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Environmental management — Life cycle assessment — Life cycle impact assessment

Management environnemental — Analyse du cycle de vie — Évaluation de l'impact du cycle de vie

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 14042 was prepared by Technical Committee ISO/TC 207, *Environmental management*, Subcommittee SC 5, *Life cycle assessment*.

Annex A forms a normative part of this International Standard.

Introduction

Life cycle impact assessment, LCIA, is the third phase of life cycle assessment described in ISO 14040. The purpose of LCIA is to assess a product system's[1)] life cycle inventory analysis (LCI) results to better understand their environmental significance. The LCIA phase models selected environmental issues, called impact categories, and uses category indicators[2)] to condense and explain the LCI results. Category indicators are intended to reflect the aggregate emissions or resource use for each impact category. These category indicators represent the "potential environmental impacts"[3)] discussed in ISO 14040. In addition, LCIA prepares for the life cycle interpretation phase.

LCIA as part of an overall LCA can, for example, be used to

— identify product system improvement opportunities and assist the prioritization of them,

— characterize or benchmark a product system and its unit processes over time,

— make relative comparisons among product systems based on selected category indicators, or

— indicate environmental issues for which other techniques can provide complementary environmental data and information useful to decision-makers.

While LCIA can assist in these applications, parties should recognize that an extensive assessment of a product system is difficult and may require the use of several different environmental assessment techniques.

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1) In this International Standard, the term "product system" also includes service systems.

2) The full expression for this term is "life cycle impact category indicator".

3) The "potential environmental impacts" referred to in ISO 14040 are a subset of the "environmental impacts" referred to in ISO 14001 resulting from the use of the functional unit calculation. The "potential environmental impacts" are relative expressions, as they are related to the functional unit of a product system.

Environmental management — Life cycle assessment — Life cycle impact assessment

1 Scope

This International Standard describes and gives guidance on a general framework for the life cycle impact assessment (LCIA) phase of life cycle assessment (LCA), and the key features and inherent limitations of LCIA. It specifies requirements for conducting the LCIA phase and the relationship of LCIA to the other LCA phases.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14001:1996, *Environmental management systems — Specification with guidance for use*.

ISO 14040:1997, *Environmental management — Life cycle assessment — Principles and framework*.

ISO 14041:1998, *Environmental management — Life cycle assessment — Goal and scope definition and life cycle inventory analysis.*

ISO 14043:2000, *Environmental management — Life cycle assessment — Life cycle interpretation.*

ISO 14050:1998, *Environmental management – Vocabulary.*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this International Standard, the following terms and definitions given in ISO 14001, ISO 14040, ISO 14041, ISO 14050 and the following apply.

3.1.1
life cycle inventory analysis result
LCI result
outcome of a life cycle inventory analysis that includes the flows crossing the system boundary and provides the starting point for life cycle impact assessment

3.1.2
impact category
class representing environmental issues of concern to which LCI results may be assigned

3.1.3
life cycle impact category indicator
quantifiable representation of an impact category

NOTE The shorter expression “category indicator” is used throughout the text of this International Standard for improved readability.

3.1.4
category endpoint
attribute or aspect of natural environment, human health or resources, identifying an environmental issue of concern

NOTE Figure 2 illustrates this term in further detail.

3.1.5
characterization factor
factor derived from a characterization model which is applied to convert the assigned LCI results to the common unit of the category indicator

NOTE The common unit allows aggregation into category indicator result.

3.1.6
environmental mechanism
system of physical, chemical and biological processes for a given impact category, linking the LCI results to category indicators and to category endpoints

3.2 Abbreviated terms

LCA life cycle assessment

LCI life cycle inventory analysis

LCIA life cycle impact assessment

4 General description of LCIA

4.1 Aim of LCIA

LCIA aims to examine the product system from an environmental perspective using impact categories and category indicators connected with the LCI results. The LCIA phase also provides information for the life cycle interpretation phase.

4.2 Key features of LCIA

Key features of the LCIA are listed below.

