

RISK TO GROUNDWATER ASSESSMENT OF PHOSPHATE AND THERMAL TREATED DREDGED SEDIMENTS

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Treatment and reuse of dredged harbor sediments in construction as alternative to disposal is desirable as it would reduce costs and conserve resources. However, because of elevated metal concentrations, stabilization of the sediments is needed to prevent leaching into the environment. In this research, phosphate addition followed by thermal treatment at 700 °C is evaluated, where organics are mineralized and heavy metals immobilized. Passaic River Estuary sediments were treated with 3 and 5% by dry weight phosphate from alternative forms, namely, $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$, CaHPO_4 , $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$, and H_3PO_4 . Batch tests were conducted to assess leaching as a function of pH in the range of 4 to 9. For cations, leaching was most significant at the lowest pH. Samples were also studied with the U.S. EPA synthetic precipitation leaching procedure (SPLP). For the phosphate forms evaluated, leaching was controlled by the final extract pH which was buffered by phosphate within a narrow range, 6.7 – 7.2 (Figure 1). The SPLP leaching results were compared with the New Jersey Department of Environmental Protection (NJDEP) limits which utilize a dilution attenuation factor (DAF) of 13 to approximate effects of leaching into groundwater. The NJDEP criteria were not met for Mn in dredged sediments. In the treated sediments, the criteria were met with the exception of NaH_2PO_4 and H_3PO_4 applied at 3% of sediments by dry weight. On the other hand, applying the state of Florida criteria with a DAF of 1 resulted in exceedances for Mn, Pb, and most treatments for Cd. These leaching studies are being compared to results from assessing speciation using x-ray absorption spectroscopy as well as sequential extraction.

Figure 1. SPLP leaching of metals from dredged sediments and sediments treated with alternative phosphates and calcination, and states risks to groundwater limits. The water of hydration is left out in labeling phosphate sources for clarity.

