



# CRADLE TO CRADLE CERTIFIED™

## PRODUCT STANDARD

### VERSION 3.1

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## THE CRADLE TO CRADLE CERTIFIED STANDARD REVISION HISTORY

REVISION	SECTION	TYPE OF CHANGE	DATE	AUTHORIZED BY
3.0	Initial Release		11/2012	MBDC & C2CPII
3.1	3	The cyclability assessment has been removed from the Material Health Assessment Methodology.	12/2014	C2CPII Certification Standards Board
3.1	4	The requirement that only A, B, and C assessed materials may count as recyclable or compostable in the Material Reutilization Score has been removed (i.e., X and GREY assessed materials may now count as recyclable or compostable when calculating the Material Reutilization Score).	12/2014	C2CPII Certification Standards Board
3.1	all	<p>The information from both the Cradle to Cradle Certified Product Standard, Version 3.0 and its associated guidance document, Supplemental Guidance for the Cradle to Cradle Certified Product Standard, Version 3.0, has been consolidated into this document.</p> <p>Tables and passages that contained information that was available elsewhere in a more accessible or up-to-date form have been removed.</p> <p>The original intent has been further clarified; inconsistencies and typos that were contained in Version 3.0 have been corrected throughout.</p>	1/2016	C2CPII
3.1	3	Information previously covered in both the Cradle to Cradle Certified Product Standard, Version 3.0 and Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.0 has been removed so that it is only present in the Assessment Methodology document.	1/2016	C2CPII
3.1	3.3, Table 4	Removed reference to commercial products with regard to PTFE	6/2018	C2CPII

# FOREWORD

## Document Purpose

This version of the Cradle to Cradle Certified™ Product Standard (Version 3.1) represents a minor revision of Version 3.0.

In December 2014 the Cradle to Cradle Products Innovation Institute's Certification Standards Board approved the development of version 3.1 of the Cradle to Cradle Certified Product Standard. The main purpose of developing version 3.1 was to remove the overlap in the Material Health and Material Reutilization categories that was introduced in version 3.0 of the standard. These requirements were added to version 3.0 to discourage the re-use of materials that contain harmful substances; however, in practice this resulted in unforeseen problems that ran counter to the intent of the standard and the continuous improvement goal of Cradle to Cradle in general. The Institute and the Certification Standards Board felt it was important to address these issues immediately in a revised version of the standard. Further, a number of minor modifications were made to reduce redundancy and enhance clarity of the standard (see '*The Cradle to Cradle Certified Standard Revision History*' above).

## The Cradle to Cradle Products Innovation Institute (C2CPII)

The Cradle to Cradle Products Innovation Institute administers the Cradle to Cradle Certified Products Program. The Certification Standards Board, using the Cradle to Cradle framework, is responsible for reviewing and approving revisions and/or amendments to the Cradle to Cradle Certified Product Standard and ensuring continuous improvement of products based upon five categories: material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness. Products that meet the criteria of this rating system will receive the Cradle to Cradle Certified certification mark for one of five levels. (<http://c2ccertified.org>)

## MBDC, LLC

MBDC originated the Cradle to Cradle design framework and has 20 years of experience helping clients go beyond minimizing harm and move towards creating a wholly positive impact on the planet. MBDC partners with innovative clients within various sectors and industries to spur creativity, differentiate their brands and recognize their market leadership, attract and retain customers, enhance competitive advantage, and reduce long-term risks. MBDC leads companies towards sustainable growth by helping clients optimize corporate strategy, communications, operations, supply chains, and product designs. MBDC is an Accredited Assessment Body in the Cradle to Cradle Certified Products Program. (<http://mbdc.com>)

## Environmental Protection Encouragement Agency, GmbH

Founded by Professor Dr. Michael Braungart in 1987, the Environmental Protection Encouragement Agency (EPEA) Internationale Umweltforschung GmbH works with clients worldwide to apply the Cradle to Cradle methodology to the design of new processes, products, and services. Materials are applied with respect for their intrinsic value and their useful afterlife in recycled or even "upcycled" products, which have value and technological sophistication that may be higher than that of their original use. EPEA is an Accredited Assessment Body in the Cradle to Cradle Certified Products Program. (<http://epea-hamburg.org>)

*Together, we take on the challenge of scientifically evaluating and innovatively designing products according to a unique design practice.*

## **SUPPORTING DOCUMENTS**

The following documents are to be used in conjunction with the Cradle to Cradle Certified Product Standard:

- *Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.1 or Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.0 and Supplemental Guidance for the Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.0.*
- *Cradle to Cradle Certified Policies and Procedures.*

All supporting documents can be downloaded from the Cradle to Cradle Products Innovation Institute website (<http://c2ccertified.org>).



# 1 INTRODUCTION TO CRADLE TO CRADLE®

*Cradle to Cradle* was developed by William McDonough and Michael Braungart, two pioneers merging intentional design, chemistry, and products for industry. Originally used loosely as a term with different meanings as connotation to “cradle to grave,”<sup>(1)</sup> Cradle to Cradle is a beneficial design approach integrating multiple attributes: safe materials, continuous reclamation and re-use of materials, clean water, renewable energy, and social fairness.

William McDonough began his career as an architect in New York pioneering approaches to building design and concepts—such as “*a building like a tree, a city like a forest*”—which became foundational to the green building movement. His projects included building the first green office in New York for the Environmental Defense Fund in 1984, design of a solar-powered daycare center operated by children (1989), and a strategy for carbon balance and offset that garnered front-page coverage in the *Wall Street Journal* three years before the 1992 Rio Earth Summit. He was a founding member of the American Institute of Architects Committee on the Environment (COTE) and a charter member of the United States Green Building Council (USGBC).

Michael Braungart formed the Environmental Protection and Encouragement Agency (EPEA) Internationale Umweltforschung GmbH<sup>(2)</sup> in 1987, and soon afterward launched the Intelligent Products System (IPS), which defined materials as nutrients with the unique characterization that such materials could be continually reused in biological and technical cycles. The IPS was based on the European precautionary principle and brought a new perspective: that materials can be seen as key parts of technical and biological metabolisms.

McDonough and Braungart met in 1991 and began to share ideas. Together they merged the concept of materials as nutrients within biological and technical cycles with the concept of intentional design. This would later become the Cradle to Cradle design framework, which is the practical approach to product design in which all materials are biological and technical nutrients with coherent use periods and reverse logistics, renewable power, safe water, and social fairness.

In 1991, William McDonough was commissioned by the City of Hannover, Germany, at the suggestion of Dr. Michael Braungart, to craft sustainable design principles for Expo 2000, The World’s Fair. *The Hannover Principles: Design for Sustainability*<sup>(3)</sup> were received and honored by Jaime Lerner, mayor of Curitiba, at the World Urban Forum of the Rio Earth Summit (UNCED) in 1992. They were delivered as a gift from the state of Lower Saxony by McDonough, who attended as the Official Representative for Architecture and City Planning for the International Union of Architects and the American Institute of Architects (dual role). In 1995, McDonough and Braungart co-founded McDonough Braungart Design Chemistry, LLC (MBDC).<sup>(4)</sup>

*The Atlantic* magazine published an article by McDonough and Braungart entitled “The Next Industrial Revolution”<sup>(5)</sup> in October 1998. This article chronicled the rise of “*eco-efficiency*” (doing more with less) as the main environmental strategy of many leading businesses and introduced the idea of “*eco-effectiveness*” to determine the right thing to do before doing it efficiently. In this article the terms

"downcycling" and "upcycling" were used to show how, by design, we can return product materials with improved, rather than degraded, quality over time.

By 2001 several case studies on the integration of the Cradle to Cradle design principles in product design by leading businesses were made available in video and DVD form by Earthome Productions.<sup>(6)</sup> Included in this compilation were stories from Designtex (Steelcase), Herman Miller, Ford, and Nike. In 2002, the book *Cradle to Cradle: Remaking The Way We Make Things* was published.<sup>(7)</sup>

MBDC launched the Cradle to Cradle Certified™ Program<sup>(8)</sup> in October 2005. As the program grew worldwide, the desire for an independent certification body was identified to bring the program into the public sphere. In August 2010 an exclusive, worldwide license was granted to the Cradle to Cradle Products Innovation Institute<sup>(9)</sup> as a third party not-for-profit organization to manage the certification program.



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## 1.1 WHAT IS CRADLE TO CRADLE® DESIGN?

The Cradle to Cradle design principles provide a positive agenda for continuous innovation around the economic, environmental, and social issues of human design and use of products and services. Specifically, the purpose of the product certification program is to improve the way we make, use, and re-use things recognizing two metabolisms, the *biological metabolism* and the *technical metabolism*, with a goal to leave a beneficial footprint for human society and the environment.

The aim is to set a positive course for product and process design and development in a way that will allow natural and technical systems, products, and processes to support the diverse living population on earth. Cradle to Cradle design mirrors the healthy, regenerative productivity of nature, and considers materials as assets, not liabilities.

Management theorist Peter Drucker has said that it is a manager's job to do something the right way—to be efficient—but it is an executive's job to do the right thing—to be effective. To date, global efforts by businesses have been focused on becoming more efficient and reducing the (bad) environmental "footprint" by optimizing existing systems, which may be wrong designs. Cradle to Cradle design is about choosing the right thing to do and then doing that thing the right way to achieve positive outcomes. In other words, to become "*more good*," not just "*less bad*."

For example, while it makes sense to slow down the use of fossil fuels, this is not the goal. Cradle to Cradle is a continuous improvement process design tool that starts with the positive or beneficial end in mind and executes efficiently towards achieving this goal. In this example the Cradle to Cradle goal is a move to renewable energy sources.

## Long-Term Goals, Short-Term Actions, and Transitions

We start by defining long-term Cradle to Cradle goals and then develop transitional strategies to achieve them. In the short term, we can make successive design-based decisions that will move us to a more sustaining condition. The short-term actions for product development start with complete identification of the materials and chemicals that make up the product and process in order to assess them for human and ecological impacts.

In the medium term the goal is for designs that are positive or beneficial in terms of cost, performance, aesthetics, material health, and material (re)utilization potential with continuous use and reuse periods. Additionally, moving renewable energy forward in a cost-effective way, celebrating clean water as a human right, and honoring social systems are part of the holistic Cradle to Cradle approach.

The long-term goals can be wholly positive and intended to support 10 billion people and other species. For example, McDonough and Braungart's long-term goal is:

*"Our goal is a delightfully diverse, safe, healthy and just world, with clean air, water, soil and power - economically, equitably, ecologically and elegantly enjoyed."*

Cradle to Cradle provides a unique frame of thinking that is based on the precautionary principle and trust in the product supply chain. This is not a framework based on guilt or intended as an opportunity for taking legal actions. Rather it is the basis for building up a support system.

We work with humility and recognize that checking single chemicals in materials and products does not give the complete picture and that there may be unintended consequences, but it is a good start. In focusing attention on chemicals it is not our intention to promote more animal testing. If a chemical bio-accumulates we would rather see alternatives substituted.

The question becomes one of design intention and we can ask, "What type of products do we want to see?" Chemists become designers and designers become chemists. As humans, we accept the limitations of our knowledge and we will make mistakes, but these mistakes need to be reversible by future generations.

The product certification program is a QUALITY statement using QUANTITY indicators. Each level represents a higher quality indicator using multiple attributes. Today the program is primarily oriented from a Western cultural perspective. Longer term, the program is expected to evolve and quality indicators respecting and celebrating cultural diversity are anticipated.

## 1.2 THE CRADLE TO CRADLE® PRINCIPLES

In nature, there is no concept of waste. Everything is effectively food for another organism or system. Materials are reutilized in safe cycles. There are no persistent, bio-accumulative materials that can lead to irreversible changes. The earth accrues biota grown from the energy of the sun. We celebrate the diversity of people and of species. We become native to place, celebrating abundance and honoring every child that is born. In short, the design of goods and provision of services can be achieved with three principles in mind:

### 1. Eliminate the Concept of Waste

- Nutrients become nutrients again. All materials are seen as potential nutrients in one of two cycles – technical and biological cycles.
- Design materials and products that are effectively “food” for other systems. This means designing materials and products to be used over and over in either technical or biological systems.
- Design materials and products that are safe. Design materials and products whose nutrient management system leaves a beneficial legacy economically, environmentally, and equitably.
- Create and participate in systems to collect and recover the value of these materials and products. This is especially important for the effective management of scarce materials.
- Clean water is vital for humans and all other organisms. Manage influent and effluent water streams responsibly, and consider local impacts of water use to promote healthy watersheds and ecosystems.
- Carbon dioxide (CO<sub>2</sub>) should be sequestered in soil. Our current practice where carbon dioxide ends up in the oceans and in the atmosphere is a mismanagement of a material.

### 2. Use Renewable Energy

- The quality of energy matters. Energy from renewable sources is paramount to effective design.
- Aligning with Green-e’s list of eligible sources, renewable energy sources are solar, wind, hydropower, biomass (when not in competition with food supplies), geothermal, and hydrogen fuel cells.

### 3. Celebrate Diversity

- Use social fairness to guide a company's operations and stakeholder relationships.
- Encourage staff participation in creative design and research projects to enhance your Cradle to Cradle story.
- Technological diversity is key for innovation; explore different options in looking for creative solutions.
- Support local biodiversity to help your local ecosystem flourish; strive to have a beneficial social, cultural, and ecological footprint.

Under the Cradle to Cradle design approach, products that result in materials flowing into the biosphere (either from the product contents or the packaging) are considered to be “products of consumption.” Materials that are recovered after use can be considered to be “products of service.” (Note: some materials such as paper or bio-plastics are products of consumption as they ultimately return to the biosphere after a number of post-use cycles.)

## 1.3 COMPLEMENTARY METABOLISMS

The Cradle to Cradle Certified™ Program focuses on the characteristics of sustainable materials, products, and systems. As a result, this method places a major emphasis on the human and ecological health impacts of a product’s ingredients at the chemical level, as well as on the ability of that product to be truly recycled or safely composted. The quality of energy used to create a product, water quantity and quality, and social fairness also are essential Cradle to Cradle characteristics and focus areas in this certification process.

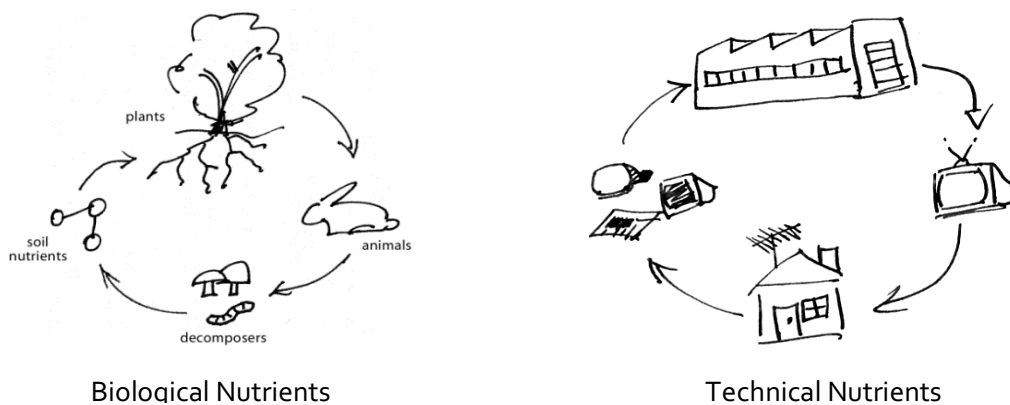
Cradle to Cradle design draws on knowledge from the fields of environmental chemistry and material flows management (broadly termed Industrial Ecology), and the fields of industrial and architectural design. It includes the *Intelligent Product System* (IPS) pioneered by chemist Dr. Michael Braungart in 1986.

Cradle to Cradle is an innovative approach that models human industry on the processes of nature's *biological nutrient metabolism* integrated with an equally effective *technical nutrient metabolism*, in which the materials of human industry safely and productively flow within the two metabolisms in a fully characterized and fully assessed way. Products that are designed as services are made from materials that cycle in the technical metabolism at the end of their use cycle. Consumption products, those that naturally end up in the environment (biological cycle) during or post-use, are made from materials that are inherently safe for the biosphere.

Nature's metabolism runs on renewable energy and returns all materials safely in cycles for reuse. Everything can be considered a nutrient with future value. All of our man-made designs exist in this metabolism and many products will result in the nutrients connecting with, and flowing directly into, this system during and after use. These materials need to meet a standard for "biological nutrients" with the highest level of safety designed in.

Products that have achieved positive design milestones along the continuum of improvement are shown to be suitable for cycling perpetually on Earth, using ingredients that are safe and beneficial – either to biodegrade naturally and restore the soil, or to be fully recycled into high-quality materials for subsequent product generations, again and again. This allows a company to eliminate the concept of waste and recover value, rather than creating a future of solid waste liability. Cradle to Cradle design turns contingent liabilities into assets.

