PCB CONTAMINATION OF ELECTRO TRANSFORMER STATION ZADAR AND SEDIMENT OF NEAR MARINE

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Introduction

During the recent war, the karst area of Croatia has been jeopardized by hazardous waste and deserves particular attention because of its exceptional ecological sensitivity and unfortunately unscrupulous destruction of natural resources, infrastructure, homes and enterprises. During 1996 waste oil and soil samples near damaged transformer stations were collected in Delnice, Zadar, Šibenik, Split, and Dubrovnik area and analyzed on polychlorinated biphenyls. Results of the analysis of polychlorinated biphenyls in soil from four locations (on some locations, on two depths), indicate significant contamination of the investigated area TS 110/35 kV - Zadar. It was reason for thoroughly investigation this site for levels of PCBs in soil samples around damaged capacitor and near coastal zone of town Zadar. Results of soil analysis were presented in Dioxine 2003 conference which shown serious contamination of soil around damaged electro transformer station[1]. Levels of PCBs in marine sediment and biota samples collected near coastal water have shown also relatively high values[2,3] so it was reason about speculation of possibilities the inflow of PCBs from damaged ETS Zadar to near marine environment. Namely, town Zadar is situated on karstic ground and there are possibilities that PCBs could be transferred through such porous media to near sea. The scope of this paper is present the results of investigation PCBs pollution in deeper layer of soil samples collected inside ETS Zadar and sediment samples collected from the near Marine.

Area of investigation

Position of hitted electro transformer station (ETS) and Marine (M) with creek Vruljica in Zadar area is presented on Figure 1.

On Figure 2 soil sample points at Zadar electro trafostation is present: C1, C2 and C3 capacitors; H1, H2 and H3 holes in concrete/asphalt base; research hole 1 outside base and research hole 2 inside concrete/asphalt base. Soil samples from research holes were collected from different depths. Soil samples from H1 to H3 holes were collected under layer of concrete/asphalt base. Marine sediment samples were collected by grab and/or corer and stations were present on Figure 3. Vruljica is a little creek which inflow into Marine on north side and samples were collected about 50 m close to Marine.

Methodology of Analysis

An air dried samples were sieved on 0.063 mm and extracted 24 hours with n-hexane by Soxhlet extraction. The analytical method used for the analysis of extracts included filtration through a column of Na_2SO_4 anh. cleaning on an alumina column and the separation of the PCB's from organochlorine insecticides on a miniature silica gel column. After concentration down from 0.3 to 1 cm^{-3}, elutes were analyzed by EC gas chromatography. During all the analytical procedures, the Mirex standard was used as the internal standard. More circumstantially details of used methods were described in numerous published papers[3,4,5].

