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Assessment of Heavy Metal Contamination in Soils Surrounding Oil and Gas Drilling Sites in East-West Godavari Districts, Andhra Pradesh, India

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Soil contamination by heavy metals stemming from oil and gas exploration poses a significant environmental and public health concern globally. This study investigates soil contamination around oil and gas drilling sites in the East-West Godavari districts of Andhra Pradesh, India, characterized by alluvial clay, sandy clay, and black clay soil types. Eighty soil samples were collected from ten drilling sites at varying depths (0–20 cm, 1 ft, 2 ft, and 3 ft) during the pre-monsoon season. Preliminary findings reveal concentrations of thirteen heavy metals (Ba, Co, Cr, Cu, Ga, Ni, Pb, Sc, Th, U, V, Zn, and Zr) analysed using wavelength dispersive X-ray fluorescence spectrometry.

Heavy metal concentrations in the soil were determined as follows: 499.1 mg/kg for Ba, 42.5 mg/kg for Co, 259.9 mg/kg for Cr, 414.2 mg/kg for Cu, 18.9 mg/kg for Ga, 72.6 mg/kg for Ni, 74.3 mg/kg for Pb, 11.3 mg/kg for Sc, 11.8 mg/kg for Th, 5.2 mg/kg for U, 233.7 mg/kg for V, 336.5 mg/kg for Zn, and 355.6 mg/kg for Zr. Geo-accumulation index and enrichment factor analysis revealed extreme contamination levels for Ba, Cr, Cu, and Pb. Five factors were found using multivariate statistical methods like principal component analysis (PCA), factor analysis (FA), and hierarchical cluster analysis (HCA). These factors explained 86.09% of the total variation in soil data. These statistical methods provide valuable insights into assessing soil quality and identifying sources of contamination. The study underscores the necessity of employing multivariate statistical approaches for evaluating soil quality and developing effective strategies to mitigate pollutants released from oil and gas drilling activities in the East-West Godavari districts of Andhra Pradesh, India. In view of the above, the data indicates that there would be both natural and anthropogenic source of contamination, majority would be anthropogenic input from backwater waste generated during drilling.