

**Conference Reports: 8th Annual Meeting of SETAC-Europe**

# Interfaces in Environmental Chemistry and Toxicology: From the Global to the Molecular Level

Bordeaux, April 10-14, 1998

## SETAC Bordeaux – First Impressions from Down Under

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### 1 Introduction

For one week during April, about a thousand environmental scientists and managers gathered in the charming, old grey city of Bordeaux (in Southern France). During this week, Life Cycle Assessment was the subject of more than 40 conference papers and some 10 working group meetings. For me, having travelled 12,000 kilometres from Australia to attend, the conference provided an invaluable chance to participate in technical LCA exchange, an activity normally limited to postal correspondence: through the International Journal for LCA, the SETAC Newsletter or technical papers.

When the first of the LCA sessions started at Bordeaux with topics such as dynamic data modeling and the role of uncertainty, I knew the conference would be special and far removed from the standard introductory LCA presentations back home. This was precisely what we had all come for – expanding not just our own understanding of LCA but also contributing to the global body of knowledge in this important and rapidly developing field. After each session, questions followed spontaneously from the floor. There was never enough time. When the speakers stated their names, I gradually became familiar with the faces of the names I knew so well: Roland Clift, Helias Udo de Haes, Jeroen Guinée, Walter Klöpffer, Göran Finnveden, and so the list grew.

From early in the program, some dominant themes began to emerge. Some papers focused on quantitative developments whilst others were based on qualitative improvements in the use of LCA. These themes spanned both inventory and impact discussions, although it soon became clear that many of the impact assessment papers were influenced by the underlying pressure of an international standard still under development. Many scientists were falling into line with the need to deliver a quantitative approach to LCIA – one that was scientifically defensible and largely reproducible. In addition to methodological developments, the presentations included a large number of useful case studies tailored to specific applications of LCA, such as waste management or product improvement. Unfortunately, many of these are not covered in this brief summary of events.

### 2 LCA – Qualitative and Quantitative Progress

Patrick HOFSTETTER delivered a useful message early in the conference program on the role of values in LCA. With the help of a simple diagram showing three inclusive circles, he

represented the techno "sphere" as the centre circle, encompassed by the natural "sphere", encompassed by the "value" sphere. In this way, he stressed the overarching role of values in the assessment process and provided a simple link between the qualitative and quantitative themes of LCA-themes which continued to be explored in later papers.

Jeroen VAN DER SLUIJS from the University of Utrecht reported on the uncertainties associated with an "issue-driven" environmental science. He noted that over the past five years, despite the increasing attention paid to climate change, the uncertainties associated with attempting to quantify resultant impacts had increased. He saw uncertainty coming from inexactness and unreliability of data, and from ignorance generally.

Albert TUCKER from TNO in the Netherlands added constructively to this theme and drew his presentation to a conclusion with some recommendations for LCA-Valuation. "There exist multiple realities in accordance with the different actor groups that exist", he said. "All parties need to be involved and the final results should respect this". He proposed a multistakeholder approach involving sets of values to be incorporated in the final results.

Other discussions, as raised by Tomas EKVAL from the Chalmers Institute, Sweden contemplated the qualitative aspects of goal definition and inventory analysis. "The issue becomes one of problem structuring to meet decision makers needs", he said. "The question becomes one of how to motivate involvement in the decision making process and encourage ownership of results – decision maker engagement is vital, not just for goal and boundary definition, but for the usefulness of results". He also raised issues relating to the LCA practitioners' duty such as the power and role of LCA for informing and influencing decision making.

Dirk CEUTERICK from VITO presented an interesting trial of LCA application concerning ecological economic values developed by the European Commission's project ExternE. The VITO team conducted a useful comparison of ExternE values and the themes approach to assess the impact of electricity generation in Belgium. The paper concluded by acknowledging the value of LCIA in making inventory data more meaningful but noted that the scientific background of the themes approach for weighting different impacts is less transparent.