Figure 1 Depiction of Biological and Technological Nutrient Cycles



### 1.3.1 Effective Material Cycles

#### Products of Consumption

A product of consumption is a material or product that is typically changed biologically, chemically, or physically during use and therefore enters the biosphere either by nature or by human intention. As a result, products of consumption should consist of biological nutrient materials.

Biological cycle materials and products need to be designed for safe combustion without the need for filters. Biological cycle products such as paper or bio-plastics may go through a series of technical cycles (e.g., recycling) before finally going safely into biological systems (e.g., composting or incineration for energy recovery).

A biological nutrient product is usable by defined living organisms to carry on life processes such as growth, cell division, synthesis of carbohydrates, energy management, and other complex functions. Any material emanating from a product of consumption that comes into intentional or likely unintentional and uncontrolled contact with biological systems is assessed for its capacity to support their metabolism. Metabolic pathways consist of oxidation, catabolism (degradation, decrease in complexity), and anabolism (construction, increase in complexity), both occurring generally in a coupled manner. The classification of products as biological nutrients (or source of nutrients) depends on the biological systems with which they interact. These systems can be more or less complex along the following organizational hierarchy:

- Organisms (nutrients for predators).
- Organic macromolecules and combinations thereof (nutrients for fungi, microorganisms, vegetarian animals; oral, dermal or olfactory nutrients).
- Minerals (nutrients for autotrophic plants).

For example, a detergent that is comprised of readily biodegradable materials could be designed such that the material or its breakdown products provide nutrition for living systems. Products like tires and brake shoes that abrade in use are also products of consumption, but have yet to be designed with biological nutrient materials.

### Products of Service

A product of service is a material or product designed to provide a service to the user without conveying ownership of the materials. Products of service are ideally comprised of technical nutrients that are recovered at the end-of-use phase.

Technical nutrients (TNs) are products or materials that “feed” technical systems. While they may or may not be suitable to return to air, soil, or water, technical nutrients are never consumed but instead are catabolized (deconstructed) and anabolized (constructed) according to the following hierarchy:

- (Dismantle and) reuse.
- (Dismantle and) physical transformation (e.g., plastic remolding).
- (Dismantle and) chemical transformation (e.g., plastic depolymerization, pyrolysis, gasification).

Technical nutrients can therefore be managed with service contracts or leasing models so that users benefit from the product service without owning the materials. In the case of scarce materials, it is especially important to use them in products of service so that they remain available over the long term as useful materials.

## Externally Managed Components (EMCs)

An EMC is a sub-assembly, component, or material within a product that is exempt from the general requirement of full characterization to the 100 ppm level because it is managed in a technical nutrient cycle as part of a supplier or manufacturer commercialized nutrient management program.

To be considered an EMC, the sub-assembly, component, or material within a product must meet the following criteria:

1. The supplier of the EMC has provided the applicant with a guarantee for take back and appropriate nutrient management. The supplier may designate a third party or parties for implementation.
2. The supplier has signed a declaration that chemicals in the EMC will not negatively impact humans or the natural environment during the intended and unintended but highly likely use of the product for which the EMC is a component. This guarantee may be provided if the EMC is Cradle to Cradle Certified (Gold level or higher), or other appropriate evidence.
3. The EMC has undergone testing by an accredited analytical laboratory to ensure that harmful substances are not being emitted from the EMC above the chemicals' analytical detection limits. Off-gas testing is required for all EMCs (See Section 3.9 for more information on volatile organic compounds [VOCs] emission testing). Migration and leaching testing may be required depending on the type of EMC.

Note that EMCs are not exempt from banned list declarations. Also note that if during use of the product for which the EMC is a component a user is exposed to any part or chemical within the component, or if any part or chemical within the component is released to the environment, the component is not considered an EMC and will be assessed and inventoried like the other materials in the product.

EMCs were introduced in version 3.0 of the Cradle to Cradle Certified Product Standard as a way to include product components that do not need to be assessed the same way as the rest of a product because they are managed as a whole by the supplier or a third party. The EMC concept was invented by the founders of the Cradle to Cradle<sup>®</sup> framework to encourage manufacturers to design complex components that are completely managed after their use phase. As of the release date of version 3.0 of this Standard, an EMC had not yet been included in a Cradle to Cradle Certified product. Examples of potential EMCs are a pneumatic cylinder in an office chair, the motherboard in a computer, the electric motor inside an automated window shade product, and a solar panel.

# 2 OVERVIEW OF THE STANDARD

## 2.1 PRODUCT SCOPE

This certification program applies to materials, sub-assemblies, and finished products. Materials and sub-assemblies can be considered “products” for certification purposes.

This program does not address performance measures associated with any products that qualify for the Cradle to Cradle Certified™ Products Program. Product compliance with all applicable laws and regulations is assumed. Some rules in the program address activities that are also subject to regulation by local, state, or federal authorities. However, nothing contained herein changes legal regulatory requirements or prescribes how compliance is to be achieved. Documentation of compliance with certain key regulations may be included in some sections of the Standard, but this in no way changes the underlying regulatory requirements.

There are a number of product attributes that may exclude a manufacturer from seeking certification. The following list depicts some cases and issues that are out of the scope of this program. The purpose of this list is to create a threshold to prevent unreasonable products from entering the system and to protect the positive values around products, as well as their usefulness. The scope of the program does not include the following:

- The presence of any chemicals from the Cradle to Cradle Certified “Banned List” (See Appendix for lists).
- Processes in and of themselves.
- Food, beverages, pharmaceuticals, or fuels and other products intended for combustion during use.
- Buildings, countries, cities.
- Products from rare or endangered species (e.g., ivory).
- Products with ethical issues (e.g., weapons, tobacco, electric chair, etc.).
- Products leading to or including animal abuse.
- Products with apparent safety concerns related to physical and chemical characteristics.
- Products from companies involved in rain forest damage, child labor, blood metals, or blood diamonds.
- Applicant involved in terror support or racism/discrimination.
- Nuclear power and/or products used to produce nuclear power.
- Products that may be contrary to the intent of the Cradle to Cradle principles.

### Product Packaging

Packaging material may be certified as a separate product or may be considered part of a product and thus included in the product certification. However, though it is encouraged, the packaging material is not required to be included in the product assessment. If the packaging material was included in the



assessment, the achievement level assigned to the packaging is provided on the product's certificate and in the entry in the Product Registry (<http://c2ccertified.org/products/registry>). If the certificate and the entry in the Product Registry do not address packaging, then the packaging is not included in the certification. Note that when packaging materials are included in the assessment, only the requirements in the Material Health and Material Reutilization categories are addressed.

Though not required to be included in the product assessment, materials in the product's primary packaging are subject to the same banned list requirements as the materials in the product and thus may not contain chemicals on the banned lists (see definition of 'primary packaging' below). Signed declarations stating that banned list chemicals have not been intentionally added at concentrations >0.1% (>1000 ppm) must be obtained for each homogeneous material used in the primary packaging, including inks, adhesives, and any materials used to label the package. Banned list declarations may be obtained from the supplier, the product manufacturer, or the assessor (see Section 3.3 of this document for more information). For primary packaging made from recycled materials, analytical testing for banned list chemicals may be required if all of the material ingredients cannot be defined with current information.

Primary packaging refers to the container that envelops a liquid, gel, paste, or powder and is intended to be kept with the product during its use or up until the moment of application (e.g., surface cleaner spray bottle, paint can, dishwasher powder box, nail polish bottle, wet-wipe pouch/packet/tub). Any materials that are intended to be removed prior to the product's use are not considered primary packaging (e.g. pallet, shrink wrap, carton). All materials meeting this definition are considered part of the primary packaging, including inks, adhesives and any materials used to label the package. Primary packaging is not in scope for products that are sold exclusively as material inputs for other products (rather than being sold to the general public).

## 2.2 STANDARD CATEGORIES AND THEIR SCOPE

Products™ seeking to be Cradle to Cradle Certified™ are evaluated against criteria in the following five categories:

**Material Health** – The ultimate goal is for all products to be manufactured using only those materials that have been optimized and do not contain any X or Grey assessed materials/chemicals. As such, products are able to achieve increasingly higher levels of certification as the percentage of assessed and optimized materials in the finished product increases.

The boundaries of review are drawn at the product leaving the direct production facility. The process chemicals associated with the production of certain inputs are included, where applicable (e.g., textiles, plated parts, paper, foam).

**Material Reutilization** – A key component of Cradle to Cradle design is the concept of technical nutrients and biological nutrients flowing perpetually in their respective metabolisms. Products are evaluated for their nutrient potential and nutrient actualization, as well as the role the manufacturer plays in material/nutrient recovery.

The intention of this category is to provide a quantitative measure of a product's design for recyclability and/or compostability. The larger the percentage of a product and/or its components that remain in a technical and/or biological metabolism, the better the score for this category.

**Renewable Energy and Carbon Management** – Cradle to Cradle products are manufactured in a way that positively impacts our energy supply, ecosystem balance, community, and ultimately strives to keep carbon in soil and earth vegetation where it belongs.

The intention of this category is to provide a quantitative measure of the percentage of renewably generated energy that is utilized in the manufacture of the product. Purchased electricity and direct on-site emissions associated with the final manufacturing stage of the product, as well as embodied energy associated with the product from Cradle to Gate, are considered, depending on the level of certification.

**Water Stewardship** – Water is a scarce and valuable resource. Product manufacturers are evaluated against their understanding of (and responsibility for) water withdrawals, consumption, and releases within the local ecology, and are rewarded for innovation in the areas of conservation and quality of discharge.

The intention of this category is to provide a quantitative and qualitative measure of water usage and water effluent related directly to the manufacture of the certified product.

**Social Fairness** – Cradle to Cradle product manufacturers strive to ensure that progress is made towards sustaining business operations that protect the value chain and contribute to all stakeholder interests, including employees, customers, community members, and the environment.

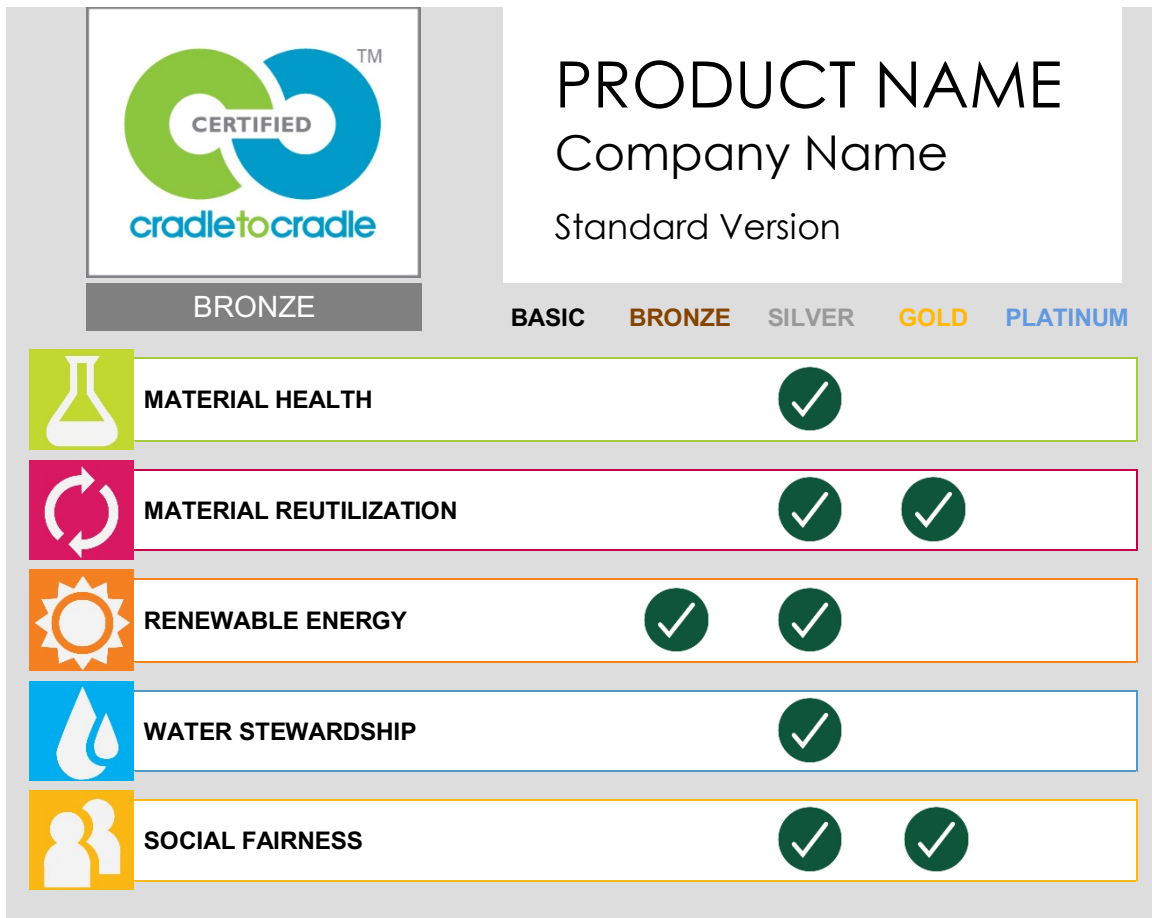
The intention of this category is to provide a qualitative measure of the impact a product’s manufacture has on people and communities, and it includes some measures of general environmental impacts. Requirements apply to the facility or facilities where the final product is manufactured unless otherwise noted.

## 2.3 CERTIFICATION LEVELS

Because this program is not based on the binary, pass/fail model, but instead incorporates the concept of continuous improvement, the certification results are split into a **5-Level System of Basic, Bronze, Silver, Gold, and Platinum**. The minimum level of achievement in any of the five categories ultimately determines the final certification level.

When products qualify for certification, the manufacturer will receive a certificate and a scorecard that can be used to educate consumers on the level of achievement attained in all five categories. In addition, the product and its related certification level and scorecard will be listed on the Cradle to Cradle Products Innovation Institute’s website (<http://c2ccertified.org>). An example scorecard is shown in Table 1.

Table 1 Example Product Scorecard



### Publication of Product Scorecard

Publication of the product scorecard on the Certified Products Registry or in a company's marketing material is encouraged, but not required. Manufacturers can opt out of having their full scorecard published on the Certified Products Registry along with their overall level of certification.

### Basic Level Is A Provisional Certification

At the Basic level, a product is just starting out on the path to certification. A company must conduct a rudimentary inventory of materials used to make the product, energy use, water stewardship, and social fairness issues affecting their industry and production region. The Basic level of certification has been designed to recognize a company's intent to improve the way their product is made, establishing a commitment to ongoing assessment and optimization.

As such, the Version 3.1 Basic level certification is a 'provisional' certification. A product may be certified only once at this level, and must re-certify at a higher level once the two year certification has expired or be delisted from the program. In addition, products certified at the Basic level under Version 3.1 may not use the certification mark on their product, but may refer to it in web and print marketing materials.

## 2.4 SUMMARY OF STANDARD REQUIREMENTS

Table 2 lists the Standard requirements for each of the five categories by certification level.

