Standards Committee on Type III Life-Cycle Impact Profile Declarations for Products, Services and Systems

Life Cycle Assessment Framework for Establishing Product, Organization, and Building, Environmental Footprints and LCAs, and Requirements for Associated Public Claims

Karsell Proposed Draft Update (2016-04-26) of Draft Main Body of the LEO-SCS-002 Standard

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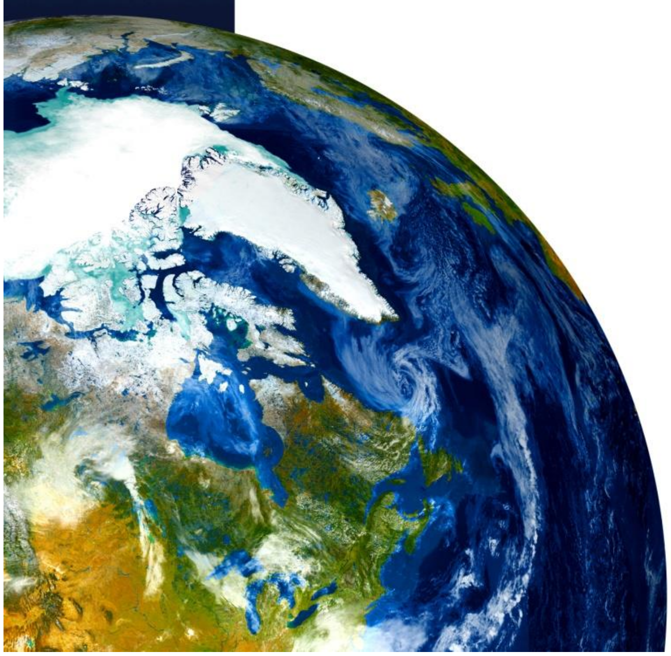

For more information, please contact:
Leonardo Academy, www.leonardoacademy.org, 608.280.0255

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0. Introduction.

This Section summarizes the need for the Standard.

Environmental Product Declarations (EPDs) and other public claims based in life cycle assessment (LCA) have been the subject of prior international standardization efforts. Environmental labeling guidelines defined within the international ISO 14020 standards series distinguish "Type III" environmental declarations from third-party certified eco-logos ("Type I") and self-declared single attribute environmental claims ("Type II").[1,2,3] According to ISO-14025, "Type III Environmental Declarations present quantified environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function." Environmental Declarations offer consumers, purchasers and other decision-makers a new level of transparency for evaluating and comparing the environmental performance of products and systems.[4] Type III Environmental Declarations have been used to verify the environmentally preferable product status conferred by Type I logos, to evaluate potential environmental trade-offs associated with single attribute Type II "green" claims, and to test environmental assumptions underlying product development, industry planning, and regulatory policy decisions.

Type III environmental declarations (ISO 14025) are based upon life cycle assessment (LCA). To facilitate the usefulness of environmental declarations in supporting product and system comparisons, the LCAs underlying these declarations should be conducted in a consistent, standardized manner. ISO-14044 is the international framework document providing high-level LCA requirements and guidance. This standard complements ISO 14044 and ISO 14025 by providing detailed guidance for conducting LCA, , and describing the technical requirements for establishing environmentally relevant indicators and comprehensive life cycle impact assessment (LCIA) profiles.

[1] ISO 14025: ISO/TC 207/SC3/WG1 TG Type III N22, "Type III Environmental Labeling," Scientific Certification Systems, 1997.

[2] ISO/TR 14025:2006. Environmental Labels and Declarations — Type III Environmental Declarations; http://www.iso.org/iso/catalogue_detail.htm?csnumber=38131

[3] European Commission, Summary of Discussions at the 2nd Integrated Product Policy Expert Workshop, Environmental Product Declarations (ISO 14025 Technical Report), Brussels, 16 May 2001, p 2. "Within the ISO framework an EPD contains a variety of information about the composition and environmental characteristics of a product based on life cycle assessment (LCA)... The information is then presented in a common format and in a neutral way that enables evaluations and comparisons by the purchaser but which does not seek to judge the environmental characteristics of a product. The quality of the information is then verified by a third-party source..."

[4] US Environmental Protection Agency, Environmental Labeling: Issues, Policies, and Practices Worldwide, Dec. 1998, p 13.

1. Scope.

This Section summarizes the scope of this Standard.

1.1 LCA Framework. This Standard, including its Annexes, supplements the general LCA framework described in ISO-14044 by providing:

- Guidance for defining the scope of the study such that the functional unit is scaled to accurately represent impacts occurring as a result of activities in the product system;
- guidance for developing appropriate reference baselines to serve as the basis for comparisons;
- technical guidance pertaining to the iterative process for LCA;
- a standardized list of impact categories and category indicators to be considered in LCA studies;
- guidance and requirements necessary in order to identify relevant (i.e., "core") impact categories and category indicators;
- standardized characterization models for calculating category indicator results for core impact categories;
- guidance pertaining to environmental data collection required for establishing characterization factors using characterization models; and
- guidance for data quality assessment and uncertainty analysis, to understand the overall data quality and/or uncertainty of final indicator results.

1.2. Guidelines for Environmental Declarations and Other Types of Public Claims. The Standard establishes specific guidance for EPDs, as well as for other public claims, in order to ensure a high level of rigor and consistency in the information reported (see Section 8.1). This Standard provides a sufficiently robust LCA framework to support comparative assertions in conformance with ISO 14044.

1.3. Intended Users. This Standard is intended for use by:

- product manufacturers;
- sustainability managers at large companies;
- service professionals;
- environmental professionals;
- policymakers;
- those involved in developing environmental regulation and policy;
- material and energy resource planners;
- environmental advocacy groups;
- industrial, commercial and residential customers;
- climate registries and programs;
- greenhouse gas management systems and operators;
- procurement agencies and professionals;
- LCA practitioners;
- Verifiers of EPDs.

This Standard can be used in developing environmental policy and regulation, and determining the effectiveness of existing regulation.

1.4. Voluntary Standard. This Standard is voluntary only, and does not establish regulatory requirements.

1.5. Addresses Impacts to the Environment and Human health. This Standard only addresses impacts to the environment and human health which can be documented with observed stressors, midpoints, and endpoints (the conditions of which can be measured), in a stressor-effects network based on a well-defined and distinct environmental mechanism. Economic and social impacts are not covered.

2. References.

This section lists key references that are considered normative to the Standard (incorporated by reference) and additional references.

2.1. Normative References.

- ISO 14044:2006. Environmental management — Life cycle assessment (LCA) — Requirements and guidelines
- ISO 14025:2006. Environmental labels and declarations — Type III Environmental Declarations — Principles and procedures
- ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework.
- ISO 14020:2000. Environmental labels and Declarations – General principles.

2.2. Additional References.

- Danish Ministry of the Environment. *Spatial differentiation in Life Cycle impact assessment.*
- International Life Cycle Reference Document Handbook: General guide for Life Cycle Assessment – Detailed Guidance
- International Life Cycle Reference Document Handbook: Analysis of existing Environmental Impact Assessment methodologies for use in Life Cycle Assessment
- Swiss Centre for Life Cycle Inventories, Ecoinvent Report No. 1, “Overview and Methodology, Data v2.0” (2007), Edited by Rolf Frischknecht and Niels Jungbluth.

3. Terminology.

This section defines terms and abbreviations used in this Standard and its Annexes. Terms are not defined where they retain their normal dictionary definition. Some definitions are taken from ISO-14044 or ISO-14025 and included here for the convenience of the user; these are noted. In some cases, terms defined in those standards have been updated to more precisely convey the meaning in the context of this framework. This has been noted in the definition of the term.

3.1. Terms and Definitions.

Abiotic Resource	A resource deriving from inert materials, not recently living biomass.
Anthropogenic system	Collection of unit processes with elementary and product flows, and which models the life cycle of an anthropogenic system such as a product, organization, or building. Product systems, organizational systems, and building systems, are anthropogenic systems.
Biotic Resource	A resource deriving recently from living biomass.
Biome	A part of a holistic ecosystem the character of which is defined specifically in terms of: spatial extent; time; community type (e.g., terrestrial, freshwater, wetland, marine); and defined physical and ecological components which can be subject to measurement. This definition is intended to provide for a sufficiently specific definition of an ecosystem portion in a given region such that measurements in ecological conditions can be made compared to undisturbed reference conditions.
Biome (Terrestrial)	A biotic community in a specific terrestrial area, which is defined by conditions such as prevailing vegetation structure, leaf types, plant spacing, vegetative species composition, vegetative compositional structure, vegetative age structure, presence of large living trees and snags (if relevant), presence of biomass (above and below ground), soil conditions, connectivity, landscape heterogeneity, fragmentation, climate, and topography.
Biome (Freshwater)	An interconnected biotic community, including watercourses, lakes, wetlands, and adjacent riparian areas, within specific watershed boundaries, defined by: salinity; turbidity; water temperature; sedimentation rates; sediment size distribution; flow rates; depths; channel contours; hydrology and hydraulics; water quality; watershed area; tributary areas; stream lengths; presence of large woody debris; riparian canopy cover; riparian zone vegetative species composition; climate; and geology.
Biome (wetland)	A biotic community in a specific wetland, defined by: salinity; turbidity; water quality; sedimentation rates; sediment size distribution; flow rates; depths; hydrology; vegetative cover; plant structure (if plants are present); bottom particle composition and structure; channel connectivity; channel complexity; tidal action (for saltwater wetlands); wave action (for saltwater wetlands); and climate.
Building Environmental Footprint	See Building LCA.
Building LCA	Compilation and evaluation of the inputs, outputs and the environmental and human health impacts of a building system throughout its life cycle.
Building system	Collection of building components (making up a whole building or a portion of a building) with elementary and product flows, performing one

	or more defined functions, and which models the impacts associated with the construction, operation, demolition, and other stages of a buildings life cycle.
Category Indicator	Quantifiable representation of an impact category [Ref. ISO-14044] (Also referred to as "Impact Category Indicator," or simply, "Indicator.")
Comparative Assertion	Environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. *[Ref: ISO 14044]*
Confidence Bound	A value representing the maximum (or minimum) value of a data point.
Confidence Interval	An estimated range of values which is expected to include the actual value of a data point, defined by a lower confidence bound and an upper confidence bound.
Contribution Analysis	An analysis of the quantitative contribution of different unit processes, or groups of unit processes, to different category indicator results for an anthropogenic system. Usually expressed as a percentage of each indicator result.
Core Impact Category	An impact category in which at least one unit process in the product system under study contributes measurably to observed midpoints or endpoints in the stressor-effects network. Defined independently by anthropogenic system.
Climate	Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind. *[Ref: IPCC Fifth Assessment Report Glossary]*
Climate Forcer	An emission or activity which can be linked to positive or negative climate forcing (i.e., both warming and cooling are considered).

