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Dry Binder Mixing of Field Trial Investigation Using Soil Mix Technology: Case Study on Contaminated Site Soil

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Abstract : The study explores the use of binders and additives, such as Portland cement, pulverized fuel ash, ground granulated blast furnace slag, and MgO, to decrease the concentration and leachability of pollutants in contaminated site soils. The research investigates their effectiveness and associated risks of using the binders, with a focus on Total Heavy metals (THM) and Total Petroleum Hydrocarbon (TPH). The goal of this research is to evaluate the performance and effectiveness of binders and additives in remediating soil pollutants. The study aims to assess the suitability of the mixtures for ground improvement purposes, determine the optimal dosage, and investigate the associated risks. The research utilizes physical (unconfined compressive strength) and chemical tests (batch leachability test) to assess the efficacy of the binders and additives. A completely randomized design one-way ANOVA is used to determine the significance within mix binders of THM. The study also employs incremental lifetime cancer risk assessments (ILCR) and other indexes to evaluate the associated risks. The study finds that Ground Granulated Blast Furnace Slag (GGBS): MgO is the most effective binder for remediation, particularly when using low dosages of MgO combined with higher dosages of GGBS binders on TPH. The results indicate that binders and additives can encapsulate and immobilize pollutants, thereby reducing their leachability and toxicity. The mean unconfined compressive strength of the soil ranges from 285.0- 320.5 kPa, while THM levels are less than 10 µg/l in GGBS: MgO and CEM: PFA but below 1 µg/l in CEM I based. The ILCR ranged from 6.77E-02 - 2.65E-01 and 5.444E-01 – 3.20 E+00, with the highest values observed under extreme conditions. The hazard index (HI), Risk allowable daily dose intake (ADI), and Risk chronic daily intake (CDI) were all less than 1 for the THM. The study identifies MgO as the best additive for use in soil remediation.

Keywords : risk ADI, risk CDI, ILCR, novel binders, additives binders, hazard index
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