

THE IMPACT OF THE INDUSTRIAL ACTIVITIES OVER THE WATER QUALITY IN TO THE SOMES NORD (CLUJ-NAPOCA) AREA

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ABSTRACT

The paper presents a general description of the area from the geographic and industrial point of view. It is realized a quite detailed analyze of the all companies included inside the area using Input – Process – Output principle and considering the direct impact over the environment. It is determined the main pollution sources of the water (superficial water and underground water) inside the area and the actions necessary for decrease the pollution.

1. THE STUDY ASSUMPTIONS

Considering all his activities, the human is the greater water consumer and he returns it in to the environment more or less polluted. This pollution is caused mainly by the heavy development of the industry and transportations.

One of the most important problem that occurs is the underground waters, especially phreatic waters, those are polluted by the soil's treatment using chemical fertilizers, insecticides, pesticides, by the storage of the waste or soil leaching of some substances those contact the soil. The modifying of the quality of the phreatic water influences the agricultures growing and, collateral, the human health.

Considering that the ground water is the main element that transmits the pollution and the life depend by it, it is necessary an extensive program for monitoring and survey for prevent the extension of pollution.

The paper presents the results of a three years study performed in to North-West industrial area of Cluj-Napoca city. The study is focused of the main river that cross the city and the studied area is limited to the Somes-Nord industrial area. This area was elected considering few technical and ecological particularities:

- The decreasing of the quality of the ground waters;
- The occurrences of many companies with different activities in the area: chemical industry (silicates processing and synthesis), machining engineering industry, raw materials warehouses, agricultural areas;
- Almost complete extinction of the aquatic floras and faunas in to the analyzed sector of the river;
- Frequent haphazard pollution with dangerous substances;

The study's stages were the follows:

- The analyze of the area from the geographical point of view: geographical localization, air currents, the characteristic of the climate, the ground and underground waters, the soils, the relief, etc;
- The identification of the all activities performed inside the area;
- The analyze of all industrial activities performed inside the area: the realize of the input→technological process→output analyze for each company, identification of the pollutant sources, the identification of the polluted areas and the main problems of the region environment;
- The drawing of a map that shown the polluted areas and the pollution types.

2. THE ANALYZE OF THE NATURAL SOURCES OF WATER IN TO THE SOMES-NORD AREA

The analyze of the natural sources of water those exist in to the area is necessary because this water is used for industrial processes and the preliminary treated used water and effluent water are overflowed in to the Somes river. Through the accumulation of the chemical substances in to the river and the chemical compounds of the used water, the self-treatment capacity of the river water is passed especially during the rainless ness periods when the flow rate of the river is low.

The rivers placed in to the Cluj-Napoca region are included in to the flow net of the Somesul Mic River, its drainage area being complete placed in to the Cluj County. The Somesul Mic River is born 5 km uphill by Gilau, at the Somesul Cald and Somesul Rece rivers confluence. The Somesul Mic River's branches provided from the mountain region (Somesul Cald and Somesul Rece – two rivers those have high flow rates), the Somesan Plateau and Transilvania Field (few rivers with low flow rates).

The annual average flow rate of the Somesul Mic River on to the Cluj-Napoca sector is 15.3 m³/s (measured in 1997). The most important contribution have the branches from mountain region:

- Somesul Cald River – average flow rate 7.9 m³/s
- Somesul Rece River – average flow rate 4.7 m³/s

The annual average flow is counted like flow density (l/s/km²) and present an increase of the values considering the N-E to S-V direction across the county. The highest values are recorded in to the mountain regions (20-25 l/s/km²) and the lowest are recorded in to the Transilvania Field (2.5 l/s/km²) and Somesan Plateau (2.5-5 l/s/km²).

The minimal flow is counted at the end of the summer and in the winter. The lowest values are recorded in January and are 3 to 4 times lower than in to the other months. In the July and August the minimal flow is 2.75 – 6.35 l/s/km² in to the higher areas and 0.01 – 0.5 l/s/km² in to the Somesan Plateau and Transilvania Field.