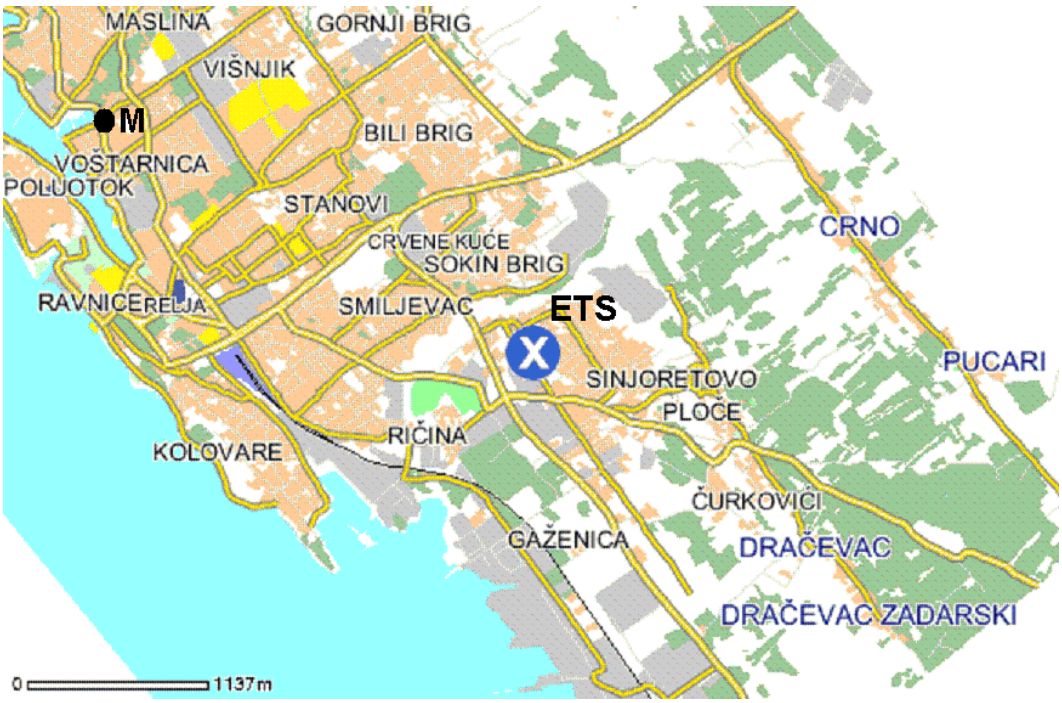

Figure 1 Position of hitted electro transformer station (ETS) and Marine (M) with creek Vruljica in Zadar area

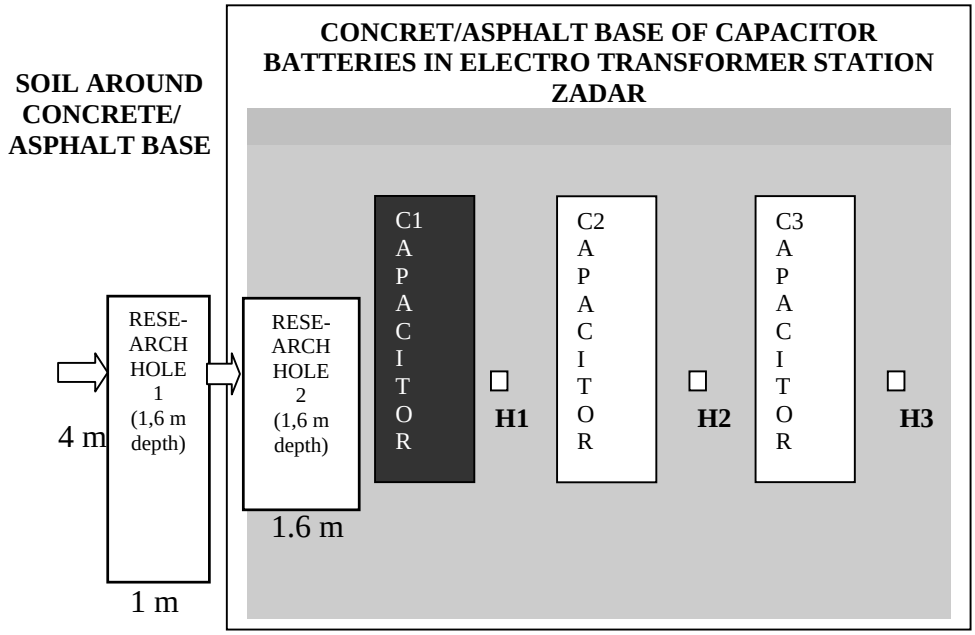

Figure 2 Soil sample points at Zadar electro trafostation: C1, C2 and C3 capacitors; H1, H2 and H3 holes in concrete/asphalt base; research hole 1 outside base and research hole 2 inside concrete/asphalt base.

