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Datum 10.05.1999
Hb/Fk-F 625
(f-625-kfe-hb.doc)

Abstract: "Leaching of environmental relevant compounds from cement-based building materials – assessment on the basis of modelling" - F625

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Before the background of an increasing awareness in the public and an increasing application of wastes in building materials, the emissions of environmentally relevant substances from cement-based materials and their impact on the environment have become an more and more important issue. Suitable and accepted concepts are still missing for a complete evaluation of the environmental compatibility.

In the frame of this research project calculations were performed in order to transfer the results from laboratory tests to practice conditions. For this purpose, different calculation models were used:

1. A diffusion model to calculate the emission of environmentally-relevant substances from the building material into the ground water/soil.
2. A groundwater flow and transport model in order to simulate the spreading of the released substances in groundwater and/or soil.

The calculations should elucidate the influence of different boundary conditions on the predicted concentrations of environmentally relevant substances leached from concrete in contact with slowly flowing ground water. Conventions for the assessment of the leaching behaviour of cement-based materials can be set on the basis of the results,.

Most of the parameters chosen for the calculations were worst case conditions. Therefore, the results don't reflect real conditions, but were selected to assess different types of concrete independent of local conditions. Following parameters were varied: type of concrete, dimensions of the building part, the distance from the building part and contact time with the building part, distance at which the concentrations can be averaged, velocity of the groundwater, groundwater downward gradient, temperature and retardation.

The results of the calculations show, that especially the groundwater velocity has an influence on the predicted concentrations. The groundwater velocity depends on the transmissivity and the downward gradient. Velocities smaller than 0,01 m/d had only a small influence on the predicted concentrations, while with higher velocities the concentrations decrease rapidly.

With an increasing size of the building part, the maximum of the concentrations does not increase, but the concentrations decrease less rapidly.

Small distances from the building part had only a very small influence, since the chosen groundwater velocities were very small. Therefore, for the assessment of the leaching behaviour, the concentrations can be averaged over a distance of 0-30 cm. In addition, the emissions should be averaged over a contact time of three months. The values resulting from this averaging should be compared with the limit values for groundwater.