— The LCIA phase, in conjunction with other LCA phases, provides a system-wide perspective of environmental and resource issues for one or more product system(s).

— LCIA assigns LCI results to impact categories. For each impact category, the category indicator is selected and the category indicator result, hereafter referred to as indicator result, is calculated. The collection of indicator results, hereafter referred to as the LCIA profile, provides information on the environmental issues associated with the inputs and outputs of the product system.

— LCIA is different from other techniques such as environmental performance evaluation, environmental impact assessment and risk assessment as it is a relative approach based on a functional unit. LCIA may use information gathered by these other techniques.

Clause 8 describes the inherent limitations of LCIA.

4.3 Elements of LCIA

4.3.1 The general framework of the LCIA phase is composed of several mandatory elements that convert LCI results to indicator results. In addition, there are optional elements for normalization, grouping or weighting of the indicator results and data quality analysis techniques. The LCIA phase is only one part of a total LCA study, and shall be coordinated with other phases of LCA as stated in annex A. The elements of the LCIA phase are illustrated in Figure 1.

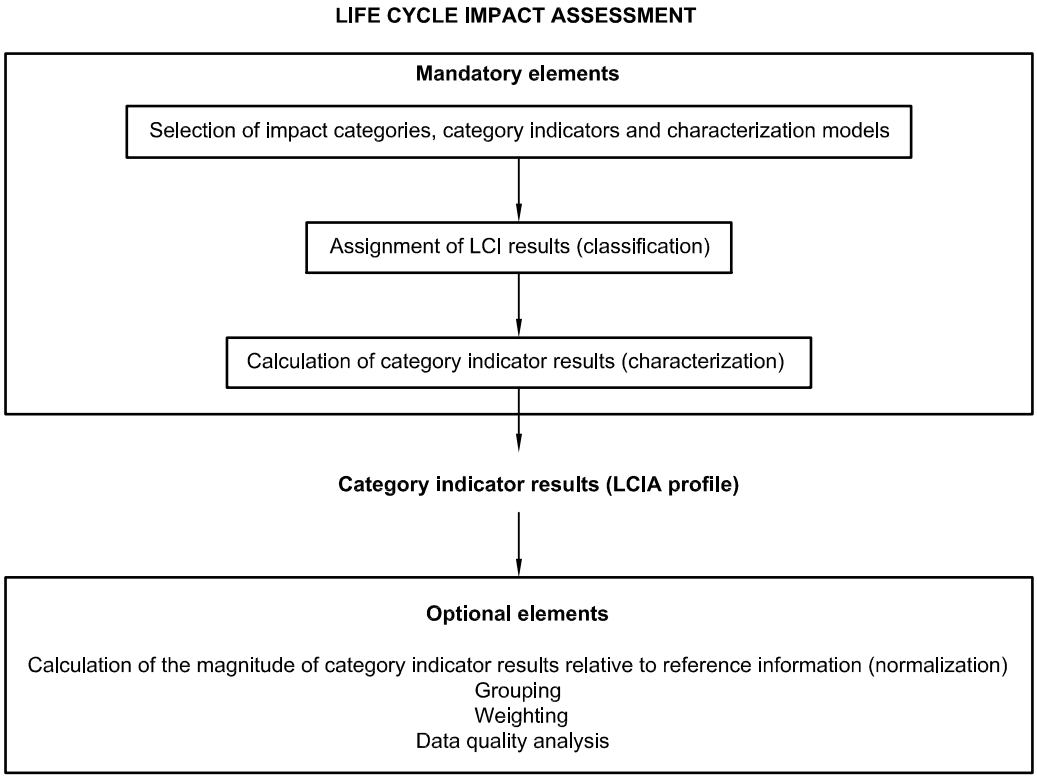

Figure 1 — Elements of the LCIA phase

Separation of the LCIA phase into different elements is necessary for several reasons.

— Each LCIA element is distinct and can be clearly defined.

— The goal and scope definition phase of an LCA study can consider each LCIA element separately.

— A quality assessment of the LCIA methods, assumptions and other decisions can be conducted for each LCIA element.

