

PRODUCT-CATEGORY
RULES
(PCR)

For preparing an environmental declaration
(EPD) for Product Group

Insulation materials

NPCR 012

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1. Introduction

This product category rules (PCR) is intended for companies in process for validating an Environmental Product Declaration (EPD) that will cover all environmental aspects for declaration of insulation materials. The PCR will be valid for all insulation materials according to standard NS-EN 13172 Thermal insulation products – Evaluation of conformity [1], NBI Report O 8541-1 (textile)[2].

The PCR are in compliance with the ISO standards, ISO 21930, Building construction - Sustainability in building construction – Environmental declaration of building products [3] and the requirements of ISO 14025, Environmental labelling and declarations – Type III environmental declarations – Principles and procedures [4] and the provisions in ISO 14040 series of standards, Environmental management — Life cycle assessment [5].

The PCR is based on LCA study of insulation materials carried out in the project “Energi- og miljøregnskap for bygg” where four manufacturers of insulation materials participated [6].

The EPD will present data that has been aggregated over the life cycle stages “Product stage”, “Construction stage”, “Building stage” and “End of life stage” or relevant portions of it. EPD following these PCR may also be based on information modules (see, ISO 21930 clause 5.5) that do not cover all stages of the product’s Life Cycle. Comparability of EPD of insulation materials shall be in accordance with the requirements for comparability as described in ISO 14025, clause 4 and 5.6.

Program operator:
Næringslivets Stiftelse for Miljødeklarasjoner
NHO, Postboks 5250 Majorstuen,
0303 Oslo

The PCR has been prepared by members of the PCR WG and SINTEF Byggforsk.

Members of the PCR WG:

Vidar Tokerud	Glava AS (manufacturer)
Dag Høston	Plastindustriforbundet (EPS-gruppen) (manufacturer)
Sverre Johnsrud	Norsk Celluloseisolasjon AS (manufacturer)
Finn-Vegard Amundsen	Pittsburgh Corning (manufacturer)
Jörgen Hægglund	HAS Consult AS (manufacturer)
Arne Støyle	Norsk glassgjenvinning AS (manufacturer)
Arne Monsen	Maxit as (user)
Ole Skytterholm	Ultimat AS (manufacturer)

Consultant:
Sverre Fossdal SINTEF Byggforsk AS

1.1 Period of validity of the document

The validity of this document is extended until January 2010 (3 years). When new requirements concerning use of chemicals will be implemented (REACH directive) this PCR may need to be revised.

2. Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

declared unit

quantity of a building product for use as a reference unit in an **EPD** (2.6), based on **LCA** (2.4), for the expression of environmental information needed in **information modules** (2.3)

Example: Mass (kg), Volume (m³)
[ISO 21930]

2.2

functional unit

quantified performance of a product system for a building product for use as a reference unit in an **EPD** (2.6) based on **LCA** (2.4)

[ISO 21930]

2.3

information module

compilation of data to be used as a basis for a **Type III environmental declaration** (2.6), covering a unit process or a combination of unit processes that are part of the life cycle of a product

[ISO 21930]

2.4

life cycle assessment (LCA)

compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[ISO 14040]

2.5

L/S ratio

ratio between the total amount of liquid (L in litre), which is drained from the dry mass (S in kg of dry matter) abbreviated L/S and expressed in l/kg

NOTE: Adapted from ISO 12457-3

2.6

product category

group of building products that can fulfill equivalent functions

[ISO 21930]

2.7

Type III environmental declaration, Environmental product declaration, EPD
environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information
[ISO 21930]

3. Description of company/organization and product

3.1 *Description of company/organization:*

The name of the company/organization as well as the place(s) of production shall be indicated (see, clause 8.1). General information about the company/organization can be included i.e. the existence of quality systems or environmental management system according to ISO 14001 or EMAS or any other environmental management system in place [7], [8].

3.2 *Description of product:*

The description of the product shall enable the user to identify the product unambiguously. The characterisation includes:

- Product identification by name (including e.g. production code) and a simple visual representation of the building product for which the EPD is developed;
- Main technical data and properties of insulation materials according to NS-EN 13162 – 13171[9-18]; NBI Report O 8541-1 (textile)[1];
- Flow diagram of main production processes according to the scope of the declaration;
- Materials and substances to be declared: Material contents of the finished product, including packaging shall be declared in terms of the main components. Substances officially classified as hazardous according to national and international regulation by CAS-No (EU directive 67/548/EWG) shall be stated. Product specific data that is confidential, because of competitive business environment, intellectual property rights or similar legal restrictions need not to be declared to the public. New requirements concerning declaration of chemicals (REACH directive) shall apply.

