Research Paper Environment

Workers Exposure and Individual Behavior in A Car Battery Plant

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ABSTRACT

We investigated a group of 188 workers from a battery plant. The workers filled in a questionnaire regarding cyclical activities, work with strenuous exercise, the use of the personal protective equipment (PPE), ventilation, personal hygiene and the general health status. Most of the workers (90 %) reported repeated activities, 76 % work with strenuous exercise. According to the filled in questionnaires PPE is provided for 98.4 % of the workers while only 64.4% of them use PPE. Shower facilities are provided for all the workers, while about 80% of them take a shower at the end of their shift. Smoking at the workplace is recorded in 3.7% of the investigated workers. Battery plant management need to implement an intervention program, to change knowledge, attitudes, practices, behavior of the workers, as controlling exposure by respirators, cleaning, personal hygiene issues it is obviously of an major emergency importance.

KEYWORDS lead, occupational exposure, workplace, intervention program

INTRODUCTION

Historically speaking man progress from the Stone Age to the Iron and Bronze Age can be measured by the increased use of metals. (Xibiao, Otto 2006) The lead found in the environment is mostly the result of human activities such as mining, smelting, refining and recycling of lead. (World Health Organization, 2010)

Occupational exposure to lead is not limited to traditional heavy industries (mining, metallurgy, machinery, etc.). Car battery industry, auto radiator repair, secondary smelters are industries found almost in every country and they are major sources of lead exposure. (Kemal et al, 2008). Car battery industry is, currently, the main consumer of lead around the world (75%).(Uzu et al, 2011)

Lead poisoning depends on a series of factors such as age and gender (women and adolescents are more sensitive to lead than seniors who show a certain resistance), alcoholism (Bardac, 2003), unbalanced diet, low in phosphorus and calcium, malnutrition, infectious disease posed by viruses (by creating a state of acidosis); habits, bad habits at work and individual hygiene failure. (Hung-Yi et al, 2008)

Respiratory route is the main way of lead entering in the body (Pizzol et al, 2010). Lead absorption starts in the nasal mucosa where the lead particle sized from 3 to 5 micron reach the upper airway in the throat and there are either expectorated or swallowed. The lungs retained 60 % of lead particles sized 1 micron and 40 % of lead particles sized 0.1 microns. (Bardac, 2003) Ingestion may be a route of lead exposure at the workplace only in cases of poor hygiene conditions (smoking in the workplace, contaminated food and clothing). Dermal exposure to lead can occur only in case of organic compounds of lead. (Tat, 1999)

MATERIAL AND METHODS

The study was developed during 2011. On the basis of a questionnaire 188 subjects were investigated from three sections of the factory: Capacity I (111 workers), Capacity II (39 workers), Injection (38 workers). In the first two sections lead and lead oxide are processed for producing the battery metal elements (section capacity I with greater technological wear and station capacity II – characterized by modern technology), in the Injection section the battery carcasses are produced and the Pb is not used as a raw material. The questionnaire included questions about work activities (cyclical activities, strenuous exercise, professional history), personal protective equipment, ventilation system at the workplace, workplace cleanliness. The questionnaires also regarded issues about personal hygiene and general health status. Databases and data processing were performed by using Excel program.

RESULTS AND DISCUSSION

Figure 1 shows the type of activities workers have in the three sections of the car battery plant. The majority of the subjects (90,4 % and respectively 89.9 %) have cyclical activities and they never changed their workplace (workplace migration). ¾ from the subjects said they make physical efforts (strenuous exercise) at their workplace.

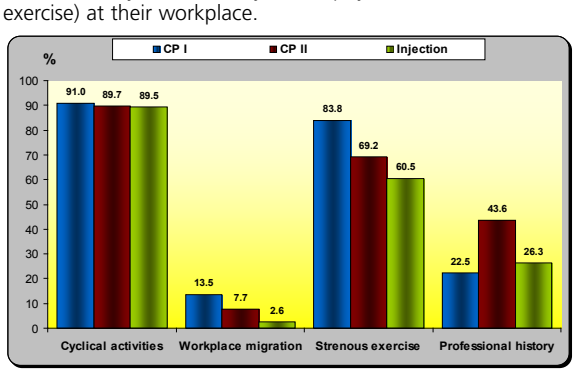


Figure 1. Workplace activities

The questionnaire included questions about the personal protective equipment (PPE) that workers must wear during their workplace activities. 98.4 % of the workers admit that the employer provides them with the PPE but only 64.4 % of them admit the use of it.

Table 1. Information about the personal protective equipment

PERSONAL PROTECTIVE EQUIPMENT				
		CPI-CPII	CPI-Injection	CPII-Injection
Provided	χ^2	2.63	0.34	2.00
	p	0.10	0.56	0.16
Used	χ^2	4.58	2.14	0.34
	p	0.03	0.14	0.56

There is statistical significance between workers using PPE in Capacity I and Capacity II.

