Working Paper No. 5
Notes Regarding LCI Substance Definition
(Environmental Interventions to be Tracked)

Introduction

An LCA study goal and scope definition will provide a basis for defining the system boundary. The system boundary will then dictate the life cycle stages, the unit processes within the stages, the time frame and geographic area to be considered. In addition, the environmental interventions (substances) to be included are also defined. All these elements are important, interdependent and a function of the defined LCA system boundary. The discussion that follows outlines the problem and related issues associated with defining a list of relevant interventions as well as possible approaches for developing such a list.

The Problem

In an ideal world all environmental flows (interventions) are probably important. From a practical standpoint, however, time and money limit LCI and LCA studies and there is usually a need to simplify what substances (interventions) will ultimately be tracked.

The project we are undertaking is a life cycle inventory (LCI) of various materials, products and related transformation processes; not a life cycle impact assessment (LCIA) study. That is, we are not characterizing, normalizing or evaluating any of the data in an attempt to add a level of interpretation to the inventory data. Once completed, our inventory is to become a "public good" for all to use in various, and unknown, tools and LCA capacities. Without knowing the goal and scope of these downstream tools and LCA studies and their underlying life cycle impact assessment (LCIA) method(s), we are at a loss to adequately distinguish what are "relevant" substances from "irrelevant" substances. That is, without full knowledge of the LCIA method (of which there are many with no one method clearly and formally accepted by all) we are unable to "reverse engineer" a list of relevant substances (interventions). So if we do not know precisely how the environmental impact of the interventions will be determined, there is no methodological basis for excluding any intervention from the inventory (Braunschweig, 1996)[1].

We also do not know the full array of unit processes and products to be included in the inventory, nor do we know the cut-off decision rules for ancillary materials. Different processes and products lead to different interventions. So for us to suggest a list of interventions without understanding the full range of what we are dealing with is premature, but we nevertheless have to agree on an approach to resolve the problem in the context of a protocol.

Different Possible Approaches

Braunschweig sets out various ways to arrive at a "relevant" list of interventions. Much of what follows has been distilled from his discussion of basic approaches for developing relevant intervention lists.

Basic environmental issues approach: all interventions that add to an impact level (category issue) are by definition "relevant interventions". For example, Global Warming (GWP) is a topical issue for which relevant contributing interventions have been developed. The issue approach would then make all **GWP** contributing gases relevant interventions to be tracked.

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[1] Braunschweig, A. 1996. Relevant Environmental Interventions. In Life Cycle Assessment (LCA) – Quo vadis? S. Schaltegger (ed.) Basel, Switzerland pp69-78

Many LCIA methodologies have taken this tact and the SETAC "Code of Practice" mentions the following issues to be considered in an LCA:

- Resource depletion - biotic and abiotic;
- Various pollution types – global warming (GWP), ozone depletion(OD), acidification (AP) eutrophication (EP), photochemical ozone creation (POCP), human toxicity (Htox), ecological toxicity (Eco-tox); and
- Land use

While an issue based approach provides a ready palette for our inventory colours we have to realise that there is no formally recognised list of issues. Also, given the broad list of issues mentioned above it is doubtful whether any intervention would be cast aside – they all would be included. Hence we do not learn which interventions are relevant, but rather how to classify the complete inventory of interventions.

Legal/Policy based approach: it might be possible to build a list of relevant interventions based on all those interventions which are regulated in the US (e.g., EPA's criteria emissions list) – TEAM {{Might be a good area to get the EPA involved.}} The list might also be expanded to reflect topical issues captured within policy statements, but as yet have not been captured in a legal framework. Focus to remain environmental relevance rather than say health and safety for example.

Data availability approach: in the past, most LCA studies captured only the available process data. That is, whatever data was available was collected. These types of studies used a mass-balance or materials-balance approach whereby the flows in and out of the system would be summed to within some percentage of each other. The mass-balance would categorically state that the available inputs represent X% of all inputs to the system and the outputs represent Y% of the mass of all available inputs. This method requires considerable calculations for non-measured emissions (e.g., CO_2), but it allows each unit process to have a unique set of interventions – whether the interventions are relevant is another matter. If the listed interventions are not judged or assessed in some way than they are meaningless (e.g., CO).

These are the basic approaches. Braunschweig (1996) provides some more practical guidance on estimating and thus only collecting interventions of certain importance, but it presumes we know the goal and scope of the LCA and its underlying impact assessment method.

Summary

1. How do we move from a complete inventory list of substances to a relevant inventory of substances?
2. To do so effectively we must know the goal and scope of the LCA, all relevant unit processes, and the final impact assessment method. None of which we know at this time.