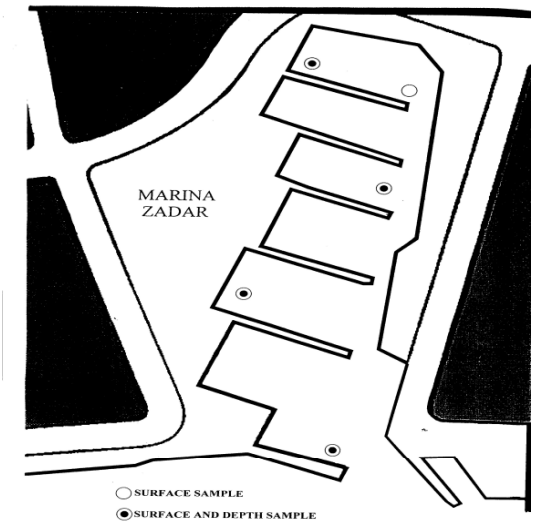

Figure 3 Marine sediment samples stations

Results and discussion

Levels of PCBs as sum of seven key PCBs (IUPAC No. PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153 and PCB 180), PCB 28 and PCB 52 in soil samples collected from outside research hole 2 at various depth are presented in Figure 4. As is seen level of PCBs relatively steeply diminished from very high level (over 200 ppm at depth of 0.025 m) to 0.6 ppm at depth 0.3 m and is almost constant until depth of 1.1 m.

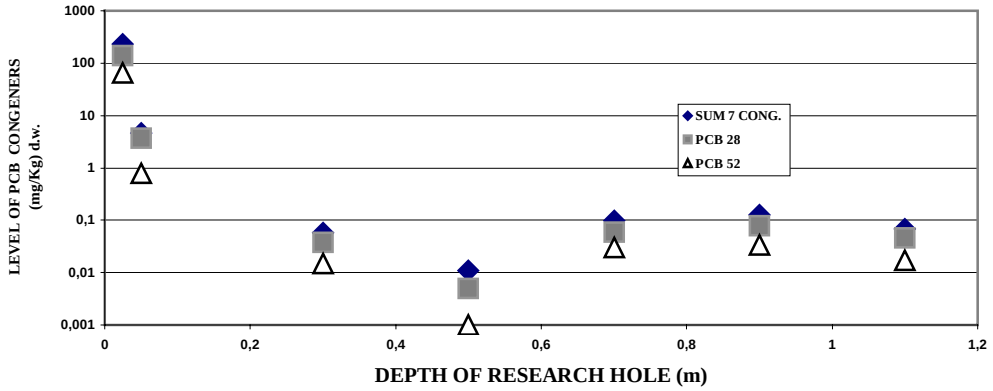

Fig 4 Levels of PCBs presented as sum of seven key PCBs (IUPAC No. PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153 and PCB 180), PCB 28 and PCB 52 in soil samples collected from outside research hole 2 at various depth.

Soil samples from research hole excavated inside concrete/asphalt base have level of sum 7 key PCBs about 0.01 ppm with maximum of 0.02 ppm in soil samples collected from depth of 0.6 m. It is could be concluded that investigated PCBs did not penetrate in the deeper depth of soil outside concrete/asphalt base. Levels of PCBs in soil samples from H1 to H3 sampling holes and research hole excavated inside concrete/asphalt base show very low levels of PCBs and it is obviously that concrete/asphalt base very effectively stopped penetration of PCBs under the concrete/asphalt base of ETS Zadar.

Surface (layer of 0-5 cm) sediment samples from Marine collected 1996 and 1999 have shown significant pollution with PCBs. In the end of February 2003 sampling of sediment samples from Marine were performed by corer and obtained results are present on Figure 6. As is seen the highest level of PCBs are in the sediment sample obtained from station 3 at depth between 8 and 21 cm. All surface samples had lower levels of PCBs.

