Nordic Industrial Fund
center for innovation and commercial development

SYSTEMS AND METHODOLOGY FOR TYPE III ENVIRONMENTAL PRODUCT DECLARATION

Final draft report from the NIMBUS project

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Summary:

The NIMBUS project has developed a four page format for EPD based on an earlier Norwegian draft version. This format is proposed as a general format for Nordic companies, but without making the format mandatory for Type III EPDs.

Emneord:
- Environmental Product Declarations
- Nordic co-ordination
- Environmental Communication
- EPD Format

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CONTENT OF REPORT

Preface

This technical report is a result of the Nordic project on implementation of environmental product declarations in the business sector (NIMBUS). Nordic Industrial Fund, Industrial federations and the participating companies have funded the project. The duration of the project has been December 1999 to March 2001. Parallel to the NIMBUS project the Nordic Council of Ministers (NCM) have funded a project considering specific LCA aspects in relation to EPD. The NCM-project contributes with input to the NIMBUS project.

During the project a number of meetings has been held in the steering committee and the project group. National seminars have been held in Denmark and Norway and finally, an international seminar has been held in Copenhagen in February 2001.

The steering committee for the project has been:

- Bjørn Sveen, Norwegian Confederation of Business and Industry (NHO) - chairman
- Inger Strømdahl, Federation of Swedish Industries (SI)
- Sven-Olof Ryding, Swedish Environmental Management Council
- Tina Sternest, Confederation of Danish Industries (DI)
- Ole Jørgen Hanssen, Østfold Research Foundation (STØ)

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The participating companies has been:

- Erik Stoltenberg-Hansson, Norcem
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- Christian F.P. Justesen, Aalborg Portland
- Annegrete Holland, Unicon Beton
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1 Introduction

1.1 Aims of the report

The aim of the present report is to present and discuss different methodological aspects of environmental product declarations (EPD's) as well as possible organisation of a Nordic co-ordination system for EPD's. In this context products cover raw materials, final products as well as services. Therefore, the report presents different options for some of the important questions. The report acts as input to both the national and Nordic consensus processes concerning EPD.

The conclusions of the consensus process are presented in a short report "Nordic co-ordination system for environmental product declarations (type III)" (Hanssen *et al*., 2001). The development of a Nordic methodology has to be seen in the light of the overall goal in the "product oriented environmental strategy": to strengthen the competition between different producers based on eco-efficiency. This goal can be achieved by improving the access to supplier specific environmental data.

As the intention is to use EPD type III in purchasing processes in order to be able to compare products from different companies, the EPD methodology and format must fulfil the minimum requirements put forward in ISO 14040 for communications with external parties.

1.2 Guide to the reader

The report is structured in 9 chapters that can be read chronologically or they can be read with the purpose of studying a specific them in EPD methodology.

Chapter 2 presents the principles behind the Nordic co-operation on the development of EPD and the proposals for a co-ordinated system.

Chapter 3 presents the fundamental principles in organising an EPD system including methods and systems for certification of EPD's.

Chapter 4 presents the procedure to be applied in the development of Product Specific Requirements (PSR).

Chapter 5 presents and gives a more explicit formulation of the LCA methodology to be used when establishing the data presented in the EPD.

Chapter 6 presents the Nordic format of an EPD.

Chapter 7 presents the terms and definitions used throughout the report.

Chapter 8 presents references to relevant literature.

The individual themes are presented and discussed according to the following headlines:

- Description of the subject
- Guiding principles
- Important methodological aspects to be covered
- Proposed Nordic methodology/procedure

The "Nordic methodology" for environmental product declarations is based on the Swedish and Norwegian methodology as well as on ISO documents on LCA and EPD:

- Bestämmelser för certificerede miljövarudeklarationer, EPD (EPD^{TM}) (Miljöstyrningsrådet; 1999)
- Miljøvaredeklarasjoner type III. Forslag til etablering av norsk system, basert på forprosjekt med syv norske bedrifter (Hanssen *et al.*, 2000)

- Environmental product declarations and life cycle assessment methodology (Stranddorf *et al*., 2001)
- Environmental labels and declarations - Type III environmental declarations, ISO/TR 14025 (ISO, 2000a)
- Environmental management - Life cycle assessment, ISO 14040, 14041, 14042, 14043, 14048 (ISO, 1997; 1998; 2000b; 2000c)

2 The principles behind the Nordic co-operation in EPD development and proposals for a co-ordinated system

2.1 Description of the subject

The report from the pilot study of the NIMBUS project described several types of organisational structures for the EPD system (Møller *et al.*, 1997). The most important functions to be discussed are:

- EPD program owner
- Registration function
- Certification and accreditation
- Information and marketing.

Those functions could be organised at the Nordic level or the national level. If a national structure is chosen, it is relevant to discuss some kind of co-ordinating organisation at the Nordic level as well.

The organisation of a co-ordination system for EPD at the Nordic level cannot be isolated from a discussion about how similar functions are organised at a European or even a global level. It might be a wrong strategy to develop too strong regional organisations at the Nordic level, when most companies want their EPD's to be certified for a more global market.

There are three main approaches to establishing a Nordic co-ordination system for EPD Type III:

i) To establish one common system and organisation for the whole Nordic region.
ii) To establish national systems without any formalised co-ordination and collaboration between them.
iii) To establish national systems with a formalised Nordic co-ordinating body.

Three important issues in the discussion of if and how to establish a Nordic system for EPD Type III are as follows:

- Is it valuable to have a co-ordinating level beyond the national level?
- Is the Nordic region a natural unit for the establishing of such a co-ordinating level, or should it preferably be established at a wider level, i.e. the European level?
- Should a permanent co-ordinating body be established at a level above the national level, or should this be a more ad hoc solution, while waiting for a more global solution?

These questions will be briefly discussed in relation to the model being proposed as the end result of this project, and as an input to final discussions and decisions in the program developing organs.

2.2 The basic principles being proposed for a Nordic EPD Type III system

The discussions in the project have shown that there is a need for different types of functions being organised at different geographic levels regarding EPD Type III.

On one hand, it is very important to develop and market the EPD Type III system as a valuable alternative or supplement to traditional environmental communication systems for companies, and to make the tool known to those companies. This is better done at the national level than at an international level, indicating the need for national bodies. It is also better to develop and operate a system with approval of validating institutes at a national level, where more knowledge about capacity, experience and practise and knowledge in consulting companies exists.

On the other hand, it is very important to develop further EPD methodology, format and especially PSR's at a higher geographical level, to ensure that products from different producers and countries are

comparable on a common basis. This can only be done through harmonisation of EPD methodologies and PSR's for different product groups, independent of where they are produced. There is, thus, an obvious need for co-ordination and harmonisation between countries in further development and specification of the EPD system. This does, however, not indicate that co-ordination and harmonisation has to be done by a formalised, trans-national body.

It is also an important question whether the Nordic region is a natural unit for many of those companies and products that are relevant for being declared. A lot of large and medium sized Nordic companies have just as many economic relations to other countries in Europe, as to other Nordic countries. A Nordic system is thus too narrow in the long run for those companies, if they should be able to benefit from international collaboration about EPD certification and registration. For most Nordic countries a more ideal unit for collaboration would, thus, be EU. On the other hand, there are conditions within the Nordic region that makes it easier to collaborate within the region than with other regions being involved. Firstly, at least Denmark, Sweden and Norway have a more or less common language, which makes it easier to communicate. Secondly, the national laws and regulations are quite similar in this area, due to collaboration within the Nordic Council of Ministers. Thirdly, for many types of products, the Nordic market is a common market, where the neighbour country is the most important trade partner. Finally, the Nordic business sector is often more open to collaboration than companies in other regions in Europe, making it easier to test and improve systems like the EPD type III system.

One aspect to be discussed, is whether a potential common Nordic system should have a definite time frame, e.g. until a broader and more international system is available. A Nordic system with a given time limit could, thus, be a model for the broader systems, and eventually be developed into a European system and an ISO system later on. If this is a good strategy, it is important not to develop a large, rigid and formal system at the Nordic level, but instead establish a looser and mostly co-ordinating body on top of the national bodies.

It is proposed that the NIMBUS project should present a minimum level for what can be regarded as sufficient for validation or certification in the Nordic countries; see Figure 2.1. This means that different countries can choose different types of systems for validation and certification of EPD's as long as the minimum requirements are fulfilled. The minimum requirements are presented in Chapter 3.

Regarding validation and certification it must be a principle that when an EPD is approved in one country with a type III system, it is automatically valid in all other countries with type III systems. Similarly, when an institution is accredited or approved as competent to certify or approve EPD in one country, it is automatically approved as validating organisations in all other countries. These are very important principles for the EPD system if it should be effective over a larger geographical area. If a company finds it necessary to buy an accredited system or a simpler and cheaper system it will then be regulated by the market.