The maximal flow is counted during the snow brake and raining period and is specified for March, April and May. In this way, the period of high level of water during 50 days in to the mountain region and 10 to 15 days in to the Somesan Plateau and Transilvania Field.

From the thermal condition point of view for the Somesul Mic River in to the Cluj-Napoca sector, the annual average value is 9°C. The highest values are recorded in July and August (15.5°C) and beginning to November is counted a decrease of the water temperature, the lower value being close to 0°C.

The annual solid flow measures the volume of the soil or the weathered rock driven by the superficial flow. It is evaluated by the turbidity index and for the Somesul Mic River is 754

mg/l. This high value is owing to the branches from the Somesan Plateau and Transilvania Field those have the drainage area in to the fragmented relief regions and where the forest surfaces are very small.

From the quality indices point of view the Somesul Mic River is characterized by two sectors:

- **the spring – uphill by Cluj-Napoca sector** – could be included in to the first class category of quality (STAS 4706/88)
- **the Cluj-Napoca – confluence to the Somesul Mare River sector** – could be included in to the first class of quality for mineralization amount and in to the second class quality for O₂ (CBO₅, CCOMn) condition and toxic indicators (NH⁺, phenols, Fe, Zn, P). On the whole, this sector of the river could be included in to the second class of quality and this decrease of quality is caused by the contaminations providing by the pollutant sources from Cluj-Napoca, Gherla and Bontida.

Consequence to the large variation of the flow rate of the river during the year and the accumulation of the great quantity of different kind of suspended materials in different sectors of the river are necessary:

- The special monitoring of the whole activity in to the area;
- The monitoring of the water quality;
- The disallowing of the overflow of the preliminary treated used waters in to the river;
- The proper storage of the raw materials for avoiding the infiltrations in to the soil and underground water;
- The disassembling of the ancient and used installations and equipments concerning to their risk of pollution.

3. THE ANALYZE OF THE SOMES-NORD INDUSTRIAL AREA

The structural organization of the Cluj-Napoca city ensures the dividing of the region in areas those have precisely destination: industrial areas, habitable areas, educational areas, parks, etc.

The industrial area has developed mainly to the North of the railway that divided the city in to two geographic regions: North and South.

Considering the possibilities of grouping, specific cooperation, road and railway access it was formed four industrial areas, one of them dedicated for storage:

1. **North-East industrial area** boundary by the Fabricii Street (on West) and the city limit (on East). The most important companies in the area are: S.C TERAPIA S.A., S.C. SINTEROM S.A., S.C. NAPOMAR S.A., S.C. POCELAIN MANUFACTURING S.A., COMBINATUL DE UTILAJ GREU, etc.
2. **The central industrial area** – this area includes S.C. IMMR 16 Februarie S.A., S.C. ARMATURA S.A., S.C. TEHNOFRIG S.A., S.C. LIBERTATEA S.A.;
3. **The West industrial area** – this area includes THE MILLING AND BREADSTUFF HOLDING BACIU, The cold storage, S.C. Mecanica BACIU S.A.;
4. **The Someseni storage area**, where, not long time ago, were developed small manufacturing companies.

3.1. The analyze of the companies site

The Somes North industrial area is placed on the base of the Sf. Gheorghe Hill on the first terrace of the Somesul Mic River at the 2 – 6 meters relative altitude. On this terrace are placed few industrial companies those neighboring the habitat areas on less than 500 meters (Iris District on West, Bulgaria District and Marasti District on South – figure 1).

The companies of this platform have different kind of activities using specifically for manufacturing the parts and assemblies, for pharmaceutical products, ceramics products, textile fabrics, etc.

The map in figure 1 shown the main companies in the area indices as followed: 1. S.C. Terapia S.A., 2. S.C. Sanex – The brick factory – this company suspended its activity and change its domain in to storage area and design laboratories, 3. Residence area, 4. S.C. Porcelain Manufacture S.A., 5. Technical University, 6. “Aurel Vlaicu” Secondary School, 7. S.C. Sinterom S.A., 8. The storage area for different kind of materials, 9. S.C. Mecanica Marius S.A., 10. The department store for photo materials, 11. S.C. Mafir S.A., 12., 15., Companies those textile fabrics, 13. Manufacturing engineering and foundry company, 14. Napomar Holding, 16. Small companies with different kind of activities, 17. CUG S.A. Holding, 18. S.C. UNIMET S.A., 19. Linde-GAZ.