3.3 *Definition of product group*

- The product group “insulation materials” includes all kind of insulation products prepared for trade like cellular glass, glass wool, rock wool, cellulose based insulation, textile based insulation and fossil based insulation (XPS, EPS).
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4. Goal

The intended application of this PCR is to give guidelines for carrying our environmental product declaration for insulation materials and to pinpoint the underlying requirements of the LCA. The user of this PCR will be manufacturers of insulation materials and other interested parties.

This PCR is valid for all insulation materials according to the standards or technical approvals shown under chapter 3.2, and on information for incorporation in a building or other construction work. (i.e., building material, products, components, or building elements).

5. Requirements for the underlying LCA

5.1 Functional and declared unit

The functional unit or declared unit of a product provides the quantitative normalisation, for comparing products of equivalent function (functional unit) or equivalent specification (declared unit). For declarations covering the complete life cycle, a functional unit is defined. The functional unit is based on the thermal property (*design*) under specific external and internal conditions which can be considered as typical of the performance of the insulation material when incorporated in a building component (NS-EN ISO 10456) [19].

For declarations not covering the complete life cycle, e.g. leaving out the use stage and/or the end of life stage, a declared unit is defined based on an expected value (*declared*) of thermal property of the insulation material assessed from measured data at reference conditions of temperature and humidity. Information provided using a declared unit shall not be used for comparison.

The functional unit (cradle to grave) is:

1 m² of insulation material with a thickness that give a design thermal resistance R = 1 and with an expected average service life of 60 years

(packaging included). The unit for the functional unit is kg and 60 years.

The declared unit (cradle to gate) is: ***1 m² of insulation material with a thickness that give a declared thermal resistance R = 1***. The unit for the declared unit is kg.

Functional and declared unit can be expressed as:

$$FU = DU = R \cdot \lambda \cdot \rho \cdot A \text{ [kg]}$$

where; R = thermal resistance [m²K/W]

λ = thermal conduction [W/mK]

ρ = density of insulation product [kg/m³]

A = Area [m²], here 1 m².

The result for any other R-values than 1 m²K/W can be found by simple multiplication.

The thermal resistance may also be expressed as: R = d/λ where d [m] is the thickness of the insulation.

A table for different insulation thickness may be worked out showing the factor the environmental impacts for R = 1 has to be multiplied with to give the corresponding environmental impacts for a given thickness.

5.2 System boundaries

The life cycle stages for the installed insulation products are shown in figure 1.

The system boundaries encompass the following processes:

5.2.1 Product stage

- Extraction/Production of raw materials
- average transport of raw materials from extraction/production to manufacturer
- Processing of recycled materials
- transport of recycled/used materials to manufacturer
- Manufacturing of insulation products
- Packaging

5.2.2 Construction stage

- transport of building products from manufacturer to stockist
- transport of building products from stockist to building site
- Installation on the building site

5.2.3 Building stage

The building stage is treated as scenario:

- The reference service life of the building is defined as 60 years and the number of replacements of the insulation products shall be declared accordingly. For other applications the service life shall be defined [20].
- Maintenance of the insulation products that under normal conditions will be necessary to get the expected reference service life. Maintenance/replacements are to be modelled according to manufacturers guidelines
- Releases to ground and surface water during the use of the insulation materials shall be declared in accordance with national standards and practice¹.
- Insulation materials exposed to the indoor environment shall be classified according to prNS 3563 [21] (M1, M2, M3), based on emissions of:
 - TVOC
 - Formaldehyde
 - Ammonia
 - Carcinogenic compounds

Methodology to carry out emission tests is shown in prEN 13419-1 [22], 13419-2 [23], prEN 13419-3 [24] and prEN 717-1 [25]. Threshold values for carcinogenic compounds are given in WHO “Air Quality Guidelines for Europe”, 1987.

