

UNEP/SETAC Life Cycle Initiative

Progresses in Life Cycle Impact Assessment within the UNEP/SETAC Life Cycle Initiative

Olivier Jolliet^{1*}, Alain Dubreuil², Thomas Gloria³ and Michael Hauschild⁴

¹ Center for Risk Science and Communication, Department of Environmental Health Sciences, School of Public Health, University of Michigan, Ann Arbor, Michigan 48109, USA

² Natural Resources Canada, Ottawa, Ontario, Canada

³ Five Winds International, Newton, Massachusetts, USA

⁴ Department of Manufacturing Engineering and Management, Technical University of Denmark (DTU), Lyngby, Denmark

* Corresponding author (ojolliet@umich.edu)

DOI: <http://dx.doi.org/10.1065/lca2005.11.006>

The Life Cycle Impact Assessment (LCIA) programme aims at the enhancement of the availability of sound LCA data and methods and at guidance about their use. More specifically it aims 1) at establishing recommended methodologies and guidelines for the different impact categories, possibly consisting of sets of factors at midpoint and at damage level, 2) at making results and recommendations widely available for users through the creation of a worldwide accessible information system. This short paper reports on latest achievements in LCIA and next steps. More information is available on the LCIA corner of the Life Cycle Initiative at <http://www.netzwerk-lebenszyklusdaten.de/lciacorner>.

Process

Four Task Forces (TF) involve actively 67 scientists from 23 nations worldwide (24% Asia Pacific, Central and South America, 27% North America and 49% Europe). Most of the work is carried by e-mail and decision taken in conference calls to ensure worldwide participation. In addition next workgroup meetings will take place at the SETAC congresses in Baltimore in November 2005 and in The Hague in May 2006. We are grateful to all Task Force and Workgroup members for their voluntary involvement. Please contact the programme manager or the task force chairs if you want to get involve or if you are interested to become a TF agenda member.

LCIA Information System and Framework (TF1 chair: Tom Gloria)

Task Force 1 aims at developing an LCIA information system on the one hand and to finalize and extend the general framework on the other hand. *The priority is to provide industry and practitioners with clear guidance and easy access to recommended method and good practice.*

Latest achievements

– Easy access has been provided on line to the mostly used LCIA methods (under 'LCIA method information' at the above web address): TRACI, JAPANESE LCIA (LIME), EDIP, CML, ECOINDICATOR 99, IMPACT 2002, SWISS ECOFACTORS, JAPANESE ECOFACTOR, EPS, GERMAN EPA. A short description of each method with corresponding hyperlink is displayed, as well as a downloadable synthetic table that compares the main method specificities in each impact category at midpoint and damage levels. Other

method developers can contribute (open call on the website), if they provide the required inputs and under the conditions that methods are freely available, transparent, documented and covers a significant number of impact categories.

- A list of ideal characteristics and criteria to select impact assessment methodologies has been developed. It is now being applied to the acidification impact category in collaboration with the transboundary impacts Task Force (TF4). Preliminary results are to be presented at Baltimore and finalized in 2006.
- Of importance is the charge of identifying as far as possible the LCA relevant impact worldwide. Several tasks have been initiated: establishment of a process for consensus, ensuring participation from a broad geographical unit representation (as defined by SETAC), the establishment of a subgroup to draft preliminary position statement. Previous UNEP LCIA programme work will be used as a starting point, aided by previous work by governments to establish risk and sustainability priorities.
- Additionally, TF1 has initiated an effort to propose a consistent approach to geographical situation and time dependency as an interface between Life Cycle Inventory and LCIA. This will include a default generic situation defined at continental level and possibly national or regional differentiation. Central to this task is the definition of archetypes of delineation (e.g. areas with high-urban, medium and low-rural population density for impacts on human health). Archetypes will be developed for the impact categories where high spatial variations in characterization factors of at least a factor 2 to 10 are observed. A draft document has been completed and is now going to be reviewed by relevant LCI and LCIA experts.

Additional tasks include:

- Identification of generic starting points and assumptions for LCIA models.
- Establishment of website links to downloadable factors and models in midpoint and damage categories.
- Development of case studies with examples of good LCIA practice in collaboration with the LCI and LCM programmes. Here case studies will be developed in close relation to industry to demonstrate the usefulness and good LCIA practice in industrial decision making and to test methods. These case studies will also help ensuring consistency between the different task forces and with the other programmes of the Life Cycle Initiative.