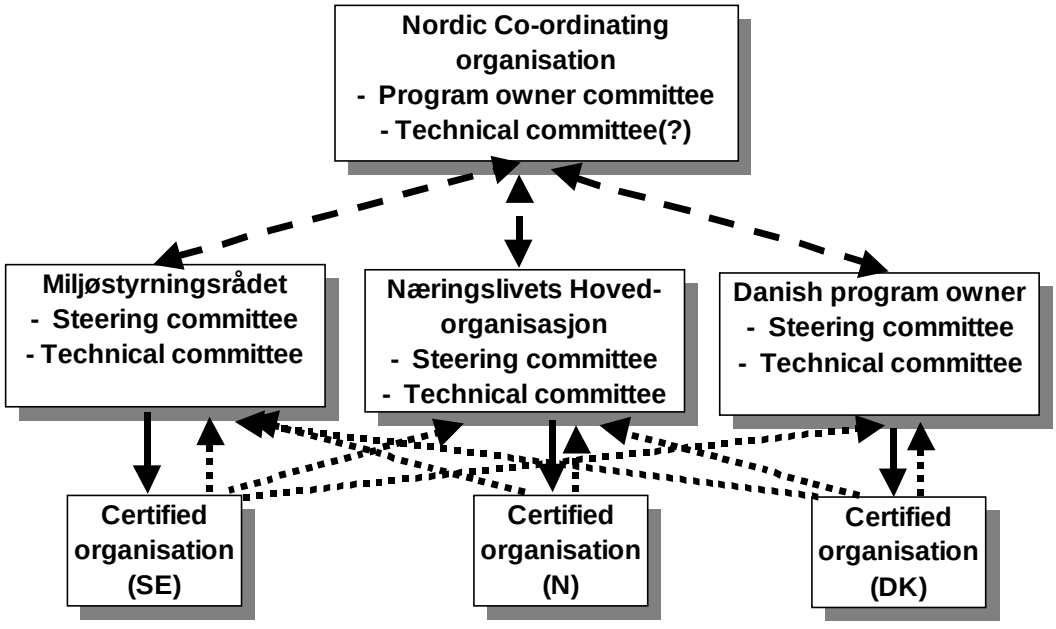


Figure 2.1
Principle model of the organisation of a Nordic Co-ordinating system for EPD.

3 Principles, methods and systems for the Certification of EPD

Chapter 3 presents the fundamental principles in certification and accredited certification of declarations in relation to a Nordic EPD system. Different options when organising a control/certification system are presented and pros and cons are discussed.

3.1 Description of the subject

Accreditation and certification may be components in the quality assurance procedure of an environmental product declaration programme. *Certification* is the procedure in which an independent organisation performs a verification of LCA data and certification of the system, i.e. certification of the declaration and presentation of data. *Accreditation* is the process of controlling the certification organisation/procedure. The certification organisation that has proved to be able to follow the prescribed procedures can get an accreditation. The organisation will be an *accredited certification organisation*.

The general principles in accreditation and certification are illustrated in Figure 3.1 by analogies to the procedures used in the certification of environmental management systems or the procedures used in environmental laboratories. The general principles in the certification procedure are described below in relation to environmental product declarations. The description is hypothetical, as "guidelines" only exist in Sweden for option I.

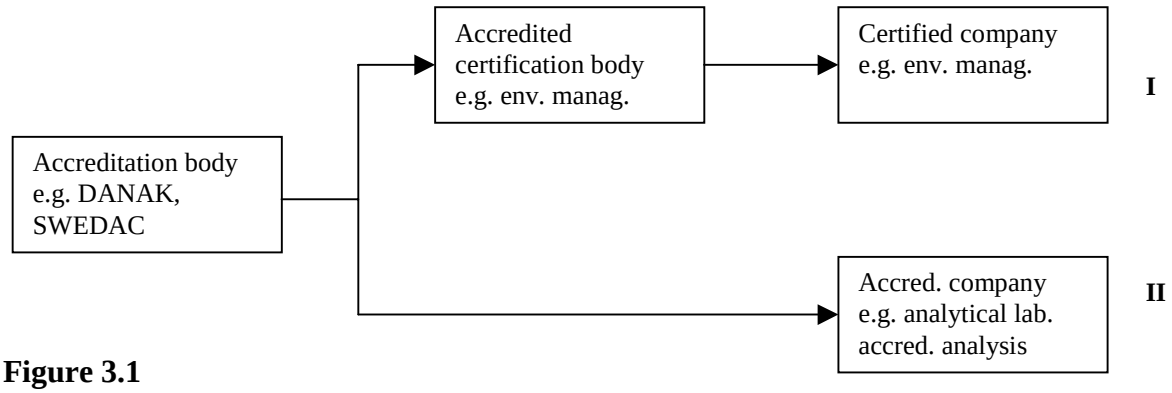


Figure 3.1
Fundamental principles in accreditation and certification.

I *The certification body* certifies the environmental product declaration. This procedure is similar to the accreditation of certification bodies involved in the certification/verification of environmental management systems (EMAS and ISO 14001).

II *The consultant is accredited to perform an LCA* and he/she guarantees that the LCA meet the requirements in ISO 14040-43. This procedure is similar to the accredited laboratory that carries out chemical analyses and guarantees that the analyses are made according to specific standards.

The independent validation i.e. the quality assurance procedure is important in order to achieve high reliability of the environmental declaration programme as well as the individual declaration. ISO TR 14025 includes certification and accreditation as optional possibilities. Regarding certification the technical report says: *"An organisation in charge of a Type III environmental declaration program may determine the requirements of the program as well as forms of verification. The act of certification of a Type III environmental declaration is the responsibility of the organisation. The certification of a Type III environmental declaration remains an option with the law and who may do it will be governed by law and by the need for credibility."* Regarding accreditation the technical report says: *"Whether or not accreditation is needed is a commercial and regulatory issue related to the practice itself. The development likely will occur within individual nations and further practice of this activity will determine its usefulness."*

Furthermore, ISO TR 14025 presents examples of the organisation of environmental product declaration programmes including a description of the roles of the different parties involved (see appendix A). The examples illustrate three different levels of environmental product declaration systems/programmes:

1. A programme with accredited certification and with independent review of the LCA.
2. A programme with certification and
   a) an independent review of the LCA,
   b) the same institution/person develop and review/certify the LCA/EPD.
3. A programme without certification but with independent review of the LCA.

The requirements to the independent (critical) review of the LCA are given in the ISO standard for LCA (ISO 14040). The ISO standard distinguishes between LCA for internal and external use, especially if comparative assertions are the goal of the LCA.

The following list presents possible solutions available, mentioned below by increasing degree of independency:

1. Development of LCA and EPD and verification by the same or another person within the company who owns the product.
2. Development of LCA and EPD and verification by the same person in an independent institution.
3. Development of LCA and EPD by one person and verification by another non-certified expert within the same independent institution.
4. Development of LCA and EPD by one person and verification by another non-certified person in another institution
5. Development of LCA and EPD by one person and verification by another certified person in an independent institution
6. Development of LCA and EPD by one person and verification by another accredited person in an independent institution.

The list is not intended to be exhaustive.

3.2 Guiding principles

The Nordic EPD system requires a certification system, firstly, to fulfil the requirements in ISO TR 14025 and secondly, to ensure high credibility among users of the EPD's. The certification in the Nordic EPD system has to follow these principles:

- Third party verification by an institution approved by the programme developer.
- Independence between the institution developing the EPD based on LCA and institution certifying the EPD.
- Certification body shall both verify that the LCA study conforms with the generic methodology and the PSR and that the EPD reflects the outcome of the LCA.
- EPD certified in one country will automatically be valid in all other participating countries.
- Institution/person approved of or accredited for certification by one country is automatically approved of by all other participating countries (at the same level of approvement).
- Specific requirements to knowledge and practise with LCA methodology in the certification body.
- An EPD can cover a group of products from the same producer and be certified for a group of products if the variety within the product group is less than xx% (specific procedures for each product should be defined in the PSR).

3.3 Proposed Nordic System for EPD certification

The most important aspects to be covered in details in the Nordic EPD methodology are:

- The overall set up of a quality assurance system
- The competence required by certification bodies/LCA experts
- The level of data certification - minimum requirements to review of LCA data
- The level of EPD certification

- The guideline on performing data control
- The guideline on performing system control

Existing technical reports like ISO TR 14025 and standards like ISO 14040-43 combined with national experience will be used in the development of the Nordic methodology framework for certification of environmental product declarations.

3.3.1 Overall set up of quality assurance system

The quality assurance system for a Nordic EPD system can either be based on one Nordic certification/accredited certification body or on individual national systems that meets a common agreed minimum level. The different options are presented for further discussion and they are illustrated in Figure 3.2 and Figure 3.3

In the process of development of a common Nordic methodology the level of control has not yet been defined. In a Nordic EPD system the following possibilities are identified:

1. Nordic certification/accredited certification body with an independent review of the LCA,
2. national certification/accredited certification bodies with an independent review of the LCA (see Figure 3.2),
3. national certification – the level of ambition of the control system may vary from country to country; the same institution/person may develop and review/certify the LCA/EPD (see Figure 3.3) or
4. no certification but with an independent review of the LCA

The options are not limited to the above mentioned as a number of variants of the four possibilities can be identified.

All the options are based on a common Nordic co-ordination body. The task of the co-ordination body is to ensure that the certification process in the participating countries no matter which certification system the individual country chooses or which level of ambition the participating countries choose for their national certification.

Nordic certification/accredited certification body
The presented system is based on *one* Nordic certification/accredited certification body. The Nordic certification body may be placed in one of the participating countries (head quarter) perhaps in combination with branches physically placed in each of the participating countries.

The decentralised branches must act according to one set of guidelines for the certification process. In the case of accreditation they may have to be accredited by the same accreditation body or at least according to the same accreditation guidelines. The certification body does not necessarily possess the relevant knowledge of LCA and therefore external LCA experts have to be involved in the certification process. Alternatively the Nordic certification body has to develop it’s own LCA expertise. This option depends on the agreed type and magnitude of the Nordic certification body.