— LCIA procedures, assumptions and other operations within each element can be made transparent for critical review and reporting.

— The use of values and subjectivity, hereafter referred to as value-choices, within each element, can be made transparent for critical review and reporting.

4.3.2 The mandatory LCIA elements are listed below.

a) **Selection of impact categories, category indicators and characterization models**; identification of the impact categories, related category indicators and characterization models, category endpoints and the associated LCI results that the LCA study will address. For example, the climate change impact category represents emissions of greenhouse gases (LCI results) using infrared radiative forcing as the category indicator. See also Table 1.

b) **Assignment of LCI results (classification)** to the impact categories.

c) Calculation of category indicator results (characterization).

The indicator results for different impact categories together represent the LCIA profile for the product system.

Clause 5 describes in more detail the mandatory elements of LCIA mentioned above and in Figure 1, and provides specific requirements.

4.3.3 There are optional elements and information as listed below which can be used depending on the goal and scope of the LCA study.

a) **Calculating the magnitude of category indicator results relative to reference information (normalization).**

b) **Grouping:** sorting and possibly ranking of the impact categories.

c) **Weighting:** converting and possibly aggregating indicator results across impact categories using numerical factors based on value-choices.

d) **Data quality analysis:** better understanding the reliability of the collection of indicator results, the LCIA profile.

5 Mandatory elements

5.1 General

For the LCIA phase, the outcome of the mandatory elements is the collection of indicator results for the different impact categories.

5.2 Concept of category indicators

Figure 2 illustrates the concept of category indicators based on an environmental mechanism. Every impact category has its own environmental mechanism. The acidification impact category is used in Figure 2 as an example.

Characterization models reflect the environmental mechanism by describing the relationship between the LCI results, category indicators and in some cases category endpoint(s). The characterization model is used to derive the characterization factors. For each impact category, the necessary components include

— identification of the category endpoint(s),

— definition of the category indicator for given category endpoint(s),

— identification of appropriate LCI results that can be assigned to the impact category, taking into account the chosen category indicator and identified category endpoint(s), and

— identification of the characterization model and the characterization factors.

This procedure facilitates the collection, assignment and characterization modelling of appropriate LCI results. This also helps to highlight the scientific and technical validity, assumptions, value-choices and degree of accuracy in the characterization model.

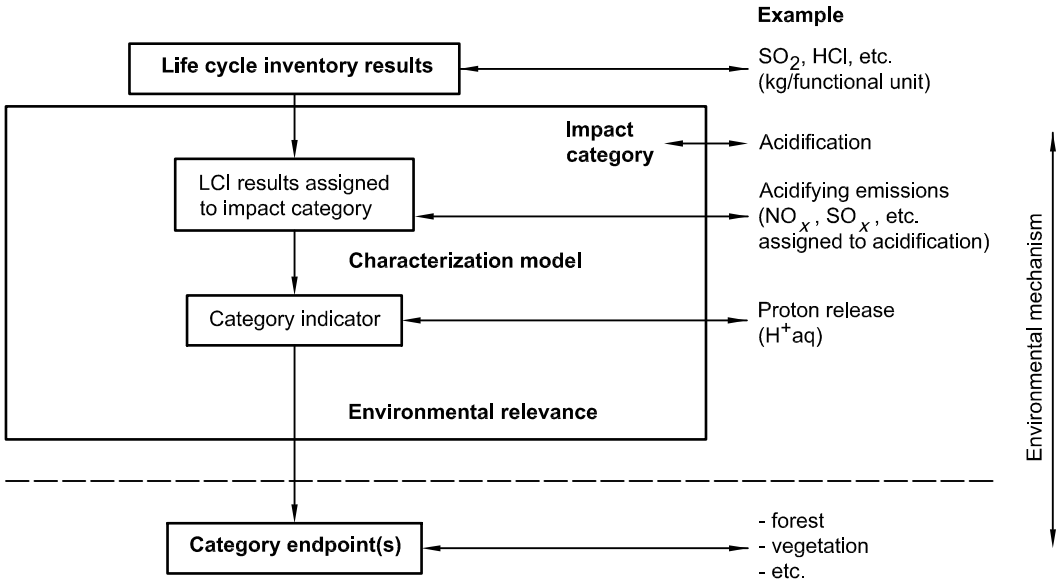

Figure 2 — Concept of category indicators

Table 1 provides examples of terms used in this International Standard. The environmental mechanism is the total of environmental processes related to climate change.

