

**International Workshop on
Environmental Aspects of Coal Ash Utilization**

Tel Aviv, Israel
December 15th – 16th 2009

Appendix to platform discussions on infrastructures and agriculture:

Application-dependent maximum values for leachable trace elements in coal ash

The discussion below is based on values obtained in laboratory analyses performed by the Israeli elution method which is equivalent to procedure EN 12457-2

Background

- Bottom ash stands the criteria for “inert” materials, based on the European Landfill Directive.¹
- Fly ash is classified as “non-hazardous” according to the EWC². According to the results of leaching tests of industrial powdered fly ash (random sample) by the Israeli version of elution method EN 12457-2, the concentration of certain elements (mg/kg dry substance, L/S=10) exceed the maximum values in the category of “inert” materials.³
- The leaching of pollutants depends on the way the ash is exposed to the environment:
 - In road construction fly ash behaves as a monolith impervious to water – the leaching of trace elements from it is negligible and it is in compliance with the category of “inert” in the European directive.
 - In structural infrastructures, the extent of water permeability is not uniform and can be relatively high, causing a rather high level of leaching.
 - If fly ash is applied on soil and mixed with it (e.g. in constructural and agricultural applications), the ash comes in intimate contact with the soil, although the amount per soil volume unit is relatively low.
- The uptake of trace elements, the source of which is in coal ash, by plants that are grown on growth media or soils containing coal ash, is negligible and in any case considerably lower than the levels permitted in foodstuff.

Existing maximum values – “useable” criterion

- The maximum allowed values⁴ (i.e., maximum concentrations) in leachates obtained in accordance with the TCLP testing process (method 1311) of the USEPA and the criteria specified in USEPA regulations for non-hazardous wastes – part of RCRA, were determined on the basis of the following “rules of thumb” with supplementary precaution as a “security factor”:

¹ [Leaching limit values](#) for waste acceptable at landfills for inert waste

² Coal ash in [European Waste Catalogue](#). For full catalogue click [here](#).

³ Arsenic (maximum deviation of 0.9 above the permitted value), Barium (max. dev. 62.25), Cadmium (max. dev. 0.036), Chromium (max. dev. 5.2), Nickel (max. dev. 0.65), Molybdenum (max. dev. 7.7), Antimony (max. dev. 0.1), Selenium (max. dev. 0.26). The last three also deviate from the category of “non-hazardous” materials.

⁴ List of maximum values in the “[useable ash](#)” criterion.

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- Reasonable values, taking into consideration the disparities between the threshold values for hazardous materials and the average values found in leachates of the ash of coals imported to Israel
- Maintaining an order of magnitude difference between the threshold value for hazardous materials and the maximum value, when the above disparities allow for it. Half of the threshold value for hazardous materials and no more than 70% of it, when these disparities are too small to enable an order of magnitude difference.
- Twice the maximum value found in the leachates of ash in studies performed on ash for elements that are not included in the EPA hazardous waste standards.
- In coal from a given source, an excess of up to 20% above the maximum permitted values is allowed for no more than two metals in ash, not including selenium, with the authorization of the chief scientist of the Ministry of Environmental Protection.

Subjects for discussion

- Determining maximum values of elements in leachates, bearing in mind the inverse relation between the risks from leaching and the amount of leachate in paving and in other fill applications.
- The Keren forecast formula for the leaching of pollutants from fly ash by water in contact with soil, as dependent on the soil's components.

Proposed maximum values – “Designated use” criteria

- The values⁵ (i.e. concentrations) in leachates obtained according to the Israeli version of the elution method EN 12457-2, will be determined on the basis of the following principles:
- **Use as structural filler in road paving according to the specifications of the Israel National Roads Company or similar specifications:**
 - 70% of the maximum allowed value for the definition of a material as nonhazardous according to the European criterion (ENH).
 - An exception of the above limit will be permitted up to the ENH, if conditions (climate, soil and groundwater) that prevail in the area of use permit it, conditioned on the approval of the Water Authority.
- **Other fill applications:**
 - The existing “rules of thumb” will remain in effect without change, adjusted to the ENH standards.
- **Stabilization and improvement of soil (agriculture and infrastructure):**

⁵ List of maximum values in the [new “useable ash”](#) criteria.

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- The percentage of the ENH maximum values will be site specific and will depend on the percentage of clay in the soil, as detailed in the platforms for discussion on the environmental conditions for the application of coal ash in agriculture and in infrastructures and road paving.