The system based on one Nordic certification body ensures the same formal requirements to the documentation and the same level in the certification in all countries. The disadvantages are “the distance” to a certification body based in one of the other Nordic countries and the necessity of establishing a new Nordic certification body.

National certification/accredited certification bodies
The presented system (Figure 3.2) is based on *national* certification/accredited certification bodies.

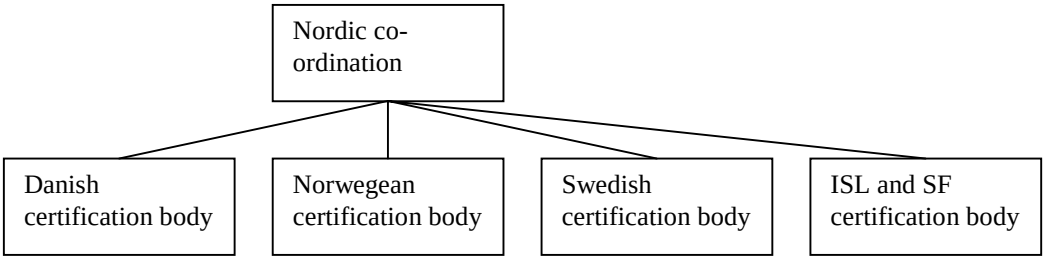


Figure 3.2
National certification/accredited certification bodies supervised by a Nordic co-ordination body. LCA experts support the certification bodies.

The certification procedures are co-ordinated by the Nordic co-ordination body. In the case of accreditation, national accreditation bodies accredit the individual certification body. The accreditation procedure follows the same accreditation guidelines. The certification body does not necessarily possess the relevant knowledge of LCA and therefore external LCA experts must be involved in the certification process.

This system requires a strong co-ordination between the Nordic organisation body and the individual certification body in order to ensure equal formal requirements to the documentation and the same level in the certification in all countries. The same requirements will meet the companies applying for certification of an EPD no matter in which country they apply, and there will be no competition between the individual certification bodies. The disadvantage is that all the Nordic countries have to agree on the same level of certification.

National certification bodies - various levels
The presented system (Figure 3.3) is based on *national* certification bodies. The certification procedures are determined at a national level. The certification body may be accredited.

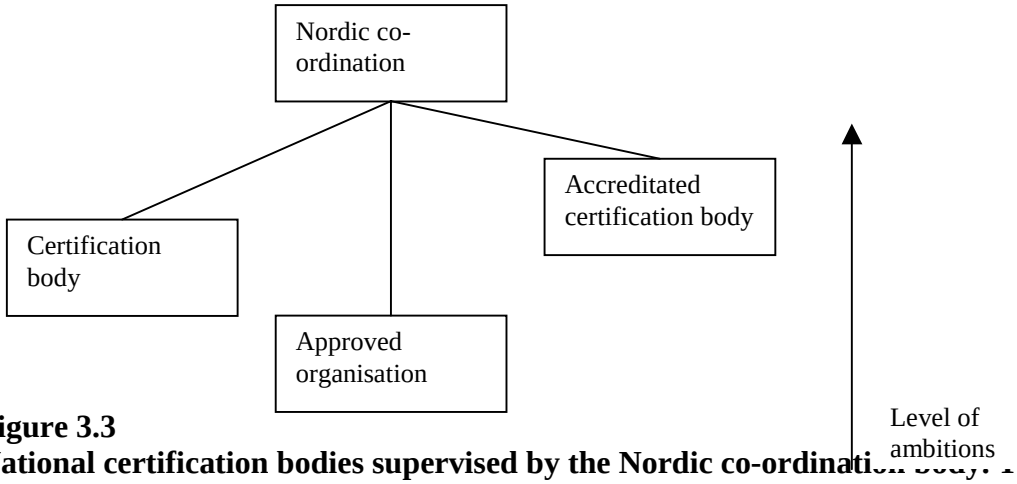


Figure 3.3
National certification bodies supervised by the Nordic co-ordination body. The level of ambitions may vary from country to country. LCA experts may support the certification bodies.

The Nordic co-ordination body defines the minimum requirements to the certification procedure and performs the control of the national bodies. The certification body does not necessarily possess the relevant knowledge of LCA and therefore external LCA experts may be involved in the certification process.

This system requires a co-ordination between the individual certification bodies performed by the Nordic co-ordination body. The individual country will be allowed to set up individual requirements to the level of certification. One of the conditions in a Nordic system is that EPD's approved or certified

in one country must be accepted in the other countries. This means that companies could be met by stronger requirements (e.g. accredited certification) if they apply in one country rather than in another country. The requirements to the certification will be reflected in the costs, which means that the companies will look for certification in countries where the requirements to the certification are less restrictive. The "market" can not be expected to be able to distinguish between EPD's approved of an accredited certification body and a non-accredited certification body and therefore the demands can be expected to focus on the least restrictive certification.

Nordic system without certification
The system does not involve system certification. The independent review of the LCA results has to be performed by LCA experts.

3.3.2 Level of data certification - minimum requirements to review of LCA data

The first part of the certification procedure is data verification. The data required for making an environmental product declaration is provided by an LCA-study. The LCA can be performed with the purpose of making a declaration and/or with other purposes. ISO 14040 describes the content of the *critical review*:

- *The methods used to carry out the LCA are consistent with this International Standard;*
- *The methods used to carry out the LCA are scientifically and technically valid;*
- *The data used are appropriate and reasonable in relation to the goal of the study;*
- *The interpretations reflect the limitations identified and the goal of the study;*
- *The study report is transparent and consistent*

According to ISO 14040 the character of the critical review is dependent on the goal of the study, as a comparative assertion requires a critical review involving interested parties and an LCA made for internal use have other requirements to the critical review. An LCA made with the purpose of generating input for an environmental product declaration is obviously not for internal use as the declaration is intended for comparing environmental performances for comparable products. Therefore, the requirements to the critical review to be performed in an LCA for environmental product declarations are proposed to be in accordance with the same principles as for comparative assertions.

This requirement may conflict with the interests of the companies making EPD's. The problem with involving interested parties can be solved within the procedure of establishing PSR, as all interested parties will be invited to participate in the development of PSR for the specific product group. Especially agreements on system boundaries and allocation requirements are crucial for the acceptance of the PSR and EPD's. The methodological considerations, which must be decided upon in the procedure of developing the product specific requirements to a certain degree replace the critical issues in performing the individual LCA. This aspect may be used as an argument for less strict requirements to the critical review.

Even if the LCA report is *critically reviewed* by independent LCA-experts additional verification is necessary in order to verify that the LCA has been performed according to the general EPD methodology and PSR. This data verification is proposed to be done by independent LCA experts. Involving independent LCA experts is necessary in order to maintain the credibility of the declaration.

3.3.3 Level of system certification

The second part of the certification procedure is the system certification. The system certification is proposed to include:

- Control of the actual material flow, book keeping etc. on the production site.
- Control of the selection of data including assumptions etc. and the presentation hereof in the declaration.
- Control of the fulfilment of the general requirements to environmental product declarations.

3.3.4 Competence required by certification bodies/LCA experts

The competence requirements to the certification bodies as well as to the LCA experts are described below. The requirements to the certification body are almost similar to the competences required for certification of environmental management systems or quality management systems whereas the requirements to the LCA experts are more technical.

Certification bodies
The competence required for the certification bodies are:

- Documented knowledge of environmental product declaration methodologies/standards (ISO 14020 and ISO TR 14025)
- Documented knowledge of environmental management and quality management systems
- Available LCA expertise according to the requirements shown below, either within their own organisation or in collaboration with other organisations
- Skills in certification procedures

LCA experts
The competences required for the LCA experts are:

- General knowledge of environmental matters in industry and product related questions and an education at University or High school level in the relevant areas.
- Documented knowledge of and minimum 2 years experience with LCA methodologies in project work.
- Documented knowledge of LCA standards (ISO 14040-43).
- Documented knowledge of environmental product declaration methodologies/standards (ISO 14020 and ISO TR 14025).
- Product and process knowledge for the relevant product groups.

3.4 Proposed Nordic organisation structure

The Nordic EPD system is proposed to be organised as shown in Figure 3.4. The Nordic EPD body co-ordinates the activities in the participating countries. All the countries have their own “program owner”, which can be Miljöstyrningsrådet in Sweden and NHO in Norway. Denmark has not yet established a national system and therefore it is not possible to point at a “program owner” for the time being.

