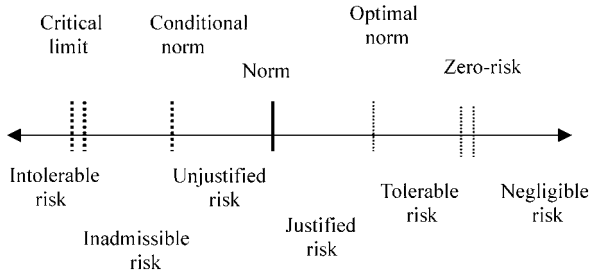

Figure 6. Six-step model

- wood dust concentration, overall in the department $\sim$1.5 mg/m^3 near the machines — 10 mg/m^3;
- noise — 98–101.2 dB;
- concentration of formaldehyde (as a component of phenol-formaldehyde varnish), 8-hr mean — 0.5 mg/m^3.

Vibration caused by wood-processing equipment was not measured, however this has to be done, because the hazard for vibration disease is rather high (it is one of the two most frequent occupational diseases alongside the physical overload disease in Estonia).

From perspective of the possibility of accidents or traumas originating from machines it was declared that one protective metallic covering component had been removed and afterwards substituted by cardboard for protection against cut injuries of fingers. This type of accident predominates in the Estonian range of work traumas nowadays (about 500 cut injury traumas of fingers a year, including amputations).

On the basis of the measurement and observations in the department the following conclusions were made:

The microclimate in the wood-processing department was rather good (considering that there is room for improvement by raising moisture content of the air). The safety of machines has to be taken into consideration when buying new equipment. Experience shows that even the machines with CE-mark can be sources for traumas if used incorrectly. Noise was above the limits (85 dB) in every workplace, but work breaks were taken and earmuffs were used. So the total amount of noise during an 8-hour workday is not over the permissible level (dose: 85 dB $\times$ 8 h). The phenol-formaldehyde varnish is a source for allergic reactions of workers. The risk phrases for this compound are: R 23/24/25, R34, R40, R43. The exposure limits (0.6 mg/m^3) were not exceeded.

The five-stage simple/flexible risk assessment model was used for the assessment of working conditions (Figure 7).

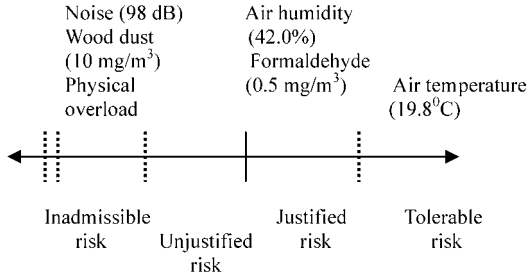

Figure 7. Assessment of working conditions using a simple risk assessment method in the wood-processing industry

ANALYSIS OF WORKING CONDITIONS IN THE TEXTILE INDUSTRY

The work environment in a middle-scale textile firm (200 workers) — in Tallinn, the capital of Estonia was analyzed. The list of hazards was compiled before the investigation by the work environment specialist of the firm.

The main risk factors in that kind of industry are hazardous tools and equipment, also heavy physical load and ergonomics for mostly female workers, noise, textile dust.

The measurements of the hazards were carried out in different departments (sewing, embroidering). The following results were obtained:

- temperature of the air — 20–26.7°C;
- moisture of the air — 33–38%;
- lighting — 160–1900 lx;
- textile dust concentration-overall in the department ~0.4 mg/m^3 near the machines — 1.0 mg/m^3;
- noise — 70–89.5 dB (A).

From the viewpoint of possibility of accidents/traumas originating from machines it was declared that the hazards for finger traumas exist. The last type of accidents predominates in the Estonian work traumas spectra nowadays (~500 cutting traumas of fingers a year).

On the basis of the measurement and observations in the department the following conclusions were made:

The microclimate in the textile firm was satisfactory (considering that there is room for improvement of microclimate by raising moisture content of the air and better ventilation). The safety of machines has to be taken into consideration when buying new equipment. Noise was over the limits (85 dB) in some workplaces, but breaks were taken and earmuffs were used if necessary. So the total amount of noise during an 8-hour workday is not over the permissible level (dose: 85 dB × 8 h). The five-stage simple/flexible risk assessment model was used for the assessment of working conditions (Figure 8).

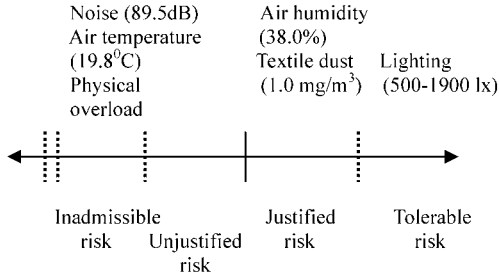

Figure 8. Assessment of working conditions using a simple risk assessment method in the textile industry

RESULTS

The working conditions in the Estonian working environment are very different. Economically successful firms are able to supply the workers with sauna, solarium etc., but in the others the conditions are extreme - for example workers have to work in cool conditions (0°C — temperature of the air inside the room in winter) or workers' home clothes are hold in the same room with smelling chemicals. In general, the working conditions are getting better from year to year.

The working conditions are often good in commerce and banking area, but in manufacturing the conditions may be yet rather bad. Tallinn enterprises are also richer than in countryside.

The working conditions at a middle-scale textile firm are satisfactory, but there is a place for improvement in microclimate of workrooms and in work organization to guarantee the workers' satisfaction from the job.

The new Estonian legislation in occupational health and safety considering the EU directives usually helps to improve the working conditions.

CONCLUSIONS

Workers have understood that if only the occupational safety and health personnel is actively implementing the measures of safety improvement, there will be no good results. The spread of information in the organization has improved, but much depends on the financial status of the organization. The greater problems are at small enterprises, where the problems are dealt with only when the accidents occur. In large enterprises a specialist in occupational safety and health is usually employed who is educated in legislation and management of hazards in the work environment.

REFERENCES

1. British Standard 8800, 1996, Guide to Occupational Health and Safety Management Systems, London: British Standards Institute.

2. European Commission. Directorate General V., 1996, Guidance on risk assessment at work. Health and Safety, Luxembourg: Author.
3. Rantanen, S., Pääkkönen, R., 1999, Työympäristön kemiallisten ja fysikaalisten riskien arviointi ja hallinta. [Assessment and management of occupational chemical and physical risks], Helsinki: Finnish Institute of Occupational Health.
4. Reinhold, K., Lell, K. 2003, Improving Garment Workers' Ergonomics, *Proceedings of the Nordic Ergonomics Society 35th Annual Conference*, Reykjavik, Iceland, August 10–13, 287–290.
5. Skriver, J., 2004, A simple model of Safety Culture, *Human Factors in Design.* Europe Chapter of the Human Factors and Ergonomics Society, D.de Waard, K.A.Brookhuis & C.M.Weikert (Eds.), Maastricht: Shaker Publishing BV, 51–59.
6. Tint, P, Saarela, K.L., 1994, Possibilities of development of occupational safety at Estonian enterprises, *Estonian Newsletter on Occupational Health and Safety*, 2–3, 23–24.
7. Tint, P., 1998, Risk Assessment in the Working Environment in Estonia, *International Journal of Occupational Safety and Ergonomics, 4*(2): 237–248.
8. Tint, P., 2000, Possibilities of introducing safety culture in societies in transition, Safety in the Modern Society. Work, home, leisure. Rantanen J., Lehtinen S. & Saarela K. L. (Eds.), *People and Work. Research Reports* No. 33, (pp. 29–34), Helsinki: Finnish Institute of Occupational Health.