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*The evaluation of exposure to noise at workplaces
of some working population in a chemical plant*

The term working environment includes conditions in the material environment in which the process of work is performed. These conditions are formed by physical, chemical and biological factors in the environment that result from technological processes. The intensity of harmful effects determines inconvenience and may threaten health and even life of the employees. The evaluation of working environment is necessary to find out and confirm the permissible degree of exposure. The acceptable limits for levels of harmful effects at a workplace are necessary to maintain the best physical, mental and social conditions in the working population. The health of the working population depends on many contributory factors at the workplace.

A variety of factors accompanied by different degrees of exposure often leads to interaction. Noise, which is a physical factor, poses a considerable threat to the health of the employees. The effect of strong and long lasting stimuli of high intensity exerts a harmful effect on human body (4, 6, 10, 11 14, 15).

The aim of this study is evaluation of the intensity of noise and the analysis of its harmful effects at workplaces in some departments in a chemical plant.

MATERIAL AND METHODS

The study was carried out in the Nitrogen Plant II (Zakład Azotu II in Puławy). The analysis of measurements of noise intensity was carried out in the years 1997–2001 at some workplaces in the following departments: Gas Department (PN-1), Synthesis (PN-2), Department for Nitric Acid (PN-3), Department of Ammonium Saltpetre (PN-4). The main sources of noise were synthesis compressors, circulating pumps driven with steam turbines, turbine-driven ammonium compressor and air compressor. Measurements of the intensity of noise were carried out using SVAN 912A (AE) meter, which enabled the measurement of equivalent maximum, peak sound level.

The results helped to evaluate the exposure of employees to noise in the studied departments and morbidity according to the register of occupational diseases and suspected occupational diseases.

RESULTS AND THEIR ANALYSIS

The results are presented in tables and figures. The maximum values of the intensity of noise in the studied departments in the years 1997–2001 are presented in Table 1. The structure

Table 1. Maximum values of the intensity of noise in the studies eaprtments in the years 1997 – 2001

The years / Department	1997			1998			1999			2000			2001		
	rów	max	szcz	rów	max	szcz	rów	max	szcz	rów	max	szcz	rów	maz	szcz
PN - 1	96.7	107.3		97	107		96	104	107	96	118	118	99	104	118
PN - 2	92.5	99.2		89	100		90	103	107	91	101	113	92	96	112
PN - 3	85.3	102		84	99		88	98		94	99	114	89	95	110
PN - 4	84.7	111.6		86	100		84	94		85	97	116	86	98	115

PN-1 – Departament of Gas, PN-2 – Departament of Synthesis, PN-3 – Department for Nitric Acid, PN-4 – Department of Production and Packing of Ammonium Saltpetre, rów – the equivalent sound level, max – the maximum sound level, szcz – the peak sound level

of equivalent, maximum, peak sound level in these departments is presented in Figures 1, 2, 3. The analysis of the results over the years revealed the greatest exposure to noise in the Gas Department (PN-1), Department of Synthesis (PN-2), Department for Nitric Acid (PN-3) and Department for Production and Packing of Ammonium Saltpetre (PN-4).

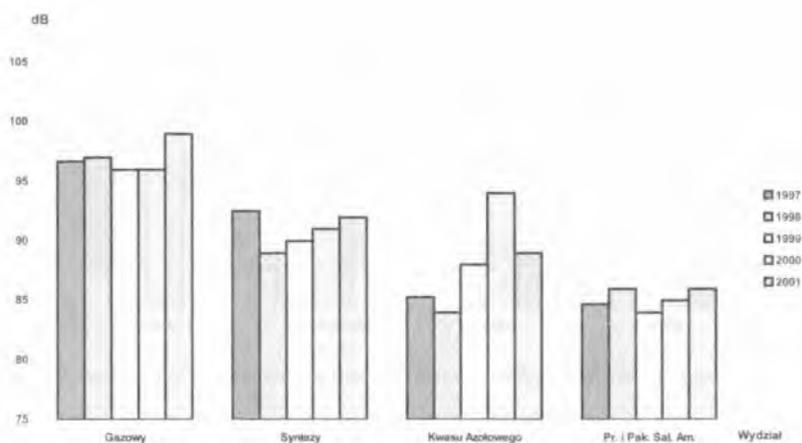


Fig. 1. The structure of the highest value of equivalent sound level in the studied departments in the years 1997-2001