Table 2 Cradle to Cradle Certified™ Product Standard, Version 3.1

1. MATERIAL HEALTH	Basic	Bronze	Silver	Gold	Platinum
No Banned List chemicals are present above thresholds.	●	●	●	●	●
Materials defined as biological or technical nutrients.	●	●	●	●	●
100% "characterized" (i.e., all generic materials listed).	●	●	●	●	●
Strategy developed to optimize all remaining x-assessed chemicals.		●	●	●	●
At least 75% assessed by weight (Complete formulation information collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use).		●	●	●	●
At least 95% assessed by weight (Complete formulation information collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use).			●	●	●
Assessed materials do not contain carcinogenic, mutagenic, or reproductively toxic (CMR) chemicals in a form that may result in plausible exposure.			●	●	●
100% assessed by weight.				●	●
Formulation optimized (i.e., all x-assessed chemicals replaced or phased out).				●	●
Meets Cradle to Cradle VOC emission standards where relevant.				●	●
All process chemicals assessed and no x-assessed chemicals present.					●
2. MATERIAL REUTILIZATION	Basic	Bronze	Silver	Gold	Platinum
Defined the appropriate cycle (i.e., technical or biological) for the product.	●	●	●	●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score $\geq 35$ .		●	●	●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score $\geq 50$ .			●	●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score $\geq 65$ .				●	●

Well-defined nutrient management strategy (including scope, timeline, and budget) for developing the logistics and recovery systems for this class of product or material.				●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score of 100.					●
The product is actively being recovered and cycled in a technical or biological metabolism.					●
<b>3. RENEWABLE ENERGY AND CARBON MANAGEMENT</b>	<b>Basic</b>	<b>Bronze</b>	<b>Silver</b>	<b>Gold</b>	<b>Platinum</b>
Purchased electricity and direct on-site emissions associated with the final manufacturing stage of the product are quantified.	●	●	●	●	●
A renewable energy use and carbon management strategy is developed.		●	●	●	●
For the final manufacturing stage of the product, 5% of purchased electricity is renewably sourced or offset with renewable energy projects, and 5% of direct on-site emissions are offset.			●	●	●
For the final manufacturing stage of the product, 50% of purchased electricity is renewably sourced or offset with renewable energy projects, and 50% of direct on-site emissions are offset.				●	●
For the final manufacturing stage of the product, >100% of purchased electricity is renewably sourced or offset with renewable energy projects, and >100% of direct on-site emissions are offset.					●
The embodied energy associated with the product from Cradle to Gate is characterized and quantified, and a strategy to optimize is developed.					●
≥ 5% of the embodied energy associated with the product from Cradle to Gate is covered by offsets or otherwise addressed (e.g., through projects with suppliers, product re-design, savings during the use phase, etc.).					●
<b>4. WATER STEWARDSHIP</b>	<b>Basic</b>	<b>Bronze</b>	<b>Silver</b>	<b>Gold</b>	<b>Platinum</b>

The manufacturer has not received a significant violation of their discharge permit related to their product within the last two years.	●	●	●	●	●
Local- and business-specific water-related issues are characterized (e.g., the manufacturer will determine if water scarcity is an issue and/or if sensitive ecosystems are at risk due to direct operations).	●	●	●	●	●
A statement of water stewardship intentions describing what action is being taken for mitigating identified problems and concerns is provided.	●	●	●	●	●
A facility-wide water audit is completed.		●	●	●	●
Product-related process chemicals in effluent are characterized and assessed (required for facilities with product-relevant effluent).  OR  Supply chain-relevant water issues for at least 20% of Tier 1 suppliers are characterized and a positive impact strategy is developed (required for facilities with <u>no</u> product-relevant effluent).			●	●	●
Product-related process chemicals in effluent are optimized (effluents identified as problematic are kept flowing in systems of nutrient recovery; effluents leaving facility do not contain chemicals assessed as problematic) (required for facilities with product-relevant effluent).  OR  Demonstrated progress against the strategy developed for the Silver-level requirements (required for facilities with <u>no</u> product-relevant effluent).				●	●
All water leaving the manufacturing facility meets drinking water quality standards.					●

5. SOCIAL FAIRNESS	Basic	Bronze	Silver	Gold	Platinum
A streamlined self-audit is conducted to assess protection of fundamental human rights.	●	●	●	●	●
Management procedures aiming to address any identified issues have been provided.	●	●	●	●	●
A full social responsibility self-audit is complete and a positive impact strategy is developed (based on UN Global Compact Tool or B-Corp).		●	●	●	●
Material-specific and/or issue-related audit or certification relevant to a minimum of 25% of the product material by weight is complete (FSC Certified, Fair Trade, etc.).  OR  Supply chain-relevant social issues are fully investigated and a positive impact strategy is developed.  OR  The company is actively conducting an innovative social project that positively impacts employees' lives, the local community, global community, or social aspects of the product's supply chain or recycling/reuse.					
Two of the Silver-level requirements are complete.				●	●
All three Silver-level requirements are complete.					●
A facility-level audit is completed by a third party against an internationally recognized social responsibility program (e.g., SA8000 standard or B-Corp).					●

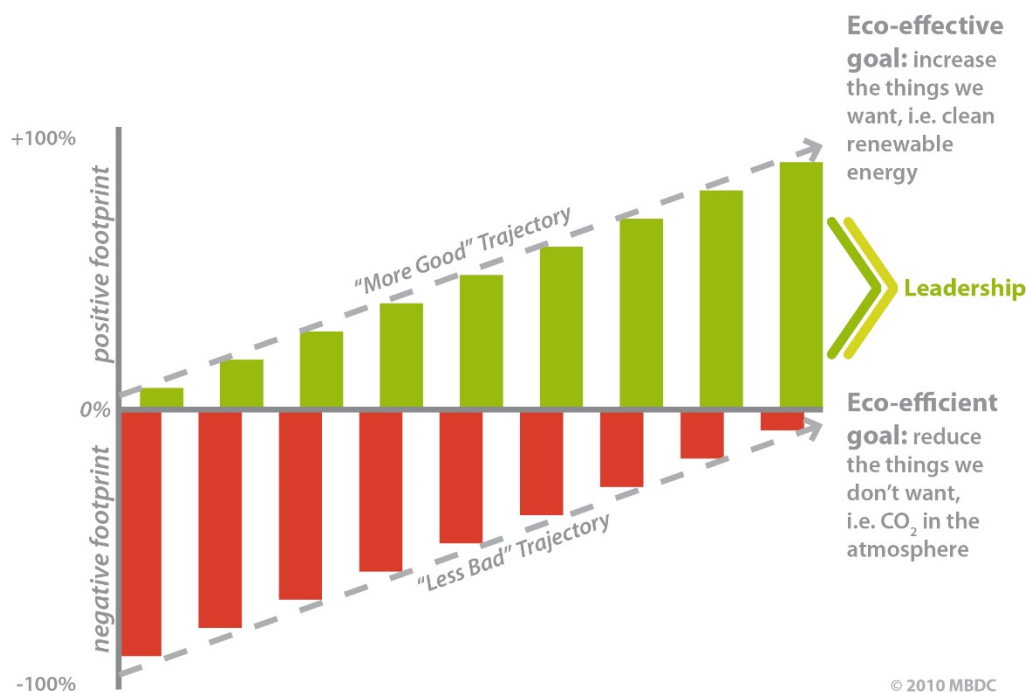
## 2.5 CONTINUOUS IMPROVEMENT AND OPTIMIZATION

It is expected that certification holders will make a good faith effort toward optimization in all five categories. Program conformance requires that all applicants outline their intention for the eventual phase-out/replacement of problematic substances (i.e., those materials or chemicals with X ratings) as

part of certification. The plan constructed is meant to lay the foundation for prioritizing the phase-out of problematic product inputs in order to move along the Cradle to Cradle® continuum. The Accredited Assessor will help gauge whether significant progress has been made on the optimization of x-assessed substances to maintain or improve the certification level.

The continuous improvement chart shown in Figure 2 clearly shows how the goal is not “zero” but instead to combine the progressive reduction of “bad” with the increase in “good” to reach a beneficial Cradle to Cradle goal.

Figure 2 Continuous Improvement Chart



## 2.6 CERTIFICATION MARKS

Companies receiving certification will have the opportunity to license the Cradle to Cradle Certified™ Marks. This Mark signifies to the global marketplace that the company has chosen a positive path toward using chemicals, materials, and processes for production that are healthy and fit in perpetual use cycles.

The Certification Mark(s) may only be used under license and in direct association with the certified product or that product’s marketing materials. The Certification Mark(s) depicted below may be printed on the product with the exception of products certified at the Basic level. Because product certification at the Basic level is a two-year provisional certification, the Certification Mark for Basic may not be used on the products. In general, the certification mark may not be used as a general-purpose mark associated with the company and its products. A style guide is available to demonstrate correct usage.

Figure 3 Cradle to Cradle Certified™ Marks





## 2.7 CERTIFICATION CYCLE AND RECERTIFICATION REQUIREMENT

Each product certification is valid for two years under Version 3.1 of the Standard. Certification holders must renew each certification prior to its expiration date to maintain Cradle to Cradle Certified™ product status. As part of the recertification process, certification holders must work with an accredited assessor to submit an updated assessment summary, which reports a good faith effort towards continually improving the product in accordance with Cradle to Cradle principles.

# 3 MATERIAL HEALTH

## Safe and Healthy Materials

The review for Material Health generates material assessment ratings based on the hazards of chemicals in products and their relative routes of exposure during the intended (and highly likely unintended) use and end-of-use product phases. The ultimate goal is for all products to be manufactured using only those materials that have been optimized and do not contain any X or Grey assessed materials. As such, products are able to achieve increasingly higher levels of certification as the percentage of optimized materials in the finished product increases.

Table 3 lists each requirement within the Material Health category. To achieve a given level, the requirements at all lower levels are to be met as well. The sections that follow provide interpretation and suggested methods for achievement.

Table 3 Material Health Requirements

LEVEL	ACHIEVEMENT
<b>BASIC</b>	The product is 100% characterized by its generic materials (e.g., aluminum, polyethylene, steel, etc.) and/or product categories and names (e.g., coatings).
	The appropriate metabolism (i.e., technical nutrient (TN) or biological nutrient (BN) is identified for the product and its materials and/or chemicals.
	The materials subject to review in the product do not contain any Banned List chemicals above allowable thresholds based on supplier declarations.
<b>BRONZE</b>	The product is at least 75% assessed (by weight) using ABC-X ratings. Externally Managed Components (EMCs) are considered assessed and contribute to the overall percentage of the product that has been assessed. Complete formulation information needs to have been collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use (e.g., cosmetics, personal care, soaps, detergents, paint, etc.).
	A phase-out or optimization strategy has been developed for those materials with an X rating.
<b>SILVER</b>	The product has been at least 95% assessed (by weight) using ABC-X ratings. Externally Managed Components (EMCs) are considered assessed and contribute to the overall percentage of the product that has been assessed. Complete formulation information needs to have been collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use (e.g., cosmetics, personal care, soaps, detergents, paint, etc.).
	The product does not contain substances known or suspected to cause cancer, birth defects, genetic damage, or reproductive harm (CMRs) in a form that may result in plausible exposure.
<b>GOLD</b>	The product has been 100% assessed (by weight) using ABC ratings. All EMCs are considered assessed as non-X.

	The product contains no X assessed materials (optimization strategy is not required).
	Product meets Cradle to Cradle VOC emissions standards where relevant
<b>PLATINUM</b>	All process chemicals have been assessed and none have been assessed as x.

### 3.1 GENERIC MATERIAL TYPE AND INPUTS SUBJECT TO REVIEW

#### Standard Requirement

The product is 100% characterized by its generic materials (e.g., aluminum, polyethylene, steel, etc.) and/or product categories and names (e.g., coatings).

#### Applicable Levels of Certification

This requirement applies to all levels of certification (Basic, Bronze, Silver, Gold, and Platinum).

#### Intent

The intent of this requirement is to identify the generic materials used in the product and list them in a Bill of Materials. The Bill of Materials will be used at higher levels of certification to guide the identification of the chemicals present in those materials that will be assessed for their potential to impact human and environmental health. The intent of this requirement is also to assist a manufacturer with understanding all of the materials that are present in the product that may be subject to review.

#### Methods

Use a Bill of Materials to record the information below. The Bill of Materials should include the following column headings: part number, part description, number of parts per product, generic material, part weight, total weight (all parts), and percent of total weight. Some of these may not be relevant depending on product configuration.

Trade names and grades for purchased materials (exact material specification), color of polymers, finish type information, supplier name, location, and contact information are additional columns that will be useful if the applicant is applying at certification levels above Basic and/or if an assessor will be assisting with data collection from the supply chain.

1. List all homogeneous materials that are present in the product by generic material type and/or product categories and names within the Bill of Materials. Parts and components of assemblies and sub-assemblies of non-homogeneous (i.e., heterogeneous) materials are to be broken down to the homogeneous material level.
  - a. Homogeneous materials are defined as materials of uniform composition throughout that cannot be mechanically disjointed, in principle, into different materials. Examples of homogeneous materials are polypropylene, steel, shampoo, glass cleaner, nylon yarn, finish, and coating.
  - b. Examples of non-homogeneous materials are powder-coated steel, a printed bottle label, plywood, laminate, and chair casters.

Material safety data sheets (MSDSs) may be useful in completing this first step of characterizing the breakdown of the product; however, it will likely be necessary to consult with material suppliers. ***It cannot be assumed that MSDSs contain complete materials information even at a generic level.***

2. Weigh each material and record the weights in the Bill of Materials. When more than one of a single product input is used, remember to multiply the weight of a single material by the total number of items used in the product.
3. Determine the materials subject to review. First, weigh the entire product. Divide the weight of each material in the product by the total product weight to calculate the percentage of total weight for each material. All homogeneous materials present at  $\geq 0.01\%$  ( $\geq 100$  ppm) are subject to review, with the following exceptions: finishes (coatings, plating, paints), blowing agents, textile auxiliaries, paper bleaching agents, and plating chemistry are subject to review at any concentration level when the part these are relevant to is itself present at  $\geq 0.01\%$  in the product. For example, a blowing agent used to manufacture foam that is present at  $< 0.01\%$  within the overall product does not need to be reviewed. The blowing agent does need to be reviewed for foam present at  $\geq 0.01\%$ , even if the blowing agent itself is present at levels below  $0.01\%$ .

### Required Documentation

Ideally, separate Bills of Material will be provided for each product configuration under review. This may, however, be very difficult in the case of complex product systems. A single Bill of Materials can only be used for a product or group of products that share all of the same materials (or chemicals) in the same concentrations, with the exception of material (or chemical) components that can be substituted into the product (or Bill of Materials) without substantially changing the concentrations of each material (or chemical) in the product (e.g., a chair in different color styles or patterns, or soap in different fragrances; not an office set that includes a cabinet that is 95% "Alloy A" and a desk that is 10% "Alloy A"). For multiple products featuring various concentrations of materials (or chemicals), each product configuration is required to be reported.

## 3.2 IDENTIFYING APPROPRIATE METABOLISM(S)

### Standard Requirement

The appropriate metabolism (i.e., biological or technical) has been identified for the product and its material components.

### Applicable Levels of Certification

This requirement applies to all levels of certification (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to identify the intended nutrient cycle (i.e., biological or technical) for the product and its components, which can then be used to guide the development and implementation of an appropriate nutrient management strategy required for higher levels of certification.

### Methods

For each homogeneous material subject to review, as determined according to the process described in Section 3.1, identify in the Bill of Materials whether it is part of a technical or biological nutrient cycle. It may be that a material still needs to be designed for the most appropriate metabolism; the goal at this

stage is to simply define what is appropriate. The following definitions and examples will aid in categorizing each material as well as the overall product.

#### Technical Nutrients (TNs)

- Materials or products that are capable of “feeding” technical systems: they may be dismantled and reused, or physically or chemically transformed, but are not consumed (i.e., materials that do not enter the biosphere).
- Materials or products that generally cannot be processed by biological systems.
- Materials or products that are items used as Products of Service. A Product of Service is a material or product designed to provide a service to the user without conveying ownership of the materials.
- Metals and plastics are examples of TNs. Bio-plastics, although they are from the biosphere, may be designed as TNs (i.e., kept in technical cycles).
- Externally Managed Components (EMCs) are a type of TN defined in Section 1.3.1.3.

#### Biological Nutrients (BNs)

- Materials or products that are usable by living organisms to carry on life processes.
- Materials or products that are items used as Products of Consumption, which are typically changed biologically, chemically, or physically during use and therefore enter the biosphere either by nature or human intention. Such products should be designed for the biological system and thus are categorized and evaluated as biological nutrients. For example, brake pads, which abrade into the environment upon use, should ideally be designed for the biological cycle and will be reviewed with that intention in mind.
- Cleaning products, cosmetics, personal care products, and paper are examples of BNs.

Note that the classification as TN or BN will determine which Banned List applies to the product, and will be considered in the material health assessment.

#### **Required Documentation**

Clearly identify in the Bill of Materials whether each material is part of a technical or biological nutrient cycle. This may be accomplished by adding a column in the Bill of Materials.

### **3.3 DETERMINING ABSENCE OF BANNED LIST CHEMICALS**

#### **Standard Requirement**

The materials subject to review in the product do not contain any Banned List chemicals above the allowable thresholds based on supplier declarations.

#### **Applicable Levels of Certification**

This requirement applies to all levels of certification (Basic, Bronze, Silver, Gold, and Platinum). However, in cases where an applicant is applying for levels above Basic, full material disclosures (as described in Section 3.4) may be used in place of Banned List declarations.

## Intent

The intent of this requirement is to ensure, to the extent possible, that chemicals considered harmful to humans or the environment are not intentionally added to materials in the certified products above a designated threshold. By requiring suppliers to submit declarations, the onus for confirming absence of Banned List chemicals is placed on the supplier to give them some responsibility for understanding the chemical composition of their materials and removing an additional obligation from manufacturers to test for all Banned List chemicals.