5.2.3 End of life stage

The end of life stage is treated as scenario:

- Dismantling/Demolition

¹ The releases shall refer to specified PH-values, L/S ratio and availability

- transport from building site to recycling/reuse/land fill
- Recycling/reuse

The manufacturing and the installation processes shall be declared separately from both the use/maintenance processes (building/use stage) and from the demolition processes (end of life stage). The building stage and the end of life stage are both based on typical scenarios for the products. The scenarios shall be described in detail.

Any other transportation data than identified above shall be indicated. If transportation information is included in other stages than indicated, or if no transportation information exists and assumptions are made, this should be noted.

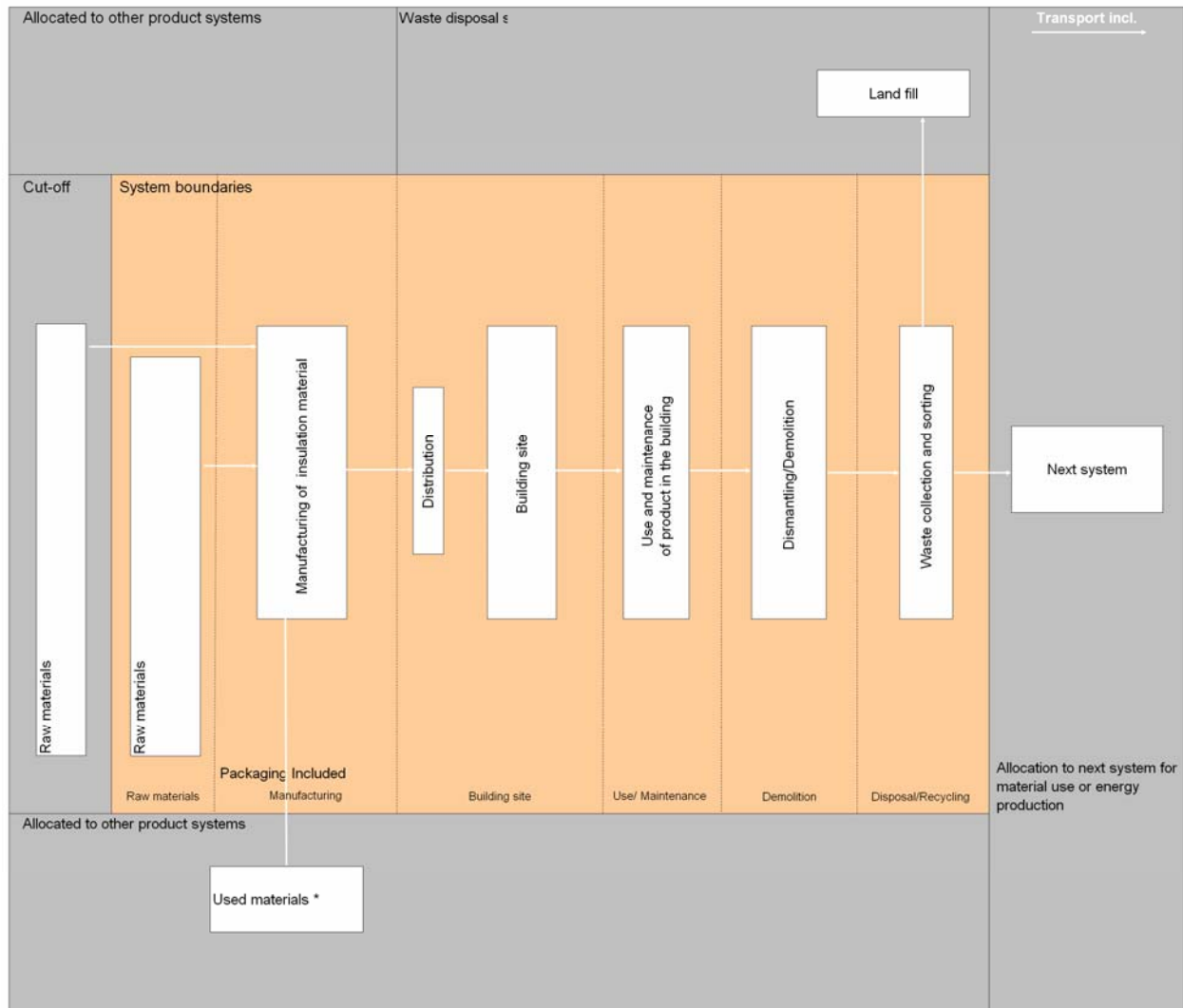


Figure 1 System boundaries and life cycle stages of insulation products.