Climate System	A highl complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations and anthropogenic forcings such as the changing composition of the atmosphere and land use change. *[Ref: IPCC Fifth Assessment Report Glossary]* In this standard, a climate system is defined on a specific spatial scale, considering either the global climate system, or regional climate systems within specific geographic regions.
Cumulative Risk Factor	A unitless factor which characterizes the relative severity of risks of human exposure over defined thresholds.
Damage	Diminishment of environmental quality or functionality (e.g., air quality, water quality, climate stability, ecosystem services).
Data Quality	Characteristics of data that relate to their ability to satisfy stated requirements *[Ref: ISO 14044].*

Data Quality Indicators	Qualitative indicators that relate the ability of a piece of data to satisfy the stated requirements.
Disturbance	Average deviation in overall ecological conditions in a biome, when compared to undisturbed conditions (i.e., unaffected by anthropogenic activities since the pre-industrial era) and fully disturbed conditions (i.e., representing maximally disturbed areas) in an area within the same biome type.
Earth system	In this standard refers to a non-anthropogenic system (e.g., climate system or ecosystem) consisting of components interacting with each other and their environment such that energy and mass is exchanged. The components included must be observable with conditions that can be measured or modeled. Earth system components which are altered due to a measurable degree are either midpoints or endpoints in an environmental mechanism in a specific impact category.
Ecosystem	An ecosystem is a community of organisms interacting with each other and with their environment such that energy is exchanged and system-level processes, such as the cycling of elements, emerge. In practice can refer to a variety of spatial scales from microbial to the Earth as a whole.
Effect	A change to human health or the environment.
Emission Loading	A measurable contribution to a midpoint or endpoint, measured in units of mass or volume.
Endpoint	Attribute or aspect of natural environment, human health, or resources, identifying an environmental issue giving cause for concern *[ISO-14044]* In this standard refers to observable alterations in conditions of a component of an Earth system which can be measured or modeled.
Environmental Characterization Data	Data used in the characterization model to establish the relevant characterization factors for category indicators.
Environmental Data	See environmental characterization data.
Midpoint Characterization Factor	A factor characterizing the temporal nature, spatial extent, severity, reversibility, and/or exceedance of thresholds, of impacts on a specific midpoint or endpoint.
Environmental Product Declaration	Claim which indicates the environmental aspects of a product or service, providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information *[Ref: 14025]* Also known as a Type III environmental declaration.
Environmental Mechanism	System of physical, chemical, radiological, and biological processes for a given impact category, linking stressor(s) to midpoints and to category endpoints. *[Based on 14044]*
Environmentally Preferable	A product which, for all category indicators included in the LCIA profile has lower results than the reference baseline.
Environmental Relevance	The degree of linkage between a category indicator result and the category endpoint(s). *[Ref. ISO 14044, § 4.4.2.2.2]*
Exceedance of threshold	For a given impact category, represents the surpassing of a threshold (defined below).
Functional Unit	Quantified performance of a product system for use as a reference unit. *[Ref. ISO 14044].* In this standard, the functional unit shall be based on

	the performance of a product system over at least a 10 year time period, which can evaluated for as long as a 50 year time period.
Impact	An effect on human health or the environment.
Impact Category	Class representing environmental issues of concern to which life cycle inventory analysis results may be assigned *[Ref: ISO-14044]*. The issues of concern are represented in a distinct environmental mechanism, which can be modeled with a stressor-effects network made up of observable stressors, midpoints, and endpoints.
Impact Group	Impact categories with similar endpoints and environmental mechanisms.
Impact Profile	See LCIA Profile. *(Also referred to as "profile" or "eco-profile.")*
Hot Spot	A midpoint or endpoint experiencing a significant alteration. See Section 6.1.5.
Hot Spot Analysis	An analysis identifying all hot spots within an anthropogenic system.
Key unit process	A unit operation for which associated stressors are significant contributors to final indicator results, based upon contribution analysis.
Key unit process analysis	See Contribution Analysis.
Input	Product, material or energy flow that enters a unit process. *[Ref. ISO 14044].*
Life Cycle	Consecutive and interlinked stages of a product system, from raw material acquisition or generation from providing environment to final disposal.
Life Cycle Assessment (LCA)	Compilation and evaluation of the inputs, outputs and the environmental and human health impacts of a product system throughout its life cycle. *[Based on ISO 14044]*
LCA Screening	LCA screenings identify the set of relevant impact categories for the LCA and also describe any contribution to impact hot spots.
LCA Time Horizon	The specific time horizon considered in a product LCA, organizational LCA, or building LCA.
Life Cycle Impact Assessment (LCIA)	Phase of life cycle assessment aimed at determining the magnitude and significance of the environmental and human health impacts for a product system throughout the life cycle of the product. *[Based on ISO 14044]*
LCIA Profile	A discrete compilation of the LCIA category indicator results for different impact categories. *[Ref: ISO 14044, §4.4.2.5]*
Life Cycle Inventory (LCI)	Phase of a life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle. *[Ref: ISO 14044]*
Life Cycle Interpretation	Phase of life cycle assessment in which findings of either the inventory analysis or the impact assessment, or both, are evaluated in relation to the defined goal and scope in order to reach conclusions and recommendations. *[Ref: ISO 14044]*
Midpoints	A distinct node in a stressor-effects network representing an observed chemical, physical, radiological or biological impact that is linked to the final category endpoint(s). In this standard refers to observable alterations in conditions of a component of an Earth system which can be measured or modeled.

Node	The modeled representation of an observed chemical, physical, radiological, or biological impact within a distinct stressor-effects network.
Organization	Company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration. *[Ref: ISO 14064:1]* In this Standard, also includes nations of sub-national entities (e.g., states or provinces).
Organizational Environmental Footprint	See Organizational LCA.
Organizational LCA	Compilation and evaluation of the inputs, outputs and the environmental and human health impacts of an organizational system.
Organizational system	Collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the impacts associated with the operations of an organization.
Output	Product, material or energy flow that leaves a unit process . *[Ref. ISO 14044]*.
Population Exposure Coefficient	Population Exposure Coefficient (PEC) for a grid cell is the population in the grid cell, assessed using population density maps. The PEC has units of persons.
Product	Any goods or service. *[Ref: ISO 14025]*.
Product Category	Group of products that can fulfill equivalent functions *[Ref: ISO 14025]*.
Product Environmental Footprint	See Product LCA.
Product LCA	Compilation and evaluation of the inputs, outputs and the environmental and human health impacts of a product system throughout its life cycle. In this case, the product system is a product performing one or more defined functions.
Product Category Rule (PCR)	A set of specific rules, requirements and guidelines for developing Type III environmental declarations for specific product categories *[Ref: ISO 14025]*.
Product system	Collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product. *[Ref. ISO 14044]*
Program Operator	Body or bodies that conduct a Type III environmental declaration program. *[Ref. ISO 14025]*
Providing Environment	The environment from which raw materials are extracted.
Whole Building Environmental Footprint	See Whole Building LCA.
Whole Building LCA	Compilation and evaluation of the inputs, outputs and the environmental and human health impacts of a building system throughout its life cycle.

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Public claim	In this Standard, refers to any communication intended for public communication which includes results based in LCA.

Receiving Environment	The environment affected by stressor(s) including emissions, land use, or wastes.
Reference Baseline	The scenario against which a product is compared.
Reference Flow	The reference flow is the measure of the outputs from processes in a given product system required to fulfill the function expressed by the functional unit. *[Ref. ISO-14044]* In this standard, the reference flow includes outputs over at least a 10 year time period, which can evaluated for as long as a 50 year time period (based on the functional unit definition).
Resource Depletion	The degree to which the net consumption of a resource results in a reduction in its reserve base, taking into account the extent of reserve base and projected consumption.
Sensitivity Analysis	Systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a study. *[Ref. ISO-14044]*
Stressor	Any life cycle inventory input, output, or other activity associated with a unit process that can be linked to observable midpoints and endpoints in a defined environmental mechanism.
Potency Potential Characterization Factor	A factor characterizing the relative potency of individual stressors which contribute to a common endpoint. Used to aggregate related stressors into a single category indicator.
Stressor-Effects Network	A model used to represent an environmental mechanism, beginning with stressor(s) associated with a given unit process, which lead to midpoint(s) and eventually category endpoint(s) within an impact category. *(Also referred to as "Cause-Effect Chain")*
System	See anthropogenic system.
Third Party	Person or body that is recognized as being independent of the parties involved, as concerns the issues in question. *[Ref. ISO 14025]*
Threshold	A recognized environmental condition that, when exceeded, is linked to nonlinear changes in impacts to environment or human health.
Time Horizon	A specified timeframe.
Ton	Metric ton (1,000 kilograms or 2,204.6 pounds).
Uncertainty Analysis	Systematic procedure to quantify the uncertainty introduced in the results of a life cycle assessment due to the cumulative effects of model imprecision, input uncertainty and data variability.
Unit Operation	A group of linked unit processes.
Unit Process	Smallest element considered in the life cycle assessment for which input and output data are quantified *[Ref: ISO 14044].*
Verification	Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled. *[Ref: ISO 14025].*
Verifier	Person or body that carries out verification. *[Ref: ISO 14025].*

