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ABSTRACT

„Update of the assessment concept concerning the environmental compatibility of concrete“

F 7119

This project was a follow up to a project completed in 2019, which dealt with the revision of the DIBt's current assessment concept for the environmental compatibility of concrete. The motive for the previous project was the lowering of the insignificance thresholds for ground water (GFS) specified in 2004 for many environmentally relevant parameters by the Working Group on water issues of the Federal States and the Federal Government (LAWA) in 2016. Adopting the current GFS from 2016 in the currently valid assessment concept would mean that many standardized concretes would no longer meet the requirements. The revised concept without taking into account the interactions of leached substances with the soil would lead to a further reduction of the permissible release. However, it was shown that taking into account sorption by means of a K_d value calculated for a Dutch standard sandy soil by geochemical modeling would lead to an extreme increase in the permissible release. However, this K_d value is relatively high and therefore it does not appear suitable for a worst-case scenario. Therefore, in this project, minimum K_d values were determined according to the revised assessment concept which would be needed to reach a compliance with the requirements for standardized concretes.

The 95th percentiles of the release of the 16 elements regulated by LAWA were determined by evaluating the ibac's internal tank test database. Assuming diffusion-controlled release, simulations with varying K_d values were carried out. Then the functional relation between the quotient of the simulated groundwater concentration and the release E_{64d} in the tank test was determined. For each element the minimum K_d value required to comply with the GFS was determined using the quotient of the GFS and the 95th percentile of the release.

For modeling, the following differences to the current model were adopted from the previous project:

- The averaging of the concentrations at the point of compliance was carried out spatially over $2 \cdot 2 \cdot 2$ m^3. Alternatively, two further variants were calculated: an averaging over a volume of $1.5 \cdot 1.5 \cdot 1.5$ m^3 and the observation of the concentration at a point in a distance of 1.5 m from the building in the middle of its flow shadow.
- The conversion factor $f_P = 0.1$ considering the effective porosity of the soil has been omitted.
- The conversion factor $f_W = 0.3$ has been applied to take into account the more aggressive test conditions caused by the use of deionized water instead of groundwater.
- Using the transport simulations, the points in time at which the maximum concentrations occur within a period of 100 years after installation were determined. These concentrations, averaged within the defined volume, were used for the assessment.

For most of the elements a K_d value of 1 l/kg is sufficient in order to update the current assessment concept using the model from this project and the currently valid GFS from 2016. K_d values of up to 11.2 l/kg would be required for thallium. About 23 % higher K_d values are needed if concentrations are averaged over a volume of $1.5 \cdot 1.5 \cdot 1.5$ m^3 instead of $2 \cdot 2 \cdot 2$ m^3. If a point at a distance of 1.5 m is used as point of compliance, lower K_d values in comparison to averaging over a volume of $2 \cdot 2 \cdot 2$ m^3 would be sufficient (max. 21 % lower).