

ENVIRONMENTAL BENEFITS OF FLOWABLE SLURRY INCORPORATING INDUSTRIAL AND POST-CONSUMER BY-PRODUCTS

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ABSTRACT

This project was conducted to evaluate the environmental impact of use of Controlled Low Strength Materials (CLSM) incorporating industrial by-products (coal and wood fly ash, and used foundry sand) and post-consumer by-products (plastics, crushed glass, and on-site excavated materials) on green house gases. Different flowable fly ash slurry reference mixtures were proportioned for strength levels in the range of 0.3 to 0.7 MPa (50 to 100 psi), at 28 days, using various sources of ASTM Class F and clean coal fly ashes. For each reference mixture, other mixtures were proportioned using various by-products (e.g., foundry sand as a replacement of fly ash in the range of 30 to 85 percent).

The ingredients of the slurry mixtures, such as fly ash, used foundry sand, crushed glass, etc., were tested for their physical and chemical properties, and leachate characteristics. All CLSM mixtures made with and without by-products were evaluated for settlement, setting and hardening characteristics, compressive strength, permeability, and leachate characteristics. The leachate results of these CLSM-making materials were below the Enforcement Standard of the Wisconsin Department of Natural Resources (WDNR) Groundwater Quality Standard. They also met practically all the parameters of the Drinking Water Standards (DWS). The use of coal fly ash and used foundry sand in flowable CLSM mixtures provided favorable environmental impact in terms of reduction of green house gases as well as maintaining drinking water and ground water quality standards.

Generally, the compressive strength of the flowable slurry materials increased with age. It was found to vary between 0.3 and 0.7 MPa (50 to 100 psi) for the mixtures tested at 28 days. The leachate results of all the CLSM mixtures made with and without foundry sand were below the Enforcement Standard, and they also met practically all the parameters of the Drinking Water Standards. Generally, addition of the foundry sand caused substantial reduction in concentration of the elements that are considered hazardous in accordance with WDNR Groundwater Quality Standard. Therefore, the use of by-products would provide favorable environmental impact.