3.2. Abbreviations and Acronyms. The following abbreviations and acronyms are found in the Standard and its Annexes.

AOT60	Accumulated Ozone Concentration over Threshold (>60 ppb)
BDF	Biome Disturbance Factor
$CaCO_3$	Calcium Carbonate
CAA	Clean Air Act
CI	Confidence interval
CF	Climate Forcer
CFC	Chlorofluorocarbon
CFR	US Code of Federal Regulations
CRF	Cumulative Risk Factor
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalents
F-PCR	Functional Product Category Rule
CREL	Chronic Reference Exposure Level
CRF	Cumulative Risk Factor
DQI	Data Quality Indicator
DQR	Data Quality Rating
EDIP	Danish LCIA Guidelines
EEA	European Environmental Agency
EIA	Energy Information Agency
EOT	Exceedance of Threshold
EPA	US Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPD	Environmental Product Declaration
EPP	Environmentally Preferable Product
ERL	Effects Range-Low
EU	European Union
g	Grams
GHG	Greenhouse Gas
GLO	Ground Level Ozone
GMT	Global Mean Temperature
GWP	Global Warming Potential
Ha	Hectare
HAAC	Hazardous Ambient Air Contaminant
HDF	Habitat Disturbance Factor
HEC	Hazardous Environmental Contaminant
HFC	Hydrofluorocarbons
HFWC	Hazardous Food or Water Contaminant
HIAC	Hazardous Indoor Air Contaminant
HLF	Habitat Loss Factor
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory model
IARC	International Agency for Research on Cancer
ILCD	International Life Cycle Reference Document
IPCC	Intergovernmental Panel on Climate Change
IRIS	Integrated Risk Information System
ISO	International Organization for Standardization
J	Joules
kg	Kilograms

KPF	Kyoto Protocol Framework
km	Kilometer
K_{OC}	Soil adsorption coefficient
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory Analysis
LCIA	Life Cycle Impact Assessment
LOAEL	Lowest Observable Adverse Effects Level
m	Meter
M-CF	Midpoint Characterization Factor
MIR	Maximum Incidental Reactivity
N	Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observable Adverse Effects Level
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
O_3	Ozone
ODS	Ozone Depleting Substance
ODP	Ozone Depletion Potential
P	Phosphorus
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
pCO_2	Partial pressure carbon dioxide
PCR	Product Category Rule
PEC	Population Exposure Coefficient
pH	Measure of acidity or basicity
PM	Particulate Matter
PO_4	Phosphate
PP-CF	Potency Potential Characterization Factor
ppm	Parts per million
ppb	Parts per billion
RCRA	Resource Conservation and Recovery Act
RDF	Resource Depletion Factor
RF	Radiative Forcing
RfC	Reference Concentration
RfD	Reference Dose
RMT	Regional Mean Temperature
SDF	Species Depletion Factor
SLCF	Short-lived climate forcer
SO_2	Sulfur dioxide
SOx	Sulfur oxides
TCLP	Toxicity Characteristic Leaching Procedure
TH	Time horizon
TO	Tropospheric Ozone
TRI	Toxic Release Inventory
TSA	Tropospheric Sulfate Aerosol
µg	Micrograms
µm	Micrometers
USGS	US Geological Survey
VOC	Volatile Organic Compound
W/m^2	Watts per meter squared

WHO	World Health Organization
WMGHG	Well-mixed greenhouse gas
VSLCF	Very short-lived climate forcer

4. Significance and Use.

This section summarizes the key objectives fulfilled by the Standard.

4.1. Complements Existing ISO Standards. Existing standards for assessment of impacts on the environment and human health of products, organizations, and building, include draft and final ISO standards in the ISO 14040 and ISO 14060 series standards. These standards provide guidance focused mainly on scope definition, with little emphasis placed on metrics used to assess impacts.

A very important standard is ISO 14044, which provides the most detailed guidance on the LCIA phase used to assess LCAs for product systems of any existing ISO standard. However, this guidance in ISO 14044 is still very general. This Standard provides additional guidance enabling users to conduct LCA in a manner sufficiently rigorous to support EPDs and other public claims. This includes guidance on:

- the iterative process involved in conducting an LCA for products, organizations, and buildings,
- a description of data collection requirements,
- guidance on classification and characterization (e.g., spatial, temporal, potency, intensification), and
- characterization models for each impact category.

In addition, the framework supports comparative assertions and other public claims by establishing environmentally relevant category indicators, and describing the requirements for uncertainty analysis in making comparisons.

4.2. Provides Standardized Protocols for Public Claims. The Standard sets out specific requirements for public claims based on LCA. These requirements supplement those in existing ISO standards, and are intended to facilitate a standard method for ensuring accurate and complete reports by offering more specificity than these standards.

4.3. Supports Technology Neutrality. The Standard is technology-neutral. Environmental performance is documented for all core impact categories, regardless of the technology used in the anthropogenic system. If comparing two products, advantages and trade-offs between category indicators are made transparent in the LCIA profile.

4.4. Supports Tracking of Incremental Changes. Consistent with the overall goals of standards in this area, the Standard allows for the tracking of incremental changes in impact levels over time in each impact category.

4.5. Supports Continuous Improvement in Environmental Performance. Consistent with the overall goals of standards in this area, the Standard allows for implementation of procedures and systems to facilitate continuous improvement environmental performance through the planned mitigation of all relevant impacts on the environment and human health.

5. General Requirements

This section summarizes the LCA process. Further details pertaining to the LCIA phase are described in Section 6. For each impact category, detailed stressor-effects networks, and required steps and guidance for classification, characterization (including environmental characterization data needs, characterization models, and data quality requirements), are provided in Annexes A and B of this Standard.

5.1. Goal and Scope Definition for Product LCA. Goal and scope are defined consistent with ISO 14044 guidance. For an LCA study, the goal and scope definition should address product system(s) under study, and any reference baseline(s) against which a product is to be compared.

5.1.1. LCA Time Horizons for Product LCAs. In this Standard, the functional unit (and reference flow) considers continuous use and production over at least a 10 year period (see Terms and Definitions). The LCA time horizon is the length of time chosen. This enables understanding of the implications of different procurement and design choices over time, and provides the transparency needed for impacts of high complexity and which accumulate.

5.1.2. Scale of Functional Unit. The functional unit shall be defined such that the indicator results are at a scale which reflects observed consequences of stressors in the product system on category midpoints and endpoints for the core impact categories. The functional unit shall not be set arbitrarily low, which could make category indicator results appear negligible, even in cases where impacts are occurring and can be linked to stressors at unit processes in the product system under study. Sensitivity analysis should be used to scale the functional unit to determine if the scale of results is reflective of consequences on midpoints or endpoints.

> ***FOR EXAMPLE***. The functional unit can be scaled such that the reference flow represents the annual production volume of a product over the 20 years.

For the purposes of this Standard, the functional unit shall be defined so that category indicator results for core impact categories are equal to or higher than the minimum reporting levels in Table 3, considering the uncertainty in results. These minimum reporting levels represent a minimum scale of results which are reflective of consequences on midpoints and endpoints (see Section 6.3.2).

> ***FOR EXAMPLE.*** The declared unit for a cradle-to-gate LCA study of a recycled paper product could be production of 2,500 tons of paper each year for 20 years.

> ***FOR EXAMPLE.*** The functional unit can consider the requirements for use of 60 million utility poles in a given region from 2015 to 2050. The reference flow includes the number of poles required to replace poles which are destroyed each year, as well as the maintenance requirements for each year.

Accurate incorporation of enhanced performance is a key component of the definition of a reference flow. PCRs should include equivalencies to account for differences in useful lifetime, durability or functionality among products in a given product category. This will be helpful to users of this Standard in the development of EPDs and C-EPDs.

5.1.3. Reference Baselines for Product LCAs. The LCIA profile of a product can be compared to a reference baseline. Multiple products performing equivalent functions can also be compared to a common reference baseline.

The following types of reference baselines are recognized by this Standard:

- **Industry average baseline.** This baseline represents an average result for products in the same product category, and is established separately for each category indicator. The sample used for this type of baseline shall be selected from representative products available in the same market as the product is sold, considering the major product types, materials and technologies used in production, and regions of production. These representative products must be functionally equivalent to the product to which it is compared. The sample size used shall be three or more. The process used to select representative products shall be described in the LCA report.

- **Direct Comparative Assertion Baselines.** This type of baseline represents the LCIA profile of a product against which the LCIA profile of a competing product is compared, on an indicator-by-indicator basis. *Note:* This type of reference baseline cannot be used in C-EPDs, based on the requirement of ISO 14025 §4. See Section 8.1.

- **Standard Practice or Standard Design Baselines.** The complexity of many products may make the use of industry average baselines impractical. In such cases, standard practice or designs that would typically be applied to the product can serve as the reference baseline.

5.2. Scope Definition for Organizational LCAs. Defining the scope of an organizational LCAs or organizational environmental footprints (OEF) is an iterative process; boundaries are defined initially based upon high-level goals in measurement and understanding of organizational impacts, and refined based upon preliminary results. Organizational boundaries and operational boundaries define the scope of the OEF.

Before finalizing the scope of the OEF, organizations should examine the significance of all impacts which could result from all stressors associated with all facilities which could be included in the scope. This will help to avoid the inadvertent omission of stressors which are major contributors to impacts from the organization.

> ***NOTE.*** The process of defining organizational and operational boundaries should draw upon the WRI GHG Protocol and ISO 14064:1 standards as much as possible. Organizations already with a GHG inventory completed under these standards can modify the scope of these inventories for use in defining the scope of the OEF. However, the WRI GHG Protocol and ISO 14064:1 only consider a subset of stressors relevant to one impact category: Global Climate Change. Any previously-defined organizational and operational boundaries intended for a GHG inventory may need to be refined.

When established the RF footprint for the organization for the impact categories related to climate change, requirements and guidance from Annex C shall be used.