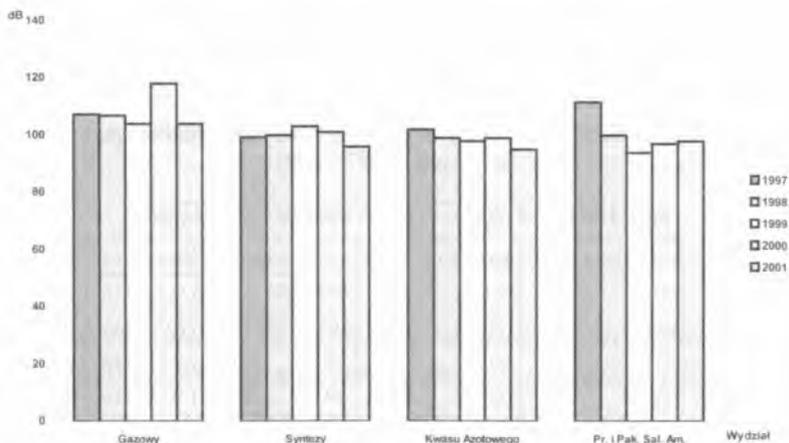


Fig. 2. The structure of the highest value of maximum sound level in the studied departments in the years 1997-2001

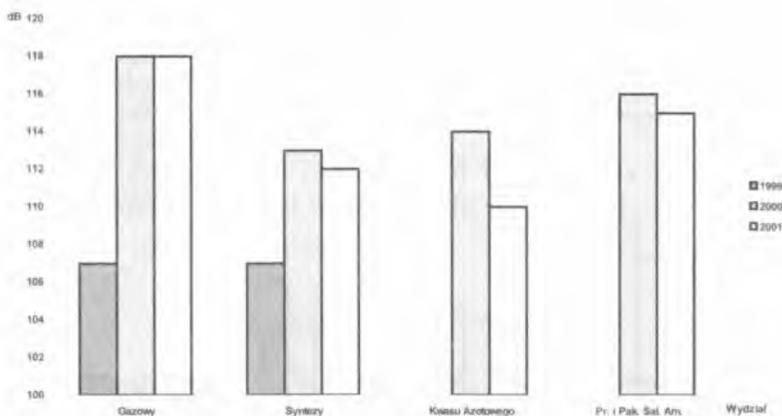


Fig. 3. The structure of the highest value of peak sound level in the studied departments in the years 1997-2001

The level of noise intensity in particular departments in the years 1997–2001 is presented in Figures 4–7. In the Gas Department the highest value of equivalent level of noise was found in 2001, but the highest maximum sound level was found in 2000 and the highest peak level in the years 2000–2001 (Fig. 4). The analysis of noise intensity in the Department of Synthesis revealed that in 1997 the level of equivalent sound reached the highest value. The highest level

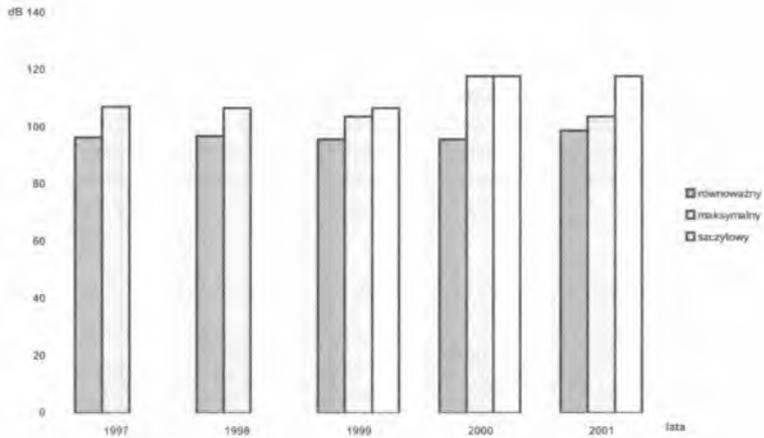


Fig. 4. The level of noise intensity in the Department of Gas in the years 1997–2001

