ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA
VOL. LIX, N 1, 62 SECTIO D 2004

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Occupational hazard evaluation of working population in a select automotive industrial plant

Environmental conditions and the job performed exert a considerable influence on the state of health of working population. It is the influence upon man of many physical, chemical, biological and psychosocial factors. Disorders of body functions related to the job performed may lead to an increase in the sick rate of occupational and paraoccupational diseases and occupational dangers to health and life of the working population.

In industrial plants, physical and chemical factors of work-stations play and important role in evaluation of working conditions. In the working process man is often exposed to activities of many factors at the same time, which may occur in different mutual schemes and sometimes there may be an interaction (1, 5, 6, 9, 13).

The aim of the undertaken research was the evaluation of the scale of the dangers resulting from the exposition to some physical and chemical factors at work-stations of working population in an automotive industrial plant.

MATERIAL AND METHODS

The research done in the department of Assembly was concerned with the evaluation of working conditions by measuring physical factors such as noise, mechanical vibration, dustiness, and some chemical factors, i.a. carbon monoxide, nitrogen oxides, manganese and iron compounds and some solvents. Measurements were taken in the Institutional Laboratory of Work Environment Protection.

The measurement of the noise level was done with the use of sound level meter of type 1–10 acc. to PN-N-01307. The measurement of the mechanical vibration was done with the use of vibration meters WH-31 acc. to PN-91-N 01352. The measurement of free crystalline silica content in the total respirabile dust in the air was done acc. to PN-91-Z 0418/04; PN-91-Z 04030/05; PN-91-04030/06. The concentration of carbon monoxide was measured with a method of tubular indicators of type C-0.25 and degasser WG-2M. The measurement of manganese and its compounds, iron oxides was done with a method of absorbent atomic spectrophotometry.

The measurement of solvents concentrations were done with a method of gas chromatography acc. to PN-89-Z-04023/02.

RESULTS

The results of the measurements of the physical factors level (minimum and maximum values) at work-stations are shown in Table 1.

Table 1. The exposure to the selected physical factors on post in the years 1999–2000 (minimal and maximum values)

Physical factors			Norm	1999		2000	
				minimal values	maximum values	minimal values	maximum values
Noise	Equivalent level of exposition (dB)		85 db	63.2	96.5	58.0	90.0
	Peak level of C sound (dB)		135 dB	86.5	130.1	83.0	133.0
	Maximum level of A sound(dB)		115 db	76.7	11.3	64.0	11.0
Mechanical vibrations	(m/s^2)		2.800 m/s^2	0.07	2.63	0.78	1.69
Pollution	Dust containing 2–50% free crystalline silica	Total dust	4.0 mg/m^3	0.094	3.529	0.667	4.180
		Respirable dust	1.0 mg/m^3	0.008	0.668	0.0469	0.802
	Dust containing below 2% crystalline silica	Total dust	10.0 mg/m^3	0.819	3.333	2.900	3.310

On estimating the values of notice level it was shown that at many work-stands the highest permissible levels (NDN) were exceeded. Exceeding of NDN was observed in 1999 at work- stations in the departments of Pressing and Welding, in 2000 in the department of Process and Product Audit.

On analyzing the values of mechanical vibration in the period of study the exceeding of standard values was not found.

Dustiness at work-stations was within the bounds of mandatory standards with the exception of one exceeding in 2000 in the department of Pressing at Hand working work-station (4.12 mg/m^3) and in the department of Welding at work-stations – Motor-car body grinding (4.10 mg/m^3), Wagon Retouch (4.11 mg/m^3) and Cab Retouch (4.18 mg/m^3).

The values of chemical compounds concentrations in the work environment in the years of 1999–2000 did not exceed standard values (Table 2).

Table 2. The exposure to the selected chemical factors on post in the years 1999–2000 (minimal and maximum values)

Chemical factors	NDS (mg/m^3)	1999		2000	
		minimal values	maximum values	minimal values	maximum values
Carbon oxide (CO)	30.0	0.3875	6.2	4.65	15.5
Nitrogen oxide (NO_x)	5.0	0.08	1.1	0.03	0.631
Manganese compounds	0.3	0.049	0.1569	0.006	0.136
Iron oxides	5.0	0.1609	2.03	0.0601	1.65
Solvents					
Ethanol	1000	2.07	105.09	1.77	99.1
Butane-1-ol	50.0	0.9285	14.01	1.01	12.6
Gasoline	300.0	61.25	-	10.0	-
Petroleum oil	100.0	6.88	-	-	-
Toluene	100.0	0.2053	1.44	-	-
Xylene	100.0	1.75	39.49	0.812	62.90
Ethylobenzene	100.0	1.04	8.33	1.16	7.33
Cyclohexane	300.0	1.45	49.38	1.87	72.70
Octane-N-butyl	200.0	3.06	6.52	6.38	9.60
2-butyxyethanol	100.0	1.25	3.48	7.61	-

DISCUSSION

The state of health of working population is conditioned by many detrimental factors occurring in the work environment. Estimation of occupational hazard gives rise to evaluation of sanitary results occurrence as a consequence of the exposition to a specified detrimental factor (2, 5, 11, 12).