## Methods

1. Refer to the Banned Lists of Chemicals for the Cradle to Cradle Certified™ Products Program (Appendix). Note there are two banned lists, one for technical nutrient (TN) materials and one for biological nutrient (BN) materials. See Table 4 for a guide to determine where Banned List chemicals are often used, and where to expect and look for their presence.
2. For each homogeneous material identified in the product, gather supplier declarations stating that Banned List chemicals have not been *intentionally added* above the allowable threshold (generally 1000 ppm, with the exceptions noted below). An *intentionally added* substance is a substance that has been added to the material for a specific purpose. A substance is also considered to be intentionally added to a material if a manufacturer chooses to use a material coming from a source that is likely to contain the substance. 'Intentionally added' also means 'known to contain.' Also note the following:
  - a. The concentration of the banned chemical within each homogeneous material, and not the concentration of each banned chemical within the overall product, is the basis for this review.
  - b. Exceptions to the TN Banned List and the 1000 ppm allowable threshold are as follows:
    - i. Lead, PTFE, and PAHs are substances that are on the Biological Nutrients Banned List but not the Technical Nutrients Banned List. While these substances can be used in some materials as technical nutrients where exposure is not expected to occur (e.g., lead in aluminum, PAHs in carbon black), they are harmful chemicals and should not be present in materials that may result in exposure to humans and the environment. The following therefore applies:
      - a. When present above 1000 ppm, lead, PTFE, and PAHs are also banned for use in TN materials where direct exposure to humans or the environment is highly likely to occur. Examples of these materials include paints, coatings, and finishes that are used on the surface of products such as toys or other children's products and jewelry.
      - b. PTFE is banned in TNs if it is the primary component of the product. PTFE is considered a primary component when it represents more than 50% of the product (not material) by weight.
    - ii. The thresholds for metals in BN materials are 2 ppm for cadmium, 90 ppm for lead, 100 ppm for chromium, 1 ppm for mercury, and 10 ppm for arsenic. With the exception of the lead threshold, these are the lowest soil screening values (SVs) among those of eleven European countries whose SVs are compared in Armiento et al. (2011) [[www.tandfonline.com/doi/abs/10.1080/02757540.2010.534085](http://www.tandfonline.com/doi/abs/10.1080/02757540.2010.534085)]. The lead threshold is based on the legal threshold for paint in the US (90 ppm), which is lower than the lowest SV for the metal [[www.cpsc.gov](http://www.cpsc.gov)].

- c. EMCs are not exempt from Banned List declarations.
- d. Banned list declarations are also required for each homogeneous material used in the product's primary packaging (if any), including inks, adhesives, and any materials used to label the package (see Section 2.1 of this document for more information).
- e. Analytical testing for Banned List chemicals is not accepted in lieu of supplier declarations, but is required in the following situations:
  - i. To ensure absence of Banned List chemicals from recycled content when full data cannot or will not be gathered. See section 3.3.1 for further information.

### Required Documentation

A signed statement from each supplier must be obtained and submitted to the assessor to verify that the product or material does not contain banned chemicals. Product manufacturers or the assessor may also sign these declarations if they have detailed knowledge of the material's chemical constituents. A supplier may submit a Banned List declaration that broadly covers all inputs provided to a manufacturer. At a minimum, these statements must:

1. Clearly identify the supplier and the material by product identification number, trade name, and/or grade as appropriate.
2. Include the full listing of Banned List chemicals (ensure that the correct list is used depending on whether each item has been categorized as a BN or TN).
3. Include the statement that such chemicals have not been intentionally added at >0.1% (lower levels apply for BN).

A convenient way to track whether materials contain Banned List chemicals and/or whether signed supplier declarations have been received for the inputs is to add a column to the Bill of Materials where comments can be included to that effect.

Table 4 Major Uses and Primary Human Health and Environmental Issues Associated with Banned List Chemicals

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
<b>Metals: Lead, cadmium, chromium VI, mercury</b>	Intentional inputs to some metal alloys, inks, colorants and stains. Lead and cadmium are used in batteries. Chromium VI may be used as a wood preservative, in leather tanning, and as a metal coating. Mercury is used in fluorescent bulbs and other specialty applications. These metals are contaminants found in many materials including polymers, paper, metals, glass, paint and coatings, etc.	Lead: potent neurotoxin, possible carcinogen (IARC).  Cadmium and chromium VI: carcinogenic to humans (IARC).  Mercury: potent neurotoxin, highly toxic to the respiratory system and kidneys.
<b>Metals: Arsenic</b>	Alloying agent and/or impurity of copper, brass and bronze, wood preservative (chromated copper arsenate).	Carcinogenic to humans (IARC).

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
<b>Flame Retardants</b>	Additive to polymers used in electronics, appliances, and automotive applications, carpet, furniture foam, upholstery, and textiles.	Environmental persistence, bioaccumulation, endocrine disruption, liver and neurodevelopmental toxicity.  TDCP/TDCPP: Known carcinogen (CA Prop 65).
<b>Phthalates</b>	Used as plasticizers (to increase softness and flexibility) in PVC and other polymers, inks, and adhesives, personal care products such as nail polish and hair gels, and medical devices. May be found as contaminants in recycled polymers and paper at low levels.	Endocrine disruption, reproductive development toxicity.
<b>Halogenated Polymers</b>	<p>PVC is widely used in a variety of products from packaging to construction. It is somewhat common for PET to be contaminated with PVC due to similar specific gravity.</p> <p>A common use of PVDC is in films (e.g., Saran Wrap). CPVC (chlorinated polyvinyl chloride) is used to manufacture pipes. Polychloroprene (neoprene) is used to manufacture wet suits, laptop sleeves, iPod holders, gaskets and hoses.</p> <p>Polytetrafluoroethylene (PTFE) is used in a wide range of products where low friction and/or scratch resistance is required, including cookware, inks, paints, coatings, textiles, etc.</p>	<p>Production and release of potent toxins including dioxins, furans, and hydrogen chloride upon combustion.</p> <p>Vinyl chloride monomer is carcinogenic to humans (IARC). Chloroprene monomer is possibly carcinogenic to humans (IARC) and a known carcinogen (CA Prop. 65).</p> <p>PFOA, used during manufacture of PTFE, may be released when PTFE is heated to high temperatures. (Also see below for more information; PFOA is also on the Banned List). PTFE is associated with pulmonary edema upon inhalation of fumes when heated to high temperatures.</p> <p>Additives such as phthalates used widely in halogenated polymers are also problematic.</p>



Banned List Category	Major Uses and Contamination Concerns	Primary Issues
<b>Chlorinated Hydrocarbons</b>	<p>The chlorinated hydrocarbons on the Banned List are primarily used as pesticides (insecticides, fungicides); some are banned for use in the U.S., EU, and other countries.</p> <p>Secondary uses of some compounds are solvents for waxes, gums, resins, tars, rubbers, oils, asphalts, dyes and intermediates.</p> <p>Hexachlorobenzene is used in the manufacture of synthetic rubber and as a plasticizing agent in PVC.</p> <p>SCCPs are used in lubricants, plasticizers, flame retardants.</p> <p>(Note: It is currently unlikely to find these as intentional inputs to consumer products.)</p>	<p>Toxicity concerns vary depending on the chemical and include carcinogenicity, reproductive toxicity, endocrine disruption, persistence, bioaccumulation, and aquatic toxicity at low concentrations.</p>
<b>Polycyclic aromatic hydrocarbons (PAHs)</b>	<p>PAHs are present in fossil fuels (coal, mineral oil, etc.). They are produced during incomplete combustion of organic materials and released in vehicle, factory, and other exhausts. PAHs are also found in a variety of consumer products as contaminants due to the use of extender oils and carbon black. PAHs may be found in soft polymers (rubber and elastomers) and black hard polymers.</p>	<p>Some are known carcinogens, mutagens, and reproductive toxins.</p>
<b>Pentachlorophenol (PCP)</b>	<p>Fungicide banned for use in the U.S. except as a wood preservative for telephone poles, pilings, and other heavy-duty applications. PCP may be used as a cotton and leather preservative. It is no longer produced in the EU and is banned in some countries.</p>	<p>Known carcinogen (CA Prop 65).</p>
<b>Octylphenol, Octylphenol ethoxylates; Nonylphenol, Nonylphenol ethoxylates</b>	<p>Surfactants and wetting agents used in cleaning products, paints, inks, adhesives, pesticides, textiles, and paper processing. Canada and the EU have restricted the use of NPEs.</p>	<p>Persistent in the aquatic environment, moderately bioaccumulative, extremely toxic to aquatic organisms, endocrine disruption.</p>

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
<b>Triorganotin compounds (-butyl, -octyl, -phenyl)</b>	Fungicides and bactericides that may be used in textile, leather, pulp and paper manufacturing. In this context they are primarily of concern due to their effects on aquatic organisms, as they may be released with process water. May also be used as PVC stabilizers, wood preservatives, and pesticide treatment for textiles and carpet. Use is restricted in the EU, U.S., and other countries.	Highly toxic to aquatic organisms, endocrine disruption
<b>Perfluorooctane-sulfonate (PFOS), Perfluorooctanoic acid (PFOA)</b>	PFOS: May be used as a stain repellent for textiles and carpet (phased out in U.S. and EU), mist suppressant in chromium VI metal plating process, fire fighting foam, photo-imaging, paper coating (repels oil and water)  PFOA: Used in the production of PTFE and other fluoropolymers; PTFE may degrade to PFOA.	Persistent, bioaccumulative, present at low levels in the human body; PFOS and PFOA have been associated with a variety of toxic effects in mammals, including developmental toxicity and liver toxicity; human health effects are not fully understood.

### 3.3.1 Recycled Content

It may be necessary to test materials containing recycled content for Banned List chemicals. Analytical testing is required for certain material types and sources in cases where full ingredient data cannot or will not be gathered and where there are concerns about possible contamination. The intent of this requirement is to ensure the use of safe materials in recycling streams. The assessor, in consultation with the manufacturer, is responsible for determining whether a material is likely to contain Banned List chemicals based on its source, and requiring analytical testing when the presence of Banned List chemicals above the designated threshold is a concern.

Table 5 can be used as a reference for examples of materials with known issues with regard to Banned List chemicals.

Note that for metals, testing will generally not be necessary. Identification of the specific alloy grade being used will allow determination of the full chemical composition of the metal alloy down to 0.01%. Potentially useful references for looking up metal composition based on grade include [www.matweb.com](http://www.matweb.com), [www.efunda.com](http://www.efunda.com), and [www.copper.org](http://www.copper.org).

Table 5 Examples of Materials with Known Issues with Regard to Banned List Chemicals and Suggested Analytical Methods

Banned List Category	Recycled Material Types to Test	Method (suggested)
<b>Metals: chromium VI, mercury</b>	All materials.	<p>Chromium VI: ICP/MS or ICP/AES (ICP/OES) with detection limits in the low ppm range. Note that if ashing digestion techniques are required, mercury, arsenic, and tin may volatilize from the sample, increasing detection limits, though an acceptable detection limit should still be attainable. If total chromium in the material is greater than that allowed for the desired certification level, then further testing will be required to determine the amount of hexavalent chromium present using alkaline digestion techniques (most cases). XRF testing methods are allowed for glass.</p> <p>Mercury: ICP or CVAA/direct mercury analysis with detection limits in the low ppm range.</p>
<b>Metals: lead, cadmium</b>	All materials identified as biological nutrients, or in technical nutrients with no guaranteed management plan.	Same as above for chromium VI.
<b>Metals: arsenic</b>	Copper, brass, bronze, recycled wood where full data cannot be gathered.	Same as above for chromium VI.
<b>Halogenated Flame Retardants (refers only to those on the Banned List)</b>	Polymers sourced from electronic, appliance, and automotive sources, recycled carpet, upholstery foam, and textiles.	<p>GC/MS; Detection limit &lt;0.1% for Basic level and the Banned List chemicals; Detection limit &lt;0.01% (100 ppm) for Bronze level and above.</p> <p>If flame retardants are not expected to be present (unlikely for these material types): oxygen bomb combustion sample preparation followed by ion chromatography with detection limits in the low ppm range (25 ppm max, ~5ppm or less preferred) may be used. This is a screen for all halogens including inorganic so will cover the halogenated polymer test as well. Request that bromine, chlorine, and fluorine be reported separately.</p>

Banned List Category	Recycled Material Types to Test	Method (suggested)
<b>Phthalates: DEHP, BBP, DBP</b>	Flexible polymers other than PET, HDPE, and PP from standard post-consumer recycling streams. (Franz et al. (2004) found phthalate contamination in recycled PET in the 0.05-0.5 ppm range. Vinggaard et al. (2000) found the maximum concentration of phthalates in paper to be 28 ppm for DBP).	CPSC-CH-C1001-09.3 Standard Operating Procedure for Determination of Phthalates (or more recent version). GC/MS; detection limit <0.1% (1000ppm).
<b>Halogenated Polymers: PVC, PVDC, CPVC, Polychloroprene, PTFE</b>	All polymers	<p>If flame retardants or other halogens are not expected to be present, this method is recommended: oxygen bomb combustion sample preparation followed by ion chromatography with detection limits in low ppm range (25 ppm max, ~5ppm or less preferred). This is a screen for all halogens including inorganic. Request that bromine, chlorine, and fluorine be reported separately.</p> <p>If flame retardants or other halogens are expected to be present: GC/MS; detection limit &lt;0.1% for Basic level and the Banned List chemicals; detection limit &lt;0.01% (100 ppm) for Bronze level and above. (Complete this test and the oxygen bomb screening test if applying above the Basic level and hoping to achieve an X or grey assessment for recycled content).</p> <p>Other common halogen sources that are not on the Banned List of chemicals: chlorinated pigments, additional flame retardants, UV stabilizers, and biocides. If these are expected to be present, it is recommended to use GC/MS methods to test for specific chemicals on the Banned List.</p>

Banned List Category	Recycled Material Types to Test	Method (suggested)
<b>Chlorinated Hydrocarbons (refers only to those on the Banned List)</b>	Testing is not required unless applying at the Gold level.	The VOC testing required at the Gold level covers this requirement. Single materials will not need to be tested; instead the entire product is tested. See VOC Emissions Testing (Section 3.9).
<b>Polycyclic aromatic hydrocarbons (PAHs)</b>	Testing is not required.	Not applicable.
<b>Pentachlorophenol (PCP)</b>	Recycled wood from heavy-duty applications such as utility poles, railroad ties, etc., cotton and leather.	GC/ECD; (See Becker, Buge and Win. Determination of PCP I waste wood – method comparison by a collaborative trial. Chemosphere 47 (2002): 1001-1006). Detection limit <0.1% for Basic level and the Banned List chemicals; Detection limit <0.01% (100 ppm) for Bronze level and above.
<b>Octylphenol, Octylphenol ethoxylates; Nonylphenol, Nonylphenol ethoxylates</b>	Recycled textiles, reclaimed fibers, recycled leather.	LC/MS; detection limit <0.1% (1000 ppm).
<b>Triorganotin compounds (-butyl, -octyl, -phenyl)</b>	Recycled wood, carpet, textiles.	GC/MS; detection limit <0.1% (1000 ppm).
<b>Perfluorooctanesulfonate (PFOS) Perfluorooctanoic acid (PFOA)</b>	Recycled textiles, reclaimed fiber.	LC/MS; detection <0.1% (1000 ppm).

### Testing Intervals

Testing of recycled content to ensure absence of banned substances is required when complete data cannot be obtained. At a minimum, testing is required at the time of the initial certification and again at each subsequent re-application.

An exception to this requirement is for materials containing recycled content for which a C or better material assessment is desirable (so that they may contribute to the percentage assessed to Gold certified products). In these cases, testing is required on a semi-annual basis (every six months). These semi-annual test results must be provided to the assessor immediately after testing is completed. If any test shows problematic chemicals present above the required thresholds, the material will no longer be assessed as C or better. This will affect the overall certification level immediately (i.e., demotion from Gold). For this reason it is recommended that only consistent and relatively clean material streams be used, especially in the case of Gold certified products. Note that testing is usually not required for steel, aluminum, and other metals.

## Selecting a Testing Laboratory and Analytical Method

Laboratories conducting the analytical testing of recycled content must be certified to ISO 17025 and experienced in materials analysis. There are many laboratories that specialize in testing environmental samples (e.g., air, water, and soil); however, these labs may not have expertise in extracting and analyzing contaminants from other material types. It is recommended that applicants work with their assessor to select an appropriate laboratory to conduct the analyses.

Table 5 lists appropriate testing methods for common material types and contaminants. It may, however, be necessary to determine appropriate methods on a case-by-case basis. In addition, different laboratories may use somewhat different methods based on equipment availability and expertise. Some laboratories may also use proprietary sample preparation methods that they will not fully disclose. Instrumentation may include ICP/MS, ICP/AES, GC/MS, GC/ECD, or LC/LMS, among others. The appropriate method is dependent on the contaminant of interest, material type, and analytical laboratory. In some cases X-ray fluorescence (XRF) methods may be used (i.e., for glass elemental analysis). In speaking with and selecting a laboratory, it must be ensured that:

1. Detection limits are low enough.
  - a. If applying only at the Basic level, detection limits of <1000 ppm for each contaminant are acceptable in most cases. Exceptions to this are metals in biological nutrients.
  - b. If applying for levels above Basic, detection limits of <100 ppm are needed for the metals (lead, cadmium, mercury, chromium VI), flame retardants, and halogenated polymers (see Section 3.4.2). A detection limit of <100 ppm is sufficient for any other contaminant(s) that will be tested.
  - c. Generally, detection limits of much less than 1000 ppm will be achievable.
2. Sample preparation and contaminant extraction methods are appropriate. Generally, solvent extractions will be necessary. Environmental laboratories experienced in testing air, water, and soil samples may use U.S. Environmental Protection Agency (EPA) standardized methods; however, such methods may not be appropriate for extraction of contaminants from materials such as polymers.

## Required Testing Documentation

Test reports including contaminants tested for, detection limits, description of material sample(s) tested, test method(s), laboratory certification information, and laboratory contact information must be submitted to the assessor.

