

Use of ashes in a landfill covers

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Background

Incineration residues have been used for a long time and in many countries, e.g. Japan, USA, UK, Germany, Denmark, France, Finland, and India. Construction related applications (e.g. replacement for cement, grouting mixes, friction materials and mineral fillers in asphalt paving) are the most frequent types of re-use but also applications in agriculture and forestry are documented. In recent years, the re-use of ashes in landfill liner and cover constructions has come into focus as a substitute for natural materials as clay, soil or gravel (Kumar & Stewart, 2003; Nhan et al. 1996; Tham et al. 2005; Tham & Ifwer, 2006).

One of the incentives for using e.g. fly ashes in liners is, apart from favourable geotechnical properties of the fresh material, their capacity for chemical-mineralogical changes leading to the formation of clay-like structures. Zevenbergen et al. (1996, 1999) observed a rapid and wide spread formation of amorphous clay in an 8-10 year old coal fly ash resulting in higher a content of non-crystalline clay than in weathered 250 year old volcanic ash.

Alteration processes have been observed in a 20-year old ash deposit at the Tveta Landfill Site south of Stockholm, Sweden. Samples from four drill holes in the ash deposit have shown low water percolation due to diffusion processes by forming a monolithic structure (Sjöblom et al. 2004a/b). From a long term stability point of view it is of great interest to study the mechanisms behind the alteration processes and potential clay mineralization.

Research questions:

- What are the practical experiences from using ashes in landfill constructions?
- How do ashes in landfill constructions behave in the long-term?
- Can we expect a development of monolithic structures?
- If so, what factors and processes contribute to the formation of a monolithic structure?

Results and Conclusions

The ashes used for the construction of a landfill cover at the Tveta landfill derive from the combustion of wood-based fuels. They have very favourable properties for seal formation. The fresh fly ashes cure to a moderately deformable and watertight material after compaction. The curing processes can be modified by suitable combination of parameters to allow appropriate management of the material during the installation.

In 2002, the 20 years old ash deposit at Tveta was investigated by four drilling holes. The goal was to determine the hydraulic properties as a basis for predicting the environmental impact as well as mapping the chemical composition in order to quality assure the material for future

use for landfill covering purposes. In the course of the work it became apparent that ageing processes can make the material impermeable, and, moreover, that similar new material might be used as liners in landfill cover systems.

The most crucial aspect is probably the development over time. Available data and information indicate that the sealing improves with time. This is due to:

Hydratisation	≈ / > Day
Dissolution and precipitation of Al- and Si-containing oxides	≈ / > Month
Formation of clay minerals	≈ / > Year
Reduction of sulphate	≈ / > Decade

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