5.2.1. LCA Time Horizon for Organizational LCAs. The scope of the OEF considers all impacts occurring since pre-industrial times, represented by the year 1750 (i.e., the LCA time horizon is from at least 1750 to the present time). For impacts with accumulating midpoints (see Table 3 and Section 6.4.3), this will include the "legacy" impacts from activities associated with the organization since it was initially founded.

Organizations should additionally look forward in time, considering multiple scenarios of impact levels for at least 10 years in the future, and as far forward 50 years in the future (i.e., the LCA time horizon can be as long as from 1750 to 50 years in the future). This shall include at least on scenario representing "business-as-usual" conditions for the organization, and should include options for lowering impact levels in different impact categories. This exploration of multiple scenarios can assist in decision-making regarding how to reduce impact levels associated with the organization's activities.

5.2.2. Organizational Boundaries. Organizational boundaries are defined to include all or a subset of facilities over which the organization has control or influence. All facilities over which the organization has control or influence should be identified and considered for inclusion in the organizational boundaries.

The organizational boundaries shall be defined based on:

a) The equity-share approach, where impact levels are allocated based upon the share of the organization's equity in the facility.
b) The control approach, only stressors at facilities under the control of the organization are included in the scope; joint ventures are excluded, and there is no allocation.

> ***NOTE.*** These two approaches are identical to those allowed under ISO 14064:1 and the WRI/WBCSD GHG Protocol. See these standards for more information.

5.2.3. Operational Boundaries. Operational boundaries are defined to include a set of impact drivers (i.e., stressors) associated with the organization's activities. In this Standard, impact drivers within the operational boundaries can be grouped as follows (based on ISO 14064:1):

- Direct impact drivers include those associated with activities which occur at facilities within the organizational boundaries.

  > ***EXAMPLE.*** Emissions from combustion at boilers or furnaces at facilities in the organizational boundaries will contribute to impacts such as climate change and ozone exposures. Mining or forestry activities will lead to land use ecological impacts. These are examples of direct impact drivers.

- Indirect impact drivers include those associated with generation of electricity, heat, or steam, which occurs at facilities outside of the organizational boundaries, but are consumed at facilities within the organizational boundaries. These also include all other impact drivers associated with the organization, which do not occur at facilities within the organizational boundaries.

The categorization of other indirect impact drivers shall follow the ISO 14064-1 definitions for other indirect GHG emissions (GHG emissions are a type of impact driver). The group of impact drivers included in the operational boundaries shall be clearly defined. Direct impact drivers shall be included in the operational boundaries. If other indirect impact drivers are included, energy indirect impact drivers shall also be included.

5.2.4. Reference Baselines for Organizational LCAs. The following types of reference baselines are recognized for organizational LCAs by this Standard:

- **Historic Impact Baseline.** This type of baseline represents the organizational LCA results of the organization at a specific date in the past. The date used in this baseline shall be disclosed in the LCA report. Comparisons to this type of baseline can be used to demonstrate improvements, but must disclose any trade-offs in results for different category indicators.

5.3. Scope Definition for Building LCAs. Defining the scope of a building LCA is an iterative process; boundaries are defined initially based upon high-level goals in measurement and understanding of building impacts, and refined based upon preliminary results. Initially, there are four steps in defining the scoping of the building LCA:

1. Identifying and defining the building site(s) which are considered in the scope.
2. Defining the project type.
3. Defining the analysis modules to be considered.
4. Defining the impact boundaries.

5.3.1. LCA Time Horizon for Building LCAs. The scope of the building LCA considers all impacts occurring since pre-industrial times, represented by the year 1750 (i.e., the LCA time horizon is from at least 1750 to the present time). For impacts with accumulating midpoints (see Table 3 and Section 6.4.3), this will include the "legacy" impacts from activities associated with the building since it was first built.

Additionally, the scope of building LCAs should look forward in time, considering multiple scenarios of impact levels for at least 10 years in the future, and as far at 50 years in the future (i.e., the LCA time horizon can be as long as from 1750 to 50 years in the future). This shall include at least on scenario representing "business-as-usual" conditions for the building, and should include options for lowering impact levels in different impact categories. This exploration of multiple scenarios can assist in decision-making regarding how to reduce impact levels associated with the building's operations.

5.3.2. Defining Building Site in the Scope of the Building LCA. A building site is a whole building or a portion thereof. The building site included in the scope shall be clearly defined. This includes building site in which the organization operates, or intends to operate.

> ***NOTE.*** A building site can include a portion of a building, such as the floor of an office building.

EXAMPLE 1. An organization could define a single building site to be an office occupying a single floor in which it operates; this would be the building site in the scope of the building LCA.

EXAMPLE 2. An organization could define all of the locations in which it operates to be in the scope of the BSMS, which may include multiple offices in multiple locations, some of which may be under construction.

If only a portion of the building is included, the result shall be referred to as a Building LCA, not a Whole Building LCA.

5.5.4.3. Defining the Project Type. Once the building site in the scope has been established, the project type of each must be clearly defined. There are three project types covered by this Standard:

a) New construction.
b) Renovation.
c) Use.

Depending on the building site in the scope, there may be multiple project types which are included.

5.3.3. Defining Analysis Modules. Once a project type has been clearly defined for each building site in the scope of the Whole Building LCA, the analysis modules to be applied to each are defined. There are five modules:

- Analysis Module 1: Construction. (Relevant only to new construction and renovation projects.) This considers impacts resulting from the production and installation of construction materials and building equipment. Also includes impacts from the demolition of existing structures conducted in order to complete the project (if applicable).
- Analysis Module 2: Building operations and maintenance. Considers impacts resulting from: equipment operations (e.g., heating, ventilation, cooling, lighting, manufacturing equipment, office equipment); and regular maintenance activities of building and building equipment.
- Analysis Module 3: Occupant transportation. Considers impacts resulting from occupant commuting and business travel.
- Analysis Module 4: Indoor air quality. Considers impacts resulting from exposure of building occupants to hazardous indoor air contaminants (HIACs).
- Analysis Module 5: Occupant goods and services. Considers impacts resulting from production of goods and services used in the building (e.g., furnishings, computers and office equipment, paper, office supplies, food).

For each project type, the following analysis modules are required:

a) New construction. Analysis modules 1, 2, 3.
b) Renovation. Analysis modules 1, 2, 3.
c) Use. Analysis modules 2, 3.

Analysis modules 4 and 5 require significantly more data collection than other modules, and are optional for all project types. A screening is encouraged to understand the impacts relevant to these modules, and their scale.

5.3.4. Reference Baselines for Building LCAs. The following types of reference baselines are recognized for Building LCAs by this Standard:

- **Historic Impact Baseline.** This type of baseline represents the LCA of the building at a specific date in the past. The date used in this baseline shall be disclosed in the LCA report. Comparisons to this type of baseline can be used to demonstrate improvements, but must disclose any trade-offs in results for different category indicators.

- **Average performance baseline.** This baseline represents an average result for buildings in the region, and is established separately for each category indicator. The sample used for this type of baseline shall be selected from representative buildings in the same region as where the building is located, and must be of the same type of building (e.g., Commercial buildings can be compared to commercial buildings but not residential buildings). The sample size used shall be three or more. The process used to select representative buildings shall be described in the LCA report.

- **Standard Practice or Standard Design Baselines.** The complexity of buildings may make the use of industry average baselines impractical. In such cases, standard practice or designs that would typically be used in building design and construction can serve as the reference baseline. For example, a building LCA could compare proposed "green" building practices with building design options meeting mandatory minimum requirements of local building codes.

5.4. Scope Definition for Impact Reduction Projects. The LCIA Technical Framework described in Section 6 and Annex A can be used to quantify the impact reductions achieved by projects within different impact categories. Under this Standard, the following approach shall be used to quantify these impact reductions:

- Project types shall be identified which could result in measurable reductions in the midpoint and endpoint of the stressor-effects network. The project type shall be described in terms of needed geographic size, temporal nature, scale of achieved reduction, and technologies, activities, or processes, which could achieve the impact reductions. The business-as-usual conditions shall also be specified.
- Detailed protocols for implementation and verification of impact reductions should be developed for this project type.
- For a given project, the baseline scenario and project scenario shall be described.
- Projects are implemented, and impact reductions measured against the baseline scenario, which should be stated over multiple years of project implementation.
- Claims of impact reduction can be made considering the impact reduction that is achieved, and subject to verification.

Detailed requirements for radiative forcing reduction projects are found in Annex C.

6. LCIA Technical Framework

This section describes the requirements and guidance under the LCIA technical framework of this Standard.

This Standard supplements the guidance and requirements for LCIA under ISO 14044, by providing:

- Using "Reverse Effects Characterization" to Establish a Comprehensive set of impact categories.
- Grouping of impact categories with similar endpoints (Section 6.1).
- A list of distinct impact categories with observed midpoints and endpoints in well-defined environmental mechanisms which must be considered for a given LCA study (Section 6.2).
- Procedures to establish category indicators and characterization factors (using characterization models), which are environmentally relevant and provide accurate results (Section 6.3). These category indicators and characterization models are based upon modeled stressor-effects networks.

The provisions for LCIA in this Standard provide sufficient requirements and guidance to enable the development of environmentally relevant and accurate LCIA profiles, which are able to support EPDs, C-EPDs, and other types of public claims.

6.1. Using "Reverse Effects Characterization" to establish a comprehensive set of impact categories. The characterization process starts with "reverse effects characterization" at the impact (i.e., effects) level by characterizing the cumulative, permanent (irreversible) and seasonal midpoints and endpoints that can readily be identified in the peer-reviewed literature, through stakeholder concerns, and through regulatory processes.

NOTE. Reverse effects characterization is akin to reverse engineering, which starts with the final product and works backward to yield how the product was made, the scale of resources used, etc. In much the same manner, by first establishing the types and scale of such effects, the rough scale of the midpoints and endpoints can be characterized before attempting to attribute by source.