RoHS directive testing reports may be submitted to ensure conformance with the Banned List for metals (mercury, chromium VI) and some flame retardants (RoHS does not cover TBBPA or TDCP). RoHS compliance statements fully cover the Basic-level requirements for these contaminants.

To determine that metals and halogens are present at <100 ppm, as required at the Bronze level and above for assessing recycled content, full RoHS test reports including detection limits and contaminant concentrations should be provided (compliance statements alone are not sufficient). If detection limits are <100 ppm, the RoHS test report applies.

CONEG compliance statements (relevant to packaging in the U.S.) apply for lead, cadmium, chromium VI, and mercury testing for paper and other packaging materials with recycled content.

## 3.4 COLLECTION OF MATERIAL COMPOSITION DATA

### Standard Requirement

Material ingredient data must be collected to generate ABC-X assessments for each material in a product.

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to assist a manufacturer with understanding the chemicals that are present in the product so that they may be assessed for their potential to adversely impact human or environmental health.

### Methods

1. Sign necessary confidentiality agreements with suppliers and sub-suppliers, if necessary. Confidentiality is a major concern for many manufacturers so it will often be necessary to sign confidentiality agreements assuring that ingredient data will be held as confidential. Three-way agreements may be necessary in cases where a consultant is gathering data and sending it on to an assessor.
2. Collect data for each homogeneous material subject to review (as determined in Section 3.1) until the desired percentage of the materials in the product have been assessed. It will often be necessary to collect data from multiple sequential tiers of a supply chain to identify all chemicals subject to review in each homogeneous material. The chemicals subject to review in each material are those present at a concentration  $\geq 0.01\%$  ( $\geq 100$  ppm), and those subject to review at any concentration (see f. and g. below). Chemicals subject to review are limited to intentionally added inputs (see Section 3.1 for definition of intentionally added). Request the following information at each tier as necessary to identify all chemicals subject to review in each homogeneous material:
  - a. Name of each chemical or specific manufacturer trade name and grade in the case of purchased chemicals or chemical mixtures.
  - b. Unique CAS for all raw chemicals.
  - c. Concentration or concentration range (e.g., 0-1%, 1-5%, etc.) of each chemical or chemical mixture (note the concentrations must add to 100% or a statement from the supplier that all ingredients are present is required).
  - d. The function each chemical or chemical mixture serves within the material or product (i.e., resin, main polymer, catalyst, antioxidant, UV stabilizer, pigment, impurity, etc.; note this information is useful to have when conducting assessments but is not required).
  - e. Percent recycled content, if any, including indication of type (post-consumer or post-industrial).
  - f. The concentrations of lead, mercury, hexavalent chromium, cadmium, pigments, dyes and other colorants, phthalates, halogenated organics, and scarce elements or substances specified in the *Material Health Assessment Methodology* document (i.e., indium, gold, diamond, etc.) when present at any concentration.

- g. Process chemicals used that are metal plating agents (i.e., hexavalent chromium), textile auxiliaries (i.e., textile process chemicals), blowing agents, and paper bleaching agents. These process chemicals are subject to review even if they are not expected or known to be present in the finished product. Note that for paper, manufacturers may not know if process chemicals remain in the final product at  $\geq 100$ ppm. If they are unsure, it is required that they provide data on process chemicals as well. Octylphenol, octylphenol ethoxylates, nonylphenol, nonylphenol ethoxylates, and triorganotin compounds (-butyl, -octyl, -phenyl) are Banned List chemicals that may be used in textile, paper, and pulp processing. Evaluation and optimization of process chemicals will extend into all product-relevant processes at the Platinum level.
3. Identify all chemicals present at 0.01% or greater in the material (or at any concentration for the exceptions listed in 2.f. and 2.g. above) if the goal is for a material to receive an A, B, or C assessment. If it has become clear that a material will be X assessed before the full chemical composition has been obtained, it is allowable to have incomplete data such as those reported on an MSDS. In such cases, a supplier declaration stating that no Banned List chemicals are present must be obtained.

There are analytical testing and other requirements for EMCs and materials containing recycled content, but analytical testing is generally not required for identifying chemicals subject to review. See Sections 3.4.1 and 3.4.2 for further information on EMCs and materials containing recycled content.

4. Common follow-up questions relevant to conducting assessments once data have been provided are:
- a. For polymers, what are the residual monomer concentrations (in cases where monomers are x assessed)?
  - b. Have petroleum distillates been severely hydro-treated?
  - c. In cases where chemical concentrations have been provided, what is the final concentration of that chemical in the product? Note that some chemicals that were added or used during the manufacturing process may not be present in the final product.

The applicant is required to provide the information to answer these common follow-up questions.

For polymers, the residual monomer concentrations must be reported in cases where the monomers are 'x' assessed or on the Banned Lists (e.g., PFOA and PFOS concentrations must be reported for materials containing PTFE). Analytical testing to determine the monomer concentration in the material is required if the monomer concentration cannot be obtained from existing information.

Knowing what ingredients to expect in different material types is helpful in determining whether accurate information has been provided. See Table 6 for guidance.

Table 6 Typical Ingredients in Common Materials

MATERIAL TYPE	DESCRIPTION	TYPICAL INGREDIENTS
<b>Adhesives</b>	Glues, tapes, binders, etc.	Resins, fillers, antioxidants, catalysts, film backers, preservatives, solvents, tackifiers, defoamers, etc.



<b>Adhesives – Formaldehyde-based Binders</b>	Melamine-Formaldehyde (MF), Phenol-Formaldehyde (PF), Urea-Formaldehyde (UF), Wet Strength, M-UF, P-UF, Non-Scavenged UF, etc.	Base resin, residuals, etc.
<b>Fabric</b>	Natural or synthetic fibers, yarn, etc. Woven and non-woven textiles.	Base fiber, dyes and/or pigments, recycled content, auxiliaries, flame retardants, residual pesticides or preservatives.
<b>Fasteners (metal)</b>	Screws, bolts, washers, rivets, etc.	Base metal alloy, recycled content, coatings or paint, trace contamination, waxes, lubricants/plating/finishes.
<b>Finishes</b>	Most metal (structural and fasteners) will have a finish: Zinc oxide, oil, chrome, etc.	Hexavalent chromium finishes, cadmium plating, etc.
<b>Polyurethane Foam</b>	Cushions, padding, insulation, etc.	Polyol and isocyanate, blowing agent, catalyst, additives, colorants, flame retardants, etc.
<b>Glass, Fiberglass, Clay</b>	Tempered glass, fiberglass.	Glass, colorants, recycled content, trace heavy metal contamination, other additives for fiberglass reinforcements such as sizing and coatings.
<b>Inks, Dyes, Colorants, Pigments</b>	Paper inks, fabric dyes, plastics and paint colorants, printing inks for paper, fabric, labels, etc.	Colorants, biocides, solvents, polymers, minerals, fillers, resins, etc.
<b>Laminates</b>	High-pressure or low-pressure decorative laminate.	Adhesive, kraft paper, wetting agents, resins, residuals from resins, abrasion additives, decorative paper, backers, etc.
<b>Metal (not fasteners)</b>	Table legs, arms, etc. Steel, aluminum, etc.	Base metal alloy, recycled content, coatings or paint, trace contamination.
<b>Paints</b>	Coatings on a variety of substrates.	Colorants, biocides, solvents, polymers, minerals, fillers, waxes, resins, etc.
<b>Paper and Pulp</b>	Labels, packaging, envelopes, etc.	Pulp, paper, biocides, inks, bleaching agents, residual process chemicals, recycled content, trace contamination, aluminum sulfate, etc.
<b>Polymers</b>	Including copolymers, nylon, ABS, polypropylene,	Base resins, colorants, catalysts, fillers, recycled content, trace contamination,

	polyethylene, PET, PU, PC, acetals, PVC, etc	flame retardants, additives such as UV stabilizers, antioxidants, recycled content, trace, residual monomers (common problematic monomers: styrene, butadiene, acrylonitrile, bisphenol A, etc.).
<b>Wood, Natural Fibers (treated or untreated)</b>	Plywood, particleboard, veneers, oriented strand board, solid wood, jute fiber, etc.	Base material, adhesives, preservatives, flame retardants, etc.

### Required Documentation

A Bill of Substances for each homogeneous material that includes the information listed above is required. Note that “Exact Material Specification” is required for this stage.

It is recommended to also obtain a signed statement from the manufacturer indicating that, to the best of their knowledge, all chemicals that are present at 0.01% or greater in the material have been provided (or to any level for the exceptions listed above) in the Bill of Material.

#### 3.4.1 Externally Managed Components (EMCs)

The following information must be collected from the applicant or applicant’s supplier if a sub-assembly is to be defined as an EMC (see Section 1.3.1.3 for definition and more information on EMCs):

1. The supplier of the EMC has provided the applicant with a guarantee for take back and appropriate nutrient management. The supplier may designate a third party or parties for implementation.
2. The supplier has signed a declaration that chemicals in the EMC will not negatively impact humans or the natural environment during the intended and unintended but highly likely use of the product for which the EMC is a component. This guarantee may be provided if the EMC is Cradle to Cradle Certified™ (Gold level or higher), or other appropriate evidence.
3. The EMC has undergone testing by an accredited analytical laboratory to insure that harmful substances are not being emitted from the EMC above the chemical’s analytical detection limits. Off-gas testing is required for all indoor-use EMCs (See Section 3.9 for more information on VOCs emission testing). Migration and leaching testing may be required depending on the type of EMC.

If the above are completed, the general requirement for full chemical compositional identification and assessment of the EMC will not apply.

The intent of these requirements is for the supplier to indicate, to the best of their knowledge, that the sub-assembly is a sealed component that is manufactured in a way that prohibits the migration of chemicals and materials from the component. If, during use of the product for which the EMC is a component, a user is exposed to any part or chemical within the component, or if any part or chemical within the component is released to the environment, the component is not considered an EMC and will be assessed and inventoried like the other materials in the product.

It is recognized that it is not possible to know with absolute certainty that chemicals and materials in the EMC will not negatively impact humans or the natural environment during all the possible use and

re-use scenarios. The overall intent is to allow for the use of product components that do not need to be assessed the same way as the rest of a product because they are managed as a whole by the supplier or a third party. The EMC concept was invented by the founders of the Cradle to Cradle® framework to encourage manufacturers to design complex components that are completely managed after their use phase. Examples of potential EMCs are a pneumatic cylinder in an office chair, the motherboard in a computer, the electric motor inside an automated window shade product, and a solar panel.

### Required Documentation

The following documents must be submitted to the assessor:

1. A signed statement from the manufacturer guaranteeing take back and appropriate nutrient management of the EMCs, including a full description of the take back program and how the product or material will be returned.
2. A signed declaration that chemicals in the EMC will not negatively impact humans or the natural environment, as detailed above (this guarantee may be provided if the assembly/part is Cradle to Cradle Certified (Gold level or higher), or other appropriate evidence).
3. Test results, including a description of the test methods used and laboratory contact information.

### 3.4.2 Recycled Content

The information below will aid in the collection of chemical ingredient data from the applicant or applicant's supplier if the product contains recycled content.

1. **Recycled content from a single stream source** -- In cases where recycled content is coming from a single stream source, it may be possible to gather ingredient data from the original manufacturer as described above for other homogeneous material types. For example, a single stream, post-industrial recycled material source may be made up of one or two materials of known trade name and grade. In this case, analytical testing is not required, assuming the actual material formulation has been obtained.
2. **Recycled content from an undefined source** -- In many cases, it is not possible to obtain sufficient ingredient data on materials containing recycled content from undefined sources (the majority of post-consumer recycled materials are undefined) to ensure that Banned List chemicals are not present above allowable thresholds, determine whether toxic metals and organohalogens are present at  $\leq 100$  ppm, and to complete an A, B, C, or X material assessment. This may be done through a combination of analytical testing and ingredient disclosures as follows:
  - a. **Metals:** Metals are some of the most highly recyclable and recycled materials known. Steel mills, aluminum plants, and other facilities that recycle metal alloys perform analytical tests for the purpose of identifying and tightly controlling the elemental composition of the alloys being manufactured using recycled scrap. Therefore, the ingredient composition for metal alloys can usually be found in publicly available sources (e.g., AISI, JIS, Aluminum Association) or in the mill certificate provided by the metal supplier<sup>1</sup>.

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<sup>1</sup> The user must have the specific alloy number for the metal before being able to identify its composition (i.e. AISI 1020 Steel; JIS G 3101 Steel; 6061 Aluminum).

If possible, obtain the alloy grade and look up standard composition in the available databases or obtain the mill certificate with full composition information. Identifying the specific alloy grade being used will allow determination of the full chemical composition of the metal alloy down to the 100ppm (0.01%) level. The following websites are potentially useful references for looking up metal composition: [www.matweb.com](http://www.matweb.com), [www.efunda.com](http://www.efunda.com), and [www.copper.org](http://www.copper.org).

Alternatively, analytical testing can be used to obtain the full chemical composition down to 0.01% and then conduct the material assessment. Analytical methods with detection limits that are  $\leq 100\text{ppm}$  (0.01%) for lead, mercury, cadmium, and chromium VI must be used. Analytical testing for lead is required in cases where available alloy composition data for recycled cast aluminum does not report the lead concentration.

- b. Glass: Glass is also one of the most recyclable materials today. Similar to recycled metals, a series of simple and inexpensive analytical tests can be performed to identify the full elemental composition of the inorganic material.

If possible, obtain an ingredient disclosure from the supplier to identify the full elemental composition of the glass material. If a disclosure cannot be obtained, conduct analytical testing with detection limits that are  $\leq 100\text{ppm}$  (0.01%) to obtain the full chemical composition down to 0.01% and then generate the material assessment. XRF methods may be used for elemental analysis of glass.

- c. Paper and Natural Cellulosic Fibers: Recycled paper and other natural fibers compose one of the largest recycled material pools by weight worldwide. In some cases, paper composition information can be obtained from the paper mill(s). Alternatively, analytical testing must be conducted.

Identify chemicals that are present in the material at concentrations  $\geq 100$  ppm and pulp bleaching agents at any concentration (it is required that pulp suppliers disclose the type of bleaching process used). Data are to cover final product composition as opposed to input composition, if possible. In addition to pulp bleaching agents, a number of different process chemicals (e.g., de-inkers, sizing agents) may be used in the recycling of paper and natural fiber materials to make them suitable for manufactured products in their next use phase, and these must be considered. If it is unclear whether or not process chemicals remain in the final product, it is recommended to gather data on process chemicals as well. Analytical testing for metals (excluding arsenic) is required for the assessment of paper containing recycled content.

To be eligible to earn an A, B, or C material assessment rating, the ingredients remaining on the finished paper must be fully identified and assessed. The assessor must then evaluate all ingredients that compose  $\geq 0.01\%$  of the finished paper product using the Cradle to Cradle Certified Material Health Assessment Methodology. For untreated post-consumer recycled paper, if the recycled paper remains in an untreated state (i.e., raw recycled paper), then it might not be possible to determine the full composition by weight for all ingredients. In these cases, a material assessment cannot be performed and the material will earn a GREY assessment and is added to prioritized optimization plan.

- d. Polymers: Plastics are an integral part of everyday life and are seen as valuable technical nutrients that need to be kept in closed-loop material flows rather than burned for energy or dumped in landfills. There are usually significant challenges in obtaining the full composition of a post-consumer recycled plastic due to contamination, varying grades of resin from different manufacturers, various product labels, and content residues. However, when a material comes

from just one or two known sources, it may be possible to go back to the original manufacturer to gather full chemical ingredient data, as for virgin materials.

Polymers must be from relatively consistent recycling streams in order to receive an A, B, or C material assessment. If an A, B, or C assessment is of interest:

- i. Define the recycling stream. For example, is the material sourced only from clear PET bottles, milk jugs, battery casings, etc.? How has the material been separated from other types of plastic? Discuss separation techniques with the material provider(s) and document any known contamination issues.
  - ii. In addition to testing for the presence of Banned List chemicals above the allowable thresholds, testing for other contaminants may be required depending on discussions with material providers and knowledge of the specific material types. The goal is to determine if any chemicals that would result in an X assessment are present at  $\geq 100$  ppm. For example, in the case of recycled PET, antimony testing may be required as it is expected to be present. In these cases, testing regimens will need to be developed on a case-by-case basis. If total halogen concentrations are greater than 100 ppm based on a screening test, it will be necessary to identify the specific halogen compound or compounds present in the product to determine whether any one organohalogen compound is present at a concentration of 100 ppm or greater. Note that the total halogen test will also detect inorganic halides such as chloride salts, which are typically not problematic.
3. Materials subject to analytical testing are those containing recycled content from undefined sources (i.e., most post-consumer sources) for which full chemical ingredient data cannot be gathered and/or contamination is suspected. At a minimum, testing is to be done as described in Section 3.3.1 to determine the absence of Banned List chemicals above the allowable thresholds.
  4. Note that it may not be possible to gather full chemical ingredient data on materials that contain recycled content from undefined sources. Recycled content that has passed testing for Banned List chemicals (see Section 3.3.1), but for which full ingredient data cannot be gathered or adequately determined (i.e., for polymers from inconsistent streams), will not count toward the total percentage assessed (it is considered "un-assessed" or GREY). This will be a common situation for post-consumer recycled plastics from variable and mixed streams and paper that has not been re-pulped but only shredded for reuse.

