

## THE IMPACT OF THE ANTHROPIC ACTIVITIES ON THE SOIL IN THE INDUSTRIAL ZONE SOMES-NORD OF CLUJ-NAPOCA CITY

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*The paper presents the industrial zone Somes-Nord of Cluj-Napoca city and the summary characterization of the soil in this zone. There are presented the main sources and ways of soils contamination which are linked to the industrial activity of the companies in this zone. The documentary inquiry and the study of the terrain, which were done, established that the soil in the industrial zone Somes-Nord is a little polluted with metals, residues, hydrocarbons, sulphur (in general, without passing the limits). The pollution appeared because of the anthropic activities which were developed here during the years. The results of this study require the continuation of monitoring the quality of soil in the enclosure but also in the bordering area of the companies and it is also necessary to take some measures to reduce or to eliminate the pollution.*

### 1. INTRODUCTION

The industrial area Somes-Nord of Cluj-Napoca city it is situated at the base of St. Gheorghe hill, which is situated between the Somesul Mic river and the Valea Calda valley. The industrial area is situated on the first level of the Somesul Mic river, with the relative height of 2-6 m. On the surface of this terrace, there are more industrial factories (1, 2, ... ,11), which develop different activities: machine building, ferrous metallurgy, castings and forgings production, medicines production, materials construction production etc, which are near some inhabited areas, situated at a distance of 500 m (Iris district - West, Bulgaria district and Mărăști district - South) (Figure 1).

Considering the geological aspect, the industrial area Somes Nord is situated on a structure which is composed by tortonian age warehouses - represented by loamy clay and marls with tuffs and gyps interposition. Over this formations there are disposed some quaternary age warehouses (thickness of 3,2-11,7m) composed by coarse alluviums (aggregate and boulders in sand mass) in the alluvial plain area and also by loamy depositions in the versants area.

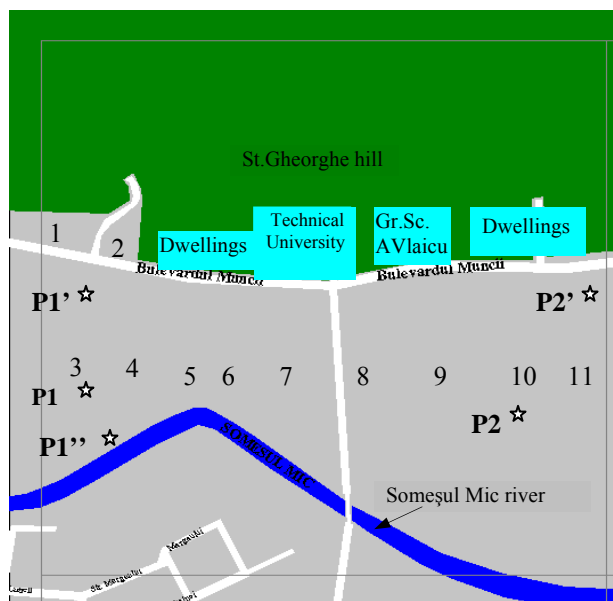


Figure 1. Map of the Industrial Area Somes Nord of Cluj-Napoca City

According to the characteristic relief shapes of industrial area Somes-Nord, the soils are:

- alluvial soils, hydromorphic type, specific to Someșul Mic alluvial plain;
- zonal soils, formed on the low inclined versants, represented by levigable chernozems;
- extra zonal eubasic soils, specific to hills with large peaks situated in the north area of Cluj-Napoca city, represented by brown, podsol and pseudogleysat soils.

In accordance with geological prospectations, it was highlighted that the terrain in industrial area Somes-North presents an incline of about 3% from NV to SE, and the versants that border the alluvial plain zone have inclines of 10-22 %. The drillings, that were done on entire industrial platform, highlighted a stratification, characteristic to cliffs: aggregate and sand (0-2,7 m), hydrostatic layer being situated at the depth of 3,4 m.

## 2. THE ASSESSMENT OF ANTHROPIC ACTIVITIES IN INDUSTRIAL ZONE SOMES-NORD IMPACT ON THE SOIL: RESULTS AND DISCUSSIONS

For the assessment of anthropic activities in industrial zone Somes-Nord impact on the soil, the authors of the present paper did a documentary inquiry (at the Environmental Protection Regional Agency Cluj, at the companies in area etc) in order to collect information about the pollution level of the soils in industrial area Somes-Nord [1, 2]. Also, in years 2003 and 2004 we did a terrain study which meant soil sampling from points P1, P1', P1'', P2, P2', laboratory analysis.

The main soil sources and soil contamination ways existing in industrial area Someș-Nord are connected especially to companies in this area industrial activity.

