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HISTORICAL SOIL AND GROUNDWATER POLLUTION IN DEVELOPING PERI-URBAN AREAS

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Introduction

The rising trend of urbanization in Romania is resulting in higher population densities in the peri-urban areas. However, the fast-paced urbanization process is surpassing the ability of the developing cities to provide adequate infrastructure and facilities to its inhabitants, creating major environmental issues. In many cases, the proposed solutions to these problems are not an integrated part of an environmentally sustainable planning, but rather uncorrelated solutions (independent sanitation solutions, groundwater catchment areas etc).

In addition to the higher population densities, the old industrial activities from the peri-urban neighborhoods add even more complexity to the environmental context due to the historical contamination of soil and groundwater. This is also the case of Pantelimon - Cernica area situated in the eastern part of Bucharest, near the Ring Road. This old industrial zone was developed previously near the Neferal and Acumulatorul metallurgical units and are now active urbanization areas, mainly due to the presence of Pantelimon and Cernica lakes and the surrounding wooded area.

The authors of this paper aim to emphasize and quantify the current stage of the soil and groundwater pollution processes determined by historical contamination and to correlate the results with the dynamics of the peri-urban areas.

Materials and methods

The main source of land pollution is represented by the metallurgical unit Neferal, that is specialized in non-ferrous metal waste processing and specific alloys production. In particular, the Aluminium waste processing has generated a significant quantity of slag, deposited as a non-compliant stockpile that occupies an area of approximately 16 000 sqm and it is situated in the northern part of the industrial zone. In order to identify the pollution processes, complex analyses were carried out based on surface water and groundwater samples, as well as samples collected from the stockpile. The results of the analyses were used to build mathematical models of the water flow and to simulate the transport of metals in soil and in groundwater.

In the analytical stage of the study, the composition of the samples collected from the stockpile was determined through microscopy. The metallic cations were identified using graphite furnace atomic absorption spectrometry, whereas the anions were

separated through ion chromatography. The analyses were carried out at Ruhr-Universität Bochum and at the University of Bucharest. The hydrogeologic mapping is based on available data from the wells located in the study area, correlated with data obtained from vertical electrical sounding surveys.

Results and conclusions

From the hydrogeological characterization and the developed conceptual model resulted unidimensional spatial distribution profiles for the unsaturated zone and bidimensional profiles (distribution maps) for the aquifer. These results emphasise not only the pollution plume for each analysed element, but also the cumulative nature of the process in time.

The assessment of the current environmental situation and the dynamics of the urbanization is possible by analysing the remote sensing data available for the area of interest collected at different time intervals – 2008 – 2009 with complete coverage of the area, and 2002 – 2008 with incomplete data collection.

The distribution maps of the environmental contaminants resulted from the developed mathematical models were integrated in GIS in order to correlate them with the available remote sensing data, that indicate the urban areas and the areas with high potential of urbanization in the future.

Following the assessment, maps were drawn up highlighting current risk areas and other possible areas that may be at risk in the future, based on the proximity of the residential zones to the land contamination area.

Both the correct information of the population, as well as the substantiation of the decision-making processes, become impossible in the absence of effective management tools, based on relevant data about the specific processes.