### Required Documentation

See Section 3.3.1 for required documentation.

## 3.5 MATERIAL ASSESSMENTS

### Standard Requirement

Materials in a product must be assessed using the ABC-X rating system. The required percentage of the product that is assessed is dependent on the certification level.

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

## Intent

The intent of this requirement is to assist the manufacturer with understanding the potential for the chemicals in their product to adversely impact human or environmental health (chemical hazard profiling), and whether or not the materials in the product support Cradle to Cradle® material health objectives. The intent is also to give designers a tool to evaluate and profile the hazards associated with a chemical by which they can make educated and informed decisions when creating products.

## Methods

See the document entitled *Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.1* (available for download on the Cradle to Cradle Products Innovation Institute website at [www.c2ccertified.org](http://www.c2ccertified.org)).

## Required Documentation

A column in the Bill of Materials can be used to list and track assessment ratings for each homogeneous material. At a minimum, this level of information must be reported to the Cradle to Cradle Products Innovation Institute. Assessment ratings for each chemical ingredient in each homogeneous material may or may not be reported, although each assessor will be required to track this information for each project and for auditing purposes.

# 3.6 DETERMINING PERCENTAGE ASSESSED

## Standard Requirement

Materials in a product must be assessed using the ABC-X rating system. The following percentage of materials in the product that are assessed is required for each certification level:

<b>Bronze level</b>	TNs and BNs are at least 75% assessed as A, B, C, or X. Complete formulation information needs to have been collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use (e.g., cosmetics, personal care, soaps, detergents, paint, etc.).
<b>Silver level</b>	TNs and BNs are at least 95% assessed as A, B, C, or X. Complete formulation information needs to have been collected for 100% of BN materials that are released directly into the biosphere as a part of their intended use (e.g., cosmetics, personal care, soaps, detergents, paint, etc.).
<b>Gold level</b>	TNs and BNs are 100% assessed as A, B, or C.

## Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

## Intent

The intent of this requirement is to encourage manufacturers to identify the extent to which the materials in their product may adversely impact human or environmental health by increasing the percentage of materials that are assessed with each higher level of certification.

## Methods

1. In order for a homogeneous material subject to review to be counted as “assessed,” the following must be true:
  - a. For materials assessed as A, B, or C, all chemicals subject to review have been identified and none of those chemicals were assigned an ‘x’ or ‘grey’ single chemical risk rating. This refers to chemical substances as present in the homogeneous materials of the finished product. For example, if the manufacturer mixes a base resin with a color masterbatch during production, the resin and masterbatch together are a single homogeneous material for the purpose of the assessment and this is where the 100ppm threshold is applied. If any substance subject to review in this homogeneous material receives a single chemical risk rating of ‘x’, the entire homogeneous material will be x-assessed, regardless of whether the substance was an ingredient of the base resin or the masterbatch. See Section 3.4 for more information on chemicals subject to review in each material.
  - b. The concentrations of the following chemical ingredients in the material have been collected, regardless of their concentration in the material:
    - i. Lead, mercury, hexavalent chromium, cadmium, pigments, dyes and other colorants, phthalates, halogenated organics, and scarce elements (i.e., elements such as indium and gold).
    - ii. Process chemicals: metal plating agents (i.e., hexavalent chromium), textile auxiliaries, blowing agents, and paper bleaching agents.
  - c. Analytical testing has been completed and thresholds have been met where relevant for EMCs and materials containing recycled content. See guidance in Section 3.4 for further information.
  - d. The material has received an A, B, C, or X assessment, or it is defined as an EMC (Section 3.4.1).
2. The total percentage of materials in the product assessed equals the sum of the individual percentages by weight of each homogeneous material that meet the requirements listed above, with one exception as follows. In the case that the finished product is a single-material product, then the percentages for each input product/mixture and/or chemical are used in determining the percentage of the product assessed. For this purpose, a product is considered a single-material product if it is composed of:
  - a single homogeneous material, or
  - a single homogeneous material that is at least 95% of the final product by weight and 5% or less of other materials that are either a coating, finish, print, paint, ink, other surface treatment, film, or interlayer.

Note that the percentage assessed required for each certification level corresponds to the percentage of materials, not the chemicals, assessed by weight in the product. This is because:

- Only chemicals  $\geq 100\text{ppm}$  in the material (plus exceptions noted above), and not all chemicals in the material, are subject to review. It is possible that a small percentage of the material contains chemicals that have not been identified and assessed.
- X-assessed materials may have one or more ingredients that have not been identified. The identification process may have been discontinued once a problematic ingredient was identified in the material.

Note also that in cases where the finished product is a single-material product, the percentages for each assessed chemical substance by weight are used in determining the percentage of the product assessed.

A material may be identified as GREY if the supplier refuses to provide the complete formulation, or expert judgment by the assessor concludes a substance has been omitted from the material formulation. A material may also be identified as GREY if certain hazard data are not available for one or more chemicals in the material (for more information on the chemical risk assessment process see the *Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.1*). Because there is not enough information to render an assessment, chemicals or materials assigned a GREY rating do not count toward the percentage assessed. Once the missing information is obtained, a GREY material may become an A, B, C, or X assessed material and count toward the percentage assessed.

In order for a material to count towards the percentage assessed at the Silver level, one of the following is required to ensure carcinogens, mutagens, or reproductive toxins (CMRs) are not present in those materials:

- All of the chemicals subject to review in the material have been identified (i.e., no GREY ingredients) and none received a single chemical risk score of 'x' as a result of being a CMR, OR
- In cases where an X-assessed material may have one or more ingredients that have not been identified (i.e., GREY ingredients), the material supplier or other party with knowledge of the chemical composition of the material has signed a declaration stating that CMRs are not present in the material.

### Required Documentation

It is recommended that a column(s) in the Bill of Materials be used to tabulate and calculate the total percentage of the product that has been assessed.

## 3.7 MATERIAL OPTIMIZATION STRATEGY

### Standard Requirement

A phase-out or optimization strategy has been developed for those materials with an X rating.

### Applicable Levels of Certification

This requirement applies to the Bronze and Silver levels of certification. (By definition, Gold- and Platinum-level products will not contain any x-assessed substances and therefore will not need a material optimization plan.)

### Intent

The intent of this requirement is to encourage the manufacturer to develop a plan for phasing out the use of all chemicals or materials in their product that may adversely impact human or environmental health and advance along the continuous improvement pathway to higher levels of product certification.

### Methods

1. Each applicant will receive a certification report from their consultant or assessor. This report will include assessment comments, indicating as much as possible what the issues are with a given material. The report will also contain a recommendations section that may provide some guidance on which materials are most feasible to work on in the near term. Some consultants / assessors will also track optimization opportunities in the Bill of Materials. These documents are the starting point



for developing an optimization plan. The following information will be needed to construct the optimization strategy:

- a. Assessment results (A, B, C, X, or Grey) and description/comments.
  - b. Initial optimization recommendations and next steps.
  - c. Indication of how difficult it will be to optimize each material.
2. All X (problematic) and Grey (data missing) materials are to be included in the optimization plan. The exception is for materials assessed as Grey only because of recycled content, which is difficult to define. These may be excluded from the plan.
  3. Generally, optimization will be done through current suppliers.
    - a. The first step in most cases will be to approach the suppliers to inquire if they would be willing to work on optimizing the materials that are purchased from them.
    - b. When contacting suppliers, discuss with them the assessment results. Suppliers may also contact the consultants / assessors for further detail if needed, as much of their ingredient information is confidential and cannot be provided.
  4. Include a plan timeline.
    - a. It is recommended to divide the timeline into near-term optimization (next 1-2 years) and longer-term optimization (> 2 years).
    - b. Focus near-term optimization on materials that are most feasible to optimize.
    - c. It is acceptable to select only one or two materials to work on in the near term.
  5. Include a plan budget.
    - a. It is understood that this will be a rough estimate.
    - b. Changes to materials may result in increased, decreased, or no change to a material's cost. Indicate what change in cost is expected, if possible.
    - c. Any time needed to test potential new materials and staff time to work with suppliers on optimization may also be included in the budget, if significant.
  6. **It is required that some optimization progress be made prior to each successive re-application.** Note, however, that X assessed items are allowed at the Basic to Silver levels of certification (excluding carcinogens, mutagens, and reproductive toxins at Silver). Complete phase-out of at least one X assessed item is preferable; however, it may not always be possible to fully substitute materials prior to re-application. Acceptable progress includes:
    - a. Work has been done towards the goal of fully characterizing materials previously assessed as Grey (i.e., new material ingredient information has been gathered).
    - b. Research has been completed and documented regarding possible alternative materials, including performance issues, costs, etc.
    - c. Performance testing has been completed on alternative materials.
  7. For products that do not contain any X or Grey assessed materials, it is required that progress be made in other program categories (i.e., Material Reutilization, Renewable Energy and Carbon Management, Water Stewardship, or Social Fairness). See Section 8 (Continuous Improvement and Optimization) for further information.

## Required Documentation

A complete strategy or plan addressing all items listed above for each X or Grey assessed material is required. This information may be provided in the form of a table, or as part of the original Bill of Material, with the following column headings: component, assessment, optimization recommendation (from consultants or assessors), opportunity (feasibility or difficulty), action plan including timeline (near term or long term), budget or cost, and progress (for reporting progress at re-application).

## 3.8 DETERMINING ABSENCE OF CMR SUBSTANCES

### Standard Requirement

The product does not contain substances known or suspected to cause cancer, birth defects, genetic damage, or reproductive harm (CMRs) in a form that may result in plausible exposure during the product scenarios evaluated.

### Applicable Levels of Certification

This requirement applies to the Silver level of certification and above (Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to prevent the use of chemicals that have been identified as CMRs in materials or products. These chemicals are considered to be particularly harmful to humans and wildlife.

### Methods

The chemical hazard profiles are used to generate A, B, C, or X assessments and verify that any X assessed materials do not contain a chemical with a single chemical risk score of 'X' as a result of being a carcinogen, mutagen, or reproductive toxicant (CMR).

This requirement shall be interpreted to mean that the 95% or more of the materials in the product that have been assessed as A, B, C, or X do not contain known or suspected CMRs in a form that will result in plausible exposure to humans or the environment during the product scenarios evaluated. Because the A, B, C, X material health assessment methodology incorporates both hazard and exposure considerations, materials containing known or suspected CMRs may receive a C assessment, and thus be allowed for use in a Silver-certified product, if the assessor determined that relevant exposure to those CMRs is not plausible. If the assessor determined that plausible exposure to the CMR may occur as a result of its use in the material, the material receives an X assessment and is not permitted for use in a Silver-certified product. Further details of the material health assessment methodology are available in a separate document (*Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.1*).

Note that all chemicals, including CMRs, are treated equally in the material health assessment methodology. Generally, the chemicals that are present at concentrations below 100 ppm in each homogeneous material are not subject to review, and the homogeneous materials that are present at concentrations below 100 ppm in a product are not subject to review either. Thus it is possible that CMRs are present in a certified product if they are below the concentration subject to review or are present in a material that is not subject to review. However, if a CMR is in a material, or is one of the chemical types that are subject to review at *any* concentration in the product, it is subject to review (see Section 3.4 for a complete list). When a material assessment is completed, the assessor will report back to the consultant and/or applicant regarding which materials contain these chemicals.

### Required Documentation

Chemical hazard profiles are generally not fully documented with reports provided to applicants due to confidentiality reasons. In order to track and verify the presence or absence of CMRs for each homogeneous material, it is suggested that a column be added to the standard Bill of Materials.

## 3.9 VOLATILE ORGANIC COMPOUND (VOC) EMISSIONS TESTING

### Standard Requirement

A product designed for indoor use, or one that could potentially impact indoor air quality, meets Cradle to Cradle Certified™ VOC emissions standards.

### Applicable Levels of Certification

This requirement applies to the Gold level of certification and above (Gold and Platinum) and EMCs at all certification levels.

### Intent

The intent of this requirement is to ensure that VOCs are not being emitted from products used indoors or products that impact the concentration of VOCs in the indoor environment.

### Methods

Indoor-use products are those with intended or likely unintended use scenarios in interior spaces (i.e., inside a building).

Due to the short duration of exposure, consumable indoor products fully designed as biological nutrients (e.g., detergents, personal care products, toilet paper) are not subject to the VOC emissions testing requirement. Furthermore, VOC tests are not required for products that are sold exclusively as material inputs for other products (rather than being sold to the general public).

The VOCs with established Chronic Reference Exposure Levels (CRELs) listed in the [California Department of Public Health's \(CDPH\) Standard Method v1.1-2010](#) must be included in emissions testing. CREL values are continuously updated by the California Office of Environmental Health Hazard Assessment (see <http://oehha.ca.gov/air/allrels.html>). If the assessor has reason to believe other problematic substances may be present in the product (e.g., radioactive substances in granite), these may also be required for testing. Although 4-Phenylcyclohexene is not listed in the CDPH Standard Method v1.1-2010 as of the time of this writing, it must also be included in emissions testing of any carpet or flooring product seeking to fulfill this requirement.

To demonstrate compliance with emissions standards, a product must comply with the following requirements:

1. One of the following test methods to quantify emissions has been used:
  - a. ASTM D5116 for small chamber or equivalent.
  - b. EU standard.
  - c. ASTM D6670 for large chamber or equivalent EU standard.

- d. ANSI/BIFMA M7.1 for office furniture or equivalent EU standard.
  - e. ISO 16000 series for VOCs
2. One of the following loading scenarios to quantify emissions has been used:
    - a. ANSI/BIFMA M7.1 for office furniture.
    - b. California Department of Health Services section 01350 for all other products.
  3. Emissions results
    - a. VOCs that are considered known carcinogens, endocrine disruptors, mutagens, reproductive toxins, or teratogens are below detection limits (detection limits must be < 9.0 µg/m<sup>3</sup> for formaldehyde and < 2µg/m<sup>3</sup> for all other chemicals).
    - b. TVOC must be < 0.5 mg/m<sup>3</sup>.
    - c. Individual VOCs that would receive an x assessment must be < (0.01) x [the lower of the TLV or MAK value].
    - d. The time point used is 7 days for VOCs and IVOCs.
    - e. The analytical laboratory used must be ISO 17025 accredited.

These thresholds were designed to reflect those required in the California Department of Public Health's Standard Method v1.1-2010.

### Required Documentation

Testing reports, including a description of the samples tested, the analytical methods used, the method detection limits, and laboratory contact information must be submitted to the assessor.

## 3.10 PROCESS CHEMICALS

### Standard Requirement

All process chemicals used during the final manufacturing stage of the product are assessed and none are assessed with an x rating (no GREYs).

### Applicable Levels of Certification

This requirement applies to the Platinum level of certification only.

### Intent

The intent of this requirement is to ensure that chemicals used in the product manufacturing process do not adversely impact human or environmental health.

### Methods

All process chemicals used during the final manufacturing stage of the product are subject to review.

A process chemical is defined as any substance that comes into direct contact with the product or any of its material constituents during any of processes that constitute the final manufacturing stage of the product. It is used as an intentional part of any of these processes to fulfill a specific function or achieve a specific effect in the product or any of its material constituents. Within this definition, process

chemicals are limited to pure chemical substances and chemical substances present in a mixture at a concentration of 1,000 ppm or above. Mixtures include liquids, sprays, gases, aerosols, solids, etc. The concentration threshold applies to process mixtures directly as received by the supplier and prior to any dilution that may take place at the manufacturing site(s). This definition does not include maintenance agents for machinery, effluent or wastewater treatment chemicals, chemicals used in steam boilers, or cleaning agents used for the production area, offices, and/or lavatories. Distilled water, tap water, and ambient air in their chemically unaltered state are excluded from the assessment.

The same methodology is applied in assessing process chemicals as for product inputs, although different exposure scenarios will be important to consider. The single chemical risk rating (as a, b, c, or x) must be reported for each process chemical identified. The single chemical risk rating considers the chemical's hazards and exposure via any relevant exposure scenarios determined by the assessor. Note that the assessment must be conducted using the final reacted form of the parent chemical resulting in exposure. For example, if the exposure is via effluent, the assessment must be conducted on the primary hydrolyzed or reacted form of the parent chemical that would appear in the effluent. See the *Material Health Assessment Methodology* document for further details on how the single chemical risk score is determined.

### Required Documentation

If applying for the Platinum level in the Material Health category, a list of all process chemicals in the Bill of Materials is required. Indicate under the "generic material" that it is a process chemical. Also report the single chemical risk rating (a, b, c, or x) for each chemical.

