

Pollution potential of groundwater by Boron leached from fine coal bottom ash (FBA) on groundwater

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The present summary tries to evaluate the amount of FBA that can be used in fills without causing any harm to the environment. It is based mainly on the reports of M. Ben-Hur (2000), Y. Deutsch (2001) and R. Keren (2001).

Leachates from bottom ash in general and even from FBA in particular (grain size less than 1 mm) have very low concentrations of most of the toxic elements (less than those allowed for drinking water). Boron is an exception and has concentrations in FBA leachates, which are similar or even higher than those of coal fly ash leachates. Boron is not a toxic element in drinking water but although it is a necessary nutrition element for plants, in concentrations of above 400 ppb in irrigation water it is toxic to some plants, especially citrus.

TCLP leaching experiments showed that some 15 mg of B were leached from 1 kg of FBA. The TCLP experiments are carried out on ground material and at a pH of around 6. Since B leachability is pH dependent and the pH of the mixture, distilled water – fine bottom ash, is ~9, we can expect that at most 5 mg B will be leached by rain from 1 kg of non-ground FBA. This leads us to 25 kg B leached from 5,000 tons of FBA. It should be stressed that this is an improbable worst case scenario.

Since B can be toxic only in irrigation water, we only have to consider the effect of this amount of B on active aquifers. An active aquifer (from which water is pumped for drinking and /or irrigation water) has to have at least a reservoir of 500,000 m³. This means that the B concentration in the aquifer would be 50 ppb per liter if all of the leachable B would be dissolved. Obviously, this is a schematic calculation (over estimation) because (1) the B adsorption by the soil in the vadose zone was neglected; and, 2) no calculation has been done for B absorption in the way to the aquifer or for the dilution due to replenishment or for T, the time needed for B enriched water to reach an active well.

Taking into consideration the exponential reduction in B leaching, it is clear that the B concentration in the leachate will be reduced at least by an order of magnitude already after one year of an average rainfall. We are speaking of a reduction by at least one order of magnitude.

In conclusion, it is possible to allow the use of up to 5,000 tons of FBA for fill use. To allow a new use of FBA in the same area one of the following conditions must apply: at least after 5 years or at least a distance of 5km from the area where FBA was first used.