AN ECOLOGICAL RISK ASSESSMENT ON COASTAL SEA SEDIMENTS AT THE BAGNOLI BROWNFIELD SITE (ITALY)

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The Bagnoli brownfield site, one of the largest Italian dismantled industrial areas undergoing remediation, is located in the western sector of the urban territory of the city of Naples (Southern Italy) inside the active volcanic field of Campi Flegrei. The remediation project, funded by the Italian government, started in 1996 in the brownfield site; viceversa only monitoring activities have been carried out on the coastal area sea sediments facing the brownfield site. A total of 384 sea sediment samples were collected from 128 boreholes at different depths (0–20 cm, 20–30 cm, 30–50 cm, 100–120 cm, 150–180 cm, 180–200 cm, 280–300 cm, and 380–400 cm) down the seabed along the coastline. Analyzed samples show that the coastal area facing the brownfield site is strongly contaminated by both metals, whose distribution seems to be controlled by the grain size of the sediments, and by organic compounds (PAHs and PCBs). Geochemical mapping and R-mode factor score analysis allowed us to identify the ground waters, emanating from the brownfield site to the sea across an artificial structure ("Colmata a mare") limited by two piers and filled by scum, slag and landfill material, as the main source of contaminants. Groundwater metal contamination was proven to be mostly dependent on a natural hydrothermal enrichment process related to the volcanic activity of Campi Flegrei (De Vivo and Lima, 2008. In: Environmental Geochemistry: Site characterization, Data analysis and Case histories, Elsevier, 355–3859), whereas PAHs and PCBs, which occur well above the concentration levels permitted by the Italian Law, are undoubtedly anthropogenic. Generic Hazard Quotient (HQ) (maximum measured pollutant concentration divided by a selected reference value representing the predicted "no effect concentration") has been calculated for As, Cd, Cr, Hg, Ni, Pb, PAHs and PCBs in seabed sediments (0–20 sampling depth) with the aim of performing an Ecological Risk Assessment (ERA). Result obtained showed that the Bagnoli brownfield site coastal sea sediments are always characterized by HQ > 1 up to the remarkable values of 14,737 and 1,666 respectively for PAHs and PCBs. Since the higher the HQ, the more frequent adverse ecological effects are expected, a remediation project should be planned, as a priority, the PAHs and PCBs occurring in the sea sediments next to the coastline, since the area in the summer time is crowded by family and children.

Keywords: sea sediments, ecological risk assessment, Campi Flegrei