

Summary of Reports on Leachability of Trace Metal Elements from EcoSmart™ Concrete

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With the increasing use of fly ash in concrete, there are general concerns raised regarding the contamination of the surface and ground water by the leaching of trace minerals from fly ash. The two papers referenced below present results of investigations on the leaching of trace minerals from a number of fly ashes from Canadian and US sources, as well as from concretes incorporating these fly ashes.

The leachability of the fly ashes was determined according to the Environmental Protection Agency (USA) Testing Method 1311 – Toxicity Characteristic Leaching Procedure (TCLP). Different leaching conditions were simulated, such as column leaching testes to model wetting and drying and batch-leaching tests using synthetic acid rain as leachant.

The test results show that the concentrations of all regulated elements Ag, As, B, Ba, Cd, Cr, Cu, Hg, Pb, and Se in the leachates from the nine fly ashes tested were within the limits of the EPA (USA) and the Transportation of Dangerous Goods Act Regulations of Canada. Elements such as As, B, Ni, and Se appeared to leach more when their content in fly ash was higher. In general, the concentration of As in the leachate from fly ash derived from bituminous coals was found to be higher than that from the fly ashes originating from lignite or sub-bituminous coals.

In the TCLP regulatory leaching test, the trace metals found in the leachates from the fly ash concrete samples were within the regulated concentration limits set by the EPA (USA) and the Transportation of Dangerous Goods Act regulations of Canada. These results were true, regardless of the following factors: type and percentage of the fly ash used, w/cm of the concrete, and curing conditions. The results of the batch- and column leaching tests indicated that the levels of leached trace metals were well below the regulatory levels for the leachate quality criteria. Therefore, it is concluded that the concretes incorporating fly ashes do not pose a threat to the environment in terms of leaching of trace minerals into surface and ground water.

1. Zhang, M. H., Blanchette, M., and Malhotra, V. M., "***Leachability of Trace Metal Elements from Fly Ashes and Concrete Incorporating the Fly Ashes,***" Fly Ash, Silica Fume, Slag, and Natural Pozzolans in Concrete, ACI Special Publication SP-199, July 2001, pp. 1-28.
2. Zhang, M. H., Blanchette, M., and Malhotra, V. M., "***Leachability of Trace Metal Elements from Fly Ash Concrete: Results from Column-Leaching and Batch-Leaching Tests,***" ACI Materials Journal, March-April 2001, pp. 126-136.