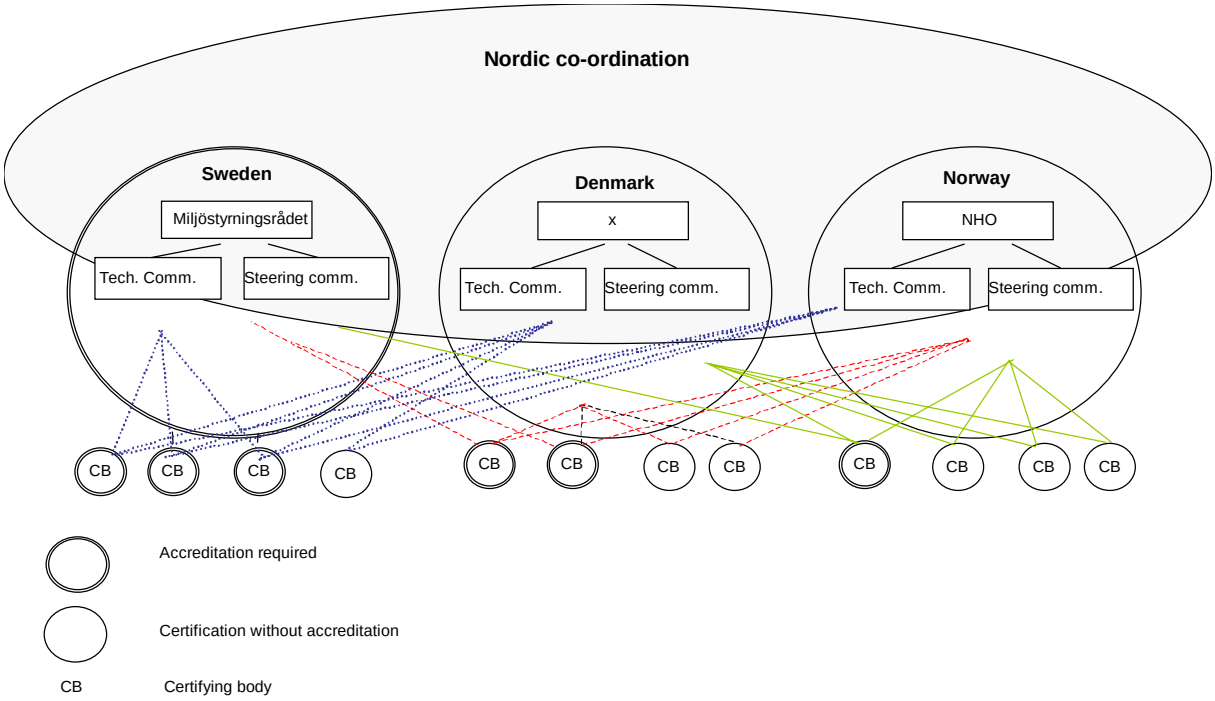


Figure 3.4
The proposed organisation of a Nordic EPD system.

Figure 3.4 presents different levels of requirements to the certification bodies. The figure indicates that the Swedish companies choose accredited certification in accordance with the existing Swedish system whereas the Danish and Norwegian companies choose freely among accredited and non-accredited certification bodies. A consequence of choosing this approach may be that the companies will choose the least restrictive certification. In the long term, the certification can be expected to be transferred from accredited certification to certification, as the users can not be expected to be able to distinguish between EPD's with accredited certification and non-accredited certification.

4 Development of Product Specific Requirements

4.1 Description of the subject

One important aspect of certified environmental declarations is that they provide objectivity, credibility and comparability between declarations within a product group or type of service. To achieve this, the basic data must be calculated in the same way and with the same general requirements. This applies, for instance, to different forms of assumptions as well as settings of system boundaries and the choice of calculation methods. Product (Group[1]) Specific Requirements (PSR) as a guideline for data collection and calculation in the LCA study are therefore essential, also to ensure that all significant environmental aspects are included in the certified environmental product declaration.

The work to prepare the PSR for a product group or service must be done as a co-operation between manufactures, importers and representatives of industrial organisations, branch organisations and other stakeholders. It is important that it is co-ordinated at a Nordic level to ensure a broad consensus in the relevant business sectors in the Nordic countries. This ensures that products or services within the same product group may be provided with comparable environmental product declarations in the Nordic business region.

This chapter suggests guiding requirements and methodological aspects for setting the PSR for certified environmental product declarations for all product groups and service types.

The PSR is to be seen as an integrated part of the Nordic EPD methodology (chapter 5) and hints to specific issues to be considered in development of PSR are given for the different methodological aspects.

4.2 Guiding principles

The ISO 14040-43 standards (ISO 1997, 1998, 2000b, 2000c) describe the general principles or requirements for the LCA study. These standards guarantee that the same basic principles have been followed in the performance of the LCA for all product groups and service types even though the standards allow a certain flexibility in the definition of system boundaries etc.

The general principles or requirements in the ISO standards should be followed as far as possible in the Nordic EPD Type III System and deviations and special conditions should be stated in the PSR.

However, specific parts in a certified product declaration may differ when comparing two products or services within the same product group. Therefore it may be necessary to prepare different PSR from case to case.

4.3 Important methodological aspects

It is important to consider some methodological aspects when developing PSR for environmental product declarations. To use these methodological aspects means that you identify the areas within the product system characteristics of the product or service and the potential alternative products or services.

These aspects (listed in this section) are based on the general principles of the ISO 14040-43 standards. The definition of PSR must include the following aspects:

- A description of the product group or service system including all possible alternative products or services. This includes process flow diagrams.
- A definition of the functional unit.

[1] The term ”Product Group” has been used to clarify that the requirements concerns a group of products and not only a specific product. It is however more convenient to use the term ”Product Specific Requirements”.

- Specific information needs and requirements explained by customers and other important stakeholders, which should be fulfilled by the EPD.

PSR must consider the following aspects where they deviate from the Nordic EPD methodology:

- The definition of the system boundaries that considering the product or service and its alternative are to be used in the LCA study.
- The product or service specific cut-off criteria.
- The definition of data quality requirements, including accepted generic data.
- The definition of allocation rules.
- The identification of special environmental aspects to be covered.
- The definition of specific impact categories.
- The identification of assumptions and limitations of the LCA study.

If any of these aspects are not considered, this must be specially justified.

4.4 Proposed Nordic procedure

The procedure of developing PSR for a product group or service type requires co-operation between manufactures importers and representatives of industrial organisations, branch organisations and other stakeholders to ensure objectivity, credibility and comparability between declarations within product group or service type. It is important that this work is co-ordinated the same a Nordic level to reach a broad consensus, i.e. securing comparable environmental product declarations in the Nordic business region.

Figure 4.1 suggests a procedure for developing PSR for a product group or a service type. Interested parties include customers, users, relevant producers, branch organisations, authorities etc. (cf. ISO 14025).

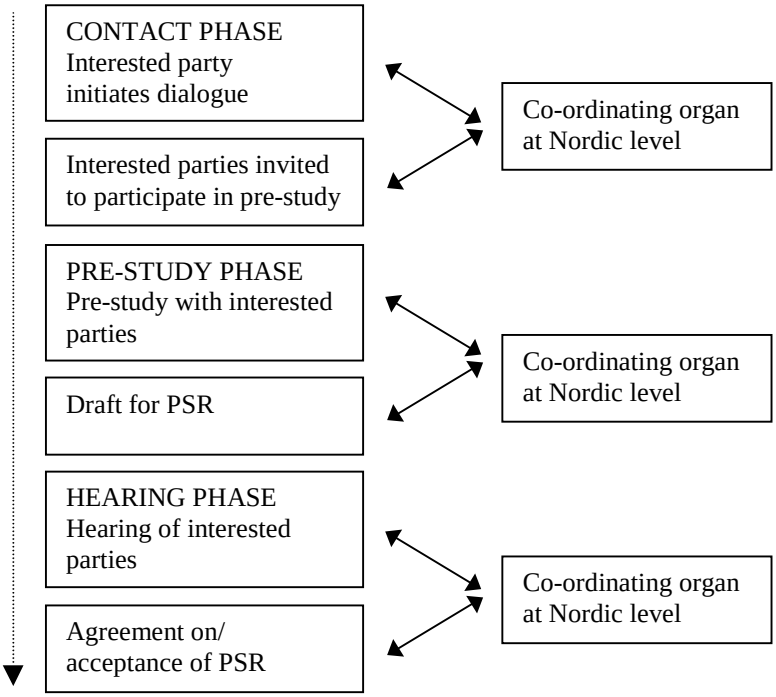


Figure 4.1 Flow sheet showing the different steps in developing PSR for a product group or service.

A Nordic company initiates the system or process of developing PSR.

In general, it is the Nordic business sector that defines the PSR and proposals for PSR are prepared by LCA practitioners in co-operation with the interested parties in the Nordic business sector. To ensure

that all interested parties are informed and committed an independent organ co-ordinates the work. An independent organ is appointed for each product group or service. This organ, which has knowledge of the ISO 14040-43 standards, ISO 14020 and ISO TR 14025, contributes with all necessary expertise during the work securing that the PSR are developed according to the standards.

Contact phase
The purpose of the contact phase is to gather all interested parties in the Nordic business sector in the discussion and development of PSR for the relevant product or service group.

The individual company that wishes to start a process of preparing PSR for a relevant product or service group contacts the co-ordinating (Nordic) organ or secretary. The organ invites this company and other Nordic companies in the same line of business together with representatives of industry, branch and interest organisations to participate in the preparation of a proposal for PSR.

Pre-study phase
Firstly, the purpose of the pre-study phase is to compile relevant LCA studies or perform an LCA study for the product group or service in question. Secondly, the purpose is to discuss and develop a draft-set of PSR for the product or service group in question.

The invited parties initiate the work of preparing a draft for the PSR. In this phase the co-ordinating organ gives support according to the ISO 14040-43 standards and prepares the meetings and the final draft for the PSR.

Hearing phase
In this phase the PSR is sent to all involved parties in the Nordic business sector to ensure a broad and general acceptance in that specific field as a whole. Depending on the outcome of the hearing phase the PSR are accepted or rejected. If they are rejected a new draft for the PSR is prepared.

5 EPD methodology

5.1 Description of the subject

The main aim of the generic requirements for LCA studies carried out as a basis for EPD's is to make the data and information additive throughout the systems and comparable between the systems. To achieve those aims, it has been recommended from the Swedish methodological work on LCA to use an *auditive approach* to LCA methodology (Tillmann, 2000) as the basis for EPD's. This means that the LCA data in general should be based on data from actual producers/suppliers.

