

Human Health Risk Assessment from Metals Present in a Soil Contaminated by Crude Oil

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Abstract : The main sources of soil pollution due to petroleum contaminants are industrial processes involve crude oil. Soil polluted with crude oil is toxic for plants, animals, and humans. Human exposure to the contaminated soil occurs through different exposure pathways: Soil ingestion, diet, inhalation, and dermal contact. The present study research is focused on soil contamination with heavy metals as a consequence of soil pollution with petroleum products. Human exposure pathways considered are: Accidentally ingestion of contaminated soil and dermal contact. The purpose of the paper is to identify the human health risk (carcinogenic risk) from soil contaminated with heavy metals. The human exposure and risk were evaluated for five contaminants of concern of the eleven which were identified in soil. Two soil samples were collected from a bioremediation platform from Muntenia Region of Romania. The soil deposited on the bioremediation platform was contaminated through extraction and oil processing. For the research work, two average soil samples from two different plots were analyzed: The first one was slightly contaminated with petroleum products (Total Petroleum Hydrocarbons (TPH) in soil was 1420 mg/kg_{d.w.}), while the second one was highly contaminated (TPH in soil was 24306 mg/kg_{d.w.}). In order to evaluate risks posed by heavy metals due soil pollution with petroleum products, five metals known as carcinogenic were investigated: Arsenic (As), Cadmium (Cd), Chromium^{VI} (Cr^{VI}), Nickel (Ni), and Lead (Pb). Results of the chemical analysis performed on samples collected from the contaminated soil evidence soil contamination with heavy metals as following: As in Site 1 = 6.96 mg/kg_{d.w.}; As in Site 2 = 11.62 mg/kg_{d.w.}, Cd in Site 1 = 0.9 mg/kg_{d.w.}; Cd in Site 2 = 1 mg/kg_{d.w.}; Cr^{VI} was 0.1 mg/kg_{d.w.} for both sites; Ni in Site 1 = 37.00 mg/kg_{d.w.}; Ni in Site 2 = 42.46 mg/kg_{d.w.}; Pb in Site 1 = 34.67 mg/kg_{d.w.}; Pb in Site 2 = 120.44 mg/kg_{d.w.}. The concentrations for these metals exceed the normal values established in the Romanian regulation, but are smaller than the alert level for a less sensitive use of soil (industrial). Although, the concentrations do not exceed the thresholds, the next step was to assess the human health risk posed by soil contamination with these heavy metals. Results for risk were compared with the acceptable one (10^{-6} , according to World Human Organization). As, expected, the highest risk was identified for the soil with a higher degree of contamination: Individual Risk (IR) was 1.11×10^{-5} compared with 8.61×10^{-6} .

Keywords : carcinogenic risk, heavy metals, human health risk assessment, soil pollution

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