The p test shows that there is a significant difference between the percent of workers from Capacity I and Capacity II using the PPE.

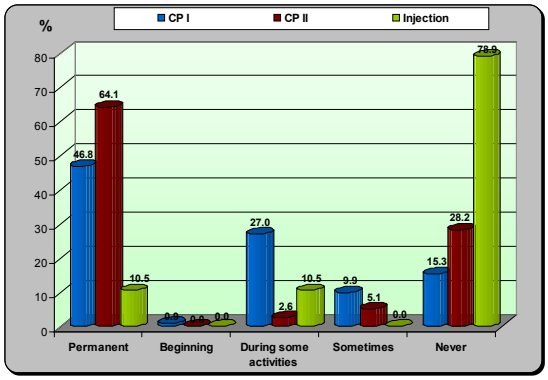


Figure 2. The use of respirator

The respirator is worn properly during the 8 hours shift only by 43.1 % from the workers. 46.8 % of the workers from Capacity I, 64.1 % of the workers from capacity II and only 10.5% of the workers from Injection wear the respirator during all shifts.

Even if less than 2 % of the subjects consider the respirator comfortable, 86.9 % of them consider it necessary and 81.1 % find it efficient. 21.3 % of the workers consider the respirator inefficient.

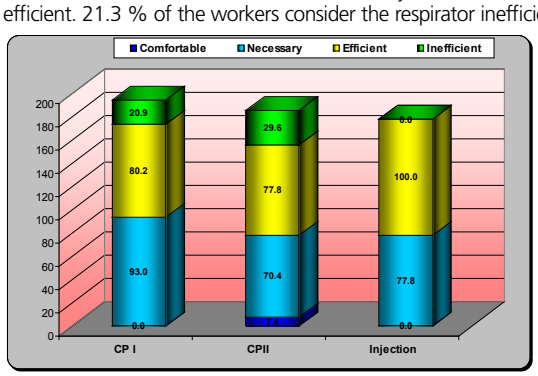


Figure 3. Respirator appreciation

Regarding the protection gloves, 67 % of subjects in the study wear them during the whole shift. 93 % of the workers consider the gloves necessary and 28% efficient.

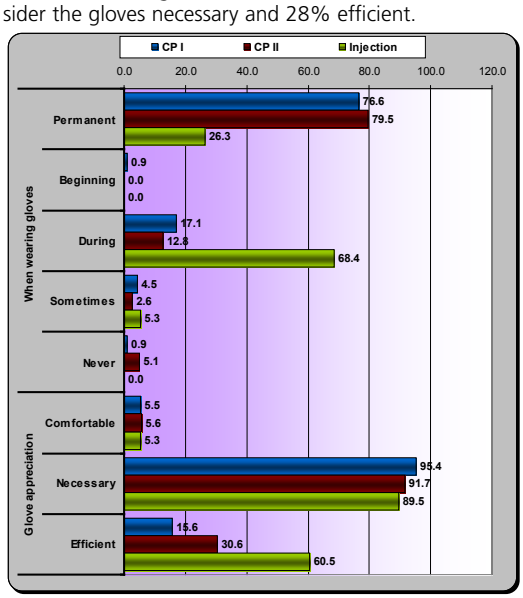


Figure 4. The use and the appreciation of the protection gloves

Almost all the workers surveyed recognize that the employer provides all the working sectors with functional and running permanently ventilation system. The ventilation system is rigorously checked periodically. 85.9 % of the subjects declared that the ventilation system is efficient but they also complained about unventilated spaces, drafts, dust and fumes and smells released from the production process.

Table 2. The ventilation system

VENTILATION SYSTEM (%)							
Sections	Answer	Provided	Efficiency	Unventilated spaces	Drafts	Dust, fumes	Smells
CP I	yes	91,0	85,2	48,1	98,1	89,3	89,9
	no	9,0	14,8	51,9	1,9	13,6	10,1
CP II	yes	84,2	84,2	54,1	89,5	92,1	82,1
	no	15,8	15,8	45,9	10,5	7,9	17,9
Injection	yes	100,0	90,3	17,9	93,3	78,4	77,1
	no	0,0	9,7	82,1	6,7	21,6	20,0
Total	yes	91,3	85,9	44,5	95,5	86,2	86,3
	no	8,7	14,1	55,5	4,5	13,8	13,7

Workplace and looker room cleanliness is done daily, especially when the shift ends. The ways to do it is both wet and dry with the industrial vacuum cleaners or brooms and water jet.

