Combined Midpoint/endpoint impact assessment

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ABSTRACT

This paper presents the current state of the initial design phase of an integrated method that combines Eco-indicator 99 (endpoint) and the CML2001 (midpoint model) under the ReCiPe project, funded by the Dutch government. The operationalization of the method will start in 2003.

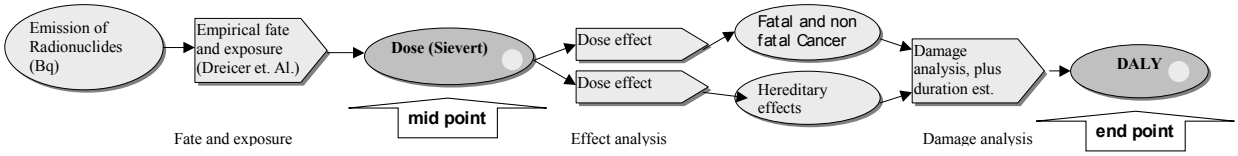

Fig 1 Simplified representation of the midpoint and endpoint approach for Ionising radiation. The Impact category indicator at the Midpoint level could (for instance) be the dose, expressed as Sievert, while the impact category indicator at the endpoint level, could be at the level of damage to human health expressed as DALY. The aim of this project is to have both indicators lie along the same environmental mechanism.

Introduction

This paper summarizes some of the initial results of the first phase of a project called "Aligning Eco-indicator 99 and LCA Guide 2001". The research has been made possible by funding by the by the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM). This phase of the project aims to describe how an integrated methodology for life cycle impact assessment (LCIA) can be developed, which can produce results at different steps in the effect chain, and hence at different levels of aggregation, as consistently as possible.

The project partners are:

- RIVM, the Dutch national institute for health and environment, developer and user of a wide range of environmental models
- CML, centre for environmental studies of Leiden University, responsible for the LCA 2 (midpoint) methodology [2]
- PRé Product ecology consultants, responsible for the development of the Eco-indicator 99 (endpoint) methodology [3]

During the project, an international scooping panel has reviewed the initial documents and provided a number of important comments.

Figure 1 gives a simplified representation of how midpoint and endpoint indicators could be placed along the mechanism for nuclear radiation. The dose is considered to be a midpoint indicator result, while the damage in terms of DALY is considered to be an endpoint indicator result.

Combining Midpoints and endpoints

Since the UNEP-EPA-CML workshop in Brighton [1], consensus has been growing about the desirability to combine midpoints and endpoint indicators in a uniform framework. This consensus can be clearly seen in the results of the SETAC Working Group on Impact Assessment (WIA) [4]. Few have however attempted to realize such an integrated structure in a well-designed way.
In order to make a really integrated structure we feel we must go beyond taking an endpoint method and add some midpoints or taking a midpoint model and add some endpoints. What is needed, is a framework where midpoints and endpoints support each other in providing useful information to the decision maker and his advisers:

- Category indicator results on the endpoint level can enhance the understanding of decision makers that want to interpret the midpoint indicator results. ISO requires that the link between the category indicators and the endpoints are described qualitatively. With the quantitative link we add more information than ISO requires (of course also qualitative information linking midpoints to other endpoints must still be supplied.)

- Category indicator results on the midpoint level can be very useful additional information for users that primary will use the endpoint level. For instance, it allows to understand better what is underneath an endpoint human health. It also allows the user to make its own judgment of the sometimes quite uncertain endpoint models, and to take into account endpoints that could not be properly modeled.

Real integration of Midpoints and Endpoint

Integrating two methods in such a way that they form a consistent framework in which the two levels support each other, requires solving a number of issues:

1. Choose midpoint and endpoint category indicators along the mechanism, in a consistent way
2. Build and apply a consistent framework for assumptions and model choices
3. Review the environmental mechanisms that link LCI results to the category indicator, and if available identify newer and better mechanisms that can be used for both methods

An important issue is the selection of the midpoint indicators; the position of the endpoint indicators is relatively clear, although also here some issues need to resolved.

Endpoint category indicators

In the Eco-indicator methods endpoints are Human Health, Ecosystem Quality and Resources. The new area of protection called: *life support system* as suggested in [4] is difficult to apply as an endpoint indicator result. We have not identified a quantifiable indicator with a unit for life support. We find that the midpoints are much better suited to express (but not quantify in a single score) the life support functions.

The review panel challenged us to explain on what basis we assume there are fewer endpoints then midpoints. For instance, Ecosystem Quality can be described with many different endpoints.

A more traditional challenge is the fact that some links to endpoints can become so uncertain that one wonders if the information is useful at all. An example of this is the climate change impact on human health.

Midpoint category indicators

Midpoints can be very useful to provide information to the stakeholders that do not want to use the sometimes quite uncertain endpoint indicator results. So the idea behind the integration of the method is that decision makers can base their judgment on the complete picture provided by the mid and endpoints.

This means that care must be taken to choose a proper level for the midpoint indicators. Ideally, they are on a place along the chain where the uncertainty is still low, while the indicator results provide environmentally relevant information for the users. So a midpoint too close to the inventory result (just using H+ equivalents) is less appropriate as an indicator that comprises a fate step first. The fate step does increase uncertainty, but provides additional information that is not too uncertain.

Consistency

In the new approach much attention must be paid to the consistency, especially regarding value choices. Important choices are of course:

- Marginal or average modeling: we propose marginal modeling for all impact categories, although this can be difficult, as for instance IPPC is based on average models
- The level of regional specification. The more detailed regions are specified the lower the uncertainty, but also the larger the practical difficulties
- The temporal scope, do we use discounting of future effects
- Level of scientific proof, what to do with very poorly documented effect chains
- Manageability: what to do with damages that can in principle be easily avoided with proper policies
- How to deal with positive effects?

Outlook

This paper is written at a time the project is not fully developed and many important decisions are about to be made. The results of the project will be published in a report early 2003.

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