Natural Resources and Land Use

(TF2 chairs: Alain Dubreuil, Claudia Peña as well as Lorenç Milà i Canals for land use)

Task Force 2 aims at establishing recommended practice and guidance for natural resources and land use categories. This resource impact category is especially crucial for developing countries, in which related impact categories such as water use and land use as well as salinisation, dessication and erosion are essential to contribute to avoiding relevant impacts. The task force has structured itself in subtasks on a) metallic and non-metallic minerals and energy carriers b) land use and c) freshwater use. *In this domain, the priority is to frame the field and to outreach for experts from other fields, involving participants of developing countries.*

Latest achievements

- The task force has co-organized sessions of the meeting on 'Sustainable Production, Use and Recycling of Natural Resources', Portland, Oregon, USA (SETAC world conference-November 2004). A selection of papers based on original work presented at the Portland Symposium has been peer reviewed and accepted for a special issue of the Int J LCA.
- A framework for land use treatment in LCIA has been drafted (see LCIA corner).
- A framework discussing mineral resources has also been drafted (see LCIA corner).

The main following tasks are foreseen:

- Define and publish current practice, clarifying potential, limitations and what is meant. Draft preparatory paper on a consistent framework for quantifying abiotic and biotic resource depletion based on dissipative use and disposal.
- Establish a consistent framework for freshwater use and land use.
- Pursue further integration of methods for minerals and energy carriers.
- Outreach to experts in land degradation/loss of biodiversity/water issues with the organisation of an expert workshop on land use in LCIA in spring 2006.

Toxic Impacts

(TF3 chairs: Michael Hauschild, Bill Adams)

Task Force 3 aims at establishing recommended practice and guidance for ecotoxicity, human toxicity and related categories with direct effects on human health (ionising radiation, accidents and noise). Photochemical smog and respiratory inorganics will be coordinated with TF 4. The task force has structured its work in a number of detailed subtasks enabling efficient progresses. It is planning a comprehensive comparison of existing characterisation models and other relevant environmental models based on their calculation of characterisation factors for a large substance database. *In this domain a significant step forward is required in term of putting all efforts in synergy to reach the required scientific quality. Guidance is required short term to help practitioner applying properly existing methods.*

Latest achievements

- Prepared Terms of Reference for a research collaboration with ICMM on ecotoxicological impacts of metals. Ap-

plications have been received and evaluated and a consortium selected in October 2005.

- Prepared report on findings of the Lausanne review workshop about 'Establishing a Framework for Life Cycle Toxicity Assessment' (see LCIA corner).
- Organized the 'Dose-Response Modeling Review Workshop' on human health, in Association with the 4th World Congress of the Society of Environmental Toxicology and Chemistry (SETAC), November 14, 2004 Portland Oregon in collaboration with USEPA.
- Planned model comparison project (1½ year duration) involving the most important existing characterization models and other fate-, exposure- and effect models for organic and inorganic chemicals.
- Announced post doc position to organize the model comparison on a part-time basis. Interested people can contact Michael Hauschild.

The main following tasks are foreseen:

- Publish paper on current practice for characterisation of toxic impacts, with guidance on use of current methods.
- Publish findings on Dose-Response Modeling Review Workshop in Portland.
- Prepare comparison workshops for toxicity factors in relation to SETAC congresses, involving scientists and industry worldwide, leading to guidance and recommendation on fate, exposure and effect modelling and related characterization factors.

Transboundary Impacts

(TF4 chairs: Norihiro Itsubo and José Potting, presently facilitated by Olivier Jolliet)

Task force 4 aims at establishing recommended practice and guidance for use in transboundary categories, i.e: climate change, ozone depletion, aquatic and terrestrial eutrophication and acidification. Photooxidant formation and respiratory inorganics (Primary and secondary particles) will be coordinated with Task Force 3.

Latest achievements

- Carried out initial description of impact pathways at mid-point with relation to damage for climate change, acidification, particulate matter, aquatic eutrophication, ozone layer depletion, photochemical ozone creation and terrestrial eutrophication.
- Defined and analyzed the state of the art on current practice in these different categories as a first basis for further recommendations.

The main following tasks are foreseen:

- Apply the criteria developed by TF1 to analyze the impact categories, starting with acidification.
- Establish guidelines and recommendations in classical categories discussing potential and limitation for practical applications.
- Prepare common workshop with the Integrated Assessment Models Community and with experts of the scientific network under the UNECE convention on Long-Range Transboundary Air Pollution. The aim of this workshop will be to explore the interfaces between LC(I)A and Integrated models and to get external input for recommended practice on the impact categories covered by the transboundary impacts task force.