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MONITORING OF PATHOLOGIES IN OIL DEEP REFINING PLANT IN ALBANIA

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Abstract. In this paper is studied a special section of toxicology that follows professional illnesses in oil refining plant in Albania, which is concerned with specification of oils structure. It is due not only to the high levels of deposition, but also to the nature of the hazardous polluting elements, which also have a high purification cost, as well as a wild soil area. The aim of this study was the analyses of the morbidity according to the place of exposition, specified according to gender and age on a wide spectrum of workers, for relatively a long period of time (1993–2006). There are presented methods and apparatuses which are used for clinical, biochemical analysis and toxicological analyses. A statistical interpretation of the collected data on health impact has been done in time and in area. This is one of the detailed studies carried out in this field in Albania.

Keywords: toxicological analyses, health impact.

AIMS AND BACKGROUND

In a preceding paper is given in details the environmental situation in the main knot of deep processing of oil in Albania (the Ballsh city) that physically is situated in an area of 60 ha, but environmental deterioration is spread in much wider space. In this plant, in an uncontrolled way are released every day about 9000 m^3 hydrocarbon gases, 340 m^3 H_2S, 300 m^3 SO_2 (Ref. 1). Gases such as CO, CO_2 and SO_2 resulting from combustion and technological processes are released in the atmosphere through the furnace chimney. Vapour hydrocarbons and H_2S are composed of oil (which has higher gravity and a high sulphur contents) and come as a result of leaks during technological processes, evaporation from raw materials reservoirs, products and half-ready products reservoirs, by tub of cleaning the water block, surface of coke, the station of loading tankers and trucks. By not taking into consideration the physical and moral depreciation of the main node (deep oil plant was put into operation in 1978), this situation has affected progressively the health of all employers (approximately 1200 per year) that in most cases have been or are in close contact with sources of toxic pollutants. For these reasons, since 1990 the plant has established a specialised health center for diseases which are caused

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by oil processing. In this paper are presented in details analytical and statistical results performed for a long period in the hottest points of pollution from toxic sources, focusing mainly on analyses of monoxide and carbon dioxide, H_2S, the SO_2 and aromatic hydrocarbons.

Generally in an integral way are conducted a wide range of clinical, biochemical and toxicological analyses using the latest instrumental techniques.

The results presented here should serve as a prompt to develop environmental and health monitoring continuously.

EXPERIMENTAL

The analyses carried out are divided in 3 main groups: clinical analyses, biochemical analyses and toxicological analyses.

In clinical analyses are included: complete blood with leukocyte formula and urine tests, complete blood and urine tests were carried out in cell counter Swelab and Bayer, respectively. Biochemical analyses are presented in Table 1.

Table 1. Biochemical analyses

Type of analyses	Normal value
SGPT	to 49 U/L
Total bilirubin	0.3–1.1 mg/dl
Glucose sober	70–120 mg/dl
Glucose 2 h after bread	70–120 mg/dl
Cholesterol	to 200 mg/dl
Triglyceride	60–150 mg/dl
Urea	20–50 mg/dl
Creatinin	0.3–1.3 mg/dl
Fibrinogen	200–400 mg/dl

Biochemical analyses were worked with kite and were measured by Visual and ERBA photometers. The accuracy of this method is high.

Glucose analyses principle. Glucose is a hydro-soluble substance that constitutes the main source for the cell energy supply. Cell continuous supply of energy requires the maintenance of blood glucose concentration in normal values. In our laboratory measuring of glucose was carried out through an enzymatic reaction. The intensity of pink colour formed is proportional to the concentration of glucose and is measured by a photometer at a wavelength of 505 nm.

Cholesterol analyses principle. Cholesterol is a polycyclic alcohol. It takes part in building cell membranes, serves as a precursor of steroid hormones. Liver is the organ where cholesterol synthesis occurs by acetyl coenzyme A. Determination of cholesterol was carried out through an enzymatic reaction. Intensity of

colour formed is proportional to the cholesterol concentration and is measured by a photometer.

Phenol analyses principle. Phenol is present in blood and it forms a blue coloured substance when it reacts with the phenol reagent. The intensity of the blue coloured substance is proportional to the concentration of phenol.

Hemoglobin analyses principle (*HB*). Photometric method of measuring the HB is fast and precise. HB is measured in a photometer at 540 nm. With this method are measured all derivatives of HB (ox hemoglobin, carboxyl hemoglobin, and met hemoglobin).

Toxicological analyses include measurement of phenol and carboxyl hemoglobin levels (that is formed when carbon monoxide is in contact with blood)[2]. Normal phenol values are smaller than 4 mg%, values between 4 and 5.3 mg% are suspicious and over 5.3 mg% exhibit different pathologies. Carboxyl hemoglobin is spread through blood circulation in tissues and cells[3].

RESULTS AND DISCUSSION

The main analyses were conducted during 1993, 1998, 2001, 2003, 2004, 2005, and 2006. The number of workers is different in the different years.