### 3 Quantitative Developments in LCIA

Some of the more quantitative approaches to developing LCA included a clever paper by G. FINNVEDEN from the University of Stockholm who reported on the use of exergy (useful energy) as a measure for abiotic depletion potential. His rationale firmly rested on the first law thermodynamics – that matter cannot be created or destroyed – and therefore, he argued, "energy is ultimately the limiting resource". Exergy, or in this case the energy required to return metal compounds back to their natural state, is a more precise measure of the environmental significance of abiotic depletion, he stated.

Bo WEIDEMA from the Technical University of Denmark examined the product system and dynamic modeling. He suggested that the question of product choice should involve not merely a comparison between product A and B. The appropriate course required an analysis of the increased demand for a product within the product system and the corresponding decreased demand associated with the alternate product system. According to WEIDEMA, such an analysis should account for marginal technologies giving consideration to the technological capacity and peak load.

Henrikke BAUMANN presented an intriguing tale of two companies that became "involved" in LCA and learnt the "hard way". BAUMANN considered that despite an original lack of direction in the companies' LCA goals, the benefits to each arising from the exercise of undertaking an LCA delivered positive, although somewhat unexpected, environmental and corporate outcomes.

FLUECKIGER of ETH, Switzerland compared the use of the environmental themes approach to LCIA – with and without the inclusion of metabolite modelling. The case study he used was an LCA for dry cleaners which he investigated for atmospheric releases of hydrocarbons and perchloroethylene. Some fascinating results showed that the inclusion of environmental chemistry through metabolite modeling significantly influenced the results of the impact assessment, thus reducing uncertainty. The study also highlighted the complexity of quantifying impacts.

A number of papers related to human toxicity potential. Anne WEGENER-SLEESWIJK from CML, Leiden University, presented new complexities involved in seeking to include multi-media emissions distribution as part of the toxicity assessment. This required the inclusion of 4 additional levels of data: emissions, fate, exposure and effects. Combining the 3 emission media of air, water and soil with the four distribution media provided 216 different equivalency factors per substance.

Edgar G. HERTWICH from Berkeley, Californian (also a partner in the fugacity study presented by JOLLIET) provided some useful conclusions from his work using Monte Carlo analysis techniques to examine uncertainty in human toxicity. These are:

1. the inclusion of fate and exposure modeling can reduce the level of uncertainty from 5-6 to 1-2 orders of magnitude,

2. further resolution offered by geographical differentiation is low,
3. the effect of the variability of exposure parameters is significant.

Mark HUIJBREGTS from the University of Amsterdam reported on some useful advice on the handling of uncertainty in LCA. He assigned uncertainty distributions to a range of recorded data with an LCA case study. A useful insight was provided as he presented the inventory data in chart format, along with their respective uncertainty.

### 4 General Hotspots

#### 4.1 Site Factors

It was pointed out by Sarah COWELL from CES at Surrey that location dependent aspects such as electricity mix and transport are included most studies but not the influence of the location concerning environmental aspects, and that issues such as water flow and background cumulative loads may be of greater significance to the impact assessment. The case study used by COWELL to demonstrate the influence of the location of production on LCA results concerned agricultural production.

Michael HAUSCHILD presented a method for the modification of linear characterisation to reflect site-specific variations. He noted that the site-specific factor, currently inherent in the themes approach, could be regarded as "1". The factor could be varied according to site-specific parameters such as fate and exposure or background concentrations. The approach is less applicable if the characterisation proceeds to endpoints.

#### 4.2 Land-Use

Erwin LINDEIJER of IVAM presented a methodology to quantify land-use effects in which the key variables of land occupation and net change in land quality are measured assuming a generic global model. This topic was particularly popular and was followed up by a workshop session.

The dominant thinking during the session favoured the use of quantitative measures such as net primary production, period of occupation (including for rehabilitation) and species-diversity indicators. Many researchers, however, remained unconvinced of the usefulness of a world model for land-use impact assessment with respect to the spatial variability of ecological systems. There was general agreement that, as always, the approach should be dependant on the intended end use of the study. Similarly, there was general agreement that LCA for **product comparison** calls for a quantitative approach while LCA for **decision support** allows the inclusion of more qualitative fields of information to support the land use assessment.

In addition to this stimulating and challenging scientific programme, the conference organisers also managed to squeeze in a range of cultural activities which gave us all a small taste of the Bordeaux and left us "thirsting" to return!