3.2. The identification of the main pollutant sources

For the identification of the main pollutant sources it was analyzed the input-output principle for all the companies of the area and their history.

The beginning of the industrial activities in the area:

- *In 1921* – it was born the first production company – TERAPIA – at beginning it was a small pharmaceutical products laboratory;
- *In 1936* – it was born “UZINA TRIUMF” – the current name is Sinterom and at beginning the profile was the manufacturing of the chemical products. Then, after 1948 the production was diversified by the starting to manufacturing of the different kind of sparking plug
- *In 1968* – it was renewed the Mecanica MARIUS S.A. Company (born in 1948), manufacturer of the agricultural equipment, tanks, trailers and spare parts for tractors and agricultural machinery;
- *In 1973* – it was born the S.C. NAPOMAR S.A. Company. It activity is specialized on the manufacturing the grinding machines and the specific hydraulic equipment for it.
- *In 1973* – it was born the Combinatul de Utilaj Greu Company. It activity covered a relatively large domain and it is specialized on the steel melting and special iron melting and the manufacturing of the huge parts by casting and plastic deformation.
- *In 1995* – it was born the Porcelain Manufacture S.A. Company. It activity is specialized on the manufacturing of the ornamental parts using the porcelain.

As could be see above, the production activity in the interest area has started approximately 80 years ago and it touches the maximum development between 1975 and 1990 period. After this period it was counted a decrease of the industrial activity in to the area.

Now, in to the interest area are developing different kind of social and industrial activities those have a negative impact over the environment. These activities could be grouping in:

- Technological processes of manufacturing the parts by casting, forging, powder metallurgy, and surfaces coating;
- Technological processes for manufacturing of the ceramic parts, porcelain and bricks;
- Technological processes for manufacturing and storage of the pharmaceutical products;
- Technological processes for manufacturing of the industrial equipments;
- Technological processes for manufacturing of the wood;
- Technological processes for manufacturing of the textile materials;
- Technological processes for producing, transport and distribution of some utilities (oxygen, nitrogen, etc);

- Special processes for storage the office equipment and photographic materials.

The social activities are covered by:

- The Technical University of Cluj-Napoca;
- The “Aurel Vlaicu” Secondary School;
- The residence areas.

Considering the data shown above it was analyzed each productive unit from the input-output inset point of view. The stages followed for each unit it was:

- The establish of the unit’s site and its activity profile;
- The establish of the all technological insets;
- The determination of the raw materials, the auxiliary materials and the utilities for each inset and their summarization;
- The determination of the all outputs for each inset (products, waste, used water outlet, emissions, etc) and their summarization;
- The determination of the legal environment measures that must be respected;
- The determination of the technological inset and its compounds those have a major impact over the environment;
- The analyze of the current state of the environment elements (phreatic water, soil, air) inside of the unit;
- The summarization of the data from whole area and drawing a map that shown the most polluted regions of the area.