The refinery has started working in 1978 with 1176 workers and 44% of them were women. In 1992 the plant of lubricants oil manufacture began working, which led to the increasing the number of workers to 2035 (Fig. 1).

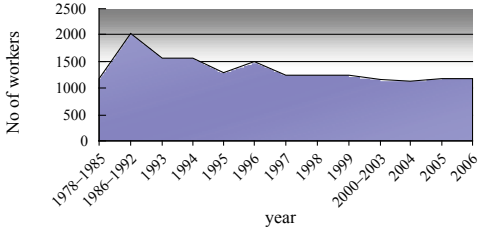

Fig. 1. Number of workers through the years

In analysis we included a total number of 370 workers, where 161 were females and 209 males. In Table 2 is presented the classification of workers according to their age.

The highest percentage belongs to the group of 40–60-year workers , which constitutes 84% of the total number of workers.

Table 2. Classification of workers according to their age

20–30-year old	8 workers	2%
30–40-year old	53 workers	14%
40–50-year old	170 workers	46%
50–60-year old	139 workers	38%

The highest percentage of age group is 40–60-year old which constitutes 84%.

RESULTS OF TOXICOLOGICAL, CLINICAL AND BIOCHEMICAL ANALYSES

In order to assess the phenol level we took blood samples from 355 workers from all departments of the refinery, 195 of them (or 54.9% of the total number) had a higher normal value than the normal phenol value which is 4 mg/dl (Refs 4 and 5). In Fig. 2 is presented the percentage of workers with phenol levels higher than the norm, according to different units.

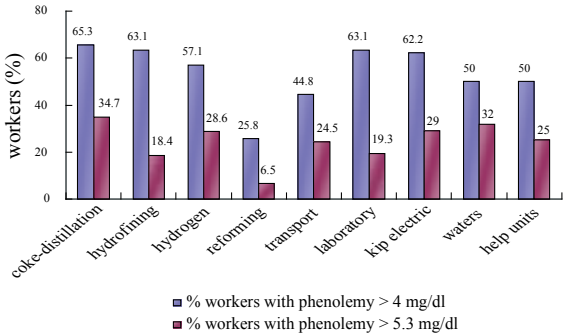

Fig. 2. Percentage of workers with phenol levels higher than the norm, according to different units

The highest percentages were identified as follows: 63.5% in workers of the coke-distillation unit, 63.2% in the laboratory units and 62.2% in the electric-kip unit. The lowest percentages have been observed in workers of the reforming unit 25.8%, followed by those working in transport with a value of 44.8%. This relates to the fact that this unit for some years has not been active. There were 86 workers or 24.2% of the total number with phenol level >5.3 mg/dl. The largest number of workers with the highest percentage of phenol >5.3 mg/dl was identified in the coke-distillation unit (34.7%). From these results we come to the conclusion that the highest percentage of workers with high phenol level comes from that unit where the indicators of pollution are high.

355 workers from all units were subjected for determination of the percentage of carboxyl hemoglobin, and of them 189 workers resulted with carboxyl hemoglobin > 4% or 53.2% of the number of all cases[4,5]. In Fig. 3 is presented the

percentage of workers (%) with carboxyl hemoglobin levels higher than the norm, according to different units.

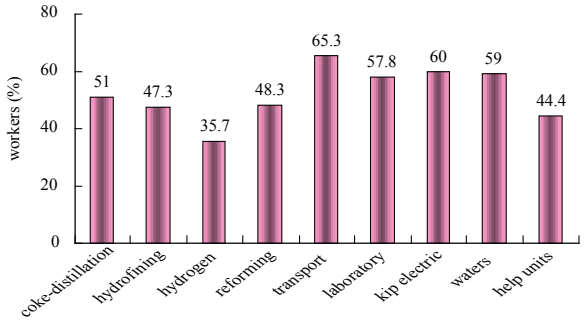

Fig. 3. Workers (%) with carboxyl hemoglobin levels higher than the norm, according to different units

The highest percentage of workers with carboxyl hemoglobin level > 4% has been observed in the workers engaged in transport – 65% and in units: electric-kip – 60% and coke-distillation – 51%. The lowest percentage is related with the workers from the hydrogen unit – 36%.

For determination of the number of red blood cells (erythrocyte) were analysed 348 cases: 41 workers of them resulted with erythrocytes < 4 million/mm^3: 3 were males and 38 were women. Also a part of a growing erythrocyte value of 5.5 million/mm^3 was mainly observed in men (6% of cases).

We analysed 348 cases for determination of the number of leucocytes and it was found out that 49 workers or 14% had leucocytes > 9000 or leucocytes < 5000. In Fig. 4 are presented the results of clinical analyses for 2006 (Refs 4 and 5).

