OIL POLLUTION IN THE VICINITY OF A HEATING PLANT IN NEW BELGRADE (SERBIA) – INFLUENCE ON THE GROUND WATER QUALITY IN ALLUVIAL PLAINS OF THE SAVA RIVER

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INTRODUCTION

The district heating plants in Belgrade (Capital of Serbia) have been using petroleum products as fuel for decades. The most used derivatives are raw petrol, ecodiesel and heavy fuel oil.

One of the largest heating plants in Belgrade is a heating plant in New Belgrade. Within the area of this facility, there are several storage tanks of petroleum products and a decanter.

Being located in the alluvial plains of the Sava River, close to its confluence to the Danube, this heating plant represents potential source of the oil pollution for the whole alluvial area.

Figure 1. Location of the investigated area.

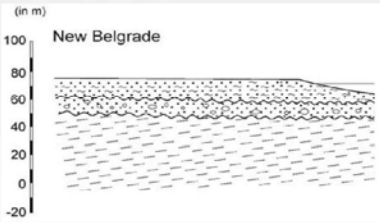

Figure 2. A simplified geologic crossection of the Sava river bank in the investigated area (modified after Knežević *et al.*, 2012.).

EXPERIMENTAL

During the months of May and June 2015. an extensive investigation of the pollution of the ground water in the vicinity of a heating plant in New Belgrade (Serbia) was conducted. The samples were analyzed from the system of 13 existing piezometers and from 3 new wells. Organic matter from the water samples was isolated with hexane in a separatory funnel. The extracts were precleaned on the column packed with Florisil® and analyzed by gas chromatography–mass spectrometry (GC–MS) techniques.

An Agilent 7890N gas chromatograph fitted with a HP5-MS capillary column (30 × 0.25 mm, 0.25 µm film; temperature range: 40 ºC for 1 min; then 15 ºC min^{-1} to 100 ºC for 1 min; then 10 ºC min^{-1} to 310 ºC for 15 min and held for 15 min; with helium as the carrier gas (flow rate 1 cm^3 min^{-1}) was used. The GC was coupled to a Hewlett- Packard 5972 MSD operated at 70 eV in the 45–550 scan range.

The peaks were identified according to the literature data (Peters et al., 2005., and references therein) or based on the total mass spectra, using mass spectra databases (NIST/EPA/NIH mass spectral library NIST2000, Wiley/NBS registry of mass spectral data, 7th ed., electronic versions.

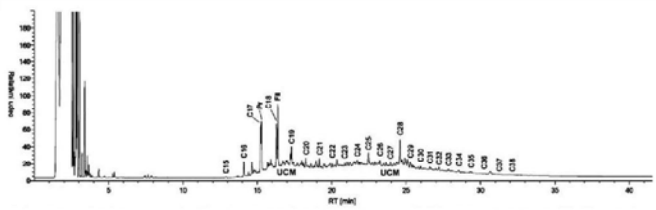

Figure 3. Gas chromatogram of an extract from a piezometric water (before flushing) sample.

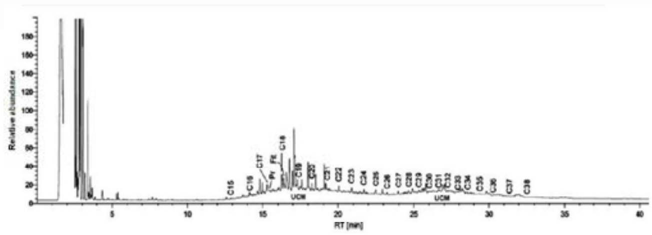

Figure 5. Gas chromatogram of an extract from a soil sample from the same locality.

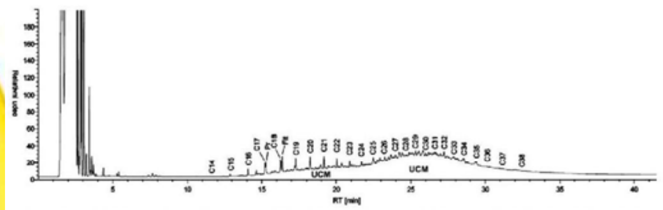

Figure 4. Gas chromatogram of an extract from a piezometric water (after flushing) sample.

RESULTS

The results proved that the groundwater in whole investigated area was contaminated with diesel and a heavy oil fuel which have been used for decades in this heating plant. Additionally, the results showed that the contamination of surrounding soils and sediments was transferred to the ground waters. In this way the pollution of the solid phase of the investigated aquifer left a "fingerprint" of its composition in the neighboring ground waters. Although these results did not indicate a significant contamination of the investigated ground waters with oil pollutant, presence of this contaminant in the aquifer means that this area should be under continuous monitoring.

REFERENCES:
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Peters, K. E., Walters, C. C. & Moldowan, J. M. 2005. The Biomarker Guide. Volume 2: Biomarkers and Isotopes in Petroleum Exploration and Earth History. Second Edition. University Press, Cambridge, New York, Melborne.

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