Not all impacts to Earth systems are caused by global industrial activities; therefore, only those effects falling within one of the six major effects groupings (see Table 1) either directly or indirectly linked to global industrial activities should be included. See Table 3 for the complete set of impact categories which have been identified as of the time of writing of this Standard.

6.1.1. Impact Groups. Impact categories are assigned to one of six groups, based upon the similarity of their endpoints and respective environmental mechanisms (Table 1).

Table 1. Grouping of Impact Categories

Group	Description
1. Biotic/Abiotic Resource Depletion Impacts	Impacts arising from exhaustion of technically recoverable reserves, resulting from the extraction of raw material resources.

2. Global and Regional Climate System Impacts	Global and regional climate change, resulting from emissions of long-lived greenhouse gases and short-lived climate forcers and other climate forcing activities.
3. Ocean Ecosystem Impacts	The impact categories in this group all have the same overall endpoint (the ocean ecosystem), although most of the impact categories involve regional endpoints.
4. Terrestrial and Freshwater Ecosystem Impacts (from Emissions)	Regional environmental impacts to the environment related to emissions associated with unit processes.
5. Terrestrial/Freshwater Ecosystem Impacts (from Land Use and Conversions)	Biome disturbance and key species losses, resulting from physical changes imposed at a landscape level caused by activities at specific unit processes.
6. Human Health Impacts (from Chronic Exposure to Hazardous Chemicals)	Impacts on human health caused by emissions associated with unit processes.

6.1.2. Distinct Impact Categories in this Standard. Distinct impact categories are established whenever the following criteria are met:

- Stressors, midpoints, and endpoints are observed, and their conditions measured, in a distinct environmental mechanism. (Impact categories with no observed stressors, midpoints, or endpoints, for which conditions cannot be measured, are not included.[5])
- The environmental mechanism can be modeled in a corresponding stressor-effect network.
- Characterization models are established which enable the assessment of category indicator results.

The list of impact categories included in Table 3 are a set of distinct impact categories established based on the preponderance of evidence, for which characterization models exist.

Impact categories may exist which are additional to those shown in Table 3. In specific LCA studies, additional impact categories may be included, if additional environmental mechanisms are identified.[6]

6.1.2.1. Environmental Mechanisms. Each impact category represents a distinct environmental mechanism, which are physical, chemical, radiological, and biological processes for a given impact category, linking stressor(s) to midpoints and to category endpoints (based on ISO 14044). Environmental mechanisms represent the set of observed alterations in specific components of an Earth system. Figure 2 shows an example of an environmental mechanism – in this case, regional acidification.

[5] Ionizing radiation is an example of an impact category that has no observed midpoints or endpoints. This impact category measures the exposure to ionizing radiation from nuclear power plants to surrounding populations. However, no measurable ionization radiation is emitted from normal nuclear plants operations that could cause any measurable risks. Any risks are instead associated with catastrophic releases resulting from breaches of containment of radioactive waste, primarily from spent nuclear fuel.

[6] In future revisions of this Standard, additional impact categories may be added, as additional environmental mechanisms are identified based on the preponderance of evidence.

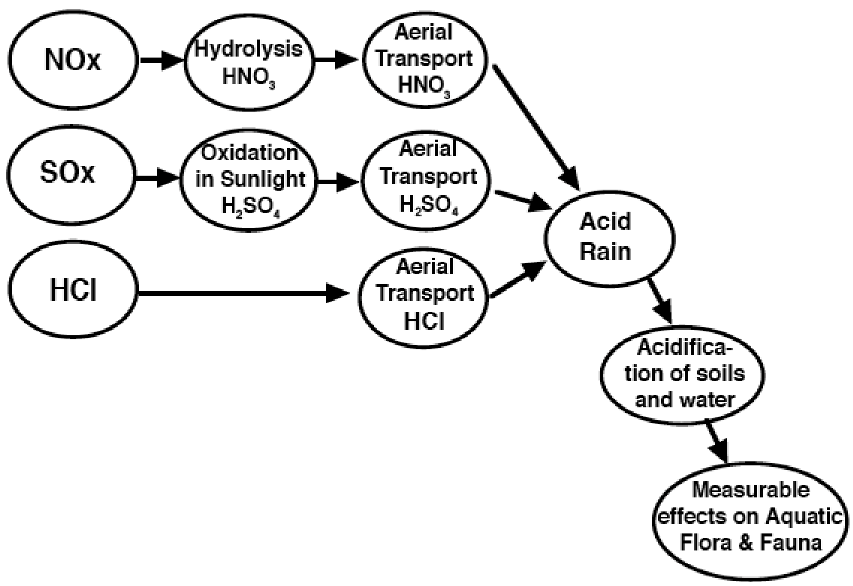

Figure 2. Example of an Environmental Mechanism: Regional Acidification

6.1.2.2. Stressor-Effects Networks. For each impact category, the environmental mechanism is modeled as a distinct stressor-effects network. A stressor-effects network is a model of the impact pathway, or cause-effect chain, that links stressor(s) associated with a unit process to the endpoints in the impact category (see Table 2). Each link in the cause-effect chain is called a node, and each modeled node in this network is a "stressor," a "midpoint" or an "endpoint," depending on its position within the pathway. The stressor-effects network starts with the stressor that initiates the environmental mechanism. In the case of Figure 2, the NO_x, SO_x and HCl emissions are the stressors (Node 1).

The current models of stressor-effects networks for each impact category are found in the Annex B. An example – the stressor-effects network for the regional acidification impact category – is shown in Table 2.

Table 2. Example of Stressor-Effects Network: Regional Acidification

Node	**Characterization of the Node**	**Uncertainty Arising from Weakness in Linkage to Endpoints**	**Uncertainty in Characterization, and Data Required to Characterize this Node**
1 (Stressors) *Very high overall uncertainty. (Very low environmental relevance.)*	Total levels of acidifying emissions (expressed in SO_2 equivalents) from a unit process.	*Very high uncertainty.* Characterization does not consider: dispersion and subsequent deposition of acids, or whether these acids deposit into sensitive regions, or pH changes in soils and waters as a result of acidic deposition from all regional sources.	*Low uncertainty.* Data requirements: Emissions levels of all acidifying substances. Potential for hydrogen ion release of emitted substances.
2 (Midpoint) *High overall uncertainty. (Low environmental relevance.)*	Contribution to increased atmospheric concentrations of acids resulting from atmospheric dispersion of acidifying emissions, leading to increased deposition of acids.	*High uncertainty.* Characterization does not consider: deposition of these acids into sensitive regions, or pH changes in soils and waters as a result of acidic deposition from all regional sources.	*Low uncertainty.* Data requirements: Emissions levels of all acidic substances. Potential for hydrogen ion release of emitted substances.

			Dispersion modeling, requiring inputs of meteorological, climatological, and other data.
3 (Midpoint) *Moderate overall uncertainty. (Moderate environmental relevance.)*	Contribution to deposition of acids into receiving environments in which buffering capacity has been exceeded.	*Moderate uncertainty.* Characterization does not consider: pH changes in soils and waters as a result of acidic deposition from all regional sources; and resulting endpoints.	*Low uncertainty.* Data requirements: Emissions levels of all acidic substances. Potential for hydrogen ion release of emitted substances. Dispersion modeling, requiring inputs of meteorological, climatological, and other data. Mapping of areas in exceedance of threshold for regional acidification.
4 (Midpoint) *Characterization at this node not possible given data limitations.*	Contribution to accumulated deposition of acids from all sources, leading to changes in pH of water bodies and soils.	*Low uncertainty.* Strongly reflective of endpoints.	Data is usually unavailable regarding the contribution of specific emission sources to pH changes for specific inland environments and water bodies.
5 (Endpoint) *Characterization at this node not possible given data limitations.*	Contribution to various endpoint effects (e.g., changes to vegetative composition, fish kills)	*Low uncertainty.* Directly reflective of endpoints.	Data is unavailable regarding the contribution of specific emission sources to endpoints of regional acidification.

For this impact category, stressors (at Node 1 in the stressor effects network) have very high overall uncertainty, and accordingly, a very low linkage to endpoints. This means that category indicator results at Node 1 will have very low environmental relevance, as described in Section 6.3.1 and Annex A.

For each distinct environmental mechanism included in the scope of an LCA study, stressors and subsequent midpoint and endpoint nodes should be understood and modeled, and the levels of environmental relevance characterized as low, moderate or high. The Annex B contains a set of stressor-effects networks for the impact categories in Table 3, which includes the environmental relevance of possible category indicators (see Section 6.3).

6.1.2.3. List of Distinct Impact Categories Considered in this Standard. For a given LCA study, the relevance of the impact categories in Table 3 shall be determined. In most cases, unit processes in the anthropogenic system will be linked to only a subset of these impact categories.

Table 3 includes: the list of impact categories which must be considered for relevance in a given LCA study; whether site or regional characterization is required to assess indicator results for each impact category; whether the characterized midpoint accumulates overtime (see Section 6.4.3); and the minimum reporting levels for each impact category. Impact categories are named based upon midpoints/endpoints of the stressor-effects networks.

Table 3. Impact Categories by Group, Site or Regional Characterization Requirements, whether midpoint accumulates over time, & Minimum Reporting Level.