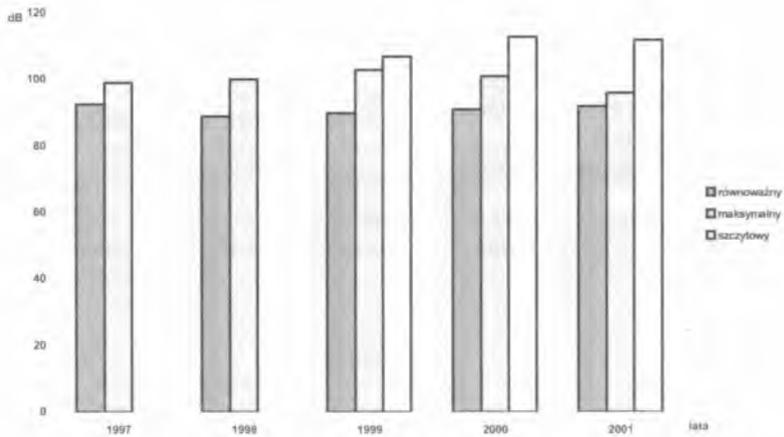


Fig. 5. The level of noise intensity in the Department of Synthesis in the years 1997–2001

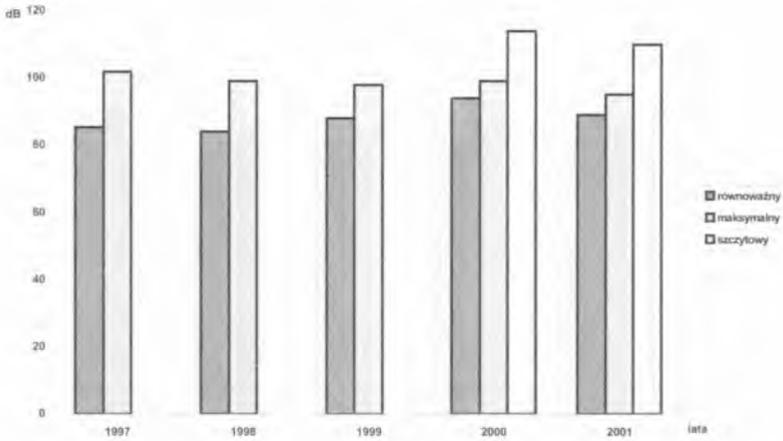


Fig. 6. The level of noise intensity in the Department for Nitric Acid in the years 1997–2001

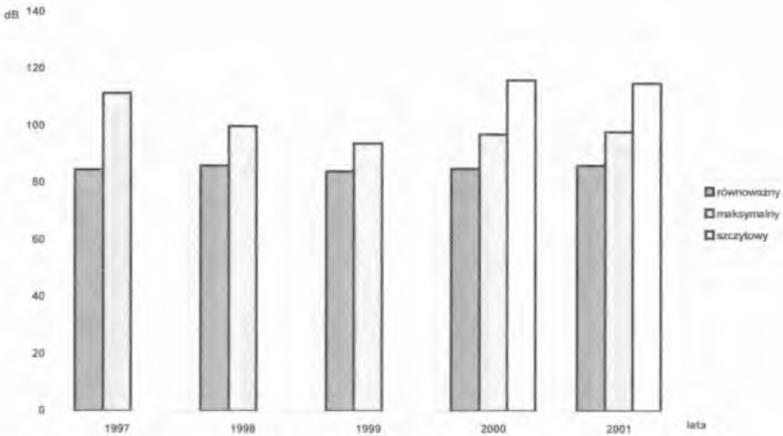


Fig. 7. The level of noise intensity in the Department of Production and Packing of Ammonium Saltpetre in the years 1997–2001

of maximum sound was found in 1999, but in the years 2000–2001 the peak level of sound was on the same level (Fig. 5). The results of the noise level in the Department for Nitric Acid are presented in Figure 6. The highest level of equivalent and peak intensity was found in 2000, but the value of maximum sound was the highest in 1997. In the Department for Production and Packing of Ammonium Saltpetre the highest level of equivalent sound was found in 1998, for the maximum intensity in 1997. The peak sound level reached the highest value in 2000 (Fig. 7).

The evaluation of morbidity due to occupational diseases in the years 1997–1999 revealed 4 cases of damage to the organ of hearing in the Department of Gas and Department for Nitric Acid. In 2000 there were 2 cases of hearing impairment (Tab. 2).