The EPD methodology is presented as a number of important methodological aspects. The proposed Nordic EPD methodology is presented as *general requirements* which should be applied in the developing of EPD supplemented of a proposal of *Product Specific Requirements* (PSR) that are meant to cover issues important to individual product groups. The procedure for developing PSR is presented in chapter 4 (Development of Product Specific Requirements).

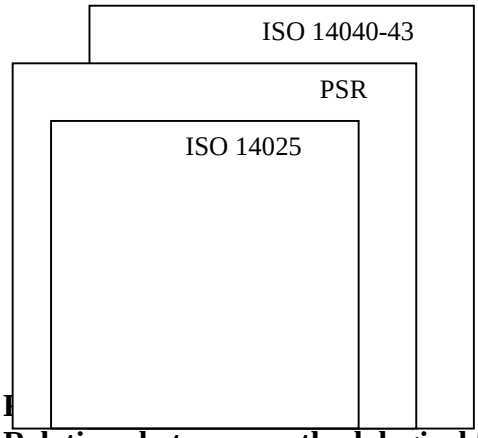
5.2 Guiding principles

The Nordic EPD methodology is based on the programmes already established in Sweden and Norway, and on the ISO 14025 Technical Guideline (ISO, 2000a) as well as on discussions in the NIMBUS project group. Inputs to the Nordic EPD methodology have also been generated in the parallel project funded by the Nordic Council of Ministers (hereafter NCM-project) (Stranddorf *et al*., 2001).

The methodology should be as comprehensive and general as possible, leaving out as little as possible to the Product Specific Requirements (PSR). There should be as little room as possible for optional methodological choices, making comparisons between different functional equal products as easy and fair as possible.

An EPD Type III must be based on Life Cycle Assessment (LCA) methodology, where the LCA studies should be carried out according to the ISO 14040-43 standards (ISO 1997, 1998, 2000b, 2000c). The methodology described in this document is based on the Swedish and Norwegian EPD Type III methodology documents (Miljöstyrningsrådet, 1999; Hanssen *et al*., 2000).

As the ISO 14040-43 standards very strictly limit the use of LCA for external comparisons between products, it is important that the suppliers do not give such comparative information in an EPD Type III. An EPD must thus not contain comparative assertions between the supplier's product and the competitor's products. A supplier might, however, present comparative assertions between his own products, for instance a new solution compared to earlier reference products from his own portfolio. The relations between the ISO 14040-43 standards, ISO/TR 14025 and PSR are illustrated in Figure 5.1.



Relations between methodological framework of ISO 14040-43, ISO 14025 and Product Specific Requirements (PSR) in EPD.

In the EPD methodology and presentation of data, it is important to distinguish between the production of materials, components and products in the manufacturing industry and the use phase and the end-of-life waste management phase of the same products. The reason for this is that the producer of the product is supposed to have full knowledge of the activities until the product leaves the company (cradle-to-gate), whereas the fate of the product in the late stages (use and waste management; gate-to-grave) is more uncertain.

The validating or certification body will be responsible for checking that these methodological aspects have been followed.

5.3 Important methodological aspects to be covered

The most important methodological aspects to be covered in detail in the EPD requirements are:

- The definition of product groups.
- The system boundaries definition.
- The functional unit definition.
- The allocation principles.
- The data - average/marginal data.
- The data quality and homogenity aspects.
- The environmental aspects to be covered.

Existing methodology guidelines like the SETAC Code of Practise (Consoli *et al*., 1993), the Nordic LCA Handbook (Lindfors *et al*., 1995) and the ISO 14040-43 standards (ISO 1997, 1998, 2000b, 2000c) are in most cases presenting options and menus for methodological choices in LCA studies, and how they should be documented and motivated. In the EPD Type III methodology, it is necessary to give clear and unambiguous guidelines for how to deal with the LCA methodology.

The proposed rules for dealing with these methodological aspects are presented in the following chapters. The rules are divided into general rules and rules on how to handle specific problems i.e. product specific problems.

5.4 Proposed Nordic EPD methodology

5.4.1 Definition of product group

To be sure that the EPD system compares homogenous groups of products, it is important to specify the criteria for which products belong to a given group. A definition of the product group is a condition for developing PSR i.e. it is the initial step in developing PSR.

It is proposed to handle the following issues in the PSR:

- A description of the product group including all possible alternative products or services.
- A process flow diagram for all alternatives.

5.4.2 System boundaries

System boundaries are defined as the separation of the product system in the EPD Type III from other product systems and from natural systems. The most important aspects to be covered in the definition of system boundaries are:

- the geographical influence area of the product
- the time dimension of products and impacts
- the separation from other related product systems
- the stages of the total life cycle that are included in the study
- the cut-off rules that are used for practical data gathering reasons
- the separation between technical and natural systems.

General rules for definition of system boundaries are given in ISO 14041, and those rules should as a general principle be used in the definition of an EPD Type III. The following subjects are given a more in-depth discussion in the NCM-project related to system boundaries:

- geographical aspects
- time aspects
- product system
- cut-off criteria

It is proposed to use the following general rules in the Nordic EPD system:

- What parts of the life cycle are included in the EPD must be shown clearly in a product tree diagram

- The production phase and the use phase/end of life phase of the EPD must be clearly separated in the reporting of data in the EPD. To represent the use phase and end-of-life phase of products in an EPD Type III, one or more typical applications for the relevant product-market situation and end-of-life scenarios can be presented in the EPD. Specific assumptions for a typical use phase should be stated in the PSR for the product group.

- Environmental impacts related to the establishment of infrastructure constructions and capital goods can in general be excluded from EPD's for products at the present state, due to the lack of representative data. If it is documented that that kind of impacts might have a significant contribution to the total impacts of a product system e.g. construction and maintenance of coal-fired power plants or hydroelectric power stations, the PSR should require including of these life cycle stages.

- Transport of staff to the working place and other staff related activities (e.g. eating) should in general not be included in the EPD.

- Emissions from waste deposits should generally be excluded from the EPD at the present state, due to the lack of reliable models and data. Emissions from waste recovery including collection and transport of waste, recycling and incineration is not included as part of the system where the waste originate. Emissions and waste generation related to wastewater cleaning plants should in general be included in the EPD data.

- Material and energy flows leaving the system as waste must be accounted for in a specific waste declaration part of the EPD. Only waste flows from producers that are part of voluntary or mandatory waste management systems (e.g. take back system, vendering system or recycling scheme) can be shown up as recovered or recycled.

- In general, at least 98% (based on total mass) of all material input to the life cycle of a product should be represented with process related emissions from their total life cycle. Emissions of specific toxic substances or hazardous chemicals given in lists from national or international authorities should be included in the EPD. Any deviations from such lists must be documented in PSR (cf. chapter 5.4.7).

These general rules can be summarised in Figure 5.2, showing the main elements in the system boundaries of an EPD:

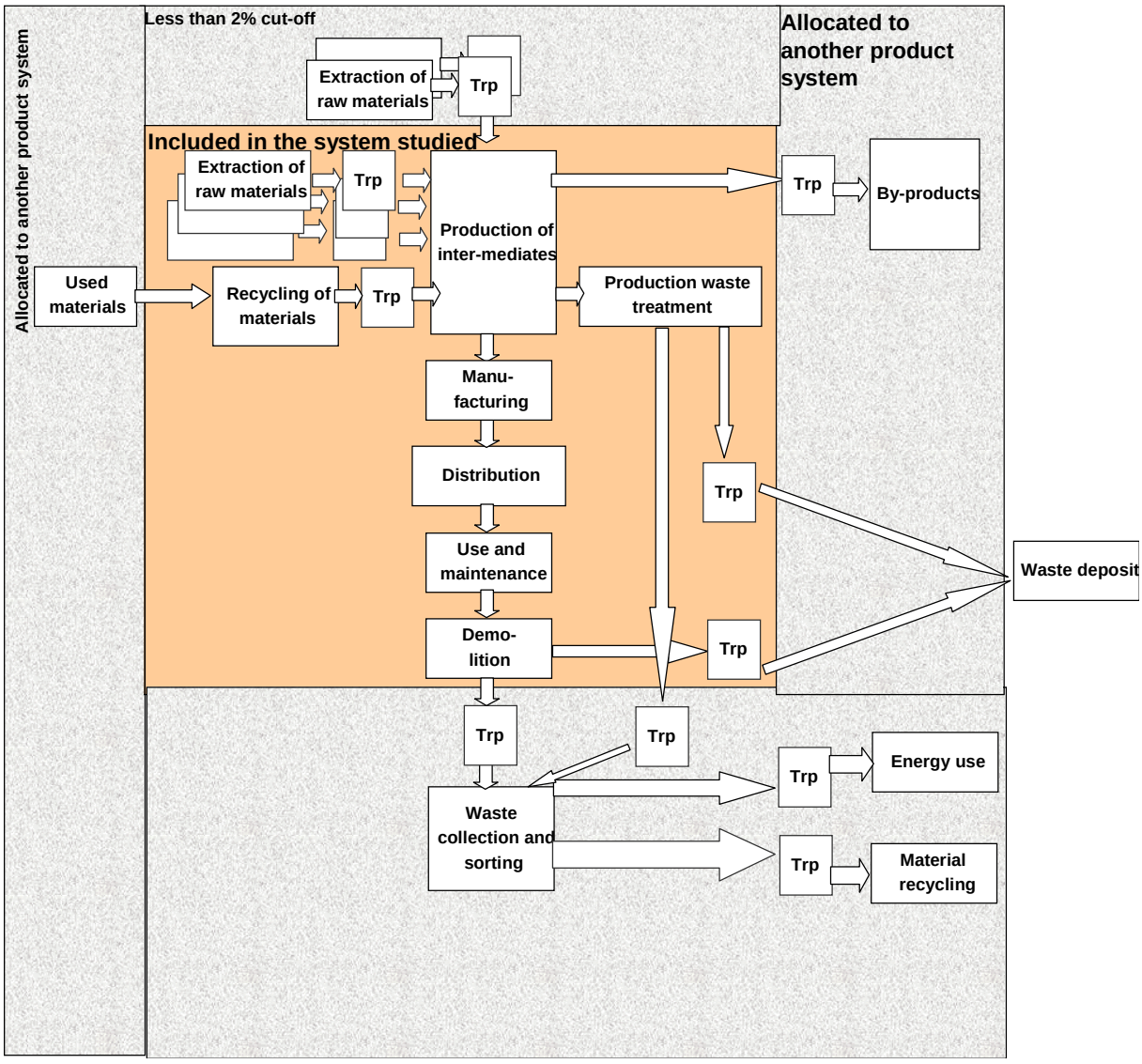


Figure 5.2
Principle definition of system boundaries for product systems in Nordic EPD methodology.