Among environmental factors noise makes a great danger. Occupational hearing disorder caused by noise has been on top of the list among occupational diseases for many years. Occupational poor hearing and, especially related to it problems with speech understanding are a serious social problem (4, 7).

Rzymełka et al. were studying dependence of speech understandability on the degree of hearing impairment and they showed that hearing defects caused by noise handicap to a great extent the understanding of speech (8).

In the examined departments of Assembly there have been exceeded noise standard values at many work-stations.

In industrial plants there is often joint exposure to noise and mechanical vibration. Exposure to mechanical vibration at levels exceeding standards may be the cause of many functional changes in the state of health, i.a. in the nervous and bone-joint systems, and occasionally may lead to vibration syndrome.

Analyzing the sick rate in the years 1982–1997, we observe a fall in the number of cases, nevertheless in some provinces a phenomenon of the growth of the number of people exposed to vibrations was recorded (3). In the examined industrial plant values of mechanical vibration intensity did not exceed mandatory standards and the vibration disease was not recorded.

Dust pollution is one of the basic dangers to people's health. The kind and intensity of pathological changes depend on the concentrations, physical and chemical qualities of the pollution and on the time of its activity (14). Starzyński et al. examined a population of workers exposed to industrial dust. The research showed a harmful influence expressed by shortening of lifetime and increase in general death rate. Epidemiological research from 1996–1998 shows that mixed and silicous pneumoconises were predominating, making respectively 52.5% and 34.8% of the total cases, whereas 7% of pneumoconioses where azbestoses (10).

On analyzing the exposure to dust pollutants of a select population in the work place under research, no exceedings of dustiness standards were observed (with the exception of singular values exceeding standards), and no lung pmeumoconioses among workers were detected.

In industrial plants, apart from physical factors, a considerable influence upon the state of health and productivity is exerted by the chemical environment. Depending on the production profile, workers may be exposed to chemical compounds, smokes, welding gases, and also chemical substances with diversified structure to which organic solvents belong. On estimating the exposure of a select working population to chemical substances occurring at work-stations, no toxicological danger was observed. Regular research in work environment allows to estimate risk factors and control the state of health.

Activities aiming at elimination or lowering of health dangers at work-stations deal with occupational hygiene and health prevention which includes employment qualification in particular working conditions, periodic medical examination and monitoring of falling ill with occupational diseases. These activities contribute to a great extent to the health protection of working population.

CONCLUSIONS

1. In the examined industrial plant exposure to noise at many work-stations exceeded the highest mandatory standard values.

2. The level of mechanical vibration was within the bounds of mandatory standards.

3. Dustiness at work-stations did not exceed the standards, with the exception of singular concentrations.

4. On evaluating the values of chemical factors concentrations at work-stations, no toxicological danger to the examined population was observed.

5. Working conditions of the examined industrial plant did not create the danger of occupational diseases.

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SUMMARY

The research was conducted in the selected vehicle industry plant. Work conditions were assessed on the assembly line by measuring chemical and physical factors. Exposure to noise in the investigated plant exceeded the values of permissible standards. The pollution on the posts did not exceed the standards except singular concentrations. While assessing the values of chemical factors concentration, no toxicological danger was revealed in the investigated population. The work conditions of the investigated plant did not create the danger of professional diseases.

Ocena ryzyka zawodowego populacji pracującej wybranego zakładu przemysłu samochodowego

Badania przeprowadzono w wybranym zakładzie przemysłu samochodowego. Oceniano warunki pracy na stanowiskach montażu poprzez pomiar czynników fizycznych i chemicznych. W badanym zakładzie ekspozycja na hałas na wielu stanowiskach pracy przekraczała wartości dopuszczalnych norm. Poziom drgań mechanicznych był w granicach obowiązujących norm. Zapylenie na stanowiskach pracy nie przekraczało norm z wyjątkiem jednostkowych stężeń. Oceniając wartości stężeń czynników chemicznych, nie wykazano zagrożenia toksykologicznego badanej populacji. Warunki pracy badanego zakładu nie stwarzały zagrożenia chorobami zawodowymi.