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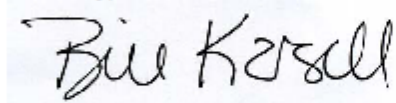
February 17, 2011

Dear Colleagues:

I am forwarding the current Committee draft, Version 2.1, of the main section of *Life Cycle Assessment Methodology Sufficient to Support Public Declarations and Claims* of environmental performance. The Committee is developing this standard practice under the sponsorship of the Leonardo Academy, an ANSI-accredited standards development organization.

The attached read-only file is titled, *LCA_CommitteeDraftStdV2_Feb82011.pdf*. Please contact me if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "Bill Karsell". The signature is written in a cursive style and is positioned above the typed name and title.

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

Committee Draft Standard, Version 2.1

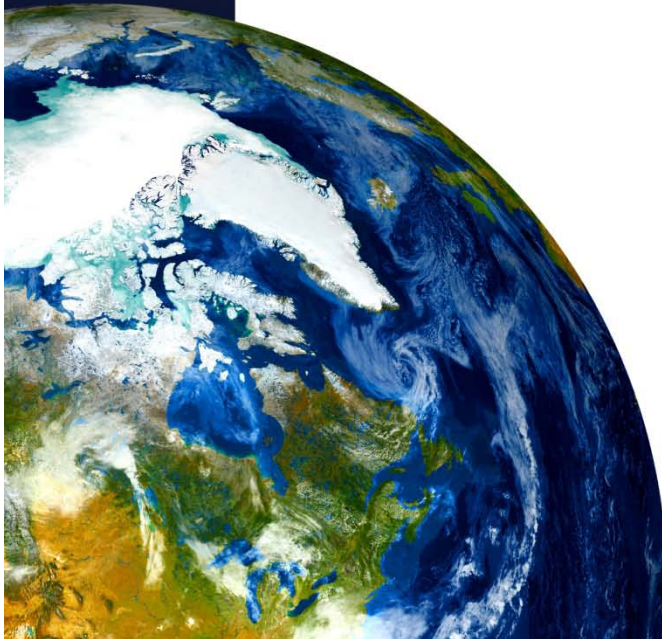
Life Cycle Assessment Methodology Sufficient
to Support Public Declarations and Claims

For Type III Environmental Declarations, Environmental
Performance Ratings, and Environmentally Preferable Product
and Environmental Sustainability Claims

February 2011

For more information, please contact:

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0. Introduction.

This Section summarizes the need for the Standard.

Environmental Declarations (also known as environmental report cards, eco-profiles, and environmental product declarations) associated with products and systems, based on life cycle assessment (LCA), help consumers, purchasers and other decision-makers evaluate and compare the environmental performance of products and systems.¹ Environmental declarations are defined within the ISO TC 207 SC3 Subcommittee on Environmental Labeling as “Type III” environmental labels, differentiated from third-party certified eco-logos (“Type I”) and self-declared single attribute environmental claims (“Type II”).^{2,3,4} In addition, 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 and the environmental ratings and market claims derived from these declarations must be based upon life cycle assessment (LCA) conducted in a consistent, standardized manner. ISO-14044 is a general framework document, providing overarching LCA requirements and guidance. What remain to be standardized are the specific guidelines for conducting and completing the iterative LCA steps —life cycle goal and scope definition, life cycle inventory (LCI), and life cycle impact assessment (LCIA) — in a manner sufficient to accurately calculate indicator results for all environmentally relevant impact categories and to support comparative Environmental Declarations.

1. Scope.

This Section summarizes the scope and limitations of the Standard.

1.1. LCA framework. This Standard, including its annexes, supplements the general LCA framework described in ISO-14044 by providing: 1) further guidance pertaining to the iterative analysis process; 2) a standardized list of category indicators to be considered in the assessment in order to identify the environmentally relevant (i.e., “core”) indicators, as well as rules for considering additional category indicators; 3) guidance pertaining to data collection, including system data, inventory data, and environmental characterization data; 4) algorithms for calculating category indicator results for all core impact categories; 5) guidance for the development of appropriate reference baselines to serve as the basis for

¹ US Environmental Protection Agency, *Environmental Labeling: Issues, Policies, and Practices Worldwide*, Dec. 1998, p 13.

² ISO 14025: ISO/TC 207/SC3/WG1 TG Type III N22, “Type III Environmental Labeling,” Scientific Certification Systems, 1997.

³ ISO/TR 14025:2006. Environmental Labels and Declarations — Type III Environmental Declarations;
http://www.iso.org/iso/catalogue_detail.htm?csnumber=38131

⁴ 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...”

comparisons, and 6) guidance for data quality assessment that integrates both LCI and LCIA data quality issues.

1.2. Guidelines for environmental declarations, ratings and claims. The Standard establishes specific guidance for Type III Environmental Declarations, environmental performance ratings, and environmentally preferable product (EPP) and sustainability claims derived from LCA to ensure a high level of rigor and consistency in the information reported (see Section 6).

- Type III Environmental Declarations — Comparative and Non-Comparative
 - Environmentally product declarations;
 - Environmental power system declarations;
 - Environmental building declarations; and
 - Climate declarations⁵
- Environmental Performance Ratings — Product ratings universally applicable to all product categories, using LCA performance indexes measured against the known range of performance in the product category.
- Environmentally Preferable Product (EPP) Claims — Claims derived from comparative environmental product declarations, indicating environmental superiority in a product category.
- Environmental Sustainability Claims — Claims based on achievement of minimum environmental sustainability requirements, as described herein.

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

- product manufacturers;
- service professionals;
- environmental professionals;
- policymakers;
- material and energy resource planners;
- environmental advocacy groups;
- industrial, commercial and residential customers;
- climate registries and programs;
- greenhouse gas management systems;
- procurement agencies and professionals;
- qualified third-party LCA practitioners and certifiers of Type III Environmental Declarations, environmental performance ratings, EPP claims, and environmental sustainability claims.

1.4. Voluntary standard. This Standard is not intended to replace regulatory requirements.

1.5. Limitations. This Standard does not address suitability for particular duty, or security and safety concerns associated with products or systems. Nor does this Standard address aspects of sustainability other than those biophysical environmental performance metrics

⁵ Consistent with WRI LCA protocols and ISO-14067.

addressed under the LCA protocols, such as labor rights, community rights or socioeconomic impacts.

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: Environmental management — Life cycle assessment (LCA) — Requirements and guidelines

2.2. Additional references.

- ISO 14025: Environmental labels and declarations — Type III Environmental Declarations -- Principles and procedures
- 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.
- ISO/IEC Guide 65: General requirements for bodies operating product certification systems
- ISO 14054: Greenhouse Gases – Requirements for Greenhouse Gases Validation and Verification Bodies for Use in Accreditation or Other Forms of Recognition

3. Terminology.

This section defines terms and abbreviations used in this Standard. Additional terms and abbreviations are defined in the Annexes to this Standard.

3.1. Terms and definitions

Accumulated Impact Functional Unit	Functional unit for impact categories with accumulated impacts, based on the environmentally relevant time horizon over which this accumulation takes place and factoring in the exceedance of threshold.
Accumulated Impact	Midpoint or endpoint effects that accumulate and/or intensify over time, due to the long retention time of the stressors (e.g., atmospheric build-up of carbon dioxide, bioaccumulation of mercury) and the resultant accumulation of effects at specific midpoint or endpoint nodes.
Accumulated Impact Profile	Impact profile comprised of accumulated impact category indicator results.