The main soil contamination sources are [3, 4, 5]:

1. Gas emissions (ex: CO, SO<sub>2</sub>, NO<sub>x</sub>, inorganic pollutants: CN<sup>-</sup>, HCl, Cl<sub>2</sub>, NH<sub>3</sub>, SO<sub>2</sub>, H<sub>2</sub>S, NO<sub>2</sub>, SO<sub>4</sub><sup>2-</sup>, organic pollutants: CH<sub>3</sub>OH, CH<sub>2</sub>O, isobutylaldehyde, acrylonitrile

etc) and powders that proceed from technological processes that through dispersion may lead to soil pollution in the enclosure of companies or in their proximity.

2. The evacuation of residual waters with big organic charge, advanced mineralization and content of  $\text{CN}^-$ ,  $\text{NH}_4^+$ , slurries etc, petroleum products (oils) from mechanical processings, hydraulic actions of machines tools and of compressors that may accidentally get in soil.
3. Temporary stockage of technological wastes in improper conditions till the transport to the final storage (different organic slimes, but also other inorganic ones polluted with  $\text{Cr}^{6+}$ ,  $\text{Al}$ ,  $\text{Zn}^{2+}$ , etc).
4. Other sources, not highlighted, but probable to appear during the operations of discharging, manipulation, storage (in closed or opened spaces) of solid materials and liquid substances (acids, ammonia, solvents and other organic substances).

The soil contamination in this zone is done through:

- entrainment, deposition and infiltration of the gas emissions evacuated in atmosphere, specially through meteoric water;
- infiltration of used waters proceeded from sewerage, basin, retention tank (in the case of reservoirs) that are damaged;
- infiltration of meteoric waters, which through washing the entire platform, may train to bottom (depth) the pollutants coming from raw materials, auxiliary materials dispersed on soil (especially in the deposit area);
- transportation, manipulation and storage in improper condition of some toxic and dangerous liquid products (mineral acids, ammonia, solvents) may lead to appearance of accidental losses from these products by using some supply equipments, inadequate run-over.

The soil sampling was done in the points P1 and P2 (situated in the enclosure of the companies) and in the points P1', P1'' and P2'' (situated in the proximity of the companies). The points of sampling are marked on the map which is presented in the Figure 1.

The soil samples were analyzed using some classical methods (gravimetric-volumetric), heavy metals through atomic absorption and total hydrocarbons from petrol were established by the gas-chromatographic method.

The results of the analyses about the samples, done in the points which were previous mentioned, confronted with the newest reglementations [6], indicate that:

- in the case of the most analyzed metals Fe, Zn, Cr, Ni, Mn, Mg, the contents were between normal values and there were found passes over the normal values for Cu, Pb, Cd (Figures 2, 3, 4);
- in the case of mineral residues, the residue content passes the admitted value (Figure 5);
- in the point P2, the sulphur ( $\text{S}^{2-}$ ) content and the petroleum total hydrocarbons content passed the normal values (Figures 6, 7).

The documentary inquiry and experimental investigations, through the obtained results, show that the soil, in the eastern part of the industrial area Someș-Nord, is a little polluted with heavy metals (Pb, Cd), mineral residues (without passing the limits). This pollution appeared because of the anthropic activities developed in the industrial area during the years.

In the western part of the industrial area, where there are some activities in the fields of machine building, ferrous metallurgy, castings and forging production, we can say that the soil is less polluted, being a little polluted with mineral residues, sulphur and petroleum hydrocarbons (especially in the fuel deposition area).

