

Improving human toxicity assessment for polycyclic aromatic hydrocarbons (PAHs) from primary aluminium production

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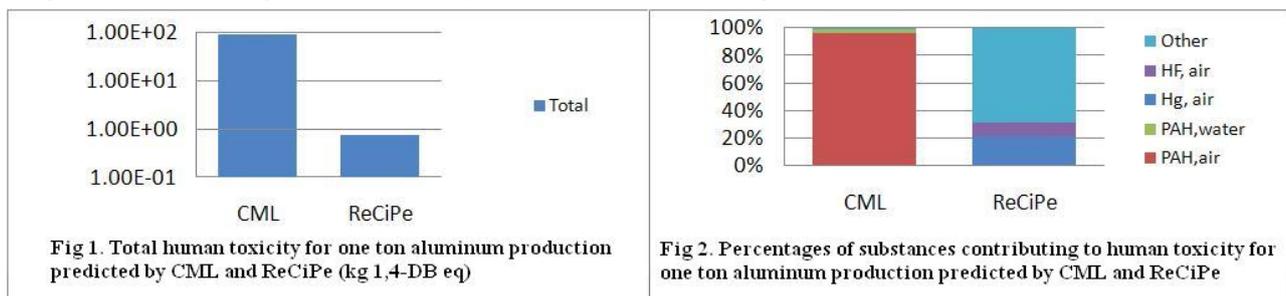
Life Cycle Assessments of aluminium products based on the University of Leiden Institute of Environmental Sciences method (CML, 2001) have previously identified primary aluminium outdoor emissions of Polycyclic Aromatic Hydrocarbons (PAHs) as the single most significant contributor to the environmental impact of aluminium products in the category “human toxicity”. However, the CML method has been superseded by ReCiPe, which is based on more up-to-date scientific knowledge. The study reported here compares the contribution of emissions of PAH on the human toxicity impact category predicted by these methods. It shows that both total human toxicity and the contribution of PAH exposure to this impact category are far lower than previously predicted by CML.

Methods compared

- CML (2001), based on the USES-LCA 1.0 model. <http://cml.leiden.edu/software/data-cmlia.html>
- ReCiPe (2009), based on USES-LCA 2.0 model. <http://www.lcia-recipe.net/>
- University of Michigan PAH specific study (2010), based on USEtox. <http://www.usetox.org/>

Overview of comparative PAHs impact results of CML and ReCiPe

Note logarithmic scale in fig.1. Human toxicity unit of measurement = kg 1,4 dichlorobenzene (1,4-DB) equivalent



- The PAH impacts are reduced by more than a factor of 10,000 in the new approach. The impact on human toxicity of the production of one ton of primary aluminum is reduced by a factor of 100 and is dominated by exposure to substances other than PAHs.
- In addition, a specific study based on USEtox and focusing on the latest scientific knowledge to determine the impacts of PAHs shows that these impacts could be even lower than those estimated by ReCiPe.

Conclusions

- The CML method over-emphasizes the impact of PAHs and has been superseded by methods based on more up-to-date scientific knowledge. Therefore, the results from CML cannot be used with full confidence.
- There are dramatic differences between the CML and ReCiPe methods, both in absolute characterization factors (in kg 1,4-DB eq/kg) and in the relative contributions of PAH emissions to the overall impact. This is mostly due to a more consistent method of comparison between carcinogenic and non-carcinogenic substances in the ReCiPe approach.

Recommendations

Since the ReCiPe and USEtox methods are based on more current scientific approaches, we recommend the use of ReCiPe and as an alternative the PAH specific estimates from USEtox, instead of CML.

Disclosure

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