It is proposed to handle the following issues in the PSR:

- Define system boundaries that consider all alternatives

- The parts of the life cycle that are *not* included in the EPD must appear clearly in the process tree diagram. The courses for the exclusion(s) must be explained in PSR.

- If the cut-off of process related emissions from a given stage of the life cycle exceeds 2% of the total emissions of that life cycle stage the reasons for this excess must be explained.

- Specific toxic substances or hazardous chemicals given in lists from authorities must be listed.

Any deviations from the general EPD requirements for a given product type, must be described in Product Specific Requirements.

5.4.3 Functional unit

The functional unit (FU) is important as a basis for making relevant and fair comparisons between products in relation to their efficiency in fulfilling one or a number of user demands. The functional unit will be the basis for estimating the reference flow of products, utility materials, energy etc. to fulfil the user requirements. It is important in this respect to consider whether a product is fulfilling only one or a number of functions for a given user (e.g. both keeping food cold and heating a room by a refrigerator).

The definition of the functional unit will be different for raw materials and intermediate components (e.g. cement and concrete) compared to finished goods and consumer products (e.g. concrete sewage pipelines).

In the Nordic EPD Type III system, the functional unit should be:

- For raw materials and intermediate products and components, the FU should be identical with the reference flow, e.g. 1 ton of cement, 1 m^3 of concrete, 1 MJ of natural gas etc. If other units than weight are used, the specific weight of the product unit should be given. For energy products, the heat value of 1 volume or weight unit should be stated.

- For products with a number of different applications, it is recommended to use one unit of the product as the FU in an EPD Type III system (e.g. a 1 l container, 1 m of foundation wall (with a specified carrying capacity), 1 m of sewage pipeline (with a specified water capacity) etc.). To show up the real differences in functional efficiency between products for different applications and user situations, additional information must then be gathered and compiled by the user of the EPD Type III. This information should be validated through approved test information on carrying capacity or water capacity.

- For final products, the FU must reflect how the user demands are fulfilled by products as far as possible, based on life-time expectations, user efficiency, fulfilment of more than one function etc. The user efficiency should be related to specific quality standards and specifications, e.g. minimum standards for insulation, maintenance, luminance etc. In most cases, it is only possible to relate this to a given application of a product and then relate the functional efficiency to this certain application.

The following aspects should be considered in determining the functional unit:

- The functional unit should consider the environmental burdens through the life-time allocated to e.g. one year (e.g. energy savings due to insulating material).
- The functional unit should consider the environmental burdens due to reuse of the product through the life-time e.g. consider the number of refills (e.g. refillable bottles for beer and soft drinks).
- The functional efficiency of the product solutions, showing the consumption of a product to fulfil a given user requirement, or the utility function of a product fulfilling the user

requirements. Both aspects should as far as possible be documented by independent tests based on standardised methods.
- Multi-functionality must be covered in the definition of the functional unit.

The functional unit must be clearly defined for all product and service alternatives in the specific requirements for the product group (PSR).

5.4.4 Allocation requirements

In many cases, allocation principles will influence significantly on the EPD results. The general principles, which are described in the ISO 14041, should be followed as far as possible in any EPD system. Any deviations should be stated in the general EPD methodology or in the PSR.

The main problem to be discussed regarding allocation in the NIMBUS project, is how to deal with the allocation in open-loop recycling systems, where materials can be used a number of times by different products.

The two allocation situations, which are the most important to consider in the methodological discussion, are

- multi input/output situations and
- open-loop recycling.

The following allocation principles are the ones proposed being used in the Nordic EPD-system:

- As far as possible, the allocation between systems should be avoided either through desegregating the process or through the use of physical causality knowledge about how emissions are related to different products.

- In the allocation of products in multi-output processes, the share of economic turnover between products should be used as the general principle. When appropriate, mass fraction or energy content of the products could be used as a proxy.

- The allocation of burdens from waste treatment systems should be based on physical causality of the materials.

- No allocation is performed for open loop recycling (cf. chapter xx).

In the product specific requirements (PSR), the allocation principles should be described and justified especially if the allocation principles deviate from the general EPD requirements.

5.4.5 Data - average/marginal data

In the LCA ”world” an ongoing discussion deals with the choice between average or marginal data. To be able to develop EPD’s containing additive data it is necessary that all developers of EPD’s in the product chain use the same approach when collecting data. In the Swedish methodological work it has been suggested to use an auditive approach (Tillmann, 2000) i.e. to use data from actual producers/suppliers.

This means that the LCA data should be based on *average data* for a process or activity over a certain historical time period (e.g. a basis year as 1999) and in general not on marginal data. The use of average data over a certain time period and a certain scale of production capacity within a process, should not be mixed with the use of average data from a group of producers, which is generally *not recommended* in the Nordic EPD system.

5.4.6 Data quality requirements

To be able to compare different products by the use of EPD’s, it is necessary that the data sets are relevant, up-dated and of good quality. The ruless for data quality requirements in LCA studies are

found in the ISO 14041, and should be used as general guiding principles for the EPD's. In addition, the following rules are given for the EPD development in the Nordic countries:

- For raw materials and intermediate products, all relevant[2] emissions to air, water and soil, waste generation and resource use should be given in a cradle to gate perspective.

- Specific data from suppliers involved in the product system to be declared should be used as far as possible in the producer part. General data should be used when they are the most relevant. In general, up to 20% of the impact values accounted for in the EPD may be based on generic data as substitute for specific data. Exceptions from this rule can be made in a pilot phase, and where only general data are available in the market.

- In all EPD's, the proportion of materials being represented by general data must be given. Within a period of 3 years, the supplier must justify the reasons for not fulfilling the requirement of maximum 20% generic data, in order to get the EPD approved for a new period.

- Product specific data should as far as possible include environmental burdens from:

    - The production processes
    - The generation of electricity in the production and application phase (cf. next section)
    - The transport (means of transport, efficiency of transport, weight or volume limitations etc.)
    - The use efficiency and total use time of the product (especially for products consuming energy in the use phase)
    - The end-of-life treatment of materials from the product.

- For electricity (and natural gas), the supplier specific data should be used for electricity being regulated through contracts based on economic transaction data. For electricity sold to or bought from the general electricity pool, average data for a representative unit of producers should be used (what is a representative unit – country specific, Nordic, European, business consortiums etc.?). The electricity produced and sold through dedicated contracts should be excluded from the data from average electricity from producers.

- The LCA data must represent average figures for the suppliers from the basis year of the EPD as far as possible. Marginal data should in general not be used as a basis for EPD's. If material data are used from a number of suppliers, a weighted average of the environmental burdens related to each producer should be used as representative data.

- The data from the use phase and the end-of-life waste treatment should be representative for the market area and the relevant functions, which are stated in the EPD for the product. Such data should as far as possible be verified by independent test programmes.

- It must be possible for the validating institution to go back into the LCA study to find data about the assumptions made in the LCA, which are important for the EPD. Data should as far as possible be represented in a format according to the draft international standard ISO 14048 for data quality.

The Product Specific Requirements should define:

- An acceptable level of generic data and the source of such data.
- A maximum of 20% of the materials involved in the EPD should be material specific. The factors lowering the data quality must be explained.

[2] Relevant means in this context those emissions and resource categories that contributes significantly to the impact categories included in the EPD format.

5.4.7 Environmental impact categories to be used in the Nordic EPD

In the Nordic EPD system normalisation and valuation of impact indicators should not be used to present impact indicators in the declaration.

The three main categories of environmental impacts, which are normally described for an LCA, are

- Resource depletion
- Health impacts
- Ecological impacts.

These impact categories are in the Nordic LCA Handbook (Lindfors *et al.*, 1995) separated into 14 subcategories, which should be covered in the LCA studies as far as possible. In the Nordic EPD system, it is proposed to use the same seven impact categories as the ones used in the Swedish and Norwegian EPD systems as a basis:

- Resource depletion
- Global warming
- Stratospheric ozone depletion
- Acidification of land and water sources
- Photo-oxidant formation
- Nutrient enrichment
- Waste.

