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CML ON ACTUAL VERSUS POTENTIAL RISKS

This letter is a reaction to De Oude's letter in the May issue. Up to now, toxic emissions have been assessed in LCA by the so-called critical volumes approach. Emissions were divided by a standard, a MAC or MIC. There are at least four relevant points of discussion.

1. Exposure is not included. A proposal to include partitioning, degradation, etc, will be made by us in a paper to appear shortly in *Chemosphere* (1).
2. MAC and MIC values include technical and economic considerations. It is feasible to use more toxicological data, such as the NOEC for ecosystems, the ADI for humans. More information can be found in the *Chemosphere* paper.
3. Different types of effects are added in the critical volumes approach. In our paper, we maintain the unweighted addition of effects. We hope that discussions among experts will lead to validation or to a better proposal.
4. It is impossible to base statements on toxicity in LCA on concentrations below the standard, be it MAC, NOEC or ADI. This is a difficult point, which is addressed below.

Assume that two methods of shaving are compared. The functional unit is one shaving activity. Method A is with a razor blade en method B involves an electric razor.. The life-cycle of method A includes the production of shaving cream. Assume this takes place in a small factory. The life-cycle of method B includes PVC production, which is assumed to take place in a large plant. A result of the LCA might be that method A is environmentally worse per functional unit than method B.

However, due to the large production volume of the PVC plant, the PVC process *in its actual extent* is worse than the shaving cream process *in its actual extent*. This aspect cannot be considered by LCA. LCA emission data are obtained by dividing annual emission amounts by the annual production. Hence, the operating *time* of the process has been divided out and the result is a number of emission loadings per amount of product. In LCA the volume of a specific process has, thus, become irrelevant. The process in its actual extent is only relevant for Environmental Impact Assessment (EIA) and Risk Assessment (RA). This is why an LCA cannot produce a statement in terms of actual risks.

We hope to have demonstrated that it is fundamentally impossible to perform an actual risk analysis within the framework of LCA. But what do the results represent? The results of a life-cycle impact assessment do not represent *actual* risks but *potential* risks. No one will die from the emissions for one shaving. But all tiny contributions of all activities together make the environmental problem.

LCA is not concerned with the degree to which a NOEC is actually *exceeded*, but with the degree to which it is potentially *filled up*. We still believe that the NOEC can be used as a suitable measure for the strength of a toxic substance in LCA. The exact form of the dose-response curve is essential for an *actual risk assessment*. Of course, the actual impacts, such as EIA and RA, are important as well and may never be replaced by LCA.

For the sake of harmonization, credibility and efficiency, LCA experts are obliged to use the knowledge gathered by environmental experts. In addition, they should find ways to adapt specific environmental models for application within the framework and conditions of LCA. These issues cannot be handled by LCA experts only. For example, the question of additivity of different (eco)toxic effects needs specific toxicological expertise. SETAC seems an appropriate platform for these types of discussions.

(1) Guinée, J.B. and R. Heijungs. A Proposal for the Classification of Toxic Substances within the Framework of Life-Cycle Assessment of Products. *Chemosphere* 26 (10) .....(in press).

R. Heijungs and J. Guinée. Centre of Environmental Science, Leiden University. P.O.Box 9518, 2300 RA Leiden, The Netherlands. Fax: +31-71-277.496.

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