



NOWODUST – ELIMINATION OF RISKS ARISING FROM EXPOSURE TO CHEMICAL SUBSTANCES AND REDUCTION OF EXPOSURE TO WOOD DUST AND NOISE IN THE TIMBER INDUSTRY

1. Organisations involved

Barlinek S.A.

2. Description of the case

2.1. Introduction

Barlinek S.A. is a long established company in the timber industry that currently employs about 1 400 people. Its main activity is the production of domestic and exotic wood flooring products.

As a result of the analysis of risks related to hazardous factors at its workstations, the company launched a programme to improve safety in 2000. This project targeted three harmful factors in particular:

- chemical substances emitted at the old varnishing line;
- wood dust emitted at the production line;
- noise emitted by the machinery.

Improvements carried out between 2000 and 2006 led to a decrease in exposure levels to wood dust and noise, and elimination of the exposure to chemical substances.

Between 1996 and 1998 the extent of occupational exposure to hazardous factors was assessed at all workstations at Barlinek S.A. The investigation revealed that the main harmful factors present at the workstations were chemical substances, wood dust and noise. In 1999 the management of the company, in consultation with national labour inspectors and OSH specialists as well as representatives from the company's various healthy departments, decided to target these harmful factors with the aim of providing safe and healthy working conditions in accordance with the requirements of Polish legislation.

The elimination or reduction of risk at source was also considered to be a very important task for at least two reasons. Firstly, the exposure to chemical substances, wood dust and noise is closely associated with a variety of adverse health effects including cancer, dermatitis, allergic respiratory effects, mucosal and non-allergic respiratory effects and occupational hearing loss. Secondly, many woodworking processes cause explosion hazards.

The results of the investigation are presented below.

Chemical substances

The investigation carried out from 1996 to 1998 indicated that harmful chemical substances emitted at the old varnishing line were volatile organic compounds (VOCs), such as acetone, toluene, n-butyl acetate, xylene, ethyl acetate, methyl ethyl ketone, and benzene. Some of these substances were recognised as carcinogenic. Due to the toxicology effects, the total exposure indicator was calculated for all these chemical substances. In 1996, an investigation of the emission of VOCs was carried out over eight working hours at the three main workstations located at the old varnishing line. All of the above hazardous substances were detected. Additionally, the results showed that the level of ethyl acetate was higher than for other chemical substances. Although the threshold limit value for each of these hazardous substances was not exceeded, the calculated total exposure indicator was higher than the threshold limit value required by law.

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In order to protect employees from hazardous chemical substances, in 1997 a rotation system was introduced on each shift. Investigations carried out one month later and one year later (in 1998) established that the applied solution had been effective because the legal limits were not being exceeded. However, all of the above mentioned volatile organic compounds (VOCs) were still detected in significant quantities.

Wood dust

A variety of activities at Barlinek S.A. generate wood dust including sawing, sanding, milling, planing, routing, etc. These activities occur from the tree felling stage to final manufacturing processes. A study of wood dust exposure conducted at Barlinek S.A. indicated that employees are exposed to airborne wood dust of different particle sizes, concentrations and compositions. The size of the dust particles, the amount of dust and the exposure of staff working in these areas depend on a number of factors including the equipment being used, the state and type of timber, the general and local exhaust ventilation and the extraction system and, finally, any personal protective equipment that may be used by employees.

By 2000 some solutions had been applied in order to reduce the exposure to wood dust, e.g. mechanical separation of the technical processes and the shavings and dust extraction systems, but even so, the indoor air quality was not good enough to conclude that these solutions fulfilled their protection functions in a satisfactory way. Unfortunately, the exposure level increased significantly in some areas of the factory. The sawing, sanding and milling were found to be the main processes that gave rise to high wood dust exposure levels.

Noise

At Barlinek S.A. employees were exposed to high level of noise generated from equipment and tools throughout the entire production process (e.g. from panel saw, circular saws, planer with saw blades). By 2000 checks had been conducted to assess occupational noise exposure and to indicate noise levels emitted from specific jobs within the company. Wood flooring operations were exposed to higher noise levels than other operations. Dangerously high levels of noise were produced by tasks including sawing, planning, sorting of finished products and varnishing. The study conducted in 1996 found that noise exposure levels in these tasks were above 85 dB(A), i.e. the noise exposure was higher than admissible by Polish law. To conclude, these results showed that workers were exposed to noise levels that put them at considerable risk of hearing loss.

