# Aquatic and terrestrial ecotoxicity as well as human toxicity characterisation factors for pesticide emissions to soil according to the methods USES-LCA and EDIP

Within the project ENDURE (European Network for the Durable Exploitation of crop protection strategies) financed by the EU sixth framework programme the LCA group of ART calculated characterisation factors for pesticides emitted to soil according to the methods USES-LCA (Huijbregts et al., 2000; Guinée et al., 2001) and EDIP 97 (Hauschild & Wenzel, 1998).

The active ingredients ecotoxicity, physico-chemical properties, partitioning coefficients and environmental degradation rates values were taken from the database of the German risk assessment tool SYNOPS[1] and the FOOTPRINT[2] Pesticide Properties Database (FOOTPRINT PPDB). The database of SYNOPS (Gutsche & Rossberg, 1997, Gutsche, 2004) was used as a reference and the FOOTPRINT PPDB to fill data gaps and as a reference for the active ingredients not included in SYNOPS. Both databases were used in versions from April 2008. The SYNOPS database includes about 360 active ingredients (a. i.). The monographs valid for the EU review process and data relative to the national legislation process are used preferably as data source. If both were not available, sources like pesticide manuals, IVA-Datasheets or publications specific for the active ingredient concerned were used. The FOOTPRINT PPDB holds data for more than 800 a.i.'s (FOOTPRINT, 2007), including all EU pesticides listed in Annex-1 and some metabolites. In priority also the monographs produced as part of the EU review process were used for the assembly. Both databases are continuously updated.

The characterisation factors according to USES-LCA were calculated using the tool provided by the method developers.

For EDIP a calculation tool is not available. The calculations were performed in EXCEL following the criteria described in Hauschild and Wenzel (1998). These criteria were adapted in order to improve the assessment, because for an initial emission to soil the original method takes into account only the volatilisation using a few simple rules to estimate the redistribution in the environment (ibid. p. 245). Pathways like run of or drainage were not included in the fate modelling. Applying these rules for nearly none of the a. i. an ecotoxicity potential for the water compartment and a human toxicity from water exists. Especially in life cycle assessments of agricultural production this might lead to an underestimation of the eco- and human toxicity potential. The characterisation factors for the aquatic system presented here were calculated as follows. In a first step the amount of a. i. in the soil water is estimated according to the original method. In a second step it is assumed, that a heavy precipitation might lead to a total replacement of the soil water and that in a drained soil the a. i. is leached into the surface water. The amount of a. i. which might be drained is used for a worst case calculation of the chronic ecotoxicity potentials for the water compartment and the human exposure via the water compartment.

The advantage of the characterisation factors presented here is that a uniform data source was used which increases the robustness of the results and strongly diminish

[1] http://nap.jki.bund.de/index.php?menuid=28
[2] http://www.eu-footprint.org/ppdb.html

the apparent inconsistencies between the assessment of pesticide application with both methods. It should contribute to a systematic assessment of eco- and human toxicity in agricultural LCAs. Nevertheless it should be mentioned that because of the continuously updating of both databases the factors have to be recalculated repeatedly and that the factors presented should only be used for agricultural processes to estimate the effects of pesticide applications in the frame of a LCA. Up to now only factors for an initial emission to soil were calculated. In a next step also other initial emission compartments should be included.

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FOOTPRINT (2007). The FOOTPRINT Pesticide Properties Database. Collated by the University of Hertfordshire as part of the EU-Funded FOOTPRINT project (FP6-SSP-022704). Http://www.eu-footprint.org/ppdb.html. Database version of 05/04/2008 subsection created specifically for the ENDURE network research project under licence. See also http://sitem.herts.ac.uk/aeru/footprint.

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