
**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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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.

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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's¹⁾ 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 indicators²⁾ 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.

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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

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3.2 Abbreviated terms

LCA life cycle assessment

LCI life cycle inventory analysis

LCIA life cycle impact assessment

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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.

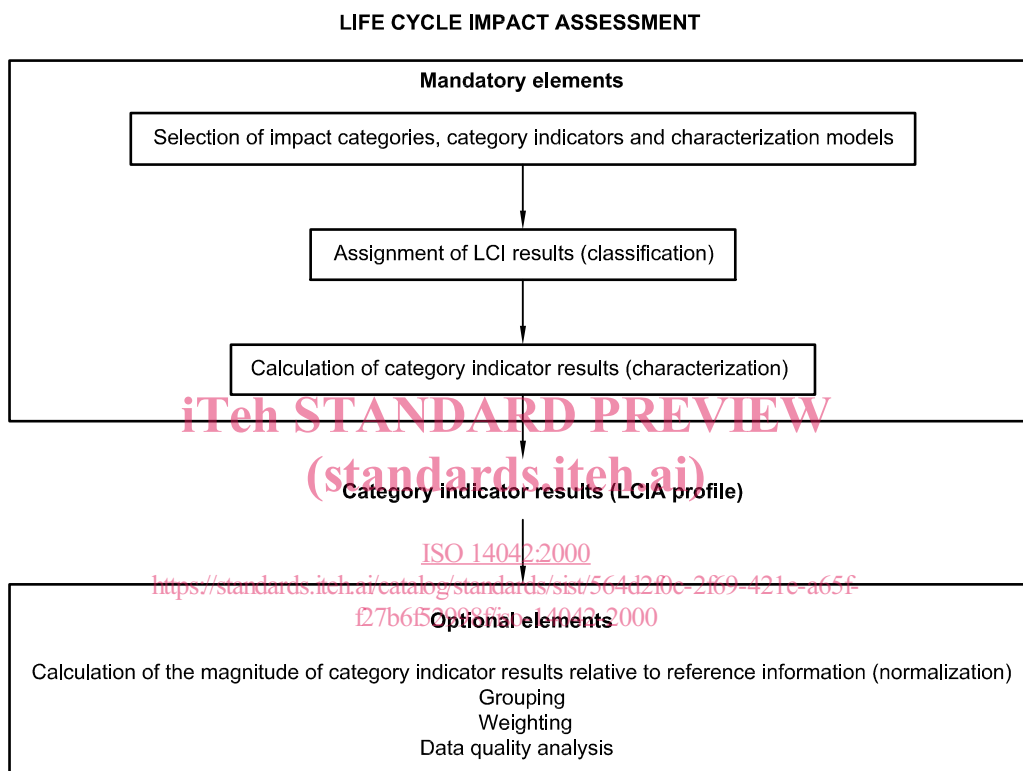


Figure 1 — Elements of the LCIA phase

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.

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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.

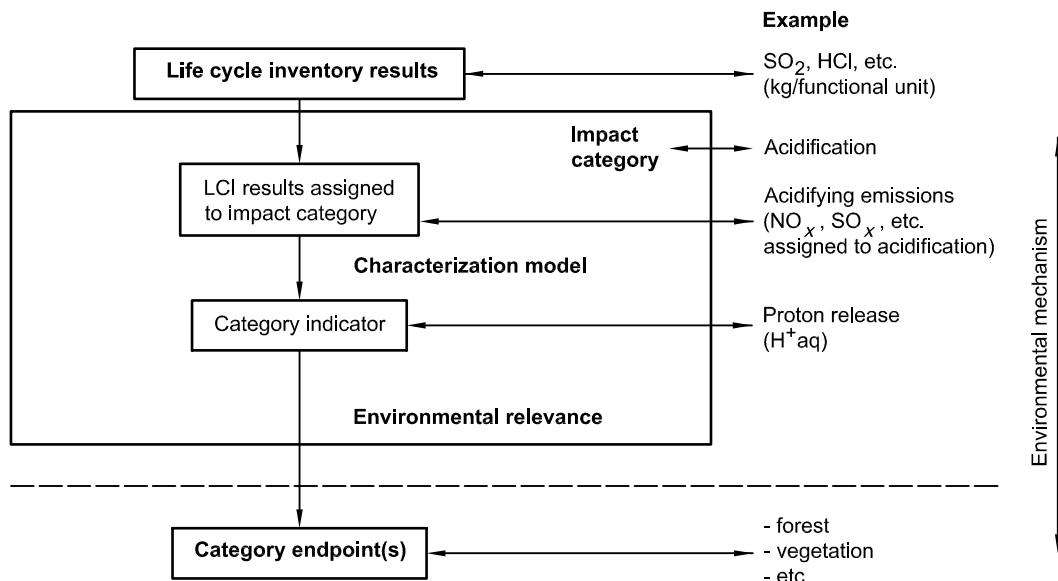


Figure 2 — Concept of category indicators

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