

## **Noise hazard in companies producing packaging**

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### **ABSTRACT**

**Poland is one of the biggest packaging markets in Europe. Currently in Poland about 7000 companies operate in the packaging industry, of which 4300 are considered as important. They include 2300 production companies, 1200 companies offering packaging services or rendering services to the packaging industry and about 800 companies that operate in the area of distribution. These companies employ about 230,000 persons. Noise is one of the harmful factors in the working environment occurring in companies producing packaging. Therefore noise measurements at workplaces in companies producing plastic, paper and cardboard, wood, metal and glass packaging were carried out. The scope of measurements included the determination of the following parameters: the A-weighted noise exposure level normalized to an 8 hour working day (daily noise exposure level), the A-weighted maximum sound pressure level and the C-weighted peak sound pressure level. The results of the measurements show that in the case of 64 percent of the tested workplaces the values of the daily noise exposure levels exceeded the limit value 85 dB(A). An analysis of the noise measurement results is presented in the paper.**

**Keywords:** Occupational noise, Packaging

**I-INCE Classification of Subject Number:** 50

### **1. INTRODUCTION**

Poland is one of the biggest packaging markets in Europe. According to data of the Polish Information and Foreign Investment Agency the packaging market in Poland has been developing dynamically in the last twenty years. Currently in Poland about 7000 companies operate in the packaging industry, of which 4300 are considered as important [1]. They include 2300 production companies, 1200 companies offering packaging services or rendering services to the packaging industry and about 800 companies that operate in the area of distribution. These companies employ about 230,000 persons. This is a total of about 1% of world's packaging industry workers.

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The structure of the Polish packaging industry, according to [2], is following:

- about 50% of the producers offer plastic packaging,
- about 38% of the producers offer paper and cardboard packaging,
- the share of each of the other group of materials (wood, metal, glass and other) constitute about 2-4% of the entire market.

About 50% of the above mentioned producers are microenterprises and small enterprises, employing up to 10 workers.

In the literature there are few papers on occupational safety and health in companies producing packaging. The available data (e.g. [3, 4, 5]) suggest that noise, mechanical hazards (originating from operation of machines) and shift work are the most common occupational hazards in places associated with the packaging industry. The adverse effects of noise on human are associated mainly with the hearing organ. Nevertheless, non-auditory effects can be also observed in the entire human body [6]. Therefore, it is necessary to determine noise exposure at workplaces and other places occupied by people.

The purpose of this study was to evaluate noise exposure at workplaces in companies producing different types of packaging.

## 2. MATERIALS AND METHODS

The measurements of noise were carried out in 6 companies producing the following types of packaging:

- glass packaging,
- metal packaging,
- wood packaging,
- plastic packaging,
- paper and cardboard packaging,

and the total number of the tested workplaces was 90.

The noise measurements results were used to compare the existing acoustic conditions in the companies producing packaging with the requirements specified in the occupational health and safety regulation.

Noise measurements were carried out in accordance with the European Standard EN ISO 9612 [7] using the task-based measurement strategy. The scope of measurements included the determination of the following parameters:

- the A-weighted noise exposure level normalized to an 8 hour working day (daily noise exposure level),  $L_{AEx,8h}$  – from the measured values of the A-weighted equivalent continuous sound pressure level,  $L_{Aeq}$ ,
- the A-weighted maximum sound pressure level,  $L_{Amax}$ ,
- the C-weighted peak sound pressure level,  $L_{Cpeak}$ .

The values of the maximum admissible intensities (MAI) of noise at workplaces are defined in the regulation of the Polish Minister of Family, Labour and Social Policy concerning the maximum admissible concentrations and intensities in the work environment for agents harmful to the health [8]. According to this Regulation, occupational noise is characterized by:

- the A-weighted noise exposure level normalized to an 8 hour working day (daily noise exposure level),  $L_{AEx,8h}$ ,
- the A-weighted maximum sound pressure level,  $L_{Amax}$ ,
- the C-weighted peak sound pressure level,  $L_{Cpeak}$ .

Table 1 specifies the values of MAI of noise.