Table 1 — Example of terms

Term	Example
Impact category	Climate change
LCI results	Greenhouse gases
Characterization model	IPCC [a] model
Category indicator	Infrared radiative forcing (W/m^2)
Characterization factor	Global warming potential for each greenhouse gas (kg CO_2-equivalents/kg gas)
Indicator result	kg of CO_2-equivalents
Category endpoints	Coral reefs, forest, crops
Environmental reference	Degree of linkage between category indicator and category endpoint
NOTE Further examples are provided in ISO/TR 14047 [1].	
[a] Intergovernmental Panel on Climate Change.	

5.3 Selection of impact categories, category indicators and characterization models

5.3.1 This subclause provides guidance and requirements for the selection of impact categories, category indicators and characterization models including the criteria for environmental relevance.

For most LCA studies, existing impact categories, category indicators or characterization models will be selected. Whenever impact categories, category indicators and characterization models are selected in an LCA study, the related information shall be referenced. The requirements and recommendations of this subclause apply to the

referenced information. However, in some cases existing impact categories, category indicators or characterization models are not sufficient to fulfil the defined goal and scope of the LCA study, and new ones have to be defined. When new impact categories, category indicators or characterization models are defined, the requirements and recommendations in this subclause also apply.

The category indicator can be chosen anywhere along the environmental mechanism between the LCI results and the category endpoint(s) (see Figure 2).

5.3.2 The following requirements apply for the selection of impact categories, category indicators and characterization models:

a) the selection of impact categories, category indicators and characterization models shall be consistent with the goal and scope of the LCA study;

b) the sources for impact categories, category indicators and characterization models shall be referenced;

c) the selection of impact categories, category indicators and characterization models shall be justified;

d) accurate and descriptive names shall be provided for the impact categories and category indicators;

e) the selection of impact categories shall reflect a comprehensive set of environmental issues related to the product system being studied, taking the goal and scope into consideration;

f) the environmental mechanism and characterization model which relate the LCI results to the category indicator and provide a basis for characterization factors shall be described;

g) the appropriateness of the characterization model used for deriving the category indicator in the context of the goal and scope of the study shall be described.

5.3.3 In addition, the following recommendations apply for the selection of impact categories, category indicators and characterization models:

a) the impact categories, category indicators and characterization models should be internationally accepted, i.e. based on an international agreement or approved by a competent international body;

b) the impact categories should represent the aggregated emissions or resource use of the product system on the category endpoint(s) through the category indicators;

c) value-choices and assumptions made during the selection of impact categories, category indicators and characterization models should be minimized;

d) the impact categories, category indicators and characterization models should avoid double counting unless required by the goal and scope definition, for example when the study includes both human health and carcinogenicity;

e) the characterization model for each category indicator should be scientifically and technically valid, and based upon a distinct identifiable environmental mechanism and/or reproducible empirical observation;

f) the extent to which the characterization model and the characterization factors are scientifically and technically valid should be identified;

g) the category indicators should be environmentally relevant.

5.3.4 Depending on the environmental mechanism and the goal and scope, spatial and temporal differentiation of the characterization model relating the LCI results to the category indicator should be considered. The fate and transport of the substances should be part of the characterization model.

LCI results other than mass and energy flow data included in an LCA study, e.g. land use, shall be identified and their relationship to corresponding category indicators shall be determined.

5.3.5 The environmental relevance of the category indicator or characterization model should be clearly stated in terms of the following criteria:

a) the ability of the category indicator to reflect the consequences of the LCI results on the category endpoint(s), at least qualitatively;

b) the addition of environmental data or information to the characterization model with respect to the category endpoint(s), including

   — the condition of the category endpoint(s),

   — the relative magnitude of the assessed change in the category endpoints,

   — the spatial aspects, such as area and scale,

   — the temporal aspects, such as duration, residence time, persistence, timing, etc.,

   — the reversibility of the environmental mechanism, and

   — the uncertainty of the linkages between the characterization model and the changes in the category endpoints.