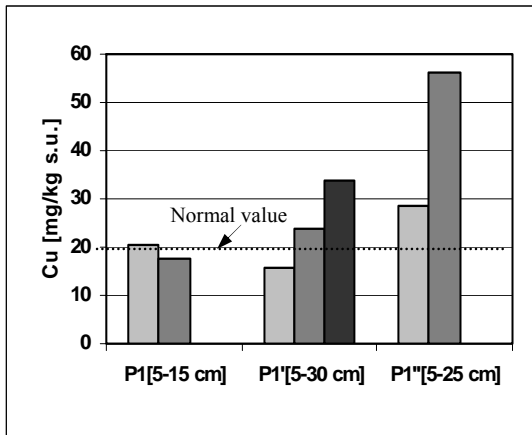


Figure 2. Copper Content Depending on the Sampling Area

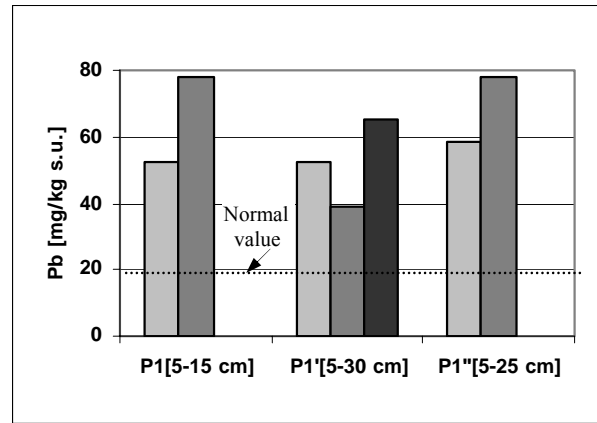


Figure 3. Lead Content Depending on the Sampling Area

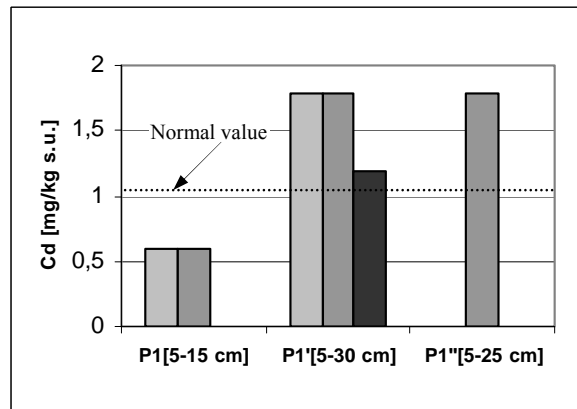


Figure 4. Cadmium Content Depending on the Sampling Area

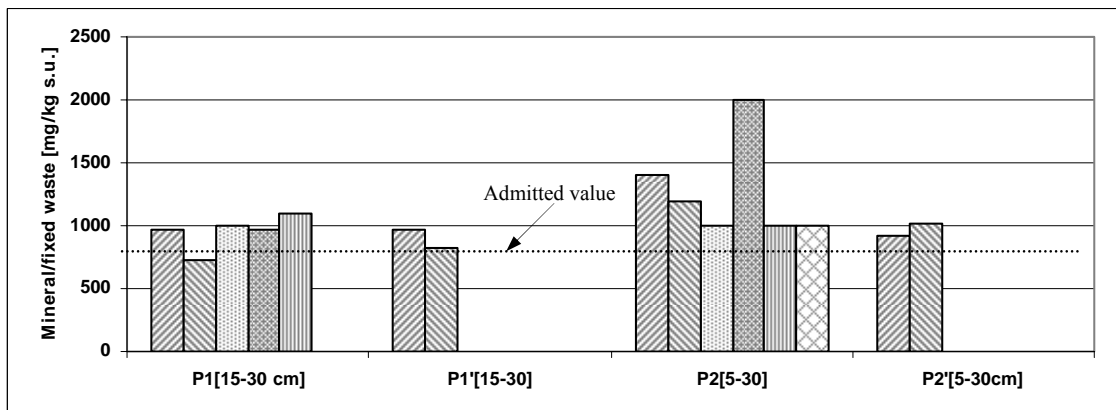


Figure 5. Mineral/Fixed Residue Content Depending on the Sampling Area

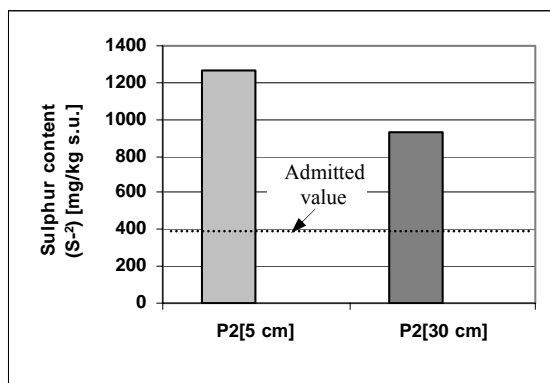


Figure 6. Sulphur Content Depending on the Sampling Depth

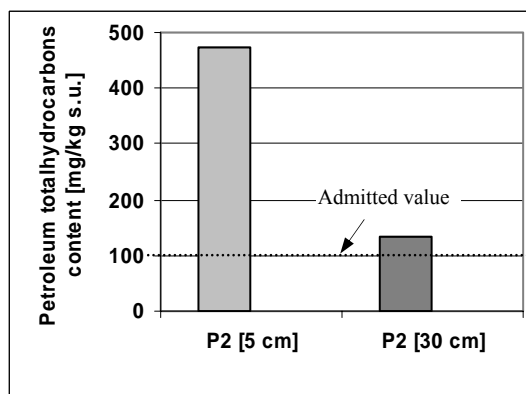


Figure 7. Petroleum Total Hydrocarbons Content Depending on the Sampling Area

### 3. CONCLUSIONS

The documentary inquiry and experimental investigations on the soil in the industrial area Somes-Nord of Cluj-Napoca city, showed the presence of some organic pollutants and polluted inorganic substances in the soil (heavy metals, mineral residues, sulphur, hydrocarbons).

It was discovered that the soil in this area is a little polluted (generally, without passing the limits). The pollution appeared because of the anthropic activities which were developed here during the years.

It is compulsory to keep observing the quality of soil in the enclosure but also in the bordering area of the companies and also we need to take some measures to reduce or to eliminate the pollution (as it's happening in this period in the case of some companies in this area).

### 5. REFERENCES

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