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Biobased Resource	A commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic forestry or agricultural materials (including plant, animal, and marine materials). ⁶
Category Endpoint	An identifiable impact on the natural environment, human health or natural resource reserves that can be linked back to a stressor(s) through a defined environmental mechanism. <i>(Also referred to as “Endpoint.”)</i>
Category Indicator	The quantifiable node within a stressor-effects network used to represent a specific impact category, for which a result is calculated. This node is selected based on the strength of its linkages to the initial stressor and to the other midpoint and endpoint nodes. <i>(Also referred to as “Impact Category Indicator,” or simply, “Indicator.”)</i>
Climate Forcer (CF)	Any gas, particulate, aerosol or other substance that is associated with radiative forcing, either positive or negative, that can contribute to climate change.
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 Parameters	An aspect of data quality that must be evaluated and described.
Data Quality Indicators	Qualitative indicators that reflect the overall data quality of LCI data and environmental characterization data. The specific parameters that apply to data quality indicators fall into one of four levels, where the highest level is Level 1 and the lowest level is Level 4.
Data Quality Ratings	Mathematical score that represents the overall data quality level achieved. The rating must reach a minimum threshold sufficient to support declarations, ratings or claims as described in this Standard.
Disturbance	Alteration in the quality or functionality of a biome.
Effect	A measurable change to human health or the environment. <i>(Also referred to as an “impact,” as in “impact category”).</i>
Emission Loading	The fraction of emissions that contribute to an impact at a level exceeding an identified environmental threshold. The emission loading is determined by taking into consideration an emission’s relative potency, fate and transport, as well as spatial and temporal and intensity characteristics of the identified environmental impact endpoints.
Environmental Characterization Data	Data used to characterize environmental conditions of the relevant providing environment or receiving environment.

⁶ Farm Security and Rural Investment Act of 2002 (Public Law 107-17), (“2002 Farm Bill”), Section 9002.

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Environmental Characterization Factor (ECF)	A mathematical expression representing the degree to which a particular stressor affects the environment or human health within a specific impact category.
Environmental Declaration	The findings of an LCA conducted in accordance with this Standard, wherein the results for each environmentally relevant category indicator are reported, and compared (where appropriate) to a reference baseline. Includes Environmental Product Declarations (EPDs) and Environmental System Declarations.
Environmental Mechanism	The distinct and measurable physical, chemical, radiological or biological process(es) that links stressor(s) to effects on human health or the environment. <i>(Also referred to as “Environmental Impact Pathway.”)</i>
Environmental Performance Rating	A rating system for products that can universally be applied to all product categories, using LCA-based environmental performance indexes measured against the known range of performance in the product category. <i>(Also referred to as “LCA Performance Rating” and “Eco-Performance Rating.”)</i>
Environmentally Preferable	A claim applied to a product or system that has lower environmental impacts than the reference baseline to which it is compared, without trade-offs in any impact category.
Environmentally Sustainable	A claim applying to a product or system whose environmental impacts do not exceed thresholds that would hinder the ability of future generations to obtain or provide the equivalent product or system without endangering species, habitats or human health, or depleting resources.
Functional Unit	A unit of production or output against which category indicator results are normalized.
Impact	A measurable change to human health or the environment. <i>(Also referred to as “effect.”)</i>
Impact Category	An issue of environmental or human health concern (e.g., ground level ozone, acid rain) that represents a distinct environmental mechanism. “Core” impact categories are those impact categories that are environmentally relevant for a given product or system under analysis, or its reference baseline.
Impact Group	A group of impact categories with common or similar midpoints/endpoints or environmental mechanisms.
Impact Profile	The cumulative summary of category indicator results representing the environmental impacts of a product or system, normalized to a specific functional unit. <i>(Also referred to as “eco-profile.”)</i>
Life Cycle Assessment (LCA)	Assessment of the environmental and human health impacts associated with a product or system, conformant to ISO-14044.
Life Cycle Impact	The LCA phase in which LCI results are converted into category

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Assessment (LCIA)	indicator results by calculating the magnitude and relevance of the impacts at subsequent nodes along the stressor-effects network.
Life Cycle Inventory (LCI)	The LCA phase involving the identification, compilation and quantification of inputs and outputs associated with a given product or system throughout its life cycle.
Midpoint Node	A point on the stressor-effects network between the stressor point (e.g., emission, extraction) and the endpoint node.
Nodal Intensification	Rising impact level representing a deviation from an historic baseline at a specific node along the stressor-effects network (e.g., climate temperature anomaly).
Node	Any chemical, biological or physical process along a stressor-effect network.
Product	A finished product or a delivered service.
Product Category Rules (PCR)	A set of specific rules, requirements, and guidelines for developing Type III environmental declarations for specific product categories (e.g., office furniture seating, power line poles, paint brushes) [Ref: ISO 14025].
Providing Environment	The area from which natural resources are derived or extracted.
Receiving Environment	The air, water, soil, and ecosystems into which emissions and wastes are released, deposited, or reside.
Reference Baseline	The scenario against which a product or system is compared.
Reserve Base	The quantification of the natural repositories of a given natural resource that are economically or technically recoverable using technology existing at the time of quantification.
Resource Depletion	The degree to which the consumption of a natural resource results in an irreversible reduction in the reserve base within a timeframe relevant to human activities, taking into consideration such mitigating factors as resource recycling rates and renewability.
Stressor	Any input, output or disruption activity associated with a product or system that can be linked to an effect.
Stressor-Effects Network	A model used to represent an environmental mechanism, in which a chain of events links the inputs, outputs, and direct landscape disruption associated with the life cycle of a product or system to impact endpoints. OR - A visual representation of the life cycle impacts accrued to a product or system.
Stressor Potency Factor (SPF)	A mathematical expression used to aggregate related stressors based on their relative potency with respect to a specific impact category. (Also referred to as “potency factor”)

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System	The life cycle processes resulting in the delivery of products or services. (Examples of industrial sector systems are regional power grids and US steel production. Examples of service systems include building systems and telecommunications systems).
Threshold	A recognized environmental condition that, when exceeded, is linked to adverse environmental or human health effects
Time Horizon	A specified timeframe within which exceedances of established threshold have occurred or may occur, or within which legacy (i.e., historic) or future impacts may accumulate.
Trade-Off	An adverse environmental or human health impact associated with a product or system.
Unit Process	Distinct activity or operation associated with a product or system over its life cycle (e.g., as identified in a process flow diagram). ⁷

3.2. Abbreviations

CF	Climate Forcer
DQI	Data Quality Indicator
DQR	Data Quality Rating
ECF	Environmental Characterization Factor
EIA	Energy Information Agency
EOT	Exceedance of Threshold
EPD	Environmental Product Declaration
EPP	Environmentally Preferable Product
GHG	Greenhouse Gas
GMT	Global Mean Temperature
ILCD	International Life Cycle Reference Document
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory Analysis
LCIA	Life Cycle Impact Assessment
ODC	Ozone Depleting Chemical
NERC	North American Electric Reliability Corporation
PCR	Product Category Rule
RF	Radiative Forcing
RMT	Regional Mean Temperature
SPF	Stressor Potency Factor

⁷ ISO 14044 defines “unit process” in terms of the analysis itself — “the smallest element considered in the LCI analysis for which input and output data are quantified.” The definition used in this Standard is intended to be fully compatible with the ISO definition.

4. Significance and use

This section summarizes the key objectives fulfilled by the Standard.

4.1. Augments the ISO-14044 LCA framework. Building upon the basic requirements and guidelines provided in ISO-14044, the Standard provides further guidance to enable users to conduct LCA in a manner sufficiently rigorous to support Type III Environmental Declarations and related ratings and claims. The Standard provides guidance on the iterative process involved in conducting an LCA, describes data collection requirements, provides impact classification and characterization guidance (e.g., spatial, temporal, potency, intensification), and provides calculation algorithms for each impact category. In addition, the framework accounts for “accumulating impact categories” — those impact categories that are linked to accumulating midpoints/endpoints over time.

4.2. Provides standardized protocols for the public reporting of findings. The Standard identifies the information to be included in public declarations, claims and ratings derived from the assessment (see Section 6). In meeting the comparative assertion requirements of ISO-14044, the Standard provides a technical basis for LCA-based claims of environmental preferability and environmental sustainability, providing a transparent record of impact reductions and demonstrating the avoidance of environmental trade-offs (i.e., adverse consequences).

4.3. Provides guidance to ensure that public claims are backed by comprehensive assessment. The Standard requires that each core impact category relevant to the product or system be analyzed, and that results be fully reported without inappropriate aggregation or oversimplification.

4.4. Supports technology neutrality. The Standard is technology-neutral. Environmental performance is documented for all core impact categories, and any advantages and trade-offs against a reference baseline are transparent.

4.5. Supports tracking of incremental changes. The Standard allows for the tracking of incremental changes in impact levels over time in each impact category.

4.6. Provides fungible environmental accounting protocols. As the assessment framework is universally applicable to products and systems: 1) results can be integrated across products and systems; 2) the relative scale of impacts can be compared to regional or global level impacts, and the significance of impact reductions achieved can be determined; and 3) transactions can be made based on the findings.