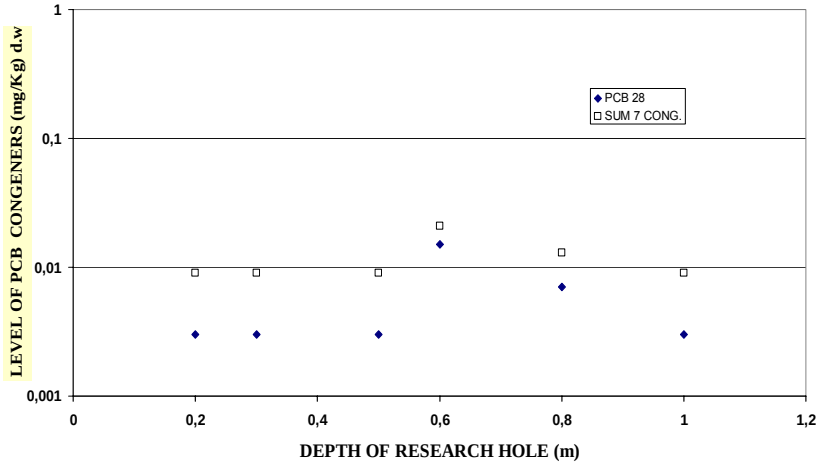

Fig 5 Levels of PCBs presented as sum of seven key PCBs (IUPAC No. PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153 and PCB 180), PCB 28 and PCB 52 in soil samples collected from inside research hole 1 at various depth.

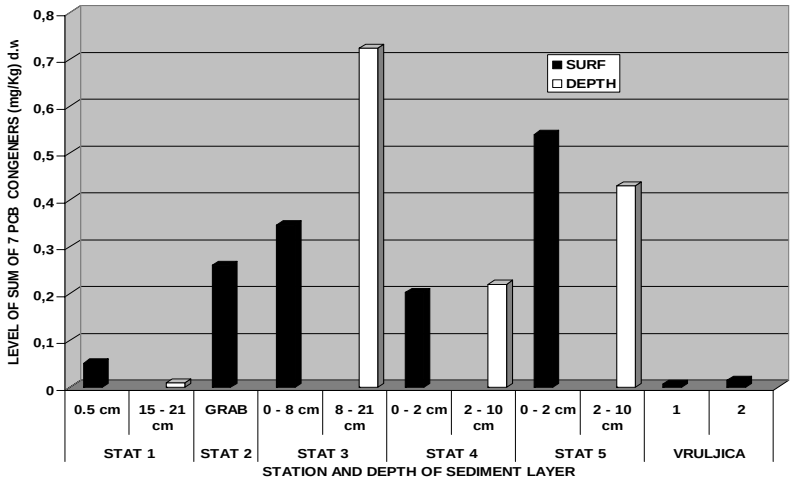

Figure 6 Levels of PCBs presented as sum of seven key PCBs (IUPAC No. PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153 and PCB 180) in sediment samples from Marine and Vruljica creek (sampling was performed 2003).

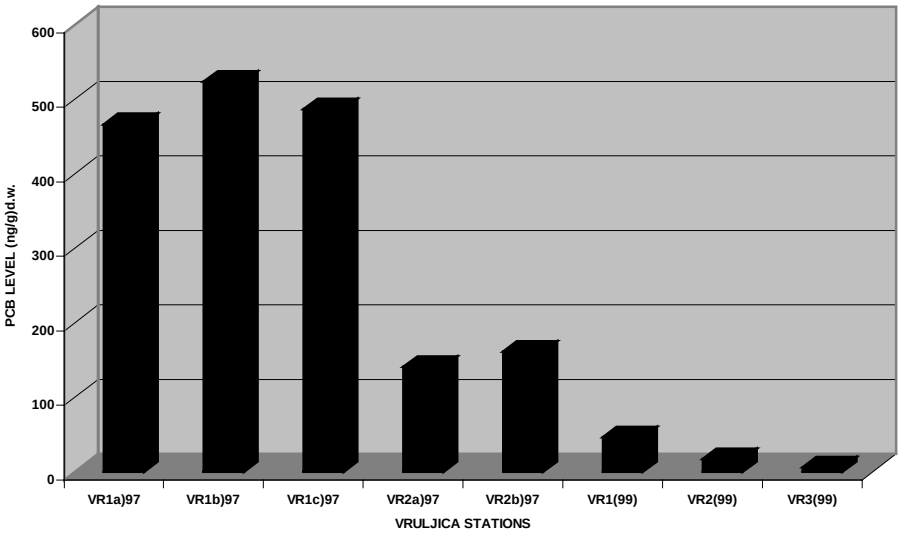

Figure 7 Levels of total PCBs (in equivalents of Aroclor 1254) in sediment of creek Vruljica collected from 1997 to 1999.

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