

# Environmental assessment of Skawina area based on selected parameters

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The main aim of this study is to evaluate the assessment of the environmental effect of the city and industry in Skawina. Skawina is a town with a population of 25,000 situated about 15 km to the south-west of Kraków (S Poland). The main industrial facilities, located in the western part of the city, include: a coal-fired electric power plant, Lajkonik Snacks S.A. (food industry), the Vesuvius refractory ceramics factory and about 50 smaller industrial entities. Until 1980s of last century, one of the largest Polish aluminum smelters was operating in the western part of town. In 1981 the electrolysis department was closed due to huge emission of lethal fluorine, which was the major source of air, soil and water pollution in the area. It is hypothesized here that current environmental problems in the area result from contemporary and local urban or industrial activities rather than from historical pollution.

Skawina is located at the junction of transit routes. The prevailing winds are SW and W bringing the air pollution from nearby Silesia. The town lies on the Skawinka River, a tributary to the Vistula River. Since the prevailing winds are SW and W, parallel to the river valley, temperature inversions and fogs are frequent. The Skawinka River is the source of city water for Skawina. In the lower part it receives a large volume of cooling water from the power plant. This is the Vistula River processed in the plant. It accepts municipal wastewater discharge too. Studies conducted in the 1970s showed extremely high levels of SO<sub>2</sub> and particular matter in the atmosphere of Skawina. However, since the 1980s, there has been a significant improvement in

air quality following decreases of industrial emissions. According to the data from the air monitoring network in the Małopolska region (Małopolska Sieć Monitoringu Powietrza 2007) and reports by the Voivodship Inspectorate for Environmental Protection in Kraków (Wojewódzki Inspektorat Ochrony Środowiska w Krakowie 1994–2005), the improvement is observed for the whole Małopolska region.

This study involved 10 soil samples from selected locations in the city of Skawina and 10 samples of water from the Skawinka River. The pH, loss of ignition and total elemental composition (using X-ray fluorescence XRF) was determined in soils. Bioavailability of selected elements was estimated based on extraction with HCl 1M. The temperature, pH, electric conductivity, colour and turbidity, as well as concentration of major ions (using atomic absorption spectrometry AAS) were determined in waters. The results were compared with current standards and legal regulations regarding water and soil pollution in urban areas. In spring 2015, a soil sampling campaign is planned for determination of current fluorine content in soils around the former aluminum processing plant.

The soils are typical for urban areas: rich in clay and silt and lacking horizontal stratification. The pH exhibits bimodal distribution with maximums around 5 and around 8. Alkaline pH correlates with higher loss of ignition (ca. 8 wt. %) indicating the presence of carbonate fraction. Total concentration of selected elements in soils (particularly Ba up to 850 ppm, Zn up to 390 ppm, Pb up to 157 ppm, Cr up to 300 ppm) exceeds

the limits of soil pollution in Poland. Therefore, the soils are classified as class pollution C typical for industrial zones according to *Rozporządzenie Ministra Środowiska...* (2002). The bioavailability determined using HCl 1M varies broadly and does not correlate with other parameters. This may indicate that bioavailable forms of metals are already complexed with organic components of the soil.

The waters of the Skawinka River are strongly affected by the industry. All the physical and chemical parameters are strongly altered below the outlet of cooling water from the power plant. The plant uses water from the Wisła River. The discharge pollutes the waters of the Skawinka River mostly increasing the temperature (from 12 to 16°C) and mineralization (conductivity increases from 560 to 1230 mS/cm). Increased mineralization results mostly from increase in NaCl salinity. This results in drastic increase in turbidity (from 7 to 27 NTU) due to eutrophization. The waters are classified as II<sup>nd</sup> class according to *Rozporządzenie Ministra Środowiska...* (2011).

Comparison of the results with previous studies indicates that the improvement of the state of the

environment is small. This area was under heavy influence of various industry for many years resulting in strong deterioration of the soils. The waters of the Skawinka River are still under constant anthropogenic pressure. The results indicate that contamination of soils represents regional, long-range air pollution with historical component. The Skawinka River in turn, is under contemporary local environmental stress which should be improved particularly since recreational and sport facilities are developed on the river banks.

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## REFERENCES

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