4.7. Provides a framework for climate assessment. The framework can be used to calculate climate change related indicators on a life cycle basis, in order to meet the requirements of various climate management systems and assessment programs.

5. Summary of LCA Practice

This section summarizes the LCA process. Key aspects are described further in Section 6, while environmental characterization data needs, calculation algorithms and data quality requirements are provided in the Annexes to this Standard.

5.1. Minimum level of assessment required to support public assertions. The minimum level of assessment considered suitable to support Type III Environmental Declarations and related public claims under this Standard shall be LCA conducted in accordance with ISO-14044 and the protocols and requirements described herein.

5.2. Iterative assessment process. ISO-14044 describes LCA as an “iterative” assessment process. Likewise, the 2010 ILCD Handbook, “General Guide for Life Cycle Assessment — Detailed Guidance” [Ref: *ILCD, General Guide*], states: “In order to achieve the required precision with the minimum necessary effort, it is recommended to collect data and select external data sources in an iterative manner.”⁸

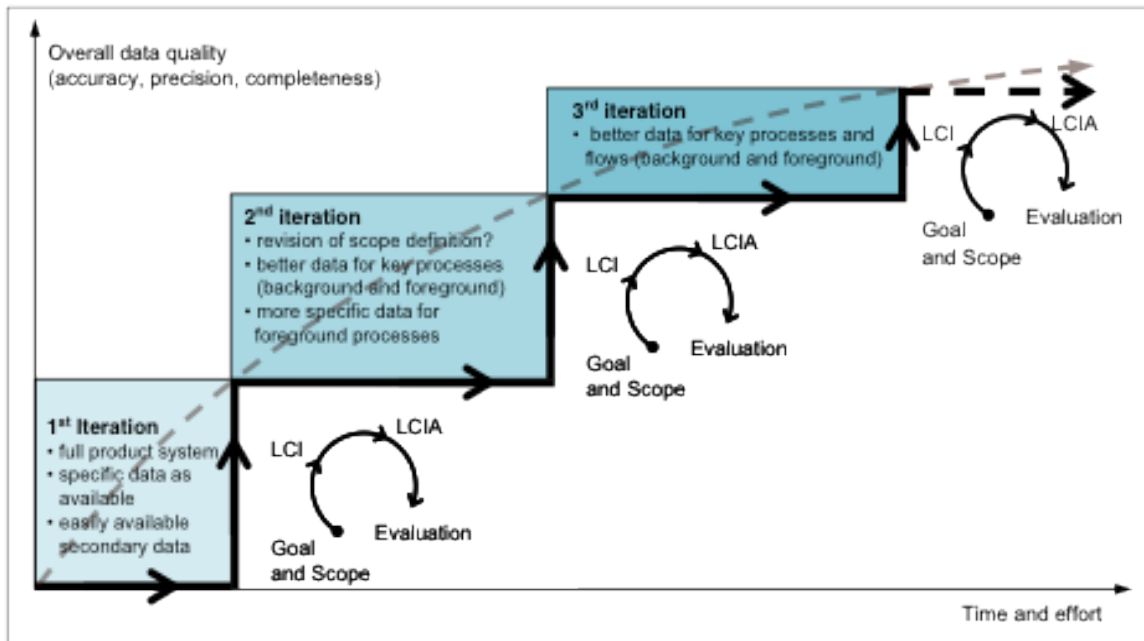


Figure 1. “Iterative nature of LCA (schematic). LCAs are performed in iterative loops of goal and scope definition, inventory data collection and modeling (LCI), impact assessment (LCIA), and with completeness, sensitivity and consistency checks (Evaluation) as a steering instrument. This is done — with a possible, limited revision of the goal and scope — until the required accuracy of the system’s model and processes and the required completeness and precision of the inventory results has been attained.” [Caption and figure from Figure 4, 2010 ILCD Handbook, *General Guide for Life Cycle Assessment — Detailed Guidance.*]

Using the iterative process, the goal and scope can be refined to reflect data evaluated at the

⁸ According to ILCD Handbook (pg. 25), “... the first iteration may use generic or average data for the background and also many parts of the foreground system ... This can be combined with expert judgment to identify the key processes and elementary flows of the product system. The main effort of data collection and acquisition can thereby be focused on the relevant parts of the system.”

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inventory and impact assessment phases, and data collection and analysis in the inventory and impact assessment phases can be narrowed down to only those data that are environmentally relevant (Figure 1 above). The remaining portions of this section summarize the iterative LCA process steps, as depicted in Figure 2.

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Figure 2. Iterative LCA process flow diagram

5.3. Goal and scope definition phase.

5.3.1. Define the goal. Consistent with ISO 14044, the goal of the study shall be defined in terms of the intended application, the reasons for carrying out the study, the intended audience, and whether the results are intended to be used to make public declarations or claims, including comparative assertions [Ref: ISO 14044]. As described in the 2010 ILCD Handbook [Ref: ILCD, General Guide], the following aspects shall be addressed and documented: the intended application(s) of the deliverables / results; limitations due to the method, assumptions, and impact coverage; reasons for carrying out the study and decision-context; target audience of the deliverables / results; comparative studies to be disclosed to the public; and the commissioner of the study and other influential actors.

5.3.2. Determine the scope.

5.3.2.1. Study boundaries. The scope of the assessment of the product or system shall be determined and described based on the study goal. In general, the scope shall include all unit processes associated with the extraction of raw materials, processing of materials, transportation, energy inputs, manufacturing, use, distribution, recycling, reuse, waste treatment and final disposition. Justification shall be provided for any exclusions. To the extent possible, all unit processes included within study boundaries shall be identified by location (e.g., by city, by GPS coordinates).

5.3.2.2. Core impact categories and category indicators. Impact categories to be included within the study scope shall be identified. All impact categories represented by the category indicators in Table 1 shall be screened for their relevance to the product, system or reference baseline. Unit processes may be linked to one or more of these impact categories. (Units of measure for each indicator are listed in Annex A.)

The practitioner shall also undertake an active effort to identify impacts beyond those listed in the table, such as those associated with non-point source emissions or site-dependent impacts (see Section 5.5.3).

Only those impact categories and their respective category indicators that have been shown to be relevant, either for the subject of the study or for the reference baseline, shall be included in the final scoping. These are referred to as “core” impact categories. Specifically, an impact category is considered relevant if “midpoint” and “endpoint” nodes along the stressor-effects network are linked to measurable damage depletion or disturbance. In some cases, relevance is easily established; however, the relevance of a given impact category may be determined at any point during the iterative impact assessment process, depending on ongoing data collection and analysis.

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Table 1. Category Indicators Representing Impact Categories

1. Extracted Resource Depletion		4. Environmental Effects Emissions
Energy Resource Depletion		Ocean Acidification Loading
Water Resource Depletion		Regional Acidification Loading
Strategic Material Resource Depletion		Stratospheric ODC Loading
Biobased Resource Depletion		Ecotoxicity Potentials
		Aquatic Eutrophication Loading
2. Landscape Disturbance Level		Terrestrial Eutrophication Loading
Terrestrial Biome Disturbance		
Aquatic (River) Biome Disturbance		5. Human Health Effects Emissions
Aquatic (Lake) Biome Disturbance		Ground Level Ozone Exposures
Riparian/Wetland Biome Disturbance		PM 2.5 Exposures
Loss of Key Species (% by species)		Regional Toxic Air Emission Exposures
		Indoor Air Emissions — Risk of Exposure
3. Climate Change Emissions		Bioaccumulative Toxicity Potentials
Global CF Loading		
Arctic & Other Regional CF Loadings		6. Untreated Hazardous Wastes
Regional CF Cooling		Risks from Radioactive Wastes
		Risks from Other Untreated Hazardous Wastes by type

Impact categories are considered irrelevant if inventory results have no known or suspected linkages to midpoint nodes or endpoint impacts, or if no midpoint nodes or endpoint impacts are observed. Likewise, unit processes that have no linkage to measurable effects shall be excluded from the final scope of work.

For specialized applications, such as uses in support of climate accounting programs, or for internal use applications, such as product development, the assessment may focus solely on one or more relevant impact groups.

5.3.2.3. Stressor-effects networks. The environmental mechanisms represented by the core impact categories shall be modeled as “stressor-effects networks,” whereby the initial stressor associated with the product or system life cycle shall be linked to subsequent midpoint and endpoint nodes (see discussion, Section 6.1.3).