In order to develop impact indicators, it is important that you use the same characterisation factors in all EPD's. A list of characterisation factors based on the Swedish EPD system is enclosed as Appendix B. For nutrient enrichment, there are two possible alternatives (Nordic Guideline or UMIP model).

In addition, important toxic substances and hazardous waste from the product or the production processes of the product should be given in the EPD.

The EPD must include a list of content of materials in the product. A list of chemicals (toxic and persistent/bio-accumulative or human toxic) that have to be reported in the EPD must be provided (to be discussed in the NCM-project).

Input of the following resource categories should be quantified in the EPD's:

- Energy resources
- Material resources
- Area resources
- Water resources.

Energy resource consumption must be quantified within the following subcategories in the EPD:

- Fossil energy resources
- Renewable energy resources
- Uranium for nuclear energy
- Energy from waste incineration.

In all EPD's it must be stated which heat values have been used for the most important energy carriers that have been used in the system.

For *material resources*, the following subcategories of resources should be used in the EPD:

- Renewable resources
- Non-renewable resources.

For both categories, it must be stated how large proportions of both that are based on externally recycled materials. The Nordic LCA Handbook (Lindfors *et al.*, 1995) has discussed renewable versus non-renewable resources but no conclusions are presented: However, it is recommended to distinguish between renewable and non-renewable resources by relating renewability to a specific time frame and

also a geographical scale. As a reasonable time frame one century is mentioned. The recommendation is to note, which resources are considered as renewable and which are considered as non-renewable in the reporting of the LCA. The same approach can be used in an EPD.

The EPD must give an overview of materials and substances with toxic impacts either in the product as such, or in emissions from the processes related to the life cycle of the product. Toxicity aspects should be stated separately in the EPD, based on a list of toxic chemicals identified according to the criteria defined in the EU Directive 67/548/EEC or mentioned in the "List of dangerous substances" EU Directive.

Regarding area resources and water resources, both the quantitative and the qualitative aspects of resource depletion (type of area, type of water source) should be considered as far as possible. It must be considered whether an area intervention should be regarded as a continuous and non-reversible intervention or as a single event with limited impacts. At present state, the last two categories might be excluded from the EPD development, until better data and models are available.

The product specific requirements should specify:

- The use of specific impact categories (those not listed in the general EPD requirements) must be described and characterised
- The use of other resource categories than those listed in the general EPD requirements must be described and characterised
- The use of other subcategories than *Renewable* and *Non-renewable* must be described and characterised
- Toxic chemicals or other hazardous substances relevant for the product group should be identified and listed.

5.4.8 Assumptions and limitations of the LCA study

Any assumptions and limitations affecting the LCA study other than those inherent to the EPD system must be described.

5.4.9 Other aspects to be covered in the EPD system – Environmental Management Systems and Measures

In many cases, documentation of the status of Environmental Management Systems (EMS) by companies being involved in the product chain of the EPD system could be important additional information. EMS might be an important basis for continuous improvements from the suppliers to the producer of the product. Inclusion in the EPD system might be an important driving force for the spreading of EMS systems in the Nordic industry.

It is proposed that the Nordic EPD system might include information about:

- How many of the specific suppliers in the product system have a certified EMS or are in the process of developing such a system (at least those suppliers which contribute to more than 5% of the total value of the product).
- How large the proportion of raw materials and services that has its own EPD is.
- If the company is part of a voluntary recycling scheme or if it has introduced take back agreements for its products or its packaging.
- New measures planned for introduction or in the process of development in order to improve the environmental performance of the company. If this information is to be certified, an implementation plan decided upon by the management of the company has to be shown up.

6 EPD Communication format

6.1 Description of the subject

The way the EPD's type III are communicated from a sender to a receiver is crucial for the understanding and use of environmental information in the marketing and purchasing processes. A common format for all types of EPD's is necessary to ensure comparability of the environmental information for different products. The format is closely related to the methodology, as all outputs from the methodology presented in chapter 5, should be found in the communication format.

6.2 Guiding principles

It is important that certified EPD's are easily recognised by the customers and easily compared with other EPD's.

EPD's developed according to the Nordic system for certified EPD must be built on a common format, including different obligatory aspects. In addition, the presentation may include other information wanted by the customers/company.

The following elements must thus be included in an EPD format, in order to make it a "stand-alone" document presenting the LCA results:

- The functions delivered by the product system
- The choice of functional unit
- A description of the product system which is studied
- The system boundaries used in the LCA study
- The allocation principles that have been used
- The impact categories presented, and which methods have been used to estimate contributions to specific impact categories
- The data quality requirements that have been applied
- The assumptions and limitations which the LCA study is based upon
- The type of validation or critical review used in the study

6.3 Important aspects to be covered in the format

The items that have to be included in the EPD format can be divided into the following sections.

1. A common front page
2. Technical information
3. Additional life cycle information
4. Resource consumption
5. Energy consumption
6. Emissions and environmental impacts
7. Treatment at end of life/Waste treatment
8. References

The sections are more precisely described below.

6.4 Proposed Nordic EPD format

6.4.1 A common front-page

To ensure a recognisable, common image for all EPD's developed according to the Nordic System it is important that the content and the layout of the front page is more or less the same.

The following items must be presented on the front page:

- The EPD logo

- The certifying organ and the certification number
- The name and technical description of the declared product
- A picture of the product (or product related picture)
- The company name with a contact person, phone and e-mail/web-address
- An organisation number
- If possible, some information on environmental management systems
- The functional unit with function description
- The parts of the life cycle included

Additional information about suppliers and other company specific information are also allowed at the front page.

6.4.2 Technical information

The technical information on the considered product or service is proposed to be described by the following items:

- Functional unit
- System boundaries including flow sheet
- Allocation rules
- Cut-off rules

6.4.3 Additional life cycle information

This section can be used for illutrating different environmental impacts relevant for different lifecycle phases. The section is optional.

6.4.4 Resource consumption

The use of the most important materials must be declared, divided into the following four categories:

- New, renewable resources
- New, non-renewable resources
- Recycled, renewable resources
- Recycled, non-renewable resources

In addition, the area use and the use of water resources must be declared.

All data must be based on a life cycle point of view, which means that resource depletion in the production of raw materials has to be included.

All values must be declared divided into the different lifecycle phases:

- The production phase: including production and transport of raw materials
- The use phase
- Waste treatment

Values should be presented both as a tables and if found appropriate by a graph to visualise the results. An example on data presentation is shown in Table 6.1.

Table 6.1
The most important material resources.

	Unit	Raw material production	Raw material transport	Pipe production	Total	Comments
Recycled, renewable resources		0	0	0	0	
New, renewable resources						
Water	ton/FU	1.2			1.2	
Recycled, non renewable resources		0	0	0	0	0
New, non renewable resources						
Bauxite	kg/FU	< 0.1	0	0	< 0.1	
Iron ore	kg/FU	< 0.1	0	0	< 0.1	
Limestone	ton/FU	4.3	0	0	4.3	From cement production
Stone	ton/FU	15.4	0	0	15.4	From aggregates
Clay	kg/FU	< 0.1	0	0	< 0.1	
Land use		Not included				

6.4.5 Consumption of energy resources

The consumption of the energy must be declared divided into the following four categories:

- Fossil fuel
- Nuclear
- Renewable energy
- Energy from waste incineration

All data must be based on a life cycle point of view, which means that the energy consumption in the production of raw materials has to be included. The energy consumption must be divided into the different life cycle phases:

- The production phase: including production and transport of raw materials
- The use phase
- Waste treatment

In addition, the total energy consumption must be declared. Values should be presented both as tables and graphs to visualise the results; see Table 6.2 and Figure 6.1.

Table 6.2
Energy consumption.

MJ/50 m pipe		Raw material production	Raw material transport	Pipe production	Total	Comments
Fossil fuel						
	Crude oil	3272	252	4158	7682	Mainly from pipe production
	Natural gas	1688	8	253	1949	From cement production
	Coal	5676			5676	From cement production
	Peat	0			0	
Nuclear energy		33			33	
Reneable fuel						
	Hydro electricity	876		1430	2306	From production of cement and pipe production.
	Bio fuels	2		3	5	
Waste						
	Waste incineration	849			849	From cement production
	Waste heat					
Total		*12396*	*260*	*5844*	***18500***	

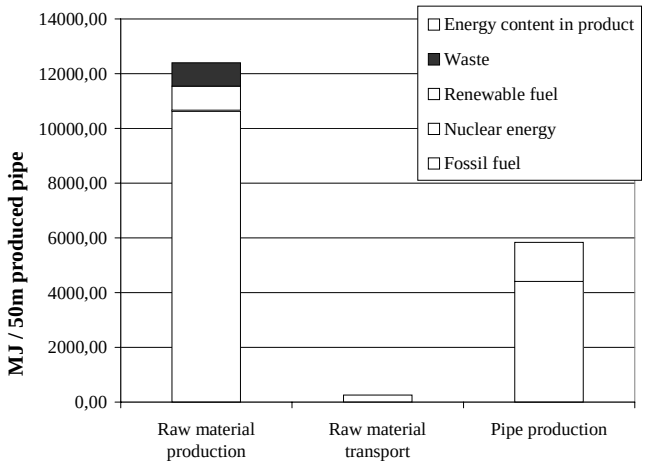


Figure 6.1
Energy consumption.

6.4.6 Environmental impacts

The environmental impacts must be declared as potential contributors to the following six categories:

- Global warming
- Acidification
- Ozone depletion
- Photochemical ozone creation potential
- Nutrient enrichment
- Waste generation

All data must be based on a life cycle point of view, which means that environmental impacts linked to the production and transport of raw materials have to be included.