Impact Groups and Impact Categories	Site or Regional Data Required	Does characterized midpoint accumulate?	Minimum Reporting Level (for product LCAs)
Group 1: Biotic/Abiotic Resource Depletion Impacts			
Energy Resource Depletion	Yes	Yes	1 Megajoule equivalent
Water Resource Depletion	Yes	No	1 liter
Minerals and Metals Resource Depletion	No	Yes	1 kilogram (by material)
Biotic Resource Depletion	Yes	Yes	Established by biotic source
Group 2: Global and Regional Climate System Impacts			
Global Climate Impacts	Yes	Yes	
Regional Climate "Hot Spot" Impacts	Yes	No	
Group 3: Ocean Ecosystem Impacts			
Ocean Acidification	No	Yes	1 kilogram H_2CO_3 equivalent
Ocean Warming	N/A*	N/A*	N/A*
Marine Biome Disturbance	N/A*	N/A*	N/A*
Marine Eutrophication		No	
Key Species Loss	N/A*	N/A*	N/A*
Persistent, Bioaccumulative, and Toxic Chemical Loading		Yes	
Cumulative Plastic Loading	N/A*	N/A*	N/A*
Group 4: Terrestrial and Freshwater Ecosystem Impacts (from Emissions)			
Regional Acidification	Yes	No	1 kilogram of SO_2 equivalent
Stratospheric Ozone Depletion (Antarctica)	No	Yes	1 kilogram of CFC-11 equivalent
Freshwater Ecotoxic Exposure Risks	Yes	Dependent on contaminants	Depends on reference contaminant
Freshwater Eutrophication	Yes	No	Depends on limiting nutrient and eutrophication symptoms
Terrestrial Eutrophication	N/A*	N/A*	N/A*
Group 5: Terrestrial/Freshwater Ecosystem Impacts (from Land Use and Conversion)			
Terrestrial Biome Disturbance	Yes	Yes	Must consider total area of affected terrestrial biome
Freshwater Biome Disturbance	Yes	Yes	Must consider disturbance across entire watershed
Wetland Biome Disturbance	Yes	Yes	Must consider total area of affected wetland biome
Key Species Habitat Disturbance		Yes	
Group 6: Human Health Impacts (from Chronic Exposure to Hazardous Chemicals)			
Ground Level Ozone Exposures	Yes	No	1 persons * ppm O_3 * hours
PM 2.5 Exposure Risks	Yes	No	1 persons * µg PM 2.5 eq. / m^3* hours
Ambient Air Exposures to Hazardous Chemicals	Yes	No	Depends on reference contaminant
Indoor Air Exposures to Hazardous Chemicals	Yes	No	Depends on reference contaminant
Ingestion Exposures to Hazardous Chemicals	Yes	No	Depends on reference contaminant

Dermal Contaminant Exposure Risks	Yes	No	Depends on reference contaminant

**This Standard does not specify metrics for these impact categories. Future versions will do so. If relevant, these impact categories shall be described as so wherever LCIA results are reported, with results reported as "No Data".*

6.1.3. Identifying Core Impacts Categories by Industry Sector Using Reverse Effects Characterization. Reverse effects characterization can be used to readily identify the core impact categories for specific industry sectors for definition in PCRs and other types of standards and other LCA applications. This can improve the practicality of LCAs on specific product categories.

> ***NOTE.*** An example of reverse effects characterization applied to roundwood and pulp/paper products can be found in the Product Category Rule developed for Environmental Paper Network.

6.1.4. Identifying Core Impact Categories for an LCA. A comprehensive set of impact categories shall be assessed for a given LCA, considering the impact categories listed in Table 3.[7] For a specific LCA study, these impact categories must be screened for their relevance to the anthropogenic system(s) under study. Those which are relevant are the "core" impact categories for the anthropogenic system.

> ***NOTE.*** For a given LCA study, only a subset of the impact categories in Table 3 will be relevant.

Only if stressors associated with unit processes in the study scope can be linked to observed midpoints and/or endpoints in distinct environmental mechanisms are impact categories considered relevant. In some cases, there may be more than one relevant category indicator per impact category, and multiple category indicators may be required to represent the range of observed impacts for a single impact category.

In identifying relevant impact categories, the following considerations apply:

- *The list of impact categories which are, in practice, relevant for all product systems.* Certain impact categories are linked to all industrial activities, and in the initial iteration, can be assumed to be relevant. This includes: Energy Resource Depletion; Global Climate Change; Ocean Acidification; Regional Acidification; Ground Level Ozone Exposure Risks; and PM2.5 Exposure Risks.
- *Conducting a literature survey to determine if there are unit processes included in the study scope which have in the past been associated with specific impacts.*
- *Identifying any stakeholder concerns, such as those expressed by environmental groups, regarding the contribution of certain unit processes to impact categories.*
- *Determining if unit processes similar to those in the study scope have been associated with specific impacts.*
- *Location of unit process.* Unit operations in highly polluted regions and/or regions not subject to environmental regulation may be linked to multiple regional impacts. In these situations, the relevance of all impact categories in the group of Human Health Impacts (see Table 3) should be considered. Which impacts are relevant depends on the condition of receiving environments and environmental regulations in the region.

Other data sources and approaches can also be used.

6.1.5. Defining Impact Hot Spots using "Reverse Effects Characterization". In this Standard, "hot spots" are defined as midpoints or endpoints for which the conditions have

[7] As the Standard is revised in the future, additional impact categories to those listed in Table 3 may be included.

been observed to be highly altered compared to conditions in an unaltered state. Specifically, "impact hot spots" are midpoints or endpoints which satisfy at least one of the following:

- The alteration of which have a significant effect on other midpoint(s) or endpoint(s) in the environmental mechanism.
- Are observed to have a relatively large magnitude of assessed change compared to the unaltered state.
- Are subject to a relatively large alteration in space.
- Have been, or are projected to, be subjected to relatively large alteration for a long period of time.
- Have experienced significant irreversible changes.
- Are in conditions exceeding clearly identified thresholds.

In some cases, it may be appropriate to define separate category indicators or impact categories for hot spots. For example, a set of climate hot spots are defined in separate impact categories.

In order to identify if an anthropogenic system is contributing to a hot spot, the following steps shall be undertaken:

- The unit processes contributing to the hot spot are identified.
- Whether the unit processes are in the anthropogenic system is determined (e.g., are purchases from suppliers contributing to the hot spot being made?).
- If the unit process is present in the anthropogenic system, the hot spot shall be relevant to the LCA.

> ***NOTE.*** In this Standard, "hot spots" refer to highly altered midpoints or endpoints, while "key unit processes" refer to major contributors to specific category indicator results. These two terms are not interchangeable and should not be confused.

6.3. Environmental Relevance

6.3.1. Establishing Environmentally Relevant Category Indicators. Category indicators are a "quantifiable representation of an impact category" [ISO 14044]. Indicators numerically represent the contribution of a stressor to a specific node in the stressor-effects network, using characterization factors (which are derived from characterization models).

The degree of linkage between a category indicator and category endpoint(s) is its environmental relevance, consistent with ISO 14044 standard. Category indicators which are more environmentally relevant will provide more useful information regarding impacts which are linked to the anthropogenic system under study.

> *Environmental Relevance*
> *Excerpts from ISO 14044:2006*
>
> ***§ 4.4.2.2.2 —*** *Environmental relevance encompasses a qualitative assessment of the degree of linkage between category indicator result and category endpoints; for example high, moderate or low linkage.*

> ***§ 4.4.2.2.4*** *— The environmental relevance of the category indicator or characterization model should be clearly stated in the following terms:*
> *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 category indicators and the category endpoints.*

When considering category indicators at different nodes in the stressor-effects network for a given impact category, the uncertainty arising from weakness in linkage to endpoint(s), and the uncertainty in characterization of that category indicator, both limit its environmental relevance. As one proceeds along the stressor-effects network, the uncertainty arising from weakness in the linkage to endpoint(s) decreases, while the uncertainty inherent in characterization increases; the selection of the most environmentally relevant category indicator requires an optimization of this trade-off, by selecting the category indicator with the least overall uncertainty. The selection of the most environmentally relevant indicators is a key part of the LCIA phase.

In Annex A, guidance and requirements are provided to select category indicators with the highest possible level of environmental relevance. Stressor-effects networks are provided for each impact category, which describe, for each possible category indicator: the characterization models which can be used; the uncertainty in linkage to endpoints; the uncertainty inherent in characterization; and the resulting overall uncertainty (and environmental relevance). A recommended category indicator is described for each impact category, and guidance and requirements are provided for cases where the recommended category indicator cannot be used due to lack of data.

As more accurate and new levels of environmental data become available, practitioners are encouraged to move to higher levels of environmental relevance for a given category indicator.[8]

6.3.2. Minimum Reporting Levels (for Product LCAs). While establishing the environmental relevance of category indicators has been widely accepted in practice according to definitions in ISO 14044, the selection of the scale of the functional unit is just as important in determining the environmental relevance of final results in the LCIA profile.

For the purposes of this Standard, the functional unit shall be scaled so that category indicators in core impact categories are reported at levels equal to or higher than those shown in Table 3. These minimum reporting levels are estimated so as to represent a minimum scale of results which are reflective of consequences on midpoints and endpoints (see Section 5.3.1.1).

[8] As the Standard is revised in the future, category indicators with greater environmental relevance may be recommended for use.

6.4. Establishing Environmentally Relevant Characterization Factors. Category indicators are assessed using characterization factors, which are derived from characterization models. Two types of characterization factors are used— Potency Potential Characterization Factors (PP-CFs) and Midpoint Characterization Factors (M-CFs). Characterization models sufficient to derive PP-CFs and M-CFs are provided for each impact category in Annex A.

6.4.1. Potency Potential Characterization Factor (PP-CF). An PP-CF represents the relative potency of individual stressors that contribute to a common endpoint. The PP-CF establishes an equivalency among these stressors, making it possible to aggregate inventory results to establish results at Node 1 in the stressor-effects network.

Category indicators can only be defined if PP-CFs can be established to aggregate individual stressors into a single result. If PP-CFs cannot be established for stressors in a fashion which is scientifically defensible, then distinct indicators must be reported for each stressor.

> ***NOTE.*** A lack of a scientific basis for the definition of PP-CFs often indicates that stressors are affecting distinct environmental mechanisms.

6.4.2. Midpoint Characterization Factor (M-CF). An M-CF characterizes the temporal nature, spatial extent, severity, reversibility, and/or exceedance of thresholds, of impacts on a specific midpoint or endpoint.