5.3.3. Select the functional unit. The functional unit — i.e., the unit of output or production of the product, service or system to which results are normalized — shall be determined. The functional unit shall be scaled at to a level of production or operation relevant to the product, service or system being assessed. It must be sufficiently large to ensure that: 1) all measurable category indicator results for core impact categories are addressed; 2) all LCI data contributing to the calculation of these results are included; 3) uncertainty is minimized; and 4) midpoint and endpoint nodes that accumulate over time are accounted for. If a functional unit is too small, the resultant data could be misinterpreted as being insignificant.

In addition, a second type of functional unit — an accumulated impact functional unit — shall be established for those category indicators representing stressor-effects networks with midpoint or endpoint nodes that intensify over extended time horizons due to the

retention of the stressors in the environment (e.g., atmospheric build-up of carbon dioxide, bioaccumulation of mercury). The accumulated impact functional unit shall reflect the environmentally relevant time horizon. Time horizons may be historic (i.e., legacy impacts), projected into the future (i.e., future impacts), or combined legacy and future impacts.

5.3.4. Additional scoping aspects. In addition, the following scoping aspects shall be clearly described and/or defined, integrating changes as the assessment progresses through repeated iterations:

- The product, service or system studied, and its function(s)
- The intended deliverable(s) of the study
- Specifications related to the product, service or system
- The LCI and LCIA modeling frameworks to be used
- Core impact categories and category indicators
- Description of system boundaries, completeness requirements and cut-off rules
- Data quality requirements
- Types and sources of required data and information
- Description of reference baseline to be used in the case of comparisons
- Critical review needs
- Intended reporting of results

5.4. LCI phase. Based on the unit processes identified during the goal and scoping phase, LCI input and output data shall be collected for each unit process consistent with the requirements of ISO 14044.

5.4.1. Initial data collection and analysis. During the initial data collection stage, generic LCI data may be used. From these data, the percentage contribution of each unit process to specific inventory line items can be calculated.

5.4.2. Subsequent data collection and analysis. During subsequent iterations, those LCI data shown to affect “core impact category” results shall be further refined to achieve the data quality requirements for Type III environmental declarations and related public claims. The data quality requirements for this Standard are described in Annex B.

5.4.3. Sensitivity analysis of LCI data. Sensitivity analysis shall be used to evaluate the relevance of LCI data to the indicator results, and simultaneously, to provide an iterative check on the scaling of the functional unit. (For instance, minor LCI data evaluated on a per kilogram of production basis may appear to be insignificant, but may be shown to be environmentally relevant when scaled up to an annual production level.)

5.5. LCIA phase. Utilizing the data collected and analyzed during the LCI stage, category indicator results shall be calculated in accordance with the three mandatory LCIA elements identified in ISO 14044: 1) selection of impact categories, category indicators and characterization models; 2) assignment of LCI results to the selected impact categories (classification); and 3) calculation of category indicator results (characterization).

5.5.1. Selection of impact categories, category indicators and characterization models. A category indicator is the “quantifiable representation of an impact category” [Ref: ISO 14044]. Through repeated iterations, the impact categories and their respective category indicators shall be narrowed down from the list provided in Table 1 to those core impact categories and indicators deemed relevant to the study, as well as any additional site-dependent categories deemed to be applicable. The characterization models used for each impact category are described in Annex A.

5.5.2. Classification. Unit process LCI results shall be assigned to the appropriate impact category(s).

5.5.3. Characterization.

5.5.3.1. Environmental characterization of LCI data. Environmental characterization data shall be collected for those unit processes with the highest percentage contribution based upon the LCI summary data. Environmental characterization data for additional unit processes shall be added during subsequent iterations in order to reduce data uncertainty and to meet the stated data quality requirements. Examples of environmental characterization data include water and air monitoring data, satellite data, soil analyses and risk assessment data. The environmental characterization data are then integrated with the unit process LCI data to calculate category indicator results. Specific calculation methods by impact category are described in Annex A.

5.5.3.2. Characterization of impacts with no LCI corollary. Some category indicators have no corresponding LCI counterparts, such as category indicators linked to landscape disturbance or loss of key species. Site-relevant environmental characterization data shall be collected for unit processes contributing to such category indicators.

5.5.3.3. Characterization of site-specific impacts. Certain site-specific impacts cannot be detected using standard LCI input/output data sets. As such, the practitioner shall endeavor to identify any additional impacts that may be linked to unit process related activities. (This is similar to ground-truthing exercises conducted for the production of environmental impact assessments and environmental impact statements.) While it would be impractical to conduct in-depth assessments for each unit process, the practitioner shall identify the unit processes connected with potentially high impacts (i.e., “hot spots”) such as local effluents into regional water bodies, regional toxic air emissions and untreated hazardous wastes.

5.5.4. Completing the assessment.

5.5.4.1. Preliminary unit process calculations. Preliminary unit process calculations shall be conducted based on data collected during the iterative LCI and LCIA phases.

5.5.4.2. Normalization. The preliminary unit process calculation results shall be normalized. Up to three types of normalization shall be applied, as applicable:

- **Normalization to the functional unit.** Impact results for each category indicator shall be normalized against the functional unit, to generate the impact profile, in accordance with ISO 14044.
- **Normalization to the accumulated impact functional unit.** Impact results for each category indicator with midpoints or endpoints that intensify over extended time horizons shall be normalized to the accumulated impact functional unit. Time horizons may be historic (i.e., legacy impacts), projected into the future (i.e., future impacts), or combined.
- **Normalization based on enhanced performance.** In the case of comparative claims, impact results for each category indicator are normalized against performance factors established to represent “enhanced performance” functional equivalencies (i.e., magnitude of enhanced durability and performance as compared to the reference baseline).

5.5.4.3. Generating the impact profile. The normalized category indicator results for all unit process results shall be added together into the overall indicator result. Together, the indicator results for all impact categories shall constitute the “impact profile.” Similarly, the “accumulated impact profile” shall be compiled for those category indicator results that have been normalized to the accumulated impact functional unit.

5.5.4.4. Establishing reference baselines for comparison. If a comparison is to be made, the impact profile (and accumulated impact profile, if applicable) of the reference baseline shall be generated as the basis of this comparison. There are three types of reference baselines.

- **Direct comparison baseline.** This baseline is the impact profile of a product or system performing a comparable function. The baseline can either be a specific product or system, or a composite of several products within a product category.
- **Average baseline.** This baseline is the average impact level in each core category indicator, where the average is determined based on the known range of performance associated with the product or system per impact category. The range of performance is determined based on a sufficient number of products or systems to be considered representative or constitute a significant market share in that sector. For products, significant market share shall be determined based on product category rules (PCRs) established by the practitioner in consultation with product category stakeholders, taking into account the universe of competing products in the category and the relative market share represented by these products.

- **Exceedance of Threshold (EOT) baseline.** This baseline is the recognized threshold over which adverse environmental consequences occur. This baseline is applied to specific category indicators in impact categories with established EOT levels (see Annex A) and is used for products or systems providing Environmental Sustainability Declarations or making related claims.

5.6. Exclusion of life cycle interpretation phase. This Standard does not include the optional life cycle interpretation phase included in ISO 14044 because that phase introduces subjective factors not linked to either midpoints or endpoints, and instead permits the aggregation of category indicators into life cycle interpretation indicators that negate the environmental relevance of the LCIA phase.

6. Establishing environmentally relevant category indicators

This section provides additional information regarding the establishment of environmentally relevant category indicators, as summarized above in Section 5.

ISO 14044 requires that the category indicators selected to account for human health and environmental impacts be “environmentally relevant,” where environmental relevance is defined as “the ability of the category indicator to reflect the consequences of the LCI results on the category endpoint.”

6.1. Sorting category indicators by endpoint groupings. The first step in establishing environmental relevant category indicators is to sort indicators into groups based on the similarity of the endpoints (Table 2).