5.4 Assignment of LCI results (classification)

This subclause provides guidance for assignment of LCI results to impact categories (often referred to as classification).

When LCI results are assigned to impact categories, environmental issues associated with the LCI results can be highlighted.

Assignment of LCI results to impact categories should consider the following, unless otherwise required by the goal and scope:

— assignment of LCI results which are exclusive to one impact category;

— identification of LCI results which relate to more than one impact category, including

   — distinction between parallel mechanisms, e.g. SO_2 is allocated between the impact categories of human health and acidification, and

   — allocation among serial mechanisms, e.g. NO_x may be assigned to both ground-level ozone formation and acidification.

If LCI results are unavailable or of insufficient data quality for the LCIA to achieve the goal and scope of the study, either an iterative data collection or an adjustment of the goal and scope is required.

5.5 Calculation of category indicator results (characterization)

This subclause provides guidance and requirements for calculation of indicator results (often referred to as characterization). The calculation involves the conversion of LCI results to common units and the aggregation of the converted results within the impact category. This conversion uses characterization factors. The outcome of the calculation is a numerical indicator result.

The method of calculating indicator results shall be identified and documented, including the value-choices and assumptions used.

The usefulness of the indicator results for a given goal and scope depends on the accuracy, validity and characteristics of the characterization models and characterization factors. The number and kind of simplifying

assumptions and value-choices used in the characterization model for the category indicator also vary between impact categories. A trade-off often exists between characterization model simplicity and accuracy. Variation in the quality of category indicators among impact categories may influence the overall accuracy of the LCA study, for example

— the complexity of the environmental mechanisms between the system boundary and the category endpoint,

— the spatial and temporal characteristics, for example the persistence of a substance in the environment, and

— the dose-response characteristics.

Calculation of indicator results involves two steps:

a) selection and use of characterization factors to convert the assigned LCI results to common units;

b) aggregation of the converted LCI results into the indicator result.

One example of a category indicator is infrared radiative forcing. A characterization factor, in this case the global warming potential factor for each greenhouse gas, is used to calculate the converted LCI results for each gas in units of carbon dioxide equivalents. Their contributions are then aggregated into an indicator result in terms of total carbon dioxide equivalents.

Additional data about the environmental condition can enhance the meaning and usability of the indicator results. This issue may also be dealt with in the data quality analysis.

6 Optional elements

6.1 General

This clause describes three optional LCIA elements: normalization, grouping and weighting. These elements may use information from outside the LCIA framework. Such information should be justified and reported. Normalization employs baselines and/or reference information. Grouping and weighting employ value-choices.

6.2 Calculating the magnitude of the category indicator results relative to reference information (normalization)

The aim of the normalization of indicator results is to better understand the relative magnitude for each indicator result of the product system under study. Calculating the magnitude of indicator results relative to reference information (often referred to as normalization) is an optional element which may be helpful in, for example

— checking for inconsistencies,

— providing and communicating information on the relative significance of the indicator results, and

— preparing for additional procedures, such as grouping, weighting or life cycle interpretation.

This procedure transforms an indicator result by dividing it by a selected reference value. Some examples of reference values are

— the total emissions or resource use for a given area, which may be global, regional, national or local,

— the total emissions or resource use for a given area on a *per capita* basis or similar measurement, and

— a baseline scenario, such as a given alternative product system.

The selection of the reference system should consider the consistency of the spatial and temporal scales of the environmental mechanism and the reference value.

The normalization of the indicator results changes the outcome of the mandatory elements of the LCIA phase. It may be desirable to use several reference systems to show the consequence on the outcome of mandatory elements of the LCIA phase. A sensitivity analysis may provide additional information about the choice of reference. The collection of normalized indicator results represents a normalized LCIA profile.

