RMRC

Recycled Materials Resource Center

THE UNIVERSITY of WISCONSIN MADISON

Research Project 50

Trace Metal Leaching from High Carbon Fly Ash Mixed Soils

Project Objectives

- Investigation of metal leaching in from fly ashes in highway bases and embankments.
- Identify the potential groundwater and soil vadose zone impacts
- Evaluation of the leaching potential of borrow materials mixed with HCFAs relative to those stabilized with conventional additives

Project Summary

Due to the increasingly stringent environmental policy stipulated by the Environmental Protection Agency (EPA) and/or local authority, the power generation industry must take measures to reduce the emission of nitrogen oxides (NOx), sulfur oxides (SOx), and Mercury (Hg). Low-NOx burners reduced emissions by changing the combustion characteristics of coal boilers, but increased the amount of residual unburned carbon in ash. Additionally, activated carbon is injected to reduce mercury emission, which also increases the carbon level in fly ash. In 2002, approximately 76.5 million tons of fly ash was produced in the U.S. and about 49.8 million tons of that was placed in landfills, resulting in significant land purchase and energy costs, and potential environmental issues. Simultaneously, most of highways in the United States were built in 1950s and 1960's and have deteriorated significantly to date. More than 96 percent of the current highways consist of asphalt pavements. Quarrying virgin aggregates for highway construction also results in environmental problems and energy consumption. An alternative to quarrying virgin materials is in-place recycling of asphalt pavement. However, there are concerns on the load-carrying capacity and deformability of a base layer made of RPM. Cementitious high carbon fly ash (CHCFA) has self-hardening properties in the presence of moisture, like the property of Class C fly ash. However, the high carbon content in CHCFA eliminates CHCFA from being used in concrete, because the carbon in fly ash absorbs the air entraining admixture in concrete, affecting the durability of concrete. Unlike concrete which 3 needs air void (generally 6%), air void is not desired in a base course of an asphalt pavement. A base course with maximum density and minimal air void lasts longer than a loose base course. Therefore, the high carbon content in CHCFA presumably does not affect the performance of a base course. Stabilization of RPM with CHCFA could create a strong base course, which improves the long-term performance of asphalt pavement and beneficially utilizes the high carbon fly ash, which would otherwise be landfilled. Our goal was to test this hypothesis.

Project Partners

University of Maryland Department of Civil and Environmental Engineering

End Products

An increase in fly ash content increases the pH values of the soil. Five metals (Arsenic, Aluminum, Chromium, Boron and Selenium) had concentration increases with fly ash amount. The concentrations of Al, B, Cr, Mn and Se metals begin to stabilize after 10 – 15 pore volumes of flows. Only As metals showed lagged flush response. Cr concentrations are far below the EPA MCL limit upon reaching ground water. Therefore, according to WiscLEACH results, using fly ash as a soil amendment in embankment construction is safe when it is used at reasonable percentages.

Further Information

The Recycled Materials Resource Center (RMRC) is a national center that promotes the appropriate use of recycled materials in the highway environment. It focuses on the long-term performance and environmental implications of using recycled materials

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