Table 2. Endpoint Grouping of Category Indicators

Endpoint Grouping	Description of Common Endpoints
Extracted Resource Depletion	This group represents those impacts associated with the extraction of raw material resources for the production of products, materials and energy.
Landscape Disturbance	This group represents those adverse impacts on flora and fauna that are directly caused by biophysical changes imposed at a landscape level during the life cycle of the product or system.
Climate Change Emissions	This group represents those impacts associated with greenhouse gases and other climate forcers (CF). CFs either increase or decrease the effective watts per square meter, and may cause effects either globally or regionally.
Environmental Effects Emissions	This group represents those impacts on the environment caused by emissions associated with products or systems. Such emissions can be linked to multiple adverse environmental endpoints.
Human Health Effects Emissions	This group represents those impacts on human health caused by emissions associated with products or systems. Such emissions can be linked to multiple human health endpoints.
Untreated Hazardous Wastes	This group represents those impacts on the environment or human health associated with hazardous wastes that are not adequately treated or are untreatable, and that have the potential to breach containment causing environmental damage or disturbance over the toxicity lifetime of the wastes.

Indicators within a given group generally require similar types of environmental characterization. With few exceptions, all of the category indicators within a specific group will be located at the same node — i.e., Node Level 1 indicators, Node Level 2 indicators, etc.)

6.2. Identifying the environmental mechanism. The second step is to identify the applicable environmental mechanism per category indicator. Each impact category and associated category indicator represents a distinct environmental mechanism – i.e., the physical, chemical, radiological or biological processes that link the product or system to effects on human health or the environment. Figure 3 shows an example of an environmental mechanism.

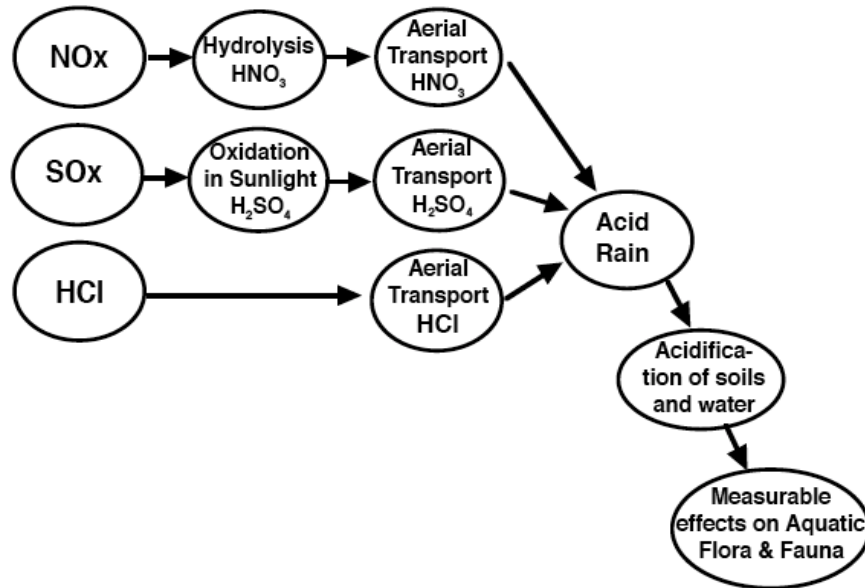


Figure 3. Regional Acidification: Environmental Mechanism

6.3. Modeling the stressor-effects network. The environmental mechanism represented by the category indicator is, in turn, modeled as a unique stressor-effects network. A stressor-effects network is a model of the impact pathway, or chain of events, that link the inputs, outputs, and direct landscape disruption activities associated with a product or system to their respective impact endpoints. Each modeled node in this network is a “potential,” a “midpoint” or an “endpoint,” depending on its position within the pathway. The stressor-effect network starts with the stressor that initiates the environmental mechanism. In the case of Figure 3, the NO_x, SO_x and HCL emissions are the stressors, expressed as equivalency potentials (Node 1). Subsequent midpoint and endpoint nodes are mapped to represent distinct levels of disturbance or damage along the environmental mechanism.

Descriptions of the current modeling of stressor-effects networks associated with each category indicator are found in Annex A. An example – the stressor-effects network for the global climate change impact category – is shown in Table 3.

Table 3. Global Climate Forcing Stressor-Effects Network

Node	Description of Node	Strength of Linkage between Nodes
Node 1 (CF Emissions)	Emission rates by source and by functional unit	<ul style="list-style-type: none"> • Weak linkage to Nodes 2 and 3 • No linkage to subsequent nodes
Node 2 (Midpoint)	Annual loadings of CF emissions	<ul style="list-style-type: none"> • Weak linkage to Node 1 • Strong linkage to Nodes 3, 4 and 5 • Weak linkage to subsequent nodes
Node 3 (Midpoint)	Accumulated (i.e., legacy and annual) CF loadings of long-lived GHG emissions ⁹	<ul style="list-style-type: none"> • Weak linkage to Node 1 • Strong linkage to Nodes 2, 4 and 5 • Weak linkage to subsequent nodes
Node 4 (Midpoint)	Global and regional radiative forcing anomalies (W/m ²) associated with CFs	<ul style="list-style-type: none"> • No linkage to Node 1 • Strong linkage to Nodes 2, 3 and 5 • Weak linkage to subsequent nodes • Linkages to Nodes 8 and 9 not characterized
Node 5 (Temporal Thermal Threshold Midpoint)	Current and projected temporal exceedances of GMT and RMT thresholds	<ul style="list-style-type: none"> • No linkage to Node 1 • Strong linkage to Node 2, 3 and 4 • Strong linkage to Node 6 and 7 • Linkages to Nodes 8 and 9 not characterized
Node 6 (Post-Thermal Threshold Midpoint)	Changes in weather patterns and frequency of weather events	<ul style="list-style-type: none"> • No linkage to Nodes 1, 2 and 3 • Weak linkage to Node 4 • Strong linkage to Nodes 5 and 7 • Linkages to Node 8 and 9 not characterized
Node 7 (Post-Thermal Threshold Midpoint)	Structural changes or ecosystem damage	<ul style="list-style-type: none"> • No linkage to Nodes 1, 2 and 3 • Weak linkage to Node 4 • Strong linkage to Nodes 5 and 6 • Linkages to Node 8 and 9 not characterized
Node 8 (Post-Thermal Threshold Endpoint)	Climate change	<ul style="list-style-type: none"> • Linkages to previous nodes not characterized
Node 9 (Structural Endpoint)	Catastrophic structural changes or ecosystem damage	<ul style="list-style-type: none"> • Linkages to previous nodes not characterized

6.4. Establishing the nodal level of the category indicator. The next step is to determine the nodal level (i.e., Node Level 1, Node Level 2, Node Level 3) of each category indicator, based on the availability of environmental characterization data. The nodal level is the node chosen for calculating category indicator results in order to minimize the degree of uncertainty in the environmental relevance of these results.

As shown in Figure 4, two degrees of uncertainty dictate which nodal level should be selected for a given category indicator: 1) the strength of the linkage of specific LCI results to the endpoint; and 2) the strength of the linkage of the endpoint back to specific LCI results. For example, in the first case shown in Figure 4 (middle), overall uncertainty decreases closer to the endpoint (e.g., regional acidification), while in the second case (right), overall uncertainty is minimized at the exposure midpoint (e.g., ground level ozone). Annex A specifies nodal levels by indicator, incorporating this uncertainty analysis.

⁹ This node is only applicable in the case of climate forcers with long atmospheric lifetimes, which therefore accumulate over time in the atmosphere.

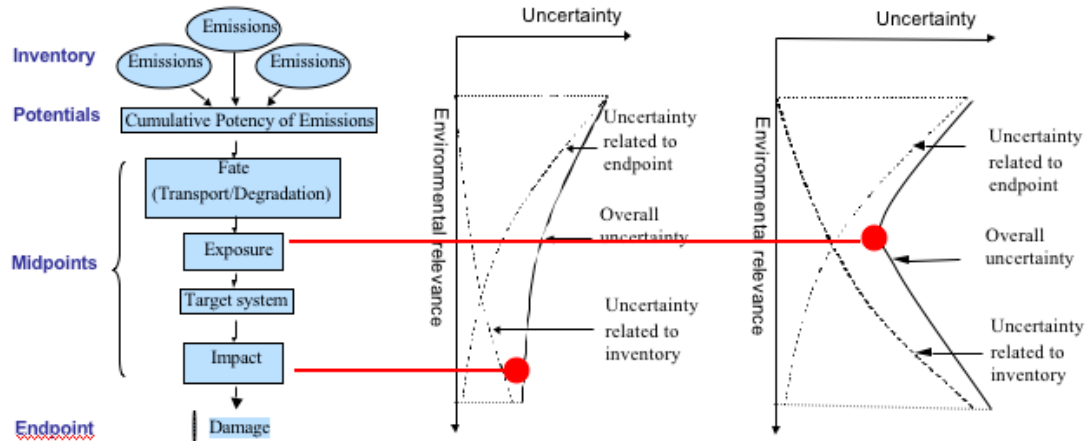


Figure 4. Identifying Nodal Levels for Category Indicators to Minimize Uncertainty

As can be seen from the modeled climate stressor effects network (Table 3 above), Nodes 2 and 3 have the strongest linkage to earlier and later nodes and therefore represent the indicator results with highest degree of certainty of environmental relevance.