2.2. Aims

The main targets of the project were to:

- eliminate or reduce the main hazardous factors at the workstations (chemical substances, wood dust and noise) in order to protect employees against them;
- apply materials, components and technological processes that meet safety requirements, e.g. not creating explosion hazards;
- decrease the amount of materials and components used in manufacturing processes and reduce the amount of timber waste (pro-ecological investments).

The actions were also taken to improve the company's competitiveness and position in the timber market.

2.3. What was done, and how?

Before action could be taken to eliminate or minimise the risks described above, a survey was done of new and existing technologies, machines and equipment.

This survey included:

- analysis of the parameters of machines currently in use at the factory;
- an examination of chemical substances, wood dust and noise levels emitted from the specific machinery and processes carried out by the company;

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- consultations with trained and professional advisers to gather information about appropriate solutions for machine constructions;
- tests on different solutions for machine constructions, e.g. machines with enclosure construction, quieter machine tools.

Elimination of occupational risk arising from exposure to chemicals

One of the main objectives of the project was to eliminate the occupational risk arising from the exposure to chemical substances emitted from the old varnishing line. The new Barlinek's varnishing house was designed to be fully automated. The new line is based on a lacquer hardened by UV technology, i.e. a water-based photohardened lacquer, which does not contain organic solvents and is mainly composed of solid components (99 %). Furthermore, there is no need to pour additional substances (e.g. solvents) into the lacquer during the varnishing process.

The modernisation of the old varnishing house permitted the elimination of the occupational risk arising from the exposure to chemical substances as well as increasing the quality of products and widening the application features of products.

Reduction of occupational risk arising from exposure to wood dust

In order to protect the employees against high levels of wood dust and to avoid a risk of explosion:

- the dust removal systems were changed, i.e. the general and the local exhaust ventilation as well as the extraction system used to remove sawdust and wood dust at source were redesigned and installed;
- machine tools that were likely to produce a lot of dust were comprehensively replaced by new ones that meet safety requirements, i.e. located inside an enclosure construction that assures adequate protection against wood dust and has vacuum or exhaust systems that capture wood dust at source;
- a modern high-efficiency filter system was purchased and installed to separate sawdust and wood dust suspended in the air;
- fully automated and computer-controlled manufacturing processes were introduced;
- an explosion hazard detecting system and automated fire fighting system were purchased and installed.

Since the introduction of these measures, the manufacturing processes have been nearly 'dust-free'.

Reduction of occupational risk arising from exposure to noise

The main actions of the programme of noise protection were:

- buying and installing of new machinery that emitted a lower level of noise (e.g. double-blade panel saw, circular saws and planer with saw blades);
- exchanging the existing compressor rooms for quieter ones;
- erection of protective baffle boards and noise suppressors which reduce the noise generated by the manufacturing equipment;
- using acoustic enclosures to separate machines and even all manufacturing processes;
- automating some workstations to protect employees against high levels of noise.

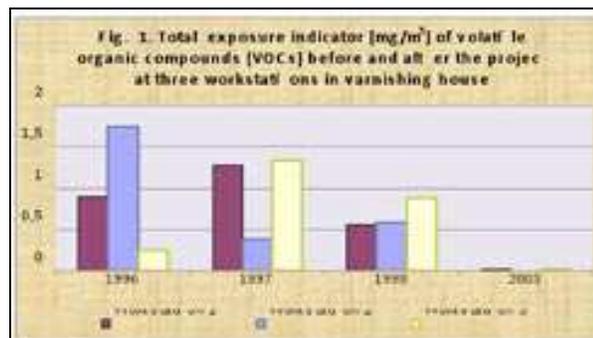
Although this project is a continuous challenge for the company, the solutions introduced have significantly reduced the level of noise emitted by machinery operated at Barlinek S.A. Resources for the project came from investment credits and the company's budget.

2.4. What was achieved?

In order to check if the company expectations were met, several investigations of exposure and assessment of occupational risks at Barlinek S.A. were carried out by the Sanitary and Epidemiological Station in Gorzow Wielkopolski or by National Institute of Hygiene in Warsaw as well as the Wood Technology Institute in Poznań and were documented in accordance with the national and international standards and Polish occupational safety and health law. In conformity with Polish law, the process was implemented at all positions of the company.