# 4 MATERIAL REUTILIZATION

## Eliminate the Concept of “Waste”

A significant focus of Cradle to Cradle® as a product design framework is to promote the creation of an optimized materials economy that eliminates the concept of “waste.” This category of the program is intended to create incentives for industry to eliminate the concept of “waste” by designing products with materials that may be perpetually cycled to retain their value. The Program challenges companies to take more responsibility for creating the infrastructure and systems necessary for recovering and recycling materials as the nutrients necessary to fuel our global economies. There are many opportunities for companies to use products as part of the services they offer their customers.

Table 7 lists each requirement within the Material Reutilization category. To achieve a given level, the requirements at all lower levels are to be met as well. The sections that follow provide interpretation and suggested methods for achievement.

Table 7 Material Reutilization Requirements

LEVEL	ACHIEVEMENT
<b>BASIC</b>	Each generic material in the product is clearly defined as an intended part of a biological or technical cycle (this is covered by the Material Health requirement at Basic level; see Material Health guidance in Section 3.2).
<b>BRONZE</b>	The product has a Material Reutilization Score that is $\geq 35$ .
<b>SILVER</b>	The product has a Material Reutilization Score that is $\geq 50$ .
<b>GOLD</b>	The product has a Material Reutilization Score that is $\geq 65$ .
	The manufacturer has completed a “nutrient management” strategy for the product including scope, timeline, and budget.
<b>PLATINUM</b>	The product has a Material Reutilization Score of 100.
	The product is actively being recovered and cycled in a technical or biological metabolism.

## 4.1 MATERIAL REUTILIZATION SCORE

### Standard Requirement

The following Material Reutilization Score is required for each certification level:

- Bronze level:  $\geq 35$
- Silver level:  $\geq 50$
- Gold level:  $\geq 65$
- Platinum level: 100

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

## Intent

The intent of this requirement is to increase the material reutilization potential of a product determined by using the Material Reutilization Scoring method described below.

## Methods

1. For each homogeneous material subject to review (as determined according to the process described in Section 3.1), indicate the recyclable, biodegradable (including compostable), rapidly renewable, and recycled content as percentages. Note that it is not required to have reutilization data for all homogeneous materials subject to review. It is recommended to first gather data on higher weight inputs. Depending on the certification level of interest, gathering data on all homogeneous materials may not be necessary in order to achieve the required reutilization score. Note also that although it is highly recommended, it is not required that recyclable, biodegradable (including compostable), and recycled content be verified by outside sources in order to receive credit.

- a. **Recyclable material:** A recyclable material is a material that can be recycled at least once after its initial use phase somewhere in the world, at least at the pilot scale, in the intended end-of-use scenario the applicant aspires to, independent of current feasibility and implementation. It does not matter whether the product is likely to be recycled in this way based on current infrastructure and/or the regions in which the product is distributed. (Note: The plan to realize the intended end-of-use scenario is due at the Gold level, and implementation needs to be demonstrated for the Platinum level). The entire material needs to be recyclable in order to be counted as recyclable in the Material Reutilization score.

The material must also be separable under normal recycling conditions, commonly separated in practice by the consumer in order for recycling to occur (e.g., just because it's possible to strip a coating from a material does not mean that the user would commonly do this in practice in order to recycle the material), and/or separated by the manufacturer or contracted third party as part of an active product recovery/take back program. The separability requirement applies only in cases where separation would be necessary in order for recycling to occur. The portion of an EMC that is recyclable once take back has occurred applies.

Renewably sourced materials that are incinerated to produce energy ('waste to energy') may be counted as recyclable (e.g., polyethylene made from sugar cane) in the Material Reutilization score if the assessor determines that incineration of the material does not lead to problematic by-products (i.e., scrubber technology has been demonstrated to efficiently remove the problematic by-products).

Note that each homogeneous material counts either as fully recyclable (i.e. with all of its mass) or not. A homogeneous material cannot be partially recyclable. This extends also to single-homogenous material products, which will either be 0 or 100% recyclable. Conversely, biodegradability may be assessed on an individual chemical substance basis for liquid, gel, powder, or paste products.

- b. **Biodegradable chemical or material:** The OECD defines the appropriate testing methods for determining ready and inherent biodegradability. The entire material needs to be biodegradable in order to be counted as biodegradable in the Material Reutilization score. If making biodegradability claims for materials that are not commonly known to be biodegradable, testing should be done according to these, or comparable, methods. Biodegradability of the material must be considered under the conditions of the material's intended end-of-use scenario.

- c. Compostable material: A compostable material is a material capable of undergoing biological decomposition in a compost site as part of an available program, such that the material is not visually distinguishable and breaks down into carbon dioxide, water, inorganic compounds, and biomass at a rate consistent with known compostable materials. If making claims on the compostable nature of materials that are not commonly known to be compostable, testing is required according to the appropriate ASTM, ISO, CEN, or DIN standard (e.g., ASTM D6400-04 for plastics). The entire material needs to be compostable and be separable from other materials in the product in order for that material to count as compostable in the Material Reutilization score.  
  
Renewably sourced materials that are incinerated to produce energy ('waste to energy') may be counted as compostable (e.g., wood) in the Material Reutilization score if the assessor determines that incineration of the material does not lead to problematic by-products (i.e., scrubber technology has been demonstrated to efficiently remove the problematic by-products).
  - d. Recycled material (combined percentage of post- and pre- consumer recycled materials).
    - ii. Post-consumer recycled material is a material that has been collected for recycling after consumer use.
    - iii. Pre-consumer recycled material is a material that has been collected for recycling prior to consumer use, comes from sources outside of the applicant manufacturer's facility, and has been modified before being suitable for recycling back into a manufacturing process. Waste materials directly incorporated back into the manufacturing process within the applicant facility do not apply.
  - d. Rapidly renewable material: A rapidly renewable material is a material that is grown and harvested in cycles of less than 10 years. FSC certified wood and wood products may also be counted as rapidly renewable, even if they are grown and harvested in cycles of more than 10 years.
2. In the case of steel parts, if it is not possible to determine the actual percentage of recycled content, the industry-wide average may be used. For other material types where it is not possible to determine recycled content, zero recycled content should be assumed. The following are the industry averages obtained from the Steel Recycling Institute ([www.recycle-steel.org](http://www.recycle-steel.org); 2010 data) for the basic oxygen furnace method (BOF) and electric arc furnace method (EAF). If the method is unknown, use the lowest value.
    - a. BOF: 33.6%
    - b. EAF: 89.9%
  3. Sum the individual percentages of recyclable and biodegradable (including compostable) materials. This sum equals "% of the product considered recyclable or biodegradable/compostable" in the formula below.
  4. Multiply the individual percentages (as proportions; e.g., 50%=0.5) of recycled and rapidly renewable content present within each homogeneous material by the percentage of those materials within the overall product and sum the results. This sum equals "% recycled or rapidly renewable content in the product" in the formula below.



5. Calculate the Material Reutilization Score as follows with percentages entered as proportions:

$$\frac{\left[ \frac{\% \text{ recycled or rapidly renewable}}{\text{product content}} \right] + 2 \left[ \frac{\% \text{ of product recyclable or biodegradable/compostable}}{\text{product content}} \right]}{3} \times 100$$

Example: Product X contains 80% recyclable materials and 40% recycled materials

$$\text{Material Reutilization Score} = \frac{[(0.40) * 1] + [(0.80) * 2]}{3} \times 100 = 67$$

### Special Considerations for Calculating the MR Score for Products Containing Water

With the exception of paints (see next section), water weight must be excluded from the product weight when calculating the Material Reutilization score. This means that water does not count as recyclable, biodegradable/compostable, rapidly renewable, or as recycled input, but that it also does not contribute to the denominator when determining the weight fractions of other chemical substances and inputs that do count as recyclable, biodegradable/compostable, rapidly renewable, or as recycled input.

### Special Considerations for Calculating the MR Score for Paint and other Wet-Applied Products

#### How to Calculate Percent Cyclable

General purpose and wall paints and other wet-applied products must be regarded as Biological Nutrients, and are thus assessed based on their safety when released into the biosphere (by erosion, washing, leaching, burning, or similar processes) and their biodegradability. Because such products are formulated, single-material products, the percent biodegradable is not based on the percent of biodegradable homogeneous materials (as for multiple-material products). Instead, the '% biodegradable content' for the MR score is based on the individual product ingredients and must be calculated in the following manner:

1. Sum the percent weight of all substances that are biodegradable in their pure form, as per the relevant OECD (or comparable) tests and definitions.
2. Add the percent weight of water in the product and the percent weight of benign minerals commonly found in surface soils and sediments. Benign minerals are defined as those having a single chemical risk rating of a, b, or c (not x or GREY). Minerals commonly found in soils or sediments are limited to Al-, Ca-, Fe-, Mg-, Mn-, Na-, K-, or Zn-containing silicates, oxides, carbonates, or phosphates that can be commercially derived without chemical alteration from surface soil or sediments (no more than 2 m below the land surface or sea level). If the applicant feels that a non- Al-, Ca-, Fe-, Mg-, Mn-, Na-, K-, or Zn-containing silicate, oxide, carbonate, or phosphate should be counted as a benign soil/sediment mineral, they must submit a request to amend this guidance to the C2CPII.
3. The resulting percentage is used as the % cyclable ('recyclable/biodegradable') content to compute the MR score.

### How to Calculate % Rapidly Renewable/Recycled Content

To derive the '% rapidly renewable content' of the product, water weight is excluded (e.g., if the paint is 15% rapidly renewable inputs by weight and 20% water by weight, the % rapidly renewable content used to derive the MR score would be  $15\% / (100\% - 20\%) = 18.75\%$ ).

#### Required Documentation

For tracking and reporting of recyclable, biodegradable (including compostable), recycled, and rapidly renewable content, it is recommended that additional columns be added to the original Bill of Materials used to report and define homogeneous materials, as described in Section 3.1.

## 4.2 NUTRIENT MANAGEMENT STRATEGY

#### Standard Requirement

The company has completed development of a "nutrient management" strategy for the product, including scope, timeline, and budget.

#### Applicable Levels of Certification

This requirement applies to the Gold level of certification and above (Gold and Platinum).

#### Intent

The intent of this requirement is to challenge manufacturers to take more responsibility for creating the infrastructure and systems necessary for recovering and recycling materials as the nutrients necessary to fuel our global economies.

#### Methods

A nutrient management strategy is defined as a process for actively recovering or cycling the technological or biological nutrients in the product in a technical or biological metabolism. Nutrient management strategies will likely be very unique to each product. See Section 4.3 for examples of nutrient management methods.

The following must be addressed in the plan for development of a "nutrient management" strategy:

1. Commencement date of program.
2. Method of recovering, reusing, recycling, or composting individual materials within the product and the product overall.
3. Method of informing customers regarding disassembly of product, if needed.
4. Method of informing customers and the public about the program and access to recycling or other options.
5. Budget allocated to execution of the plan.
6. Initial and future targets and timeline for number of units or volume of materials to be collected and recycled or composted.
7. Recovery and recycling rate data, if available (for municipal recycling, provide average rates).

- a. Partners in program (i.e., who will be recycling or composting).
- b. Target end-markets for recycled goods.
- c. Estimated market value of goods pre-recycling.

### Required Documentation

A strategy outline and narrative addressing the points listed above are required.

## 4.3 NUTRIENT CYCLING

### Standard Requirement

The product is actively being recovered and cycled in a technical or biological metabolism.

### Applicable Levels of Certification

This requirement applies to the Platinum level of certification only.

### Intent

The intent of this requirement is to ensure that manufacturers are actively recovering and recycling the product and thus working towards the goal of eliminating the concept of waste.

### Methods

1. Methods of recovering and recycling products that qualify include:
  - a. Company-sponsored collection program: The manufacturer has ownership of, and is in direct control of, creating the infrastructure for the recovery and recycling or industrial composting of the product.
  - b. Municipal recycling: The product has been designed to be recycled using the municipal recycling systems. One hundred percent of the product's materials can be separated and recycled within municipal systems. Within the U.S. and where not otherwise clearly defined by regulations, the Federal Trade Commission's (FTC) definitions of "recyclable" apply (see FTC GreenGuide). The average recycling rates and references below for the material type(s) must be reported.
  - c. Retail-sponsored collection program: A retail organization is partnering with one or more original equipment manufacturers to collect and recycle or compost selected products (e.g., recycling of electronic products through retail outlets).
  - d. Manufacturing association-sponsored collection program: The original equipment manufacturers organize a program to collect and recycle or compost selected products.
2. Collect data on the recovery and recyclability or compostability rate at which the materials are managed based on percent of volume of units sold. It should be shown that recovery rates are balanced with use and installation timelines. For example, an architectural installation made of aluminum may be on a building well over 50 years old, but the company has not yet experienced any "recovery" due to the long timeline. Since aluminum is one of the most highly recycled materials, this case is exempt from meeting positive recovery rates. In most cases, however, at least some recovery and recycling must be occurring in order to meet this requirement.

3. Conduct compostability testing for materials that are not generally known to be compostable, if applicable. See Terms and Definitions for the definition of “compostable” and applicable testing standards.

### Required Documentation

A description of the product stewardship program used to collect and recycle the product after its first use-phase must be provided. The description must address the points listed above for developing a strategy as required at the Gold level, in addition to the recovery and recyclability or compostability rate in the program. For compostable products, cite the relevant standard and provide test results.

# 5 RENEWABLE ENERGY AND CARBON MANAGEMENT

## Eco-effective energy production

Cradle to Cradle® envisions a future in which industry and commerce positively impact the energy supply, ecosystem balance, and community. This is a future powered by current solar income and built on circular material flows. The Renewable Energy and Carbon Management category is a combination of these core principles of Cradle to Cradle design: *produce and use renewable energy* and *eliminate the concept of waste*. Renewable energy displaces energy produced from fossil fuels, which emit carbon. Changing the quantity and quality of energy used affects the balance of carbon in the atmosphere and ultimately the climate. Ideally, emissions are simply eliminated, and renewable energy is produced in excess to be supplied to local communities. When emissions do occur, they are managed as biological nutrients and balanced with an equivalent uptake by natural systems. If we are to reach the ultimate goal of net positive impact, it is critical to accurately measure energy use and emissions. By obtaining these measurements, we can identify and carry out effective plans for transitioning to renewable energy use, and achieving a balance of carbon in the atmosphere and as food for building healthy soil.

Table 8 lists each unique requirement within the Renewable Energy and Carbon Management category. To achieve a given level, the requirements at all lower levels are to be met as well. The following sections provide interpretation and suggested methods for achievement.

Table 8 Renewable Energy and Carbon Management Requirements

LEVEL	ACHIEVEMENT
<b>BASIC</b>	Annual electricity use and greenhouse gas emissions associated with the final manufacturing stage of the product are quantified.
<b>BRONZE</b>	A renewable electricity use and carbon management strategy is developed.
<b>SILVER</b>	For the final manufacturing stage of the product, 5% of electricity is renewably sourced or offset with renewable electricity projects, and 5% of GHG emissions are offset.
<b>GOLD</b>	For the final manufacturing stage of the product, 50% of electricity is renewably sourced or offset with renewable electricity projects, and 50% of GHG emissions are offset.
<b>PLATINUM</b>	<p>For the final manufacturing stage of the product, &gt;100% of electricity is renewably sourced or offset with renewable electricity projects, and &gt;100% of GHG emissions are offset.</p> <p>The embodied energy associated with the product from Cradle to Gate is characterized and quantified, and a strategy to optimize is developed. At re-application, progress on the optimization plan is demonstrated.</p> <p>≥ 5% of the embodied energy associated with the product from Cradle to Gate is covered by offsets or otherwise addressed (e.g., through projects with suppliers, product re-design, savings during the use phase, etc.).</p>

## 5.1 QUANTIFYING ELECTRICITY USE AND EMISSIONS

### Standard Requirement

Annual electricity use and greenhouse gas (GHG) emissions associated with the final manufacturing stage of the product are quantified.

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum). Annual electricity use and GHG emissions associated with the final manufacturing stage of the product must be re-calculated at re-certification.

### Intent

The intent of this requirement is to assist manufacturers with understanding their baseline electricity use and GHG emissions.