6.5. Establishing characterization factors for the different nodal levels. Two types of characterization factors shall be used to calculate indicator results — stressor potency factors (SPFs) and environmental characterization factors (ECFs).

6.5.1. Stressor potency factors. SPFs represent the relative potency of individual stressors that may contribute to a common endpoint. The SPF establishes an equivalency among these stressors, making it possible to aggregate inventory results to establish Node 1 “potentials.”

6.5.2. Environmental characterization factors. For category indicators at Node Level 2 or higher, ECFs are applied to characterize both the receiving environments and providing environments. ECFs allow for the integration of four types of environmental characterization data:

- *Temporal Characterization by Node* – accounting for the duration, residence time, persistence, and timing of onset;
- *Spatial Characterization by Node* – accounting for the geographic area affected by the identified stressor-effect network;
- *Characterization of Severity of Damage, Depletion or Disturbance by Node* – measuring the intensity of specific midpoint/endpoint; and
- *Threshold Characterization by Node* – accounting for the degree to which established human health and environmental threshold(s) have been or are projected to be exceeded.

Nodal characterization is increasingly a recognized component of advanced LCIA methodologies. For instance, the 2010 ILCD Handbook, “Analysis of existing Environmental Impact Assessment methodologies for use in Life Cycle Assessment” [Ref: ILCD, Analysis], shows an example of midpoint nodal characterization and the use of Node level 2 indicators in the EDIP model (Figure 5).

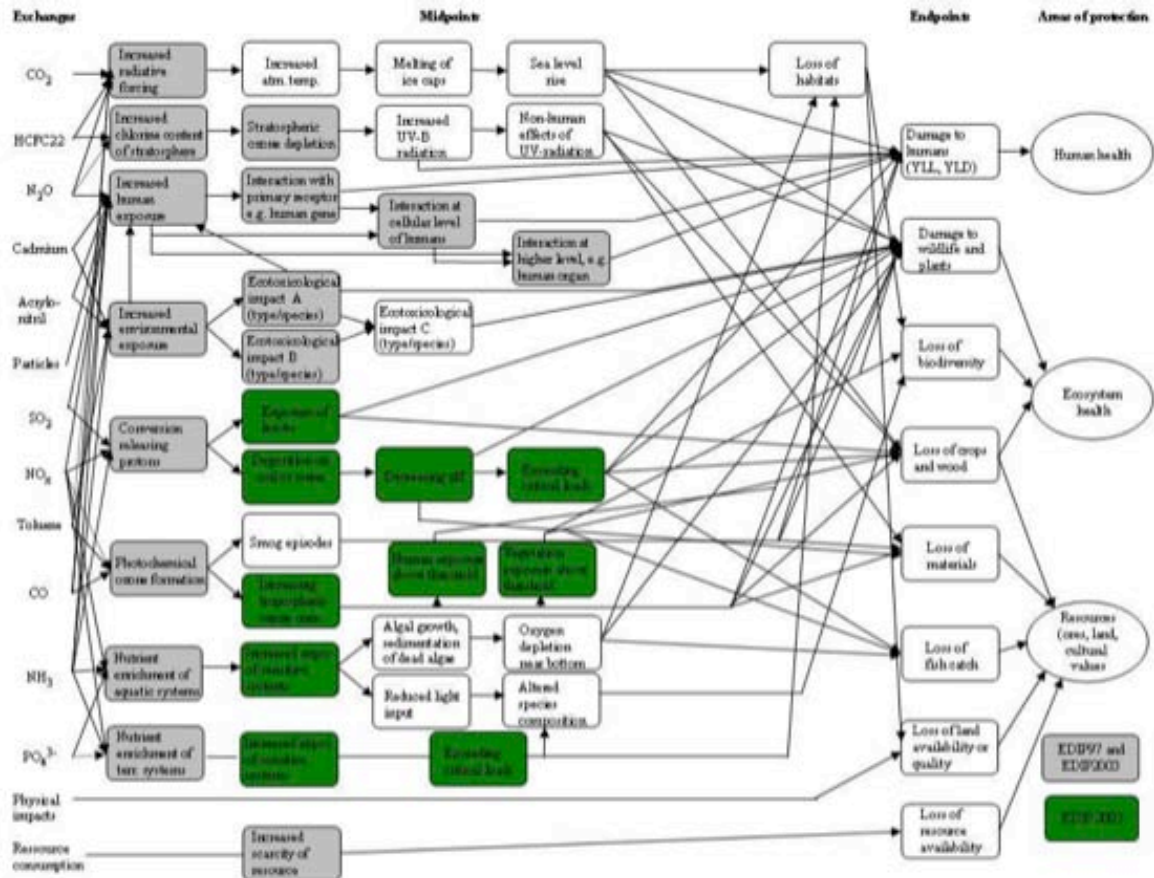


Figure 5. Impact categories and pathways covered by the EDIP Model.
 [Figure and caption are excerpted from 2010 ILCD Handbook, Analysis of existing Environmental Impact Assessment methodologies for use in Life Cycle Assessment, Figure 3.]

6.6. Establishing Category Indicators by Nodal Level. The category indicators listed in Table 4 below have frequently been shown to have active impact midpoint and endpoint intensities (i.e., increasing severity of damage, depletion or disturbance) above recognized thresholds. These indicators are described further in Annex A. As noted in Section 5, additional category indicators may be identified as relevant for specific products or systems under assessment. The practitioner shall determine if additional impact categories are applicable to the study.

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Table 4. Listing of Category Indicators by Impact Group and by Nodal Level

The “x” denotes the node at which results are calculated, based on the strength of linkages to stressor and endpoint nodes.

1. Extracted Resource Depletion	Node 1 Level Rate of resource utilization	Node 2 Level Rate of reserve base depletion from use	Node 3 - Endpoint Reserve base exhausted	
Energy Resource Depletion		×		
Water Resource Depletion		×		
Strategic Material Resource Depletion		×		
Biobased Resource Depletion		×		
2. Landscape Disturbance Level	Node 1 Level Geographic scale of disturbance from activity	Node 2 - Endpoint Size, degree and duration of biome disturbances and species loss		
Terrestrial Biome Disturbance		×		
Aquatic (River) Biome Disturbance		×		
Aquatic (Lake) Biome Disturbance		×		
Riparian/Wetland Biome Disturbance		×		
Loss of Key Species (% by species)		×		
3. Climate Change Emissions	Node 1 Level CFs converted into CO ₂ e	Node 2 Level Total loading from all CFs	Nodes 3+ Accumulation, changes in RF, GMT, RMTs, and resulting effects	
Global CF Loading		×		
Arctic & Other Regional CF Loadings		×		
Regional CF Cooling		×		
4. Environmental Effects Emissions	Node 1 Level LCI emissions, converted into stressor potency potentials	Node 2 Level Fraction of emissions linked to environmental effects	Node 3 + Environmental impacts on oceans, lakes, biomes, species	
Ocean Acidification Loading		×		
Regional Acidification Loading		×		
Stratospheric ODC Loading		×		
Ecotoxicity Potentials	×			
Aquatic Eutrophication Loading		×		
Terrestrial Eutrophication Loading		×		
5. Human Health Effects Emissions	Node 1 Level LCI emissions, converted into stressor potency potentials	Node 2 Level Fraction of emissions linked to regional receiving environments	Node 3 Level Fraction of emissions linked to # individuals exposed within receiving environments	Node 4 — Endpoint Human health effects from exposure
Ground Level Ozone Exposures			×	
PM 2.5 Exposures			×	
Regional Toxic Air Emission Exposures			×	
Indoor Air Emissions — Risk of Exposure				×
Bioaccumulative Toxicity Potentials	×			
6. Untreated Hazardous Wastes	Node 1 Level Creation of untreated hazardous waste	Node 2 Level Risks from breach of containment	Node 3 Level Fraction of emissions linked to # individuals exposed	Node 4 — Endpoint Human health or ecosystem effects from exposure
Risks from Radioactive Wastes		×		
Risks from Other Untreated Hazardous Wastes (by type)		×		

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7. Data Quality Assessment

This section describes the protocols required to conduct the overall data quality assessment, and to establish data quality ratings to support Type III Environmental Declarations and related public claims.