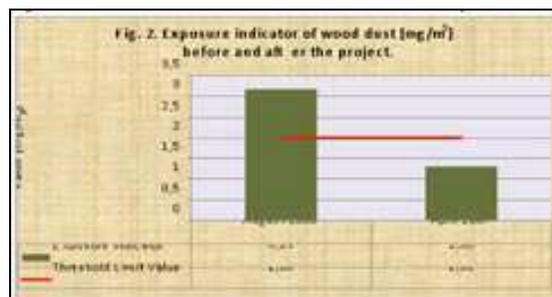
The emission rates of volatile organic compounds (VOCs) from varnishing processes were determined using procedures based on the adsorption of the tested compounds and separation of the adsorbed compounds using a gas chromatography method with use of thermal desorption and mass spectrometer identification. Before the implementation of the new varnishing house, the concentration of VOCs was very high at all workstations. The following substances were detected: acetone, methyl ethyl ketone, ethyl acetate, toluene, n-butyl acetate, and xylene. After the implementation of the new varnishing house the investigation identified only a trace amount of n-butyl acetate. The exposure indicator was significantly lower than 0.01 of threshold limit value. The results confirmed that the risk arising from the exposure to VOCs had been eliminated (see Figure 1). Therefore, the applied solution is a relevant instrument for the elimination of industrial emission of VOCs. The rotation system introduced several years ago was changed and instead of three people only one person on each shift operates the varnishing process.

Figure 1. Action taken to reduce exposure to VOCs was so successful that the risk was virtually eliminated



Actions taken to reduce the exposure to wood dust at source as well as to avoid a risk explosion were definitely successful. They reduced exposure to wood dust to the lowest level (see Figure 2).

Figure 2. Actions taken to reduce wood dust at source were very successful



Regarding the level of noise, in 2006 the exposure level was 82.1 dB(A) and was lower than the threshold limit value (according to Polish regulations) — 85 dB(A) (see Figure 3). Nevertheless, the noise reduction project is still being carried out in the hope of reducing this level even further.

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Figure 3. Noise exposure indicator before and after the project



As a result of the project the number of exposed employees decreased steadily and the working conditions at the company were improved for as many as 540 employees. Furthermore, the amount of materials and components used in manufacturing processes has decreased. This in turn translates into a reduction of expenditure on purchasing and manufacturing.

The example of Barlinek S.A. shows that health and safety initiatives should not only be seen as a legal obligation for a company but also as an essential element of the long-term development strategy.

Figure 4. Some noisy machine tools are now in acoustic enclosures



Figure 5. Some machine tools that produce a lot of dust are now enclosed in special chambers



Problems faced

The main problem was in selecting appropriate producers that provided high quality materials, machines, and equipment. Almost every producer offered a huge range of desired goods and it was very difficult to choose between them. This selection process was also time-consuming. Before the most reliable producer could be selected, Barlinek S.A had to carry out several tests on the relevant materials or equipment, or else a visit had to be paid to the company concerned in order to check how they run their business. This problem occurred at every stage of the process. To win support from the employees for the new technical solutions and to familiarise them with their use, training courses were held between 2000 and 2006. These included a course to raise employee awareness of the modified processes, machines and equipment and of occupational safety issues. Other courses aimed to change employees' routine behaviour, related, in particular, to the manual use of machinery. The employees were also trained in the correct use and maintenance of the machinery and equipment.

2.5. Success factors

The main success factors of the project were:

- elimination of the exposure to volatile organic compounds (VOCs) at source,
- reduction of the exposure to wood dust at source,

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- reduction of the risk of explosion,
- reduction of the level of noise emitted by the machinery,
- increase in the quality of products,
- improving the products' features,
- creation of the company's international image,
- improving the efficiency and productivity of the company.

2.6. Further information

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2.7. Transferability

Most of the investments, e.g. the fully automated varnishing line, the wood dust removal systems and the machinery emitting lower level of noise, could be used successfully by other companies in the timber sector.

3. References, resources:

- <http://osha.europa.eu/en/publications/reports/TEWE09001ENC>