6.3 Grouping

Grouping is assigning impact categories into one or more sets as predefined in the goal and scope definition, and it may involve sorting and/or ranking. Grouping is an optional element with two possible procedures:

— to sort the impact categories on a nominal basis, e.g. by characteristics such as emissions and resources or global regional and local spatial scales;

— to rank the impact categories in a given hierarchy, e.g. high, medium, and low priority.

Ranking is based on value-choices.

The application and use of grouping methods shall be consistent with the goal and scope of the LCA study and it shall be fully transparent.

Different individuals, organizations, and societies may have different preferences, therefore it is possible that different parties will reach different ranking results based on the same indicator results or normalized indicator results.

6.4 Weighting

Weighting is the process of converting indicator results of different impact categories by using numerical factors based on value-choices. It may include aggregation of the weighted indicator results. Weighting is an optional element with two possible procedures:

— to convert the indicator results or normalized results with selected weighting factors;

— to possibly aggregate these converted indicator results or normalized results across impact categories.

Weighting steps are based on value-choices and are not based on natural science.

The application and use of weighting methods shall be consistent with the goal and scope of the LCA study and it shall be fully transparent. Different individuals, organizations and societies may have different preferences, therefore it is possible that different parties will reach different weighting results based on the same indicator results or normalized indicator results. In an LCA study it may be desirable to use several different weighting factors and weighting methods, and to conduct sensitivity analysis to assess the consequences on the LCIA results of different value-choices and weighting methods.

All weighting methods and operations used shall be documented to provide transparency. Data and indicator results or normalized indicator results reached prior to weighting should be made available together with the weighting results. This ensures that

— trade-offs and other information remain available to decision-makers and to others, and

— users can appreciate the full extent and ramifications of the results.

7 Data quality analysis

Additional techniques and information may be needed to better understand the significance, uncertainty and sensitivity of the LCIA results in order to

— help distinguish if significant differences are or are not present,

— remove negligible LCI results, or

— guide the iterative LCIA process.

The need for and choice of techniques depend upon the accuracy and detail needed to fulfil the goal and scope of the LCA study.

The specific techniques and their purposes are described below.

— Gravity analysis (e.g. Pareto analysis) is a statistical procedure which identifies those data having the greatest contribution to the indicator result. These items may then be investigated with increased priority to ensure that sound decisions are made.

— Uncertainty analysis, as defined in ISO 14041, describes the statistical variability in data sets in order to determine if indicator results from the same impact category are significantly different from each other.

— Sensitivity analysis, as defined in ISO 14041, measures the extent to which changes, e.g. in the LCI results, characterization models, etc., influence the indicator results. Likewise, the extent to which modifications in the calculation procedures influence the LCIA profile can be examined.

Due to the iterative procedure of LCA, the result of the data quality analysis may further guide the LCI phase, e.g. refining cut-off criteria or collecting data that may have been excluded. See also annex A.

8 Limitations of LCIA

The LCIA addresses only the environmental issues that are identified in the goal and scope. Therefore, LCIA is not a complete assessment of all environmental issues of the product system under study.

LCIA has inherent limitations.

— LCIA is, wherever possible, a technical and scientific procedure. However, value-choices are used in the selection of impact categories, category indicators and characterization models, and in normalization, grouping, weighting and other procedures.

— LCIA typically excludes spatial, temporal, threshold and dose-response information, and combines emissions or activities over space and/or time. This may diminish the environmental relevance of the indicator result.

— Category indicators may vary in precision among impact categories, due to differences

  — between the characterization model and the corresponding environmental mechanism, e.g. spatial and temporal scales,

  — in the use of simplifying assumptions, and

  — within available scientific knowledge.

— LCIA results do not predict impacts on category endpoints, exceeding of thresholds, safety margins or risks.