5.3 Cut-off rules

Any processes or activities that altogether do not contribute to more than 2 % of the total mass and 1 % of the total energy use may be omitted from the inventory analysis. However omissions

of any material flows that may have a relevant contribution to the selected impact categories of the products underlying the Environmental Declaration shall be justified, if applicable by a sensitivity analysis. All hazardous and toxic materials and substances shall be included in the inventory and the cut-off rules do not apply.

5.4 Allocation rules

In a production process where more than one type of product is generated, it is necessary to allocate the environmental impacts (inputs and outputs) from the process to the different products in order to get product-based inventory data.

In principle allocation rules should reflect the goal of the production process. For production of insulation products the primary allocation rule is that allocation shall be carried out according to mass.

Raw material energy shall be allocated to material resources (kg), while process energy shall be allocated to energy resources (MJ).

When the insulation products original function is lost, it can be processed further in a waste management system, e.g. it can be recycled and/or reused.

The recycling processes shall be treated as closed loop recycling, as long as no changes occur in the inherent properties of the recycled material. In such cases, the need for allocation is avoided since the use of secondary material displaces the use of virgin (primary) materials. Thus recycled materials that are used in the fabrication of insulation products shall have no inherent environmental impact on the new product, only the processing and transport of the recycled materials.

The environmental impacts from recycling and incineration and related transports as well as the recovered energy are allocated to the products according to mass.

When allocation is used, the economic reality and other relevant aspects shall be considered to determine if other allocation criteria would be more appropriate or lead to deviating results. A sensitivity analysis should be initiated if a deviation of > 20% is foreseen.

Different data sets shall be documented and reported, if different allocation options are relevant.

5.4.1 Transportation

Allocation connected to transport shall be based on volume since it will be the volume that restricts the amount of cargo on a truck, not the weight.

5.5. Data Quality requirements

5.5.1 Calculation rules

The amount of material used as input of insulation products (functional unit) shall include related accessories and auxiliary materials.

5.5.2 Characterization factors

The factors employed to calculate the selected environmental impacts shall be taken from the following sources, table 1:

Table 1 Characterization factors

Impact category	Unit	Source
Climate change (GWP)	[kg CO ₂ equiv]	Latest version of IPCC
Destruction of atmospheric ozone (ODP)	[kg R11 equiv]	Latest version of WHO
Acidification (AP)	[kg SO ₂ equiv]	CML 2001
Eutrophication (NP)	[kg PO ₄ equiv]	CML 2001
Photochemical Ozone Creation (POCP)	[kg C ₂ H ₄ equiv]	CML 2001

5.5.3 Data collection

The data shall be representative according to temporal, geographical and technological requirements.

- **Temporal:** The obtained information from the manufacturing process should be annual approximate values and updated, i.e. from the previous 12-month period. Average background data should not be older than 10 years.
- **Geographical:** The geographic region of the production sites included in the calculation of representative data shall be documented.
- **Technological:** Data should represent technology in use.

5.5.4 Description of data

The use of specific or average background data shall be documented. As a rule the following distribution will be applied:

- Production of raw materials (specific and/or average background)
- Manufacturing of the product (specific)
- The mix of electricity used should be the official one in the country where main energy consuming processes take place, if site-specific data cannot be obtained. The mix of electricity (calculation procedure) shall be documented.
- Hazardous waste shall be specified according to EU Directives 91/689/EEC and 75/442/EEC (specific and/or average background)

The following source, table 2, for generic data shall be used for the European market.

Table 2 Databases (example)

Material	Database	Published
Steel	IISI (International Iron and Steel Institute) http://worldsteel.org	1998
Copper	ICA (International Copper Association)	1998
Electricity	ECO-PROFILES of the European plastics industry Methodology Plastics Europe (Association of Plastics Manufacturers) http://www.plasticseurope.org/	1999
Aluminium	EAA (European Aluminium Association) http://www.eaa.org/	2005
Plastics	Plastics Europe (Association of Plastics Manufacturers Europe) http://www.plasticseurope.org/	1993-1998
Chemicals	Plastics Europe (Association of Plastics Manufacturers Europe) http://www.plasticseurope.org/	1993-1998

All data have to be specified including database and year of publication (reference). Sources of data for transport models (including transport form, distances and quantities to be transported) and thermal energy production shall be documented.