7.1. Data quality indicators. Ten data quality indicators (DQIs) shall be applied to assess the LCI and environmental characterization data. These DQIs, summarized in Table 5, are based upon the ten data quality requirements described in ISO 14044.

Table 5. Data Quality Indicators Applied to this Standard

DQI Categories	Inventory DQIs	Environmental Characterization DQIs
Time related (temporal) coverage	Age of data and the length of time for which data is collected	<ul style="list-style-type: none"> - Age of data. - Duration and intensification of linked midpoint and endpoint effects. - Time of year of linked midpoint and endpoint effects. - Time horizons over which exceedances of threshold (EOTs) occur.
Geographical (spatial) coverage	Location of the unit processes	Location of the unit processes, and geographic boundaries of the linked midpoints and endpoints.
Technology Coverage	Technology or combination of technologies that perform a defined function.	Technology or combination of technologies that perform a defined function.
Precision	Measure of the variability of data values for LCI data points	Measure of the variability of data values for environmental characterization data
Completeness	Percentage of LCI data collected that meets the specified data quality levels.	Percentage of environmental characterization data collected that meets specified data quality levels.
Representativeness	Qualitative assessment of degree to which LCI dataset reflects the true population of interest (e.g., geographical coverage, time period, and technology coverage).	Qualitative assessment of degree to which the environmental characterization dataset reflects the true population of interest (e.g., geographical coverage, time period, and technology coverage).
Consistency	Qualitative assessment of whether the LCI methodology is applied uniformly to the various components of the analysis.	Qualitative assessment of whether the LCIA methodology is applied uniformly to the various components of the analysis.
Reproducibility	Extent to which LCI results can be reproduced by other accredited practitioners.	Extent to which environmental characterization data and indicator results can be reproduced by other accredited practitioners.
Sources of data	Transparency of data sources used for the LCI datasets, supported by documentation.	Transparency of data sources used for the environmental characterization datasets, supported by documentation.
Uncertainty	Uncertainty of the LCI datasets.	Uncertainty analysis of the environmental characterization datasets.

Consistent with the process outlined in the 2010 ILCD Handbook [*Ref: ILCD, Analysis*], the DQIs for LCI data and environmental characterization data are interdependent. For example, LCI data that do not measurably contribute to LCIA category indicator results have lower data quality requirements.

The cut-off rules for specific data collection are determined based on data quality requirements of the category indicator results, rather than setting data collection limits during the LCI phase.

7.2. Overall data quality. Similar to the ILCD approach [*Ref: ILCD, General Guide*], the overall level of data quality achieved shall be established based on the following DQIs: time-related coverage, geographic coverage, technology coverage, completeness, reproducibility, sources of data, precision and uncertainty. The criteria and formula for converting these DQIs into an overall data quality result are described in Annex B. The remaining DQIs – representativeness and consistency – shall be factored in separately, as described in the Annex B.

7.3. Data quality ratings. Once the overall data quality is calculated, the average level of data quality achieved for the environmentally relevant LCI and environmental characterization datasets shall be rated from 1 to 4, where the highest level (Level 1) is the most exacting. Data quality ratings for these data must be Level 1 or 2 in order to support public declarations or claims.

8. Environmental declarations, ratings and claims.

This section describes various types of environmental declarations, ratings and claims based on LCA, and the minimum requirements of each.

8.1. Type III Environmental Declarations (Comparative and Non-Comparative). The purpose of Environmental Declarations is to provide a transparent summary of the environmental and human health impacts associated with a product or system, and to provide the basis for fair, comprehensive marketplace claims and comparisons. Consistent with this goal, each declaration shall, at a minimum, present the impact profile of the product or system studied, based on LCA conducted in accordance with the LCSEA framework. The declaration shall include a description of the product or system, and shall be backed up by a description of the study scope, a summary of LCI results, key assumptions, a description of the reference baseline (if comparative) and a data quality assessment. Examples of Type III Environmental Declarations are listed below:

- **Environmental Product Declaration (EPD)** — A product’s impact profile.
- **Comparative Environmental Product Declaration** — A product’s impact profile compared either to a reference baseline (Section 5.5.6.) or to a competing product.
- **Environmental Building Declaration** — The impact profile of a building, including impacts associated with construction and materials, landscape alteration, energy consumption, the functionality of the building and its occupants over the projected service life of the building, and end-of-life.
- **Comparative Environmental Building Declaration** — A building’s impact profile compared to a reference baseline.
- **Comparative Environmental Power Declaration** — A power generation system’s impact profile compared to a regional power reference baseline. (In the U.S., the

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reference baseline is the average impact profile of power generated in a NERC region or subregion.)

- **Climate Declaration** — 1) A product or system’s climate impact profile; or 2) its projected reduction in climate indicator results compared to its baseline year impact.¹⁰

8.2. Environmental performance ratings. Environmental Performance Ratings (also referred to as LCA Performance Ratings or Eco Ratings) are product ratings derived from comparative Environmental Product Declarations intended for general public education and marketing claims.

8.2.1. Converting impact categories to performance indexes. All impact categories are converted into LCA performance indexes, as shown in Table 6 and described below.

Table 6. Conversion of Category Indicators to LCA Performance Indexes

Category Indicator(s)	LCA Performance Index
Energy Resource Depletion	Energy Conservation
Energy Resource Depletion	Energy Efficiency
Global CF loading Arctic and Other Regional CF Loadings Regional CF Cooling	Climate Protection
Ground Level Ozone Exposures PM 2.5 Exposures Regional Toxic Air Emission Exposures	Clean Air <i>(reported separately if non-linear)</i>
Indoor Air Emission Risk of Exposure	Healthy Indoor Air
Ocean Acidification Loading Ecotoxicity Potentials (Ocean) Aquatic Eutrophication (Ocean)	Ocean Protection
Ozone Depleting Chemical Loading	Stratospheric Ozone Layer Protection
Energy Resource Depletion Biobased Resource Depletion (e.g., Wood Resources) Strategic Materials Depletion	Resource Conservation <i>(reported separately)</i>
Terrestrial Biome Disturbance Aquatic (Lake) Biome Disturbance Aquatic (River) Biome Disturbance Wetland/Riparian Disturbance Loss of Key Species	Ecosystem Protection <i>(reported separately)</i>
Water Resource Depletion	Water Efficiency
Water Resource Depletion	Water Conservation
Aquatic Eutrophication Loading Regional Acidification Loading Ecotoxicity Potentials	Water Quality
Bioaccumulative Toxicity Potentials Ecotoxicity Potentials	Toxic Use Reduction
Risks from Radioactive Wastes Risks from other Untreated Hazardous Wastes	Hazardous Waste Reduction
Enhanced Functional Equivalency	Enhanced Product Performance

¹⁰ Consistent with WRI LCA protocols

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- *Energy Efficiency Index.* This index represents the range of energy use in a product category associated with the product use phase.
- *Energy Conservation Index.* This index represents the range of energy efficiencies in a product category linked to the resource extraction, manufacturing, and distribution phases.
- *Climate Protection Index.* This index represents the range of impact levels in a product category linked to global and regional (Arctic) climate loadings.
- *Clean Air Index.* The index represents the range in the rate of total population exposure rates linked to ground level ozone, small particulate matter (PM 2.5), and regional air emissions in a product category.
- *Ocean Protection Index.* This index represents the range of cumulative global and regional impacts (ocean acidification, eutrophication and ecotoxicity) in a product category affecting ocean ecosystems.
- *Health Indoor Air Index.* The index reflects the range of indoor air emissions presenting a risk of exposure in a product category. State of California 01350 thresholds provide the basis for establishing the average performance level on the index scale (1/2 CREL).¹¹ The index values are multiples of the CREL. (For example, formaldehyde has a Cal. 01350 limit of 4.5 ppb. A product that emits 9.0 ppb would be rated as doubling the risks.)
- *Stratospheric Ozone Layer Protection Index.* This index represents the range of Ozone Depleting Chemical (ODC) emissions in a product category affecting the stratospheric ozone layer.
- *Resource Conservation Index.* The index represents the range of performance in a product category related to a subset of indicators from the Extracted Resource Depletion Group, including depletion of biomass, strategic materials, and petroleum resources. Each active index shall be reported separately. For example, a product that is depleting both petroleum and copper resources would report both separately.
- *Ecosystem Protection Index.* The index represents performance in a product category related to the size, degree and duration of ecosystem disturbance during the timeframe of the occupation of the area. The upper limit for best performance represents negligible levels of disturbance. Each affected biome or species is reported separately.
- *Water Conservation Index.* The index represents the range of performance in a product category relative to the amount of water resources depleted through use or

¹¹ CREL stands for Chronic Reference Exposure Levels

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contamination that results in depletion of regional reserves of fresh water. This depletion principally occurs during the resource extraction, manufacturing, and/or distribution phases as opposed to during the use phase.

