Laboratory Testing for Optimization of Lead Stabilization at a Former Oil Refinery

Christa Bucior, ***Sophia Dore***, Donald Pope, Ryan Thomas, and Alan Weston
(GHD, Niagara Falls, New York, USA)

Background/Objectives. Stabilization can be used to prevent leaching of lead from soil. Different reagents are available which can stabilize lead, however different reagents required different cure times and addition of moisture, produce different amount of bulking, and produce material with different strenghts, densities and other properties. The stabilization of lead must be optimized to suit the properties of the soil and the requirements of the site. A laboratory study can achieve this within a short time period and at low cost.

Lead is a highly poisonous metal, affecting almost every organ and system in the body. Soil impacted by lead is often present on industrial sites associated with oil refineries, smelters and other manufacturing. Impacted soil is usually excavated and disposed of. Soil from which lead leaches at greater than 5 mg/L as measured by the toxicity characteristic leaching procedure (TCLP) must be disposed of as hazardous however if leaching can be controlled it can be disposed of as non-hazardous material.

Solidifying agents and/or bulking agents are added to treat the soil. The solid matrix encapsulates any metals present within the solid matrix where they are no longer available and cannot leach out. In this way, the metals are immobilized and are no longer considered a risk.

Lead was detected in the soil at a former oil refinery in Texas at concentrations up to 84,500 mg/kg. The soil that exceeded regulatory requirements was excavated and disposed at an off-site landfill. A treatability study was performed to optimize treatment to meet the TCLP standard of 5 mg/L.

Approach/Activities. The objective of the treatability study was to evaluate potential treatment alternatives for the soils at the Site to prevent lead from leaching from the soils. Screening of many different solidification reagents including Portland cement, Fly Ash, and several proprietary products was performed to determine whether leaching of lead could be controlled. Different mixing times, mixing methods, moisture contents and curing times were also tested to optimize treatment to prevent leaching of lead.

Treatments that performed best where further tested to better simulate field conditions. The chosen reagents were slurried using the amount of water identified in the screening tests and then added to the soil in a mechanical mixer to replicate the process that would be used in the field.

Results/Lessons Learned. The results of the study showed that laboratory treatability studies can be used to optimize all required parameters to maximize the treatment in the field. It is important to consider site specific requirements such as cure times and mixing methods in the laboratory testing in order to design a successful treatment. Portland cement was the most effective reagent. It was recommended that Portland cement solution be added as a slurry to a concentration of 10 percent by weight. A cure time of at least 14 days is required and the degree of mixing has an effect on the outcome so minimum mix times should be specified. The remedy was implemented as recommended and resulted in successful treatment with all soils passing TCLP.