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**Assessment of Environmental Risk from Israeli Fly Ash Utilized as
Structural Fill in Road Embankment using LeachXS-ORCHESTRA**

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Abstract

The characterization of release of substances from coal combustion residues has been evaluated for Israeli coal fly ashes using the new characterization leaching tests adopted in CEN (European Standardisation Body) and US-EPA (SW 846). These methods coupled with sophisticated geochemical speciation modelling form a powerful tool in assessing potential risk of coal fly ash use in beneficial applications. Such applications include use in road base, use in embankments and possible use as soil amendment.

The Israeli ashes are compared with data available in the LeachXS database, which includes data from earlier work on Israeli coal fly ash, data from field studies in Israel and data on a lysimeter studies from Denmark, which illustrate many similarities in release behaviour for a range of substances. The geochemical speciation modelling of Israeli coal fly ashes is described using the pH dependence test (CEN/TS 14429) as a starting point, followed by the modelling of a laboratory column leaching test (CEN/TS 14405). Geochemical speciation modelling and reactive transport forms the basis for prediction of long term release behaviour. Inclusion of chemical partitioning of elements between different chemical binding forms and species in solution allows assessment under a range of chemical (e.g., redox, pH) and flow (e.g., percolation, diffusion) conditions.

This laboratory information is subsequently used to address the release behaviour of selected substances in practice taking into consideration changes in chemical conditions in an embankment. The comparison with field data has shown the suitability of the percolation test in combination with the pH dependence leaching test for prediction purposes. An emphasis is placed on the role of mildly reducing conditions on the conversion of chromate in Cr (III) and the conditions that are needed to favour that conversion.

For geochemical speciation and chemical reaction/transport, the modelling framework ORCHESTRA (Objects Representing CHEmical Speciation and TRANsport models) is used, which includes thermodynamic stability data for minerals and other solubility controlling parameters such as binding to Fe-oxide, Al-oxide, dissolved organic carbon and particulate organic matter. ORCHESTRA has been integrated within a database/expert system (LeachXS) developed to facilitate data retrieval, test comparison, geochemical modelling and scenario evaluation.