5.5.5 Content of substances

A detailed list of the product's substances (chemicals), including CAS number and health class (Risk phrases), shall be included in the product content declaration. The content of substances shall be declared in weight %. In those cases where information of content could affect patent or company secrets, a list and their functions is sufficient, including the Risk phrases.

6. Units

The following units shall be used:

- SI units
- Preferred power and energy units:
 - kW (MW) for power
 - kWh (MJ) for electric energy

7. Additional environmental information

Relevant information, such as specific manufacturing processes, beneficial from the environmental point of view can be described. Technical data that is needed to model the building stage e.g. load requirements etc. A description of toxicity effects like leaching, if relevant.

8. Content of the environmental declaration (EPD)

All Type III environmental declarations in a product category shall follow the format and include the parameters as identified in this PCR.

8.1 General information to be declared

The following general information shall be declared:

- the name and address of the manufacturer(s);
- product identification by name (including e.g. production code) and a simple visual representation of the building product to which the EPD is developed;
- the description of the product's use and the functional or declared unit of the product to which the data relates;
- the description of the application (installation) of the insulation products;
- a general specification for the composition of the products shall be given;
- name of the programme and the programme operator's address and, if relevant the logo and website;
- the PCR identification;
- the date the declaration was issued and period of validity;
- additional environmental information see chapter 7;
- a statement of whether the declaration is complete or modular; see chapter 1
- a statement that environmental declarations from different programmes (ISO 14025) may not be comparable;
- a statement that this declaration represents an average performance, in such cases where an EPD declares an average performance for a number of products In addition the standard deviation of the products' performance with respect to the average is stated;
- the site(s), manufacturer or group of manufacturers or those representing them for whom the results of the LCA are representative;
- information on where explanatory material may be obtained;
- in addition to the above, table 2 shall be completed and reproduced in the Type III environmental declaration;

Table 2 *Demonstration of verification*

PCR review, was conducted by: < name and organization of the chair, and information on how to contact the chair through the programme operator >
Independent verification of the declaration and data, according to ISO 21930: <input type="checkbox"/> internal <input type="checkbox"/> external
(Where appropriate ^{a)} Third party verifier: <name of the third party verifier>

a Optional for business to business communication, mandatory for business to consumer communication.

- a diagram of the life cycle stages included in the LCA subdivided into product stage, building stage and end of life stage, and system boundaries. The stages may be further subdivided see ISO 21930 Fig 1;
- a description of the nature of the processes and ancillary materials that are required for installing the building product in the building works and their replacement and maintenance according to the cut-off criteria in the PCR.

8.2 Parameters to be declared:

Use of material and energy resources:

- depletion of non-renewable material resources
- use of renewable material resources
- depletion of non-renewable primary energy differentiated into:
 - Fossil oil
 - Natural gas
 - Coal
 - Uranium
- use of renewable primary energy differentiated into:
 - Hydropower
 - Wind power
 - Solar power and biomass
- use of potable water

Impact category indicator results for:

- Climate change. Emission of greenhouse gases (expressed as the sum of global warming potential, GWP in kg CO₂ - equivalents, 100 years).
- Destruction/depletion of ozone layer. Emission of ozone-depleting gases (expressed as the sum of ozone-depleting potential, ODP in kg CFC 11-equivalents, 20 years).
- Acidification of land and water sources. Emission of acidifying gases (expressed as the sum of acidifying potential, AP in kg SO₂ - equivalents).
- Eutrophication. Emission of substances contributing to eutrophication potential, (expressed as the sum of nutrition potential, NP in kg PO₄ -equivalents).
- Formation of photochemical oxidants. Emission of gases that contribute to the creation of ground-level ozone (expressed as the sum of ozone-creating potential, POPC, in kg C₂H₄-equivalents).

Waste to disposal

- Non hazardous waste (kg).
- Hazardous waste (kg) according to EU directive 91/689/EEC and 75/442/EE. (see also regulation of June 1, 2004 no. 930 of recycling and treatment of waste with amendment by the Ministry of the Environment 2. May 2005 (avfallsforskriften)).