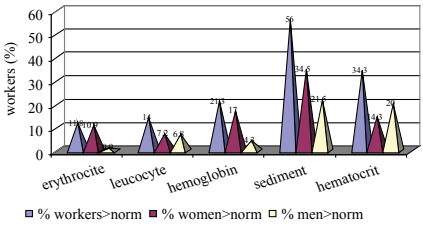

Fig. 4. Results of clinical analyses for 2006

In order to determine the hemoglobin level (HB) we studied 348 cases, 74 of which or 21.3% were with HB <12g/dl, and 59 workers or 17% of them were female.

The level of the erythrocyte sediment was determined in 348 cases, and it resulted that 195 workers or 56% of cases had erythrocyte sediment higher than 20 mm/h. There were 120 females with erythrocyte sediment higher than 20 mm/h or

34.5% of the cases. This is the clinical analysis which has the highest percentage related to the norm.

The hematocrit level (HCT) was evaluated in 210 workers. There were 32 workers, 30 of them were women or 14.3% of cases with hematocrit < 40%. This analysis is proportional to the number of red blood cells. There were 40 males with high levels of hematocrit. In Fig. 5 are presented the results of biochemical analyses during 2006 (Refs 4 and 5).

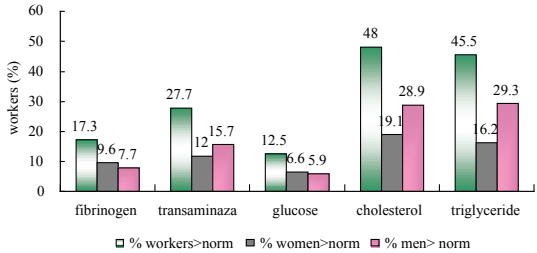

Fig. 5. Results of biochemical analyses for 2006

For the determination of SGPT levels we tested 271 cases, and 75 of them had SGPT higher than the norm or 27.7% of the total number of the workers. The number of women with SGPT higher than the norm was 32 or 12% of the total number workers.

Among the analyses with the highest percentage of normal values we can also mention total cholesterol and triglyceride where from 48% of the cases, 19.1% of them are women with total cholesterol > 200 mg/dl, while in 45.5% of the cases, 16.2% were women with triglyceride higher than the norm.

In order to evaluate glucose levels we analysed 289 cases, and of them 36 workers had glucose higher than 120 mg/dl. The number of female workers was 19 or 6.6% of the cases.

For evaluation of the fibrinogen level we analysed 208 workers, 36 of them were with fibrinogen higher than the norm, and 20 of them were women or 9.6% of cases.

The organs that are usually affected are liver, respiratory aids, cardio vascular aids, central nervous system. There were 30 workers in the plant with disability group of which 10 or 30% had symptoms of intoxication from hydrocarbons. We compared results in years and they are presented in Fig. 6. We concluded that there is a growing number of workers with glucose higher than the norm. This is explained by the fact that working in polluted environments their pancreas began to lose the ability to control blood sugar levels.

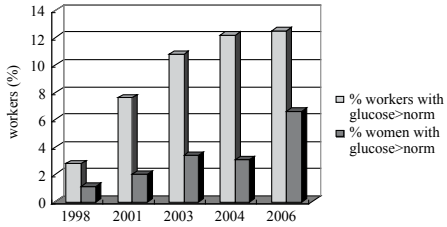

Fig. 6. Glucose level in years

Fibrinogen and hematocrit levels grow over the years and this also is influenced by climatic factors because working environments are moist and cold (Figs 7 and 8).

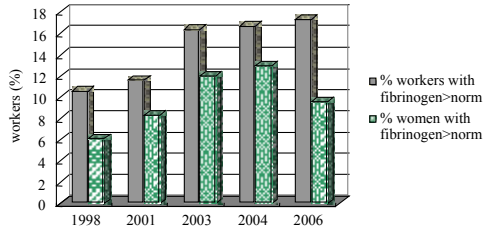

Fig. 7. Fibrinogen level in years

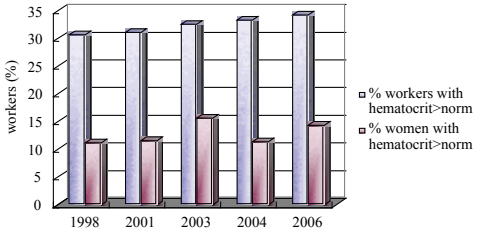

Fig. 8. Hematocrit level in years

The level of phenol in blood increases with passing of time (years) of work in such environments with oil pollution. It also expresses the ability of the body to reduce and avoid such pollutants.

CONCLUSIONS

Health impact is directly linked with technological performance. Modern technology helped in the reduction process of different pollutants and therefore to a smaller number of diseases. Higher percentage of pathology results in units with higher pollution. It is noticed a higher impact of pollution (associated with high morbidity percent) in women. High level of concentration of polluting gases in the halls of the commands and laboratory is due to lack of uptakes. High percentage

of H_2S in the environment is caused from a non-function, at that period of time, of the sulphur production unit, bringing a considerable environmental pollution and consequently increased morbidity. Due to the absence of the necessary antidotes we observed a high morbidity level.

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