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Scientific background for proposed regulatoy protocols

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Abstract

The European directive sets conditions for landfill disposal assuming the landfill is exposed to rain water, either through runoff over its surface, percolation through it or capillary rise from the soil under the landfill. The behavior of coal ash under the conditions that characterize its applications in soils (structural filler in roads infrastructure; improvement of structure of soils for agricultural and conservation purposes; stabilization of sewage sludge used as a supplement to agricultural soils) is fundamentally different from its expected behavior as a filler in a landfill as per the definitions of the directive. Consequently, the results of the tests prescribed by the directive do not reflect the anticipated situation when the ash is used for soil applications.

The most significant differences are as follows:

1. Mode of application

The directive assumes a massive, regular fill exposed to the environment, whereas the applications of ash in soils or as road infrastructure are characterized by its insulation from the environment and by different conditions from those that the directive envisioned. This is mainly due to the dispersion of the ash and its mixing with the soil in various proportions in applications in agriculture and infrastructure stabilization.

2. Coal ash aging

The directive assumes extraction of chemical elements under unchanging conditions, whereas the extractability of elements from coal ash actually varies over time as a result of chemical processes that occur on the ash's surface.

3. Environmental characteristics

Hydraulic conductivity – The directive assumes an unchanging contact between the ash and its surroundings as well as infiltration of water through the coal ash layer, whereas the exposure of coal ash to the environment (water and carbon dioxide dissolved in water) in road applications following compaction results in an impermeable layer to water.

Acidity – The directive assumes that the pH level will rise due to the addition of the coal ash, whereas the pH in the soil following ash applications is (after a relatively short time for adjustment) at the range of 8 (the soil serves as a buffer that keeps the pH level close to neutral as well as the chemical reaction taking place between calcium hydroxide and the dissolved carbon dioxide).

Reaction with soil constituents – The directive assumes an unhindered transport of solutes to groundwater, whereas following contact of the soil with the added coal ash, various interaction processes between dissolved elements and soil constituents occur, depending on the characteristics of the soil.

Therefore, the above environmental factors should be taken into account in setting criteria for using coal ash as structural filler in roads infrastructure, improvement of soil structure in agricultural and conservation purposes and application of stabilized sewage sludge (by using coal ash) in agricultural soils.