9. References

This PCR is based on the following studies

1. NS-EN 13172 Thermal insulation products – Evaluation of conformity
2. NBI Report O 8541-1, Vurdering av dokumentasjon som grunnlag for NBI Teknisk Godkjenning, NBI 2003.
3. ISO 21930 Sustainability in building construction - Environmental declaration of building products
4. ISO 14025 Environmental labels and declarations –Type III environmental declarations – Principles and procedures
5. ISO 14044 Environmental management - life cycle assessment - requirements and guidelines
6. Energi- og miljøregnskap for bygg. Prosjektrapport 173. Byggforsk. 1995.
7. ISO 14001 Environmental management systems –Requirements with guidance for use
8. EMAS – The Eco-Management and Audit Scheme
9. NS-EN 13162 Thermal insulation products for buildings - Factory made mineral wool (MW) products – Specification,
10. NS-EN 13163 Thermal insulation products for buildings - Factory made products of expanded polystyrene (EPS) – Specification
11. NS-EN 13164 Thermal insulation products for buildings - Factory made products of extruded polystyrene foam (XPS) – Specification
12. NS-EN 13165 Thermal insulation products for buildings - Factory made rigid polyurethane foam (PUR) products – Specification
13. NS-EN 13166 Thermal insulation products for buildings - Factory made products of phenolic foam (PF)
14. NS-EN 13167 Thermal insulation products for buildings - Factory made cellular glass (CG) products - Specification
15. NS-EN 13168 Thermal insulation products for buildings - Factory made wood wool (WW) products – Specification
16. NS-EN 13169 Thermal insulation products for buildings - Factory made products of expanded perlite (EPB) – Specification
17. NS-EN 13170 Thermal insulation products for buildings - Factory made products of expanded cork (ICB) – Specification
18. NS-EN 13171 Thermal insulating products for buildings - Factory made wood fibre (WF) products – Specification
19. NS-EN ISO 10456 Building materials and products. Procedures for determining declared and design thermal values.

20. ISO 15686-8 Buildings and constructed assets – Service life planning – Part 8: Reference service life.
21. prNS 3563 Ventilation for buildings - Design methods for indoor climate
22. prEN 13419-1 Building products – Determination of emissions of volatile organic compounds – Part 1: Emission test chamber method
23. prEN 13419-2 Building products – Determination of emissions of volatile organic compounds – Part 2: Emission test cell method
24. prEN 13419-3 Building products – Determination of emissions of volatile organic compounds – Part 3: Procedure for sampling storage of samples and preparation of test specimens
25. prEN 717-1 Wood-based panels – Determination of formaldehyde release – Part 1: Formaldehyde emission by the chamber method

Appendix I Project documentation/report

Project documentation shall include information, which can be made available to verifier in order to demonstrate that the requirements of ISO 21930 have been met:

- the input and output environmental data of the unit processes that are used for the LCA calculations;
- the documentation (measurements, calculations, estimates, sources, correspondence, traceable references to origin, etc) that provides the basis from which the process data for the LCA is formulated;

This includes documentation on:

- the specification used to create the manufacturer's insulation products;
- energy consumption figures;
- emission data to air, water and soil;
- waste production;
- data that demonstrates that the information is complete. In specific cases, reference can be made to, for instance, standards or quality regulations;
- referenced literature and databases from which data have been extracted;
- documentation that demonstrates that the insulation products can fulfil the desired function(s) and performance;
- documentation that demonstrates that the chosen processes and scenarios in the flow chart satisfy the requirements set in ISO 21930;
- documentation that substantiates the chosen life cycle of the insulation products;
- the documentation and substantiation of the percentages or figures used for the calculations in the waste scenario;
- documentation and substantiation of the percentages and figures (number of cycles, prices, etc.) used for the calculations in the allocation procedure;
- information showing how averages of different reporting locations have been calculated in order to obtain generic data;
- documentation used to substantiate any qualitative information in the additional environmental information;
- procedures used to carry out the data collection (questionnaires, instructions, informative material, confidentiality agreements, etc.);
- the characterization factors, normalisation factors and weighting factors used;
- the criteria and substantiation used to determine the system limits and the selection of input and output flows;
- documentation used to substantiate the other choices and assumptions

Approved 17.04.2007, valid until 17.04.2010
Norwegian EPD Foundation, PCR Review Panel