— LCIA cannot always demonstrate significant differences among impact categories and the related indicator results of alternative product systems. This may be due to the

— limited development of the characterization models used in characterization, sensitivity analysis and uncertainty analysis for the LCIA phase,

— limitations of the LCI phase, such as setting system boundaries that do not encompass all possible unit processes for a product system or include all inputs and outputs of every unit process, since there are cut-offs and data gaps,

— limitations of the LCI phase, such as insufficient LCI data quality which may for instance be caused by uncertainties or differences in allocation and aggregation procedures, and

— limitations in the collection of inventory data appropriate and representative for each impact category.

9 Comparative assertions disclosed to the public

This clause applies to the LCIA phase which provides support for comparative assertions disclosed to the public. Requirements given are in addition to those in ISO 14040:1997, 5.1.2.4 and clause 7, and ISO 14041:1998, clause 7.

LCIAs which support comparative assertions shall employ a sufficiently comprehensive set of category indicators. The comparison shall be conducted category indicator by category indicator. LCIAs shall not provide the sole basis of comparative assertions of overall environmental superiority or equivalence as additional information may be necessary to overcome some of the limitations stated in clause 8.

Weighting, as described in 6.4, shall not be used for comparative assertions[4)] disclosed to the public.

Category indicators used to support comparative assertions disclosed to the public should be internationally accepted. As a minimum, such category indicators shall be

— scientifically and technically valid, i.e. using a distinct identifiable environmental mechanism and/or reproducible empirical observation, and

— environmentally relevant, i.e. have sufficiently clear links to the category endpoint(s) including, but not limited to, spatial and temporal characteristics.

NOTE For additional information about environmental mechanism and environmental relevance, see clause 5.

An analysis of results for sensitivity and uncertainty shall be conducted for studies aimed at supporting comparative assertions.

10 Reporting and critical review

10.1 General

This clause provides requirements on the reporting and critical review of the LCIA results. These requirements are in addition to those listed in ISO 14040 and ISO 14041.

10.2 Reporting of LCIA

10.2.1 If a third-party report in accordance with ISO 14040:1997, clause 6, is prepared, the report shall include the following items:

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4) A comparative assertion is an ”environmental claim regarding the superiority or equivalence of one product versus a product which performs the same function” [ISO 14040:1997].

a) the LCIA procedures, calculations and results of the study;

b) limitations of the LCIA results relative to the defined goal and scope of the LCA study;

c) the relationship of LCIA results to the defined goal and scope, see annex A;

d) the relationship of the LCIA to the LCI results, see annex A;

e) impact categories considered, including a rationale for their selection and a reference to their source;

f) descriptions of or reference to all characterization models, characterization factors and methods used, including all assumptions and limitations;

g) descriptions of or reference to all value-choices used in relation to impact categories, characterization models, characterization factors, normalization, grouping, weighting and, elsewhere in the LCIA, a justification for their use and their influence on the results, conclusions and recommendations;

h) a statement that the LCIA results are relative expressions and do not predict impacts on category endpoints, exceedence of thresholds, safety margins or risks.

10.2.2 When included as a part of the LCA study, the following items shall also be included if a third-party report in accordance with ISO 14040:1997, clause 6, is prepared:

a) a description and justification of the definition and description of any new impact categories, category indicators or characterization models used for the LCIA;

b) a statement and justification of any grouping of the impact categories;

c) any further procedures that transform the indicator results and a justification of the selected references, weighting factors, etc.;

d) any analysis of the indicator results, for example sensitivity and uncertainty analysis or the use of environmental data, including any implication for the results;

e) data and indicator results reached prior to any normalization, grouping or weighting shall be made available together with the normalized, grouped or weighted results;

10.2.3 In addition, for comparative assertions disclosed to the public, the report shall include the following items:

a) an evaluation of the completeness of the LCIA;

b) a statement as to whether or not international acceptance exists for the selected category indicators and a justification for their use;

c) a justification for the scientific and technical validity and environmental relevance of the category indicators used in the study;

d) the results of the uncertainty and sensitivity analyses;

e) an evaluation of the significance of the differences found;

f) if grouping is included in the LCA study:

   — the procedures and results used for grouping;

   — a statement that conclusions and recommendations derived from grouping are based on value-choices;

   — a justification of the criteria used for normalization and grouping (these can be personal, organizational or national value-choices);

— the statement that “ISO 14042 does not specify any specific methodology or support the underlying value-choices used to group the impact categories”;

— the statement that “The value-choices and judgements within the grouping procedures are the sole responsibilities of the commissioner of the study (e.g. government, community, organization, etc.)”.