Table 3. Workplace cleanliness

WORKPLACE CLEANLINESS					
		CP I	CP II	Injection	TOTAL
If is done	yes	98,2	97,4	100,0	98,4
	no	1,8	2,6	0,0	1,6
How is done	dry	3,6	7,7	21,1	8,0
	wet	66,7	76,9	0,0	55,3
	mixt	29,7	15,4	78,9	36,7
With what is done	vacuum cleaner	53,2	43,6	0,0	40,4
	broom	73,9	69,2	92,1	76,6
	water jet	46,8	92,3	60,5	59,0
	others	4,5	5,1	23,7	8,5

Table 4. Locker rooms cleanliness

LOCKER ROOMS CLEANLINESS					
		CP I	CP II	Injection	TOTAL
If is done	yes	99,1	94,9	97,4	97,9
	no	0,9	2,6	2,6	1,6
How is done	dry	6,3	10,3	7,9	7,4
	wet	55,0	41,0	7,9	42,6
	mixt	36,9	43,6	84,2	47,9
With what is done	vacuum cleaner	1,8	7,7	0,0	2,7
	broom	87,4	61,5	97,4	84,0
	damp cloth	89,2	66,7	76,3	81,9
	others	0,9	7,7	10,5	4,3

Only 80.9 % of the workers taken in study take a shower at the end of shift and a smaller percentage (64.9 %) wash their

hair even if the employer provided the necessary conditions for personal hygiene.

98.9 % of the respondents are aware of the importance of respecting the rules about wearing the PPE only inside de workplace, washing hands before meals, not eating or smoking at the workplace but not all of them respect all these rules.

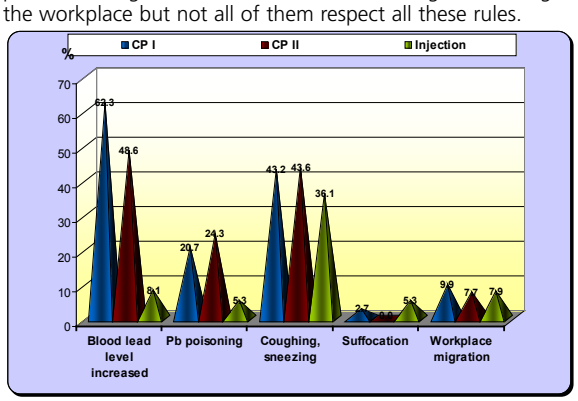


Figure 5. Health status

Regarding the health status of the workers in the study 48.3 % declared to have higher blood lead level and 34 (18.3 %) workers with lead poisoning but they were treated properly.

21.1 % from subjects working in Capacity I, 17.9 % in Capacity II and 2.6% in Injection needed at least one treatment to remove the lead from their body since they work in this plant.

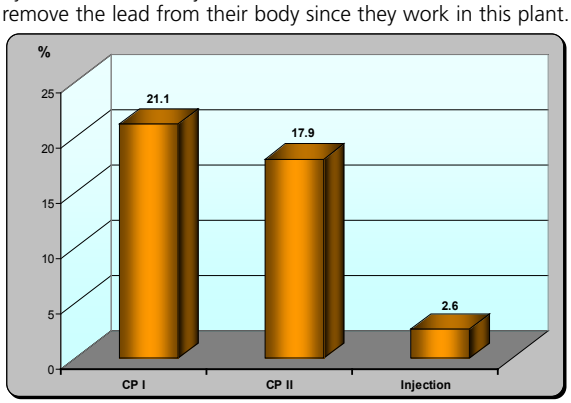


Figure 6. Workers who needed treatment to remove lead from their body.

CONCLUSIONS

Workers from the battery plant enrolled into the study have cyclical work activities with strenuous exercise. They are provided with PPE but only a part of them wear it properly because the majority of them find it uncomfortable. The ventilation system in the plant is working properly but the workers are complaining about unventilated spaces, drafts, dust and fumes and smells released from the production process. Even if they have all the conditions for their personal hygiene at the workplace and are aware about their importance, not all the subjects respect it.

To control exposure by personal protective equipment, ventilation, workplace cleanliness, personal hygiene in order to decrease associated health risks was a major conclusion of this study. As a consequence, the company starting an intervention program based on the results of this evaluation. We have been elaborated an intervention program based on the needs to change knowledge, attitudes, practices, behavior in general, of the workers, at the plant battery, as controlling exposure by respirators, cleaning, personal hygiene issues it is obviously of the major importance. This activity, as part of a social marketing program, is an exposure control approach, along with subjective indicators, such as specific questionnaires and fallows up, and measurable indicators, such as blood lead level. The measurable indicators will allow the management of the plant to evaluate the process and the progress generated by the intervention program. A fallow up evaluation is going to be conducted, soon. The management of the plant is very much involved in the ongoing social marketing activities within the battery plant.

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