The models from which M-CFs are derived can represent the following characteristics of the midpoint or endpoint node of the corresponding category indicator (based on ISO 14044 § 4.4.2.2.4):

- *Conditions of the midpoint or endpoint.*
- *The relative magnitude of the assessed change in the midpoint or endpoint,* accounting for the severity of damage, depletion or disturbance (i.e., measuring the intensity of a specific midpoint or endpoint).
- *Spatial aspects* – accounting for geographic area and scale of the midpoint or endpoint.
- *Temporal aspects,* accounting for characteristics such as the duration, residence time, persistence, and timing of onset, of the midpoint or endpoint.
- *Reversibility of the environmental mechanism.*
- *Characterization of any relevant thresholds* – accounting for the degree to which established human health and environmental threshold(s) have been or are projected to be exceeded.

To characterize these aspects into the M-CF, characterization models integrate environmental data.

Accurate terminology shall be used to describe the characterization model used to establish results for all category indicators included in the LCIA profile.

6.4.3. Characterization of Accumulating Midpoints. For some of the midpoints for certain impact categories, conditions will worsen over time as the effect of stressors accumulate. This may be due to the irreversible nature of effects from some stressors or for other reasons.

> ***FOR EXAMPLE.*** Consumption of nonrenewable energy resources is irreversible by definition; as resources are consumed, they cannot be replenished. Conditions at the midpoint of energy resource depletion will only worsen over time and cannot improve.

> ***FOR EXAMPLE.*** Emissions of long-lived GHGs accumulate in the atmosphere, leading to increasing radiative forcing. The midpoint of radiative forcing is an accumulating midpoint with respect to emissions of long-lived GHGs.

The characterization of accumulating midpoints, metrics shall be calculated which reflect the accumulation of impacts over the time horizon considered in the LCA study. Whether or not midpoints accumulated over time is detailed in Table 3.

6.5. Weighting. In the optional element of the LCIA phase called "weighting", weighting factors are used to aggregate category indicators based on value-choices. This reduces the transparency of results. Weighting is not allowed in LCA under this Standard.

6.6. Calculating the LCIA Profile. In a given year, category indicator results are additive across all unit processes included in the scope, and yield overall indicator results for the anthropogenic system for that year. The LCIA profile for a given year is the compilation of category indicator results across all unit processes in the study scope which are linked to observed impacts.

6.6.1. Calculating the LCIA Profile for Different Years. The LCIA profile can be calculated for multiple years within the LCA time horizon:

- For product LCAs, the LCIA profile shall be calculated for multiple years, including at least every 10 years.
- For organization and building LCAs, the LCIA profile shall be calculated for the current year (considering the LCA time horizon of 1750 to the present). The LCA time horizon includes years into the future, the LCIA profile shall be calculated at least every 10 years.

6.6.2. Evaluating Contribution Analyses. These analyses, also known as "key unit process analyses", identify the quantitative contribution of different unit processes, or groups of unit processes, to different category indicator results. Contribution analyses, usually expressed as a percentage of each indicator result, are necessary in order to determine the major contributors to the LCIA profile in order to identify ways to improve the environmental performance of the anthropogenic system by reducing its contributing to impacts.

6.6.3. Evaluating Hot Spot Analyses. In a hot spot analysis, unit processes contributing to impact hot spots meeting the definitions of Section 6.1.5 are identified and listed.

> ***NOTE***. A "hot spot" analysis can provide valuable information on environmental risks throughout the supply chain for complex anthropogenic systems.

6.6.4. Evaluating LCA Screenings. In situations where it is not possible to evaluate a quantitative LCIA profile for all relevant impact categories, as a result of data or resource limitations, it is possible to evaluate LCA screenings. LCA screenings identify the set of relevant impact categories for the LCA subject to the requirements of Section 6.1, and expressly list these impacts noting that "No Data" is available for characterization. LCA Screenings shall also describe, wherever results are presented, if the anthropogenic system being studied contributes to any impact hot spots subject to the requirements of Section 6.1.5.

6.7. Iterative Assessment Process. In order to ensure the LCA process is practical, a streamlined approach to assessment data collection is described in Annex D. Practitioners are encouraged to utilize Annex D in order to complete LCAs in an efficient manner.

7. Data Quality Assessment and Uncertainty Analysis

This section describes the protocols required to conduct the data quality assessment and uncertainty analysis.

The data quality and uncertainty of a given indicator result depends upon the data quality and uncertainty of all data used in the LCA study which are relevant to results, including: parameters and inventory data used in the LCI analysis; environmental data and characterization models used to derive characterization factors in the LCIA; and any other data relevant to calculation of final results (e.g., data regarding the durability or efficacy of a product in use). All of these data must be considered holistically to understand the data quality and/or uncertainty of final indicator results.

> ***NOTE.*** In practice, quantitative uncertainty analysis is the preferred approach, as it enables an objective interpretation of results. However, in most cases, quantitative uncertainty data will not be available for inventory data, preventing robust uncertainty analyses. As a result, data quality assessments are more commonly used.

Data quality assessment and/or uncertainty analysis are used to provide information regarding limitations in specific category indicator results. Evaluating data quality and/or uncertainty of final indicator results is essential for proper interpretation of results. If indicator results are presented without considering the data quality and/or uncertainty, the results can be misunderstood. In particular, comparisons between indicator results may not be reliable without considering the results of an uncertainty analysis, expressed as a confidence interval (see Section 7.2.3.).

It is recommended that in any place where results are reported, such as LCA reports and public claims, that results of any data quality assessments and/or uncertainty analyses be included.

7.1. Data Quality Assessment. In the data quality assessment, ten data quality indicators (DQIs) are evaluated, for the data relevant to assessing final indicator results. The DQIs are applied to the data used in scope definition, LCI analysis, and LCIA. Once DQIs are established, the overall data quality level is assessed for each indicator result. Each DQI and data quality level is described qualitatively, using descriptors such as "low", "medium", or "high". The DQIs and data quality levels can also be established using semi-numerical ratings systems, such as described by the Ecoinvent Centre.

> ***NOTE.*** The DQIs in Table 4 are based upon the ten data quality requirements described in ISO 14044 § 4.2.3.6.2.

Table 4. Data Quality Indicators (DQIs) in this Standard, applied to data relevant to calculating indicator results (i.e., inventory data, environmental data, and other data).

Data Quality Indicator Category	Indicator Evaluation Criteria
Time related coverage	Age of the data used and its ability to reflect current activities and stressors. Also considers the length of time over which data is collected.
Geographical coverage	Regions where data was collected, and the ability of this data to reflect activities and stressors associated with unit processes in the study scope.
Technology Coverage	The ability of data to represent the unit processes included in the study scope, when considering the technology which the data represents.
Precision	Qualitative estimate of the variability of the data values for each data expressed (e.g., variance).
Completeness	For inventory data, qualitative estimate of the percentage of relevant inventory flows associated with unit processes that is measured or estimated. For environmental data, evaluates the ability of the reported data to represent all stressors associated with unit processes.
Representativeness	Qualitative assessment of the degree to which the dataset reflects the true population of interest, considering the geographical coverage, time period coverage, and technology coverage.
Consistency	Qualitative assessment of whether the study methodology is applied uniformly to the relevant data used to calculate indicator results at each unit process. Also must consider if the study methodology is applied uniformly in evaluation of results for all unit processes in the study scope.
Reproducibility	Qualitative assessment of extent to which the methodology and data used would allow an independent practitioner to reproduce results.
Sources of data	Qualitative assessment of the transparency of the data sources, and whether the data is publicly available to independent practitioners.
Uncertainty	Qualitative assessment of the uncertainty of the data used.

DQIs can be assessed at different levels of detail, depending on the goal and scope. The DQIs related to key unit processes and other data that have significant effect on final results are the most important in determining the overall level of data quality for an indicator result.

> ***NOTE.*** In most LCAs, the number of unit processes included in the study scope is extensive. The evaluation of DQIs for all unit processes included is rarely possible. In the goal definition, the required level of detail of evaluated DQIs should be decided.

7.2. Uncertainty Analysis. If an uncertainty analysis is conducted, the uncertainty in an indicator result shall be expressed as a confidence interval (CI).[9] In this Standard, a CI is defined as an estimated range of values which is expected to include the actual value of a data point, defined by a lower confidence bound and an upper confidence bound.

[9] This addresses uncertainty arising from measurement, not uncertainty arising from weakness in linkage to endpoints. See Section 6.3.1.

The CI for a given indicator result can be evaluated in many ways, including error propagation, using multiple sensitivity analyses to estimate an expected range of results, or more advanced statistical methods (if data are available). The level of detail of the uncertainty analysis depends on the goal of the study and data availability. In evaluating the CI of a final indicator result, the uncertainty in parameter, inventory, and environmental data, should be considered, including uncertainty arising from the following:

- *Uncertainty in inventory data.* This is uncertainty related to the magnitude of flows for a unit process, arising from inherent variability and measurement uncertainty in flows (sometimes referred to as "basic uncertainty") and from lack of representativeness of data which is used (sometimes referred to as "additional uncertainty").
- *Uncertainty in characterization factors.* This arises from uncertainty in characterization data and/or results of the characterization model used to derive characterization factors.
- *Uncertainty in other data.* This arises from uncertainty in other issues which are relevant to final results (e.g., uncertainty in the useful lifetime of a product).

To the extent possible, CIs representing all of these sources of uncertainty should be used to evaluate the CI for a given indicator result.

The CI of final indicator results is typically determined primarily by uncertainty related to the key unit processes. If data regarding uncertainty is not available for all key unit processes or other significant sources of uncertainty, the effect on the CI of final results should be considered. If the missing data is significant, then an uncertainty analysis may not be possible.

In the final LCIA profile, CIs should be expressed for each individual category indicator result (if data is available). The uncertainty in different indicator results can vary broadly, based upon the inventory data, characterization model, and characterization data, used to calculate results, and this should be reflected in independent CIs included for each indicator result.

7.3. Supporting Comparisons. Regardless of the application of the LCA, comparisons between specific category indicator results are only recommended if three conditions are satisfied:

- *CIs have been established for the results.* The CIs for the results must be available and considered in the comparison.
- *Category indicator results shall have moderate to high environmental relevance.* Category indicator results with low environmental relevance can be misleading if used in comparisons (see Section 6.3.1).
- *The CI of final results must consider all significant sources of uncertainty in category indicator results.* Documentation should be available regarding how the CI was derived in the uncertainty analysis.