All values must be declared, divided into the different life cycle phases.

- The production phase: including production and transport of raw materials

- The use phase
- Waste treatment

In addition, totals of the contributing emissions must be declared.

In EPD's for raw materials, it is not always possible to include the use phase and the end use. For those producers it would be better to divide the production of raw materials to own process, own process and transports.

The values of environmental impacts should be presented both as tables and graphs to visualise the results. The graph should reflect the different life cycle phases' share (percent) of each category.

Figure 6.2 present the total contribution to the different impact categories from production of concrete pipes along with the distribution on the different life cycle phases.

	Total
Waste (kg/FU)	0.13
Nutrient enrichment (kg O_2-eq/FU)	21.91
Ozon formation (kg POCP-eq/FU)	0.65
Ozon depletion (kg ODP/FU)	0.00
Acidification (kg SO_2-eq/FU)	6.16
Global warming (ton CO_2-eq./FU)	2.42

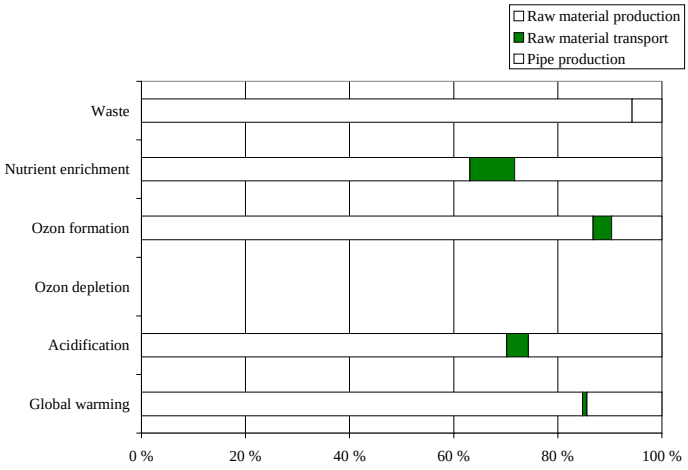


Figure 6.2
Impact categories.

The inventory results used in calculation of the impacts are shown in Table 6.3 and Table 6.4.

Table 6.3
Main emissions contributing to impact categories.

	Raw materials	**Pipe production**	**Transports**	**Total**	**Comments**
Emissions to air					
CO_2 [kg/FU]	1996	20	348	2364	Mainly from cement poduction
CH_4 [kg/FU]	1.6	<1	<1	1.6	Mainly coal extraction
N_2O [kg/FU]	7.4	1.1	1.5	10.0	
SO_2 [kg/FU]	2.3	<0.1	0.9	3.2	Raw material production
NO_x [kg/FU]	2.3	<1	1.0	3.4	Transports and raw material production
NH_3 [kg/FU]	21.7		<1	21.7	
VOC [kg/FU]	768	50	141	959	
CO [kg/FU]	2	0	0	2	Mainly cement production
Emissions to water					
Tot-N [kg/FU]	0.2	<0.1	0.8	1	
COD [kg/FU]	40	<1	5	45	Mainly cement production

Table 6.4
Product specific emissions.

	Raw materials	Pipe production	Transports	Total	Comments
Emissions to air					
Hg [mg/FU]	53			53	From cement poduction

In addition, specific emissions contributing to the impacts for each life cycle phase should be presented in a table. This table also has to include the emissions specified in the product/branch specific requirements.

6.4.7 Waste treatment

The different fractions of materials after the end use of the product must be declared:

- Reused materials
- Renewable resources to deposit
- Renewable resources to incineration
- Renewable resources to recycling
- Non-renewable resources to deposit
- Non-renewable resources to incineration
- Non-renewable resources to recycling

If the company has established a take-back system for their product after use, this system has to be described.

The categories of waste treatment options may be presented in a pie diagram showing percentages of each category. In addition, the different materials must be declared masses of each in each category for waste treatment.

An example of a pie diagram and a table presenting the waste treatment is shown in Figure 6.3 and Table 6.5.

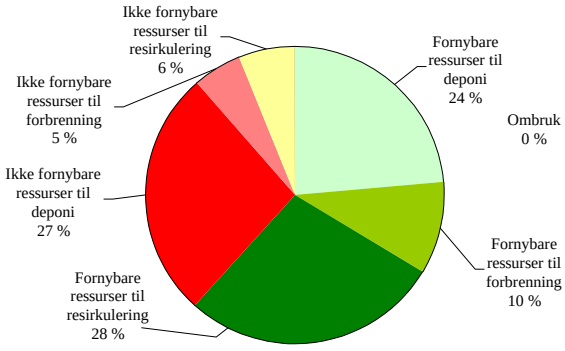


Figure 6.3
Potential waste treatment.

Table 6.5
Potential waste treatment.

Renewable materials to deposit:
- Wood: 1.6 kg
- Textile: 1.2

Renewable materials to incineration:
- Wood: 0.7 kg
- Textile: 0.2 kg

Renewable materials to recycling:
- Cardboard: 3.3 kg

Non-renewable materials to deposit:
- Steel: 1.4 kg
- Plastics: 1.5 kg
- Aluminium: 0.3 kg

Non-renewable materials to incineration:
- Plastics: 0.6 kg

Non-renewable materials to recycling:
- Steel: 0.6 kg
- Aluminium: 0.1 kg

Total mass: 12.0 kg (incl. packaging and new textiles during time of life), where of 98% is declared.

6.4.8 Description of system included and allocation rules

The description of the elements included in the background data for the product system must be described as precisely as possible in a block diagram. The included elements may be presented as boxes with drawn lines, and elements excluded may be presented as boxes with coloured filling and dotted lines. An example of a system tree is shown in Figure 6.4.

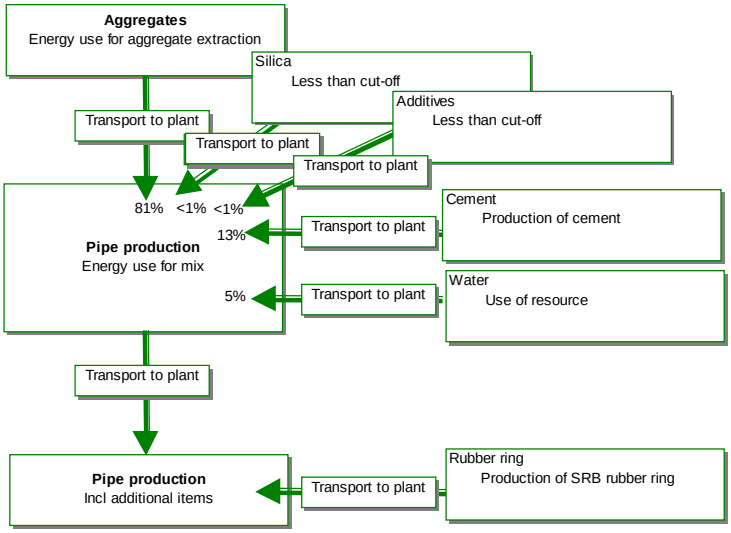


Figure 6.4
System tree.

In addition, the rules used for allocation must be described verbally.

Example:
* *For new materials, production of raw materials and resource depletion are allocated to the product.*
* *For recycled materials, only recycling processes are allocated to this product.*

6.4.9 Reference to background data

As this system for EPD certification is based on the possibility that the reviewer is the same organ as the one developing the EPD, a reference to the LCA study and the LCA meta data must be available.

7 Terms and definitions

8 References

Consoli

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Tillmann (2000).

Appendix A

Figure A.1
Examples: The roles of organisations involved in Type III Environmental Declaration Program.

	Roles (What) vs. Parties involved (Who)			
Form of program	Making a declaration	Developing and maintaining a framework of a declaration program and procedures	Conducting a critical review	Certifying that a declaration complies with necessary requirements and procedures
Program without certification	Company or organisation	Company or organisation	Independent reviewer	Not applicable
Program with certification	Company or organisation	Private or public organisation (e.g. industry association, third party practitioner, competent body)	Independent reviewer (could be same as program developer)	Certification body (could be same as program developer)
Program with Accredited certification	Company or organisation	Private or public organisation (e.g. industry association, third party practitioner, competent body)	Independent reviewer (could be same as program developer)	Accredited certification body

Who does what in a single company life cycle based environmental declaration:

Single company	Company or organisation	Company or organisation	Independent reviewer	Not applicable*

* NOTE: Today there are several individual companies developing declarations of this nature but based on the lack of sector or third party participation, these approaches may not be considered as Type III environmental declarations.

The reports from the NIMBUS project are:

I. Hanssen, O.J. et al. 2001. Nordic Co-ordinating System for Environmental Product Declarations Type III. STØ Report OR.20.01

II. Hanssen, O.J. et al. 2001. Systems and Methodology for Type III Environmental Product Declaration. STØ Report OR.21.01

III. Solèr, C. 2001. User requirement studies to Environmental Information. CPM Report 2001:4.
IV. Vold, M. et al. 2001. Environmental Product Declarations in the Concrete Sewage Pipeline industry. STØ Report OR.22.01
V . Hoffmann, L. et al. 2001. Environmental Product Declarations in the Energy Sector. Report from dK-TEKNIK ENERGY & ENVIRONMENT 2001
VI. Stranddorf, H. et al. 2001. LCA methodology in EPD methodology. Report from dK-TEKNIK ENERGY & ENVIRONMENT 2001