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COST-EFFECTIVE SAMPLING STRATEGIES FOR INVESTIGATION AND REMEDIATION OF OIL POLLUTED SOIL USING GEOCHEMICAL, GEOSTATISTICAL MODELS

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Abstract

The study aimed to develop a performance-based soil sampling approach that balances precision, accuracy, and costs for both spatially correlated variables and average characteristics. A case study was conducted on in-ground sampling, integrating field activities, laboratory analyses, statistical and geostatistical data interpretation, and economic assessments. This approach sought to evaluate soil contamination levels relative to specific critical concentrations while addressing uncertainties in measurement.
The case study focused on a site contaminated by a previous environmental spill, spanning 2700 square meters, with Total Petroleum Hydrocarbons (TPH) identified as the contaminant of interest. A preliminary investigation determined the site dimensions, the presence of contaminants, and their concentrations. A detailed investigation followed, based on a predefined sampling plan, which included individual, composite, and cluster sampling exercises. Sampling began with a maximum of 33 individual samples and concluded with a single composite sample composed of 33 increments. The results from various real and simulated sampling schemes were analyzed to identify optimal strategies.
The findings, supported by statistical and geostatistical probability values, offer insights into regulatory compliance assessment. For evaluating spatial variations in contaminant concentrations, the optimal sampling strategy involved 6–8 individual samples arranged in a zigzag pattern. For assessing the average contaminant concentration across the site, a single composite sample comprising 4–6 increments was found to be sufficient for the site's dimensions. These results demonstrate an effective balance between statistical reliability and economic efficiency in soil sampling practices.

Key words: composite sample, individual sample, in-ground sampling, soil, Total Petroleum Hydrocarbons (TPH), uncertainties

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