10.2.4 Where relevant, the items listed in this subclause should also be considered in the elaboration of other kinds of reports where LCIA results are used.

NOTE 1 A graphical presentation of LCIA results as part of the report may be useful, but it should be considered that this invites implicit comparisons and conclusions.

NOTE 2 Due to the inherent complexity of the LCIA phase, the above-mentioned documentation in addition to that required in ISO 14040 may be desired for internal and two-party reports.

10.3 Critical review

The type of critical review performed shall be defined as part of the goal and shall be consistent with ISO 14040:1997, 7.3.

When the LCA study is intended to be used for a comparative assertion disclosed to the public, a critical review shall be conducted as presented in ISO 14040:1997, 7.3.3.

For LCIA, the expertise of reviewers in the scientific disciplines relevant to the important impact categories of the study, in addition to other expertise and interest, shall be considered. The review should include the ability of the classification, characterization, normalization, grouping and weighting elements to support the life cycle interpretation phase of the LCA study.

Annex A
(normative)

Relationship of life cycle impact assessment to the LCA framework

A.1 General

The LCIA phase shall be carefully planned to achieve the goal and scope of an LCA study. Therefore, the relationship between LCIA and the other phases of LCA shall be clearly understood.

A.2 Relationship to goal and scope definition

The goal and scope definition phase should be reviewed in order to

— identify specific objectives for the LCIA phase of the LCA study,

— identify the environmental issues and concerns to be addressed,

— select the impact categories which address the identified environmental issues and concerns,

— identify the level of detail, scientific and technical validity, and environmental relevance necessary for the impact categories, category indicators and characterization models,

— select a category indicator for each impact category,

— identify other technical requirements and information related to the LCIA phase needed for the LCA study,

— identify the use of value-choices,

— determine the level of aggregation, e.g. spatial, for indicator results from different impact categories,

— determine the data quality analysis needs,

— identify the documentation and transparency requirements for reporting, which increase significantly from screening applications to comparative assertions disclosed to the public,

— define the reference(s) and calculations for each category indicator if transformation of category indicators with reference values is performed, and

— define the set of value-choices used and the procedures by which these are selected and applied if normalization, grouping or weighting are performed.

A.3 Relationship to life cycle inventory analysis

LCI analysis and LCIA are interdependent activities that require coordination. The characteristics of LCIA impact categories, category indicators and characterization models direct the collection of specific LCI data. The following shall be considered as possible omissions and sources of uncertainty:

— whether the quality of the LCI data and results are sufficient to conduct the LCIA in accordance with the study goal and scope definition;

— whether the system boundary and data cut-off decisions have been sufficiently reviewed to ensure the availability of LCI results necessary to calculate indicator results for the LCIA;

— whether the environmental relevance of the LCIA indicator results is decreased due to the LCI functional unit calculation, system wide averaging, aggregation and allocation.

A.4 Relationship to life cycle interpretation

LCIA results feed into the life cycle interpretation phase. The degree of transparency and completeness are also important in view of the iterative nature of the LCA study. As life cycle interpretation should reflect the applications and limitations of the LCA study, it is important to examine

— the selection of impact categories, category indicators and characterization models, assignment of LCI results, and calculation of category indicator results,

— the assumptions and value-choices used,

— the effects of these decisions, assumptions, etc. on the indicator results,

— the need for or the results of sensitivity and uncertainty analyses, their relative contribution to the indicator results for impact categories, environmental data, and information from other environmental techniques,

— whether the LCIA results after quality assessment indicate that any significant differences do or do not exist, and

— whether these significant differences are meaningful to the environment.

Bibliography

[1] ISO/TR 14047 [5], *Environmental management — Life cycle assessment — Examples for the application of ISO 14042*.

5) To be published.

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