Table 2. The register of occupational diseases and suspected occupational diseases

The years	Department	Name and number of occupational diseases
1997	Department of Gas	Occupational damage to hearing mechanism
1997	Department of Synthesis	Damage to hearing mechanism
1997	Department of Gas	Bilateral receiving impairment of hearing in the cochlea
1997	Department of Synthesis	Impairment of hearing
1998	Department for Nitric Acid	Occupational impairment of hearing
1998	Department of Synthesis	Failure in receiving full range of hearing
1998	Department of Gas	Bilateral receiving impairment of hearing
1999	Department for Nitric Acid	Occupational damage to hearing
1999	Department of Synthesis	Suspected occupational hearing damage
1999	Department of Gas	Occupational damage to hearing
2000	Department of Synthesis	Slight bilateral impairment of hearing at the range > 25dB
2000	Department of Gas	Bilateral impairment of hearing

The evaluation of occupational risk in the Nitrogen Plant II revealed that potential effects of exposure are average, and the exposure to noise is frequent. The qualitative evaluation of risk is classified as average risk.

DISCUSSION

Working environment and living conditions may pose a threat to the health of the working population. The exposure to unfriendly and harmful effects at the workplace may result in occupational and paraoccupational diseases. The incidence of pathologic conditions that are considered occupational reflects the condition of health of the working population and hygienic working conditions.

In the course of recent 30 years the profile of incidence of occupational diseases has changed. A number of cases of severe and chronic poisoning which constituted 1/3 of the total number of diagnosed occupational diseases in the 1960's, decreased considerably, while in 1998 their number decreased dramatically to 2.5%. The number of diagnosed conioses and vibratory syndrome also decreased considerably while damage to the organ of hearing is still a serious problem (3,13). Occupational damage to the hearing mechanism is the effect of noise, the most common physical factor in the working environment. The factual damage is demonstrated by permanent raising of the hearing threshold that considerably impairs communication or makes it even impossible (1,5,7,8,9,15).

Grzesik J. et al. tested the relationship between speech comprehension and the type of impairment of hearing using computer simulation. The study included subjects age 18–23. It was found that characteristic depressed hearing due to noise considerably impairs speech comprehension (2).

Public awareness of harmful effects of noise to health results in regular monitoring of noise pollution. Measurements of industrial noise recorded by safety inspectors in 1999 are presented in Table 4. In the study including 2065 factories the acceptable intensity of noise was exceeded in 1066 cases and only 21 factories followed the recommended safety and hygiene regulations.

In Lublin Voievodship the threat of industrial noise to health is considerably small as there are no factories in which emission of noise exceeds the acceptable level (12). In the studied departments of the chemical factory high values of intensity of noise were revealed at many workplaces. In the years 1997–1999 occupational impairment of hearing was found in 4 employees, but in the years 2000–2001 no case of occupational impairment of hearing was recorded. A decreasing number of diagnosed occupational diseases is the result and proof of very good work of qualified safety inspectors and work doctors who carry out regular evaluation of exposure to noise at workplaces and deal with prophylactics to prevent the development of hearing impairment due to noise in employees.

Protection of the organ of hearing is one of main goals of every employer if noise is the important threat to the health of employees. Regular check-ups and safety inspection at the workplace contribute to the prevention of undesirable effects on the health of the working population.

CONCLUSIONS

1. Exposure to equivalent noise in the studied departments significantly exceeds the permissible standards.
2. Maximum and peak noise levels did not exceed permissible limits (apart from an individual case when the maximum noise level was exceeded).
3. In the years 1997–2001 four cases of occupational damage to hearing were observed but in 2000–2001 no cases were found.
4. It seems that group and individual ways of protection from the harmful effect of noise are effective

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SUMMARY

The study was carried out on some workplaces in the departments of various degree of unfavourable working conditions in the chemical plant. The exposure to noise was evaluated and the incidence of occupational diseases and suspected occupational diseases was analyzed. In the studied period of time high values of intensity of noise were found at workplaces, very often exceeding the permissible hygienic standards. In the years 1997–1999 there were 4 cases of occupational damage to hearing, and within two last years no occupational damage to hearing was found.

Ocena narażenia wybranej populacji na hałas na stanowiskach pracy w zakładzie przemysłu chemicznego

W badaniach przeprowadzonych na wybranych stanowiskach pracy wydziałów o różnym stopniu uciążliwości zakładu przemysłu chemicznego oceniano narażenie na hałas oraz analizowano zachorowalność na choroby zawodowe i podejrzenie o zachorowalność na te choroby. W analizowanym okresie wykazano wysokie wartości hałasu na stanowiskach pracy, niejednokrotnie przekraczające normy higieniczne. W latach 1997–1999 stwierdzono 4 przypadki zawodowego uszkodzenia słuchu, w ciągu ostatnich dwóch lat nie zanotowano zawodowego uszkodzenia słuchu.