- *Water Efficiency Index.* The index represents the range of water use in a product category during the use phase.
- *Water Quality Index.* The index represents the range of performance in a product category related to impacts from aquatic eutrophication, ecotoxicity and acidification.
- *Toxic Use Reduction Index.* The index represents the reduction in the bioaccumulative toxicity and ecotoxicity potentials of the product compared to standard industry practices (lower limit).
- *Hazardous Waste Reduction Index.* The index represents the range of performance in a product category related to risk from untreated radioactive or other hazardous wastes generated by the product during its life cycle.
- *Enhanced Product Performance.* This index represents the enhanced functionality of a product or service compared the standard product's expected useful lifetime baseline. (For example, the useful lifetime of compact fluorescent and LED light bulbs can range from 3,000 hrs to 30,000 hrs, which represents the range for this index in this product category.)

8.2.2. Establishing the performance scale by index. The performance scale for each index reflects the range of impact levels observed for the product category. The upper and lower limits of the scale are either presented as a percentage difference or in the relevant unit of measure. Unless otherwise indicated, the "Average" performance value represents the midpoint of the range of observed impact levels of all products within the product category and does not represent a weighted average by a product's market share. Products that have higher impact levels than the established "Average" are reported with performance "Below Average," while products with lower impacts than the "Average" are reported with performance "Above Average".

For those indexes represented by more than one category indicator, the scale is determined by the number of core category indicators relevant to the product category. For example, in the case of the clean air index, there are three potential core indicators. If all three are active, the highest rating that can be achieved for any of the indicators will be 33% of the total scale. On the other hand, a product with only one core impact category relevant to this index can achieve a best rating of 100% for the entire Clean Air Index as long as the differences between products is linear. If the range for any of the category indicators is an order of magnitude greater than the other indicators, then that category indicator must be reported as a separate index.)

8.2.2.1. Setting the scale from existing government standards. For product

categories evaluated under the ENERGY STAR® and WaterSense® programs, the indexes linked to energy and water performance are scaled using government databases. For example, toilets have a maximum gallon per flush, and dishwashers must meet federal minimum requirements to be sold in the U.S. These minimum requirements are used to set the “below average” lower limit of the scale. On the upper end, the Energy Star program has identified the most energy efficient dishwashers currently available in the marketplace, which are used to set the effective “above average” boundary conditions for this product category.

8.2.2.2. Minimum scale for all indexes. The minimum range of performance for any product/service category shall be set at $\pm 50\%$ from the “Average” performance. In this way, a narrow range of performance for products in the category can be put into perspective for consumers, and the performance differential will be accurately depicted.

8.2.2.3. Representativeness. A sufficient number of products or services (e.g., as determined by product category rules) should be evaluated to be considered representative of the product category.

8.2.3. Converting results. Category indicator results are indexed against the known range of performance in the product category, consistent with the performance scales described above. The known range of performance in the product category is established for an initial five-year period, after which it shall be subject to updates every five years hence. Results for each index are calculated independently of the other indexes. Only those indexes relevant to the product category are calculated. Specific requirements for calculating each index are described further in Annex C.

8.2.4. Applicability. Environmental Performance Ratings can be developed for any product category. All products within a respective category may be rated to determine whether their performance is higher or lower than the average for the category. Some benefits to users of environmental performance ratings include:

- **Accountability.** Similar to nutrition labeling, ratings provide transparency about the relative impacts of competing products, a major aim of environmental marketing.
- **Incentivizing Improvement.** The five-year time period used to establish the range of performance by indicator provides sufficient stability for the ratings to be used in the marketplace, while simultaneously providing adequate time for manufacturers of low performing products to undertake improvements.
- **User Friendly.** LCA performance indexes are stated in positive, user-friendly terms that are accessible to consumers (e.g., energy efficiency, ecosystem protection, etc.), rather than in terms of impacts (e.g., energy resource depletion, terrestrial disturbance, etc.).

8.3. Environmentally preferable product claims. Environmentally Preferable Product (EPP) labels are derived from comparative environmental product declarations, indicating environmental superiority in a product category. An EPP label shall only be applicable for use when: (1) all category indicator results represented on the impact profile are lower than or equal to corresponding indicators in the reference baseline, and (2) there are no trade-offs in any impact category. Quantification of the exact level of impact reduction achieved 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.

8.4. Environmental sustainability claims. Environmental sustainability claims for products or systems shall meet or exceed the minimum EPP, no observable impact and EOT threshold requirements listed in Table 7. This Standard addresses only the biophysical aspects of environmental sustainability. It does not include or make specific recommendations regarding the assessment of social or economic factors, which should be included in overall sustainability claims for products or systems.

Table 7. Minimum Thresholds to be Met by Category Indicator for Environmental Sustainability Claims

Category Indicators	Threshold for Environmental Sustainability Claims
<i>Extracted Resource Depletion</i>	
Energy Resource Depletion	EPP threshold
Water Resource Depletion	EPP threshold
Strategic Material Resource Depletion	EPP threshold – extended temporal/material flows
Biobased Resource Depletion	EPP threshold – extended temporal/material flows
<i>Landscape Disturbance Level</i>	
Terrestrial Biome Disturbance*	EPP threshold
Aquatic (river) Biome Disturbance	No observable impact threshold
Aquatic (lake) Biome Disturbance	No observable impact threshold
Riparian/Wetland Biome Disturbance	No observable impact threshold
Loss of Key Species	No observable impact threshold
<i>Climate Change Emissions</i>	
Global CF Loading	EPP threshold
Arctic and other regional CF loadings	No observable impact threshold
Regional CF Cooling	No relevant threshold
<i>Environmental Effects Emissions</i>	
Ocean Acidification Loading	EPP threshold
Regional Acidification Loading	80% Reduction from EPP threshold
Stratospheric ODC Loading	No observable impact threshold
Ecotoxicity Potentials	No observable impact threshold
Aquatic Eutrophication Loading	EPP threshold
Terrestrial Eutrophication Loading	EPP threshold
<i>Human Health Effects Emissions</i>	
Ground Level Ozone Exposures	EPP threshold
PM 2.5 Emissions Exposures	EPP threshold
Regional Toxic Air Emissions Exposures	No observable impact threshold
Indoor Air Emissions — Exposure Risks	CREL threshold
Bioaccumulative Toxicity Potentials	EPP threshold
<i>Untreated Hazardous Wastes</i>	
Risks form Radioactive Wastes	No observable impact threshold
Risks form Other Untreated Hazardous Wastes	No observable impact threshold

* For biome disturbance categories, credits proportional to hectares conserved may be applied

9. Qualifications for Certifiers.

This section summarizes the qualification for third-party certifiers to this Standard.

9.1. ISO/IEC Guide 65 Accreditation. Third-party practitioners conducting assessments, quantifying results and certifying data for Type III Environmental Declarations and related claims intended for public use should, at a minimum, be accredited to ISO/IEC Guide 65 third-party certification body protocols [Ref: ISO/IEC Guide 65].

9.2. ISO 14065 Accreditation. Third-party practitioners verifying data for climate programs should, at a minimum, be accredited to ISO 14065 [Ref: ISO 14065].