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Trace elements in Israeli coal ash and its leachates

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Abstract

To support wide scale utilization of coal ash produced in Israel, particularly as a fill material in earth works, the Israel Electric Corporation has collected for more than twenty years data necessary for chemical characterization of coal ash, focusing on the components that may affect the soil and water environment. In Israeli power stations, only bituminous coal is burnt, so the ash chemical composition fits that of a siliceous pozzolanic fly ash. With regard to major elements, fly ash contains mainly oxides of silica, aluminum and iron, which together form more than 90% of the ash weight. For part of the coal sources, the calcium content can be also significant. The mineralogy of Israeli fly ash is characterized by a dominant amorphous alumino-silicate phase (glass) and lower amounts of crystalline phases (mullite and quartz). When ash is leached by water, leachable trace elements concentrations are affected by pH (alkaline) and the speciation of these elements in the ash.

According to the operations permits of the power stations "Orot Rabin" in Hadera and "Rutenberg" in Ashkelon, the Israel Electric Corporation conducts a follow-up of the concentrations of sixteen trace elements and three radionuclides in representative samples of coal, fly ash and bottom ash, collected every six months. Since 1998, this quality monitoring includes also the analysis of the fly ash samples by the leaching test of the USEPA, called Toxicity Characteristic Leaching Procedure – TCLP. The results of the quality monitoring show that the trace elements concentrations in coal ash are low, and fit the concentration ranges in soils (except boron). In view of the TCLP results for the period 7/98 - 6/12, for all trace elements, all fly ash produced by Israeli power stations can be classified as "utilizable by-product". The environmental specifications imposed on the import of new sources of coal ensure that the ash environmental quality will not be impaired in the future. More recently the low water pollution potential of Israeli fly ash was confirmed using other leaching tests performed under conditions closer to the natural ones, for example EN-12457/2, used by the European Union for characterizing the environmental risk of wastes.