> ***NOTE.*** These conditions are necessary, but not sufficient, for robust comparisons. There are other requirements for robust comparisons, which are described in ISO 14044 and elsewhere in this Standard.

In EPDs and C-EPDs, CIs should be provided wherever results are reported, if available. If CIs are not available for an indicator result, a disclaimer must be provided noting that comparisons can only be made based upon quantitative uncertainty analysis. It is useful to report data quality levels and/or CIs wherever results are reported in the LCIA profile.

8. Claims Intended for the Public.

This section describes declarations based in ISO 14025, and other public claims based on LCA, and the minimum requirements for each. All public claims shall conform to the requirements of this Standard and undergo third-party validation. Additional requirements by claim are provided by below.

8.1. Product Declarations. The following claims include declarations which must satisfy the requirements of ISO 14044, ISO 14025, and this Standard.

8.1.1. Environmental Product Declarations. The objectives of EPDs are as follows (ISO 14025 §4):

a) To provide LCA-based information and additional information on the environmental aspects of products;
b) To assist purchases and users to make informed comparisons between products;
c) To encourage improvement of environmental performance;
d) To provide information for assessing the environmental impacts of products over their life cycle.

Consistent with these goals, each EPD shall include the LCIA profile of the product studied, based on LCA conducted in accordance with this Standard, and shall include a comprehensive set of impacts which are linked to the product system under study. Any limitations in the set of impacts included shall be clearly described in the EPD. The environmental relevance, and data quality and/or confidence interval, of each category indicator result shall be included where results are presented in the EPD. LCIA profiles shall be presented within the EPD in a place of prominence, with other information being provided as supporting information.

Care should be taken to ensure that the declarations are brief and include only environmentally relevant information. Misleading information regarding the environmental performance of the product which contradicts findings in the LCIA profile should not be included.

8.1.2. Comparative Environmental Product Declarations. A Comparative Environmental Product Declaration (C-EPD) includes a comparison, category indicator by category indicator, of a product with a reference baseline (see Section 5.3).

In a C-EPD, the reference baseline must represent a product system that can fulfill the functions expressed by a functional unit which is identical to that which the product fulfills. The CI of each category indicator shall be provided for results of the product and reference baseline in the LCIA profile included in the EPD. A disclaimer should be included in the C-EPD stating any limits of comparability in the C-EPD, based on the requirements of Section 7.3.

> ***NOTE.*** In an EPD, the reference baseline used cannot be a direct comparative assertion baseline, based on the requirement of ISO 14025 §4.

The C-EPD must satisfy all requirements of ISO 14025. In addition to the reporting requirements listed in ISO 14025, the EPD shall describe:

- important assumptions; and
- a description of the reference baseline.

8.1.3. Developing Functional Product Category Rules. Functional Product Category Rules (F-PCRs) are a special class of PCRs. Special requirements regarding the product category definition and open consultation process apply, which supplement the requirements of ISO 14025. EPDs and C-EPDs developed under F-PCRs satisfy all requirements of ISO 14025 and this Standard.

The product category definition used in F-PCRs shall be based on a clear product function in use, not defined based on material type, design, or other considerations. Defining a product function in use relates the product category definition clearly to a functional unit, rather than a reference flow. In an F-PCR, the product category should be defined for maximum applicability, so that EPDs of different product types which satisfy the same functions defined in the functional unit can be compared.

The content of F-PCRs should focus on requirements for the scope definition of EPDs and C-EPDs. F-PCRs should avoid repeating the LCA requirements of either ISO 14044 or the technical requirements of this Standard. More specific requirements for LCA can be included in F-PCRs, provided they are germane to the creation of EPDs and C-EPDs, and will streamline the creation of robust LCIA profiles by program operators.

In the open consultation process, a balanced set of stakeholders should be included in the core PCR committee, including: producers; users; environmentalists; academics/government; and general interest. These stakeholders shall have voting rights on the final F-PCR which is published.

Additionally, a public comment period is required during the open consultation process. All comments which are received must be addressed, and responses voted upon by the committee as a whole. Upon publishing the PCR, all comments which were received, and the response developed by the PCR committee, must be made available upon request to any user of the F-PCR, or EPDs/C-EPDs developed based upon it.

The “underlying” LCA or LCAs upon which the F-PCR is based, according to ISO 14025 §6.7.1, shall conform to this Standard, and have been critically reviewed. The author, title, and publish date, of the underlying LCA or LCAs, shall be described in the F-PCR.

8.2. Other Public Claims for Products derived from LCA. The following types of public claims may be developed in accordance with ISO 14044 and this Standard.

8.2.1. Environmentally Preferable Product (EPP) and related claims. These claims are based on a comparison of a product to a reference baseline. This reference baseline must represent a product system that can fulfill the functions expressed by a functional unit which is identical to that which the product fulfills.

An EPP claim shall only be applicable for use when at least one category indicator result for the LCIA profile of the product is lower than corresponding indicators in the reference baseline, considering the confidence interval of results. Additionally, no category indicator results can have a higher result.

An EIP claim shall only be applicable for use when at least 50% of the category indicator results in the LCIA profile of the product is lower than corresponding indicators in the reference baseline, considering the confidence interval of results. Anywhere a public EIP claim is made, a statement shall be included where the number of impact categories showing improvement, and the total number of affected impact categories, shall both be disclosed.

> ***FOR EXAMPLE.*** A product showing improvement in 9 out of 10 relevant impact categories compared to its reference baseline shall include a statement similar to "Environmentally Improved based upon reduced impact levels in 9 out of 10 relevant impacts".

Products can be rated as Environmentally Transitional Products (ETP) when the product has at least 10% and not more than 50% of the category indicator results in the LCIA profile of lower than corresponding indicators in the reference baseline, considering the confidence interval of results.

> ***NOTE.*** This is similar to the definitions for Environmentally Improved and Transitional Papers provided by the US Environmental Paper Network, which requires environmentally improved paper to have "at least 50% of fiber" with desired environmental attributions, while environmentally transitional paper has at least 10% with desired attributes.

The types of reference baselines which are allowed for use in EPP and related claims are: industry average baselines; direct comparative assertion baselines; or standard practice or standard design baselines. A description of the reference baseline which is used must be provided along with the EPP claim.

Assessment of the impact reduction achieved by the product is not required for each impact category, provided that there is sufficient evidence to prove that the impact levels do not exceed the established reference baseline for the category.

The LCA upon which an EPP claim is based must be critically reviewed according to Section 9 of this Standard, to ensure that the requirements of ISO 14044 and this Standard are met. EPP and related claims shall be verified by an external third party.

8.2.2. Carbon/Climate Footprint. The purpose of this section is to apply LCA protocols in this Standard to summarize impacts related to the two climate-related impact categories identified in this Standard.

Two types of footprints are recognized:

- The Global Climate Footprint reports indicator results for the Global Climate Change impact category.
- The Arctic Climate Footprint reports indicator results for the Arctic Climate Change impact category.

These profiles are reported in kilograms or tons of CO_2e for each impact category, and must include all relevant life cycle stages.

8.2.3. Reduced Carbon/Climate Footprint. This claim represents the quantified reduction of the climate footprint of a product, organization, or building, against a reference baseline. The reference baseline shall be clearly defined wherever the claim is made.

8.2.3. Water Footprint. A water footprint reports indicator results for Water Resource Depletion. Results must be calculated at Node 2, according to the requirements and guidance of Annex A.

8.2.4. Environmental Facts Label. This label shall include the LCIA profile of the product, based on LCA conducted in accordance with this Standard, and shall include a comprehensive set of impacts which are linked to the product system under study. Any limitations in the set of impacts included shall be clearly described in a footnote to the label.

The LCA upon which an Environmental Facts Label is based should be critically reviewed according to Section 9 of this Standard.

Background material based in LCA should be provided in additional documentation, which contains a summary of the LCA findings, key assumptions and limitations, methodology, summary of critical review report, and other reporting requirements.

8.3. Organizational Claims.

8.3.1. Claims Related to Climate Change. See Annex C.

8.3.2. Claims of Corporate Sustainability. For public claims about organizations related to their environmental sustainability, the following requirements shall apply:

1. The term, "Environmental Sustainability," shall refer to achieving "net zero impacts" across all environmentally relevant impact categories relevant to the organization considered.
2. Progress toward Environmental Sustainability shall be determined as follows:
    a. The current LCIA profile for the organization shall be established, based on category indicators that have moderate or high degrees of environmental relevance.
    b. Within two years, the organization shall achieve at least a 50% reduction in impact levels for all impact categories with near-term or exceeded tipping points through direct reduction linked to the organization. The remaining impact reductions needed to reach the goal of net zero impacts for these categories can be achieved through purchase of offset credits directly linked to the specific impact category.
    c. Within five years, the organization shall achieve a 50% reduction in impact levels for all relevant impact categories through direct action linked to the product system or organization. The remaining impact reductions needed to reach the goal of net zero impacts for these categories can be achieved through purchase of offset credits directly linked to the specific impact category
3. The amount of impact reduction can be reported on an Environmental Sustainability Index (i.e., the percentage of impact reduction achieved).

a. The offsets shall be distinguished from the direct impact reductions for each category indicator.
b. Independent verification of impact reductions achieved, shall be conducted by a competent third-party certification body.

8.4. Whole Building Claims.

8.4.1. Published Whole Building LCA. This claim includes the LCIA profile of an entire building. The LCIA profile shall include a comprehensive set of impacts which are linked to the building system under study. Any limitations in the set of impacts included shall be clearly described in a footnote to the profile.

9. Critical Review

This section summarizes the requirements for critical review according to this Standard.

The critical review process shall ensure that [based in ISO 14044 §6.1]:

- The methods used to carry out the LCA are consistent with ISO 14044 and this Standard.
- The methods used to carry out the LCA are scientifically and technical 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, and
- The study report is transparent and consistent.

All of the critical review requirements of ISO 14044 §6 shall be followed.