

Levels of Polycyclic Aromatic Hydrocarbons and Heavy Metals in Surface Soil at Auto-Mechanic Workshops within the Accra Metropolis, Ghana

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ABSTRACT

This study investigated the concentrations of polycyclic aromatic hydrocarbons (PAHs) and five selected heavy metals (Pb, Cd, Ni, Zn and Cu) in water and soil at some selected auto-mechanic shops within the Accra Metropolis. In all 57 soil samples and 36 water samples were collected between December 2015 and February 2016 from eighteen (18) selected auto-mechanic workshops, three (3) hand-dug wells and two (2) control sites. The samples were extracted and analyzed for PAHs (naphthalene, acenaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo (a) anthracene, chrysene, benzo (b) fluoranthene, benzo (k) fluoranthene, benzo (a) pyrene, indeno (1,2,3-c,d) pyrene, dibenzo (a,h) anthracene, benzo (g,h,i) perylene) and heavy metals (Pb, Cd, Ni, Zn and Cu) using the Gas chromatography equipped with combiPal autosampler and Ni electron capture detector (ECD) and the Atomic Absorption Spectroscopy (AAS) respectively. Physicochemical properties of soil and water were determined to evaluate the quality of soil and drinking water. In addition, two hundred and thirty (230) respondents (made up of 150 auto-mechanics and 80 household' representatives) were randomly selected and interviewed using a structured questionnaire. Information on knowledge of chemical hazards, occupational habits and health related risks associated with handling of used engine oil were sought. The results obtained showed that soil and water samples analyzed from the various sites recorded concentrations of PAHs below 0.01 $\mu\text{g/g}$ and 0.01 $\mu\text{g/L}$ detection limit respectively. The ranges of heavy metal concentration in water samples analyzed were: <0.001 – 0.03 mg/L for Cu, <0.001 – 0.21 mg/L for Pb, <0.002 mg/L for Cd, <0.001 – 0.03 mg/L for Ni and <0.001 – 0.08 mg/L for Zn. The mean concentrations of metals in soil samples were in the ranges Pb (33.03 – 150.26 mg/kg), Cd (<0.002 – 0.29 mg/kg), Ni (34.02 – 87.59 mg/kg), Cu (58.40 – 102.07 mg/kg), Zn (63.92 – 187.92 mg/kg). Similarly the results of physicochemical analysis of water samples from wells over the study period were in the ranges; pH (6.17 – 6.87), temperature (27.8 – 29.8 $^{\circ}\text{C}$), EC (106.20 – 172.60 $\mu\text{S/cm}$), turbidity (0.56 – 0.71 NTU), alkalinity (72.6 – 150.83 mgCaCO₃/L), TH (244.0 – 610.2 mgCaCO₃/L), TDS (64.10 – 103.40 mg/L). In addition results

of physicochemical analysis of soil samples were in the ranges; pH (6.31 – 8.68), CEC (4.08 – 16.32 cmol/kg), %OM (6.05 - 15.30%), EC (103 – 1065 μ S/cm). The survey showed that majority of auto-mechanics were aware of the health risks associated with handling of used engine oils however only 50.7% of artisans use full Personal Protective Equipment (PPE) when working. Safety and hygienic practices among artisans were generally low. Household's also indicated their unhappiness about the siting and activities of auto-mechanics in residential areas but added that they are unable to do anything about it as they perceived it is the responsibility of the government to regulate the activities of auto-mechanics. Due to the adverse effect of heavy metals on human health it is recommended that there is regularly training for these artisans to minimize their exposure to these chemicals.

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