4. THE ACTIVITIES IMPACT OVER THE WATER

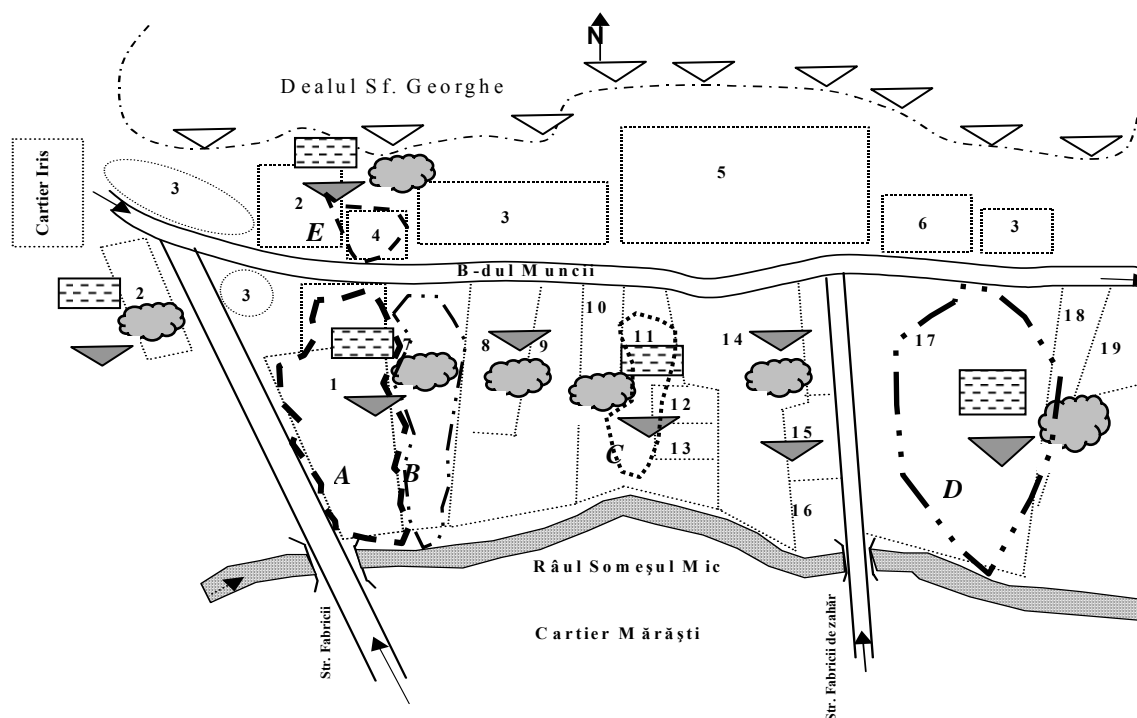
The investigations in to the area allow realizing a graduation of the main pollutant companies. In 2003 this graduation was as follow:

1. S.C. Terapia S.A.
2. Combinatul de Utilaj Greu
3. S.C. Mafir S.A.
4. S.C. Porcelain Manufacture S.A.
5. Napomar Holding
6. S.C. Mecanica Marius S.A.





Considering it, the main pollutant sources of the water are:

- Used water providing from the equipments and installations;
- Haphazard overflow of the raw materials on the soil combining with it infiltration first in phreatic water and then in to the river;
- The technological and garbage used water infiltration in to the phreatic water provided by the ancient pipes.

Figure 1 shows the pollution areas with different substances provided by the industrial processes.



The symbols of the map represent:

-  Activities that induce the ground-water pollution;
-  Activities that induce the soil pollution;
-  Sheet erosion phenomenon of the Sf. Gheorghe Hill soil;
-  Activities those induce the atmospherically pollution.

- A – organics chemical compounds pollution, Cr^{6+} , Hg, CN^- , NH_3 , and heavy metals pollution;
- B – HAP, metals, heavy metals pollution;
- C – organics chemical compounds, metals, heavy metals pollution;
- D – organics chemical compounds, metals pollution;
- E – suspended ceramic powders (Cr^{6+} , Cr^{3+} , Co, Au, Ag)

Figure 1. The Map of the Analyzed Area.

5. CONCLUSIONS

Considering the heavy environment problems recorded in to the analyzed area, the companies, the local environment authority and the specialists promoted and applied largely programs those have a positive impact over the environment.

- It is prohibited to discharge the technological used water even that partial treated.
- It is not a success yet the completely elimination of the discharge of the rain waters from the area in to the river.
- Inside the S.C. Terapia S.A. Company (specialized in chemical synthesis and drug manufacturing) it was stopped all chemical production activities, it were demolished and demounted the buildings and the installations supposed hazardous. Now they are being in to the increasing the quality of the soil and the phreatic water stage.
- Inside the Combinatul de Utilaj Greu Company (specialized in to heavy equipments manufacturing) it were stopped all the production activities. They are being in to the

totally demount stage now.

- Inside the S.C. Mafir S.A. company it were stopped all the activities in to the foundry and heat treatment – the most pollutant sectors
- S.C. Sinterom S.A. and Napomar Holding are still running away and it try to respect an strictly program of environment conformity for a future environment management system certifying.

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