Table 1. The values of MAI of noise according to [8]

Parameter	Value of MAI
The A-weighted noise exposure level normalized to an 8 hour working day (daily noise exposure level), $L_{AEx,8h}$	85.0 dB(A)
The A-weighted maximum sound pressure level, $L_{Amax}$	115.0 dB(A)
The C-weighted peak sound pressure level, $L_{Cpeak}$	135.0dB(C)

### 3. RESULTS AND DISCUSSION

As mentioned earlier, the noise measurements were carried out in 90 workplaces, including:

- 30 workplaces associated with the glass packaging production,
- 29 workplaces associated with the plastic packaging production,
- 13 workplaces associated with the metal packaging production,
- 12 workplaces associated with the paper and cardboard packaging production,
- 6 workplaces associated with the wood packaging production.

Examples of the detailed noise measurements results at the selected, six workplaces in the company producing glass packaging are shown in Table 2.

Table 2. Noise measurements results for the selected workplaces in the company producing glass packaging

Workplace number	Activity	Time, in min.	$L_{Aeq}$ , in dB(A)	$L_{AEx,8h}$ , in dB(A)	$L_{Amax}$ , in dB(A)	$L_{Cpeak}$ , in dB(C)
1	Packing of products	400	80.0	79.7	85.5	113.7
	Preparing the site	50	80.2			
	Break	30	60.0			
3	Receipt of products	200	84.4	83.1	86.8	114.3
	Weighting of products	200	82.2			
	Preparing the site	50	80.7			
	Break	30	60.0			
5	Products quality control after washing	400	95.2	94.4	98.7	116.8
	Preparing the site	50	80.7			
	Break	30	60.0			
13	Using the glass machine	400	106.6	105.7	111.7	122.5
	Preparing the site	50	69.3			
	Break	30	60.0			
25	Grinding	450	78.2	77.9	87.5	101.9
	Break	30	60.0			
29	Padding and welding of forms	450	86.3	86.0	94.2	111.1
	Break	30	60.0			

The value of MAI of the A-weighted noise exposure level normalized to an 8 hour working day,  $L_{AEx,8h}$ , (equals to 85.0 dB(A)) is exceeded in the case of the workplaces number 5, number 13 and number 29. The values of MAI of the A-weighted maximum sound pressure level,  $L_{Amax}$ , (equals to 115.0 dB(A)) and of the C-weighted peak sound pressure level,  $L_{Cpeak}$ , (equals to 135.0 dB(C)) are not exceeded.

The summary of the measurements results obtained in all tested companies producing packaging is given in Table 3. An analysis of the measurement data indicates that:

- the values of the A-weighted noise exposure levels normalized to an 8 hour working day,  $L_{AEx,8h}$ , change from 70.2 dB(A) to 105.7 dB(A),
- the values of the A-weighted maximum sound pressure levels,  $L_{Amax}$ , change from 67.0 dB(A) to 111.7 dB(A) and are lower than the value of MAI (equals to 115.0 dB(A)),
- the values of the C-weighted peak sound pressure levels,  $L_{Cpeak}$ , change from 89.2 dB(C) to 122.5 dB(C) and are lower than the value of MAI (equals to 135.0 dB(C)).

Furthermore, it was found that the value of MAI of the A-weighted noise exposure level normalized to an 8 hour working day is exceeded at:

- 9 workplaces in the company producing glass packaging,
- 26 workplaces in the companies producing plastic packaging,
- 9 workplaces in the company producing metal packaging,
- 11 workplaces in the company producing paper and cardboard packaging,
- 4 workplaces in the company producing wood packaging.

*Table 3. Noise measurements results collection*

Company – type of production	$L_{AEx,8h}$ , in dB(A)	$L_{Amax}$ , in dB(A)	$L_{Cpeak}$ , in dB(C)
Glass packaging production	73.1 to 105.7	82.3 to 111.7	100.0 to 122.5
Plastic packaging production	84.9 to 95.4	86.2 to 104.9	103.7 to 118.5
Metal packaging production	65.1 to 98.9	67.0 to 104.5	89.2 to 122.1
Paper and cardboard packaging production	70.2 to 90.7	85.8 to 92.2	96.3 to 119.0
Wood packaging production	82.7 to 89.1	96.8 to 105.6	119.2 to 121.2

#### 4. CONCLUSIONS

Noise is one of the harmful factors in the working environment occurring in companies producing packaging. The determined daily noise exposure levels exceeded the value of the maximum admissible intensity (MAI = 85.0 dB(A)) in 64% of the analysed cases.

Noise at the workplaces in the companies producing packaging poses a risk of hearing damage.

## 5. ACKNOWLEDGEMENTS

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