### Methods

1. Conduct a facility-level audit of electricity use and GHG emissions for all facilities involved in final manufacturing stage processes as follows:
  - a. The electricity use and GHG emissions calculations must pertain to the final manufacturing stage of the product only, rather than to all of the product-relevant processes at the facility. The intent of this is to establish an even playing field for manufacturers with varying levels of vertical integration and to measure electricity used for similar processes. Processes that are considered to represent the final manufacturing stage by product category can be found in the [Final Manufacturing Stage Guidance document](#), which is subject to periodic review based on assessor and applicant feedback. Please contact [certification@c2ccertified.org](mailto:certification@c2ccertified.org) if your product category is not represented or if you have comments regarding the listed processes.
  - b. Calculate the amount of electricity used, including the percent on-site renewables and the percent renewables purchased from the grid and/or compliant renewable energy certificate (REC) sources. Note that if heat is purchased directly from a utility, include it in the calculations for GHG emissions (see next section). Also note that overhead operations, including facility air conditioning and lighting, may be considered non-attributable (see the Greenhouse Gas (GHG) Protocol Product Standard for detail). Even so, if it is not possible to separate these from the total, they may be included. Electricity use must be reported in terms of kilowatt hours (kWh).
  - c. Calculate total carbon equivalent emissions from GHG emissions associated with the final manufacturing stage of the product. The GHG emissions in scope for this requirement are those that are (1) emitted directly during the product's final manufacture or on-site treatment of process wastes or (2) associated with purchased heat. GHG emissions associated with electricity generated off-site are out of scope. Be sure to include all on-site fuel uses such as gasoline for transport vehicles, propane, etc. when attributable to the product. If transport vehicles are used during the final manufacturing stage of the product, whether owned by the company or not, the emissions from the fuel used for the vehicles must be included in the total emissions calculation. Also be sure to include any relevant product-attributable, non-electricity-related emissions, such as methane from water treatment ponds, fugitive emissions from refrigerants, and/or carbon dioxide from cement production. Select a widely recognized method and guidance when calculating emissions. Appropriate references include GHG Protocol Product Standard and the

Intergovernmental Panel on Climate Change (IPCC). GHG emissions must be reported in terms of carbon dioxide equivalents (tCO<sub>2</sub>e).

- d. Allocate electricity and GHG emissions to the applicant product(s) (see definition of product-attributable processes in Chapter 7 of the [GHG Protocol -- Product Life Cycle Accounting and Reporting Standard\[1\]](#)). Select the most appropriate method for the product(s) under review. For example, if products are of similar weight across SKUs, a weight allocation is appropriate.
  - e. An applicant must work with their accredited assessment body to obtain the appropriate template for quantifying the product-allocated electricity use and emissions.
2. In addition to the requirements and questions described above and below, the following questions will help in evaluating whether all relevant GHG emissions sources have been accounted for and aid in making judgments about data accuracy:
- a. Have fugitive emissions been accounted for? These are emissions due to storage leaks or machinery leaks. In the case of refrigerants, this may be accounted for based on the amount of recharge required.
  - b. Does the company own any vehicles that are directly relevant to product manufacture or transport? For transport using company-owned vehicles, if driving distances were employed in estimating emissions (as opposed to actual fuel use), was actual driving distance available, or was distance estimated based on straight line or shortest route distances? How does this estimate compare with actual distance?
  - c. Does the company conduct on-site wastewater treatment relevant to the product? Has this been accounted for?
  - d. Are other process-relevant GHG emissions of concern (e.g., in cement manufacture)?
  - e. What reference sources have been used in selecting the emissions factors?

### Required Documentation

Record the information listed below for each facility at which the product undergoes final manufacturing (see above for more information on determining the final manufacturing stage/processes).

1. Facility name.
2. Country and region.
3. Utility name.
4. Renewable electricity purchased (delivered) through utility. Note: This is not the same as the average utility or regional grid mix. The applicant may only claim renewable electricity that is delivered to them through renewable energy pricing programs, or assurance that claims to the use of renewable electricity in the utility mix may be made by customers of the utility.
5. Total amount of electricity required for the final manufacturing stage of the product in terms of kWh.
6. Total amount of GHG emissions generated for the final manufacturing stage of the product in terms of tCO<sub>2</sub>e.
7. Total amount of renewable electricity generated on site for the final manufacturing stage of the product in terms of kWh.
8. Date range of data (calendar or fiscal year are acceptable).

9. Data source (e.g., utility bills and receipts; if other data source, please describe).
10. Indicate the GHGs that are included in this inventory. Note that carbon dioxide is to be included at a minimum. The widely used GHG Protocol stationary combustion tool also includes methane and nitrous oxide in totals.
11. Indicate and describe the method used to allocate electricity use and GHG emissions to the production of the applicant product (e.g., percentage of total production weight or volume).
12. Indicate and describe the method used to allocate electricity use and GHG emissions to the final manufacturing stage of the product.
13. Indicate guidance and/or tools used (e.g., GHG Protocol, Stationary Combustion Tool, etc.).
14. Supporting documents such as Excel worksheets from the GHG Protocol and electricity use bills may be provided and/or requested as well. These will allow the assessor to evaluate data quality and completeness.

## 5.2 RENEWABLE ELECTRICITY AND CARBON MANAGEMENT STRATEGY

### Standard Requirement

A renewable electricity use and carbon management strategy is developed.

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to challenge manufacturers to develop a strategy that not only increases renewable electricity use and reduces GHG emissions, but also achieves the ultimate goal of using > 100% renewable electricity and closing the carbon cycle for the final manufacturing stages of the product.

### Methods

1. The strategy must cover facility-level electricity use and GHG emissions for at least the final manufacturing stage of the product.
2. The following should be included in a renewable electricity and carbon management strategy:
  - a. Methods that are and/or will be employed to use renewable electricity and manage GHG emissions, including a description of whether the focus is on installation of renewables, absolute reductions (i.e., improved energy efficiency measures), and/or intensity initiatives (e.g., efficiency improvements defined as reductions in emissions normalized by total production), or carbon sequestration projects.
  - b. Quantitative targets and timeline, including dates that individual initiatives went or will go into effect.
  - c. Progress made to date and what change in absolute emissions can be attributed to integration of renewables or efficiency improvements. If no progress has been made, explain why.
  - d. Budget allocated to execution of the plan.



## Required Documentation

A strategy outline and narrative addressing the points listed above are required.

# 5.3 USING RENEWABLE ELECTRICITY AND ADDRESSING GREENHOUSE GAS EMISSIONS

## Standard Requirement

A percentage of the electricity is renewably sourced or offset with renewable energy projects, and the same percentage of GHG emissions are offset. This requirement applies only to the electricity use and GHG emissions associated with the final manufacturing stage of the product.

The following percentages are required for each certification level:

Silver level:	5%
Gold level:	50%
Platinum level:	> 100%

## Applicable Levels of Certification

This requirement applies to the Silver level of certification and above (Silver, Gold, and Platinum).

## Intent

The intent of this requirement is to encourage manufacturers to participate in the demand for renewable electricity with the goal of producing > 100% renewable electricity for a product. With only a baseline investment in renewable electricity, subsequent energy efficiency measures may increase the percentage of overall renewable electricity use, thereby incentivizing efficiency as a path to effectiveness. The intent of the following methods is to designate appropriate strategies for making valid claims to renewable electricity generation, and appropriately managing GHG emissions.

## Methods

### Using Renewable Electricity

1. Calculate the annual electricity use associated with the final manufacturing stage of the product based on data from the previous year. If there is reason to expect that electricity consumption will be much higher in the subsequent year or for new products, different methods will have to be applied. For example, if it is known that there will be a significant increase in production volume for an existing product, the allocated electricity consumption and production volume estimates should be employed to estimate the total amount of electricity required for the coming year. Estimates for new products may be based on allocated electricity consumption estimates for existing products of similar type.
2. Note that renewable electricity that is already a standard part of the grid mix does not count toward this requirement unless the applicant is participating in a voluntary green pricing program or the applicant has verified that their utility is delivering renewable electricity that may be claimed by the utility customer without being double-counted elsewhere in the system. Renewable electricity used as part of direct power purchase agreements (PPAs) with renewable energy producers may count toward the requirement as long as the purchased energy is derived from a source among those eligible (solar, wind, hydropower, biomass (when not in competition with food supplies), geothermal, and hydrogen fuel cells) and the associated attributes of renewable-based generation are also

transferred as part of the purchase agreement and not claimed or counted elsewhere (i.e., sold to a third party in the form of RECs).

3. *On-Site Renewables*: Calculate the percentage of on-site renewable electricity generation as a proportion of the overall electricity attributed to the final manufacturing stage of the product based on data from the previous year. To meet the renewable electricity use requirement for a particular level, the remaining percentage of renewable electricity must be compensated for by the purchase of RECs or offsets.
4. *Unbundled Renewable Energy Certificates (RECs)*: If purchasing unbundled RECs to compensate for the percent of renewable electricity required, the RECs must be from voluntary programs (as opposed to compliance programs). In the U.S., Green-e RECs must be purchased. Outside the U.S., the use of equivalent, verified RECs is appropriate. It is important to ensure that RECs are not double-counted and the applicant has valid claim to the use of the renewable electricity attribute provided.
5. *Offsets supporting Renewable Energy*: Registered carbon offsets that support renewable energy projects may be used in place of RECs for electricity; however, in this case the electricity needs to be converted to metric tons CO<sub>2</sub> equivalents (tCO<sub>2</sub>e) using the utility or regional grid electricity mix (this is referred to as the 'Alternative Energy Inventory' in the templates). Renewable electricity in a grid or regional mix will result in lower emissions overall, so that the amounts of offsets are less than if electricity was produced from fossil fuel sources.
  - a. **NUCLEAR POWER**: When using carbon offsets in place of RECs for electricity to meet the renewable electricity requirement ('Alternative Energy Inventory'), the emissions value that the required offset amount is based on needs to be adjusted for the share of nuclear power in the electricity mix. For all electrical sources, calculate the amount of CO<sub>2</sub>e attributed to nuclear power by using the average CO<sub>2</sub> emissions from coal. This is done because compared to energy from other fossil fuels, nuclear power is responsible for very low to zero greenhouse gas emissions, particularly when the supply chain is not considered. However, nuclear power is not a renewable source of electricity and the low CO<sub>2</sub> emissions would be an undue advantage to any manufacturer purchasing offsets for this requirement. As the environmental and human costs of nuclear energy are immeasurably high, an adjustment is made to the total GHG emissions prior to offset purchase. (Note: In most cases the conversion of electricity produced from nuclear energy to emissions is not necessary because this electricity may be treated like other non-renewable electricity sources and compensated for via the purchase of RECs.)
    - i. Using data from the World Nuclear Association (<http://world-nuclear.org>), calculate the nuclear multiplier based on the country where each final manufacturing facility is located with the following formula:  $(\text{Percent of Nuclear} * 891 \text{ grams CO}_2\text{e/kWh}) / (1,000,000 \text{ g/ton})$ . Be sure to enter the percentage as a proportion (e.g., 10%=0.1). The assumed emissions rate for electricity produced from coal is 891 g/kWh (value is from <http://world-nuclear.org>). The following website lists the most recent values for the percentage of nuclear shares of electricity generation: <http://world-nuclear.org/info/Facts-and-Figures/Nuclear-generation-by-country/>. Multiply the total *product-allocated* electricity by the nuclear multiplier and add this to the total *product-allocated* CO<sub>2</sub>e, making sure all units are in metric tons. The Excel-based worksheet made available to assessors by the Cradle to Cradle Products Innovation Institute for the collection of Energy and emissions data includes up-to-date nuclear values and the formula for adjusting emissions associated with electricity when conducting the Alternative Energy Inventory.

- ii. Optional: It is allowable to use more local electricity mix information than national grid data. The formula remains unchanged in this case:  $(\text{Percent of Nuclear} * 891 \text{ grams CO}_2\text{e/kWh}) / (1,000,000 \text{ g/ton})$ .
  - iii. Multiply total metric tons CO<sub>2</sub>e, including nuclear carbon conversion, by the desired offset percentage to determine the amount of offsets that should be purchased.
6. For electrical sources, the carbon offset project types listed below (as defined by CDM methodologies) are recommended. Carbon credits generated by hydropower projects will ideally be offset using the Gold Standard to provide assurance that the environmental and community impacts have been accounted for and will be continually monitored.
- a. AM0019: Renewable energy projects replacing part of the electricity production of one single fossil fuel-fired power plant that stands alone or supplies to a grid, excluding biomass projects.
  - b. AM0026: Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order-based dispatch grid.
  - c. AM0052: Increased electricity generation from existing hydropower stations through decision support system optimization.
  - d. AM0072: Fossil fuel displacement by geothermal resources for space heating.
  - e. AMS-I.A.: Electricity generation by the user.
  - f. AMS-I.B.: Mechanical energy for the user with or without electrical energy.
  - g. AMS-I.C.: Thermal energy production with or without electricity.
  - h. AMS-I.D.: Grid-connected renewable electricity generation.
  - i. AMS-I.F.: Renewable electricity generation for captive use and mini-grid.
  - j. ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources.

### Addressing GHG Emissions

For emissions originating from non-electrical resources (e.g., on-site natural gas, propane for forklifts, process emissions), projects supporting the sequestration of carbon into forests or soil or other carbon offset strategies are accepted. RECs are not appropriate for these emission types.

1. Calculate the annual GHG emissions associated with the final manufacturing stage of the product based on data from the previous year. On-site emissions must be calculated in terms of CO<sub>2</sub>e and based on the emissions factor of the purchased fuel. GHG emissions that have been captured through carbon capture and storage or processes that sequester carbon in the product are not included in the emissions total. To meet the offset requirement for a particular level, the given percentage of emissions must be compensated for by the purchase of offsets or via use of renewables such as biomass (i.e., the given percentage of emissions must be compensated for by the purchase of offsets, but the purchase of offsets for emissions resulting from the combustion of eligible renewable fuels, such as biomass, is not required).

Emissions from renewable fuels must be tracked and reported during the certification process; however, the emissions generated by eligible renewable fuels will not be included in the final quantity of direct on-site emissions for which offsets need to be purchased at the Silver level and

above. By using eligible renewable fuels exclusively, it is thus possible to meet the Silver, Gold, and Platinum requirements without the purchase of offsets, since all direct on-site emissions from non-renewable sources will have been avoided (provided there are no other product-attributable greenhouse gas emissions during final manufacture). Similarly, no offsets need to be purchased if the final manufacture of a product does not generate any direct on-site emissions of greenhouse gases.

Eligibility of renewable fuels for this purpose is determined based on the definitions in Section II.A 5 in [Appendix D of the Green-e National Standard](#). Renewable fuels that are not covered by the types (woody waste, agricultural crop residue, animal and other organic waste, certain energy crops, landfill gas and wastewater methane) and definitions in Section II.A 5 in the Green-e National Standard may be eligible, subject to a case-by-case review by C2CPII. The methodology presented to C2CPII must demonstrate that the eligible emissions are derived from the combustion of a fuel that can be considered renewable in accordance with the general definitions provided by Green-e. Additionally, it should be demonstrated that across its entire lifecycle, the qualifying fuel is expected to have a favorable impact on atmospheric greenhouse gas concentrations in terms of CO<sub>2</sub> equivalents.

2. To purchase offsets, navigate to the Verified Registry website of choice to set up an account and make a purchase. Offsets must be fully retired in a third party registry to meet this requirement. Below is a partial list of recommended registries.
  - a. Clean Development Mechanism (CDM): <http://cdm.unfccc.int/Registry/index.htm>.
  - b. Climate, Community, and Biodiversity: <http://www.climate-standards.org/index.html>.
  - c. Verified Carbon Standard: <http://www.vcsprojectdatabase.org/>.
  - d. Gold Standard: <http://goldstandard.apx.com/index.asp>.
  - e. Green-e Climate Certified Carbon Offsets procured from an offset provider/retail seller or carbon credits procured directly from an offset project (or through a broker) certified by a Green-e Climate Endorsed Program: <http://www.green-e.org>.
3. There are some projects that do not take into account the surrounding natural resources and often can have adverse negative effects on humans and the environment. These projects will not be considered acceptable in the Cradle to Cradle Certified™ Products Program, although they may be verified carbon offsets. For non-electrical sources, it is recommended to avoid the following project types: carbon sequestration in the ocean, clean coal, methane sequestration, and any others that do not align with Cradle to Cradle®.
4. If it is determined that excess offsets or RECs were purchased in the prior year due to use of estimates, the excess may be credited toward the amount to be purchased at the next re-application. If it is determined that insufficient offsets or RECs were purchased in the prior year, this is to be made up at the next re-application.
5. If a percentage of the facility's electricity use and GHG emissions is compensated for with renewable electricity use or offsets, that percentage may be claimed for all certified products produced at that facility. If renewable electricity or offsets compensate for the production of only the product being assessed for certification, those purchases may not be claimed for any other products.

## Required Documentation

It is recommended to use the data template provided by a Cradle to Cradle Certified accredited assessment body to calculate electricity use and GHG emissions, and to track on-site renewable electricity, REC purchases, and offsets.

1. Update electricity use and emissions calculations performed at the Basic level with the most current prior year data. If electricity consumption and/or emissions are expected to change significantly, include estimates for the upcoming two years.
2. If converting electricity to CO<sub>2</sub>e, report country, nuclear share, multiplier, nuclear carbon conversion, and total CO<sub>2</sub>e, (nuclear carbon conversion + total product-allocated CO<sub>2</sub>e calculated initially).
3. Report sources of on-site renewable electricity and annual generation attributable to the final manufacturing stage of the product.
4. Indicate the amount and percentage of RECs purchased, including registry and/or retailer.
5. If converting electricity to CO<sub>2</sub>e, indicate the amount and percentage of carbon offsets purchased to offset electricity. Provide the name of the offset registry, project, and project description.
6. Indicate the amount and percentage of carbon offsets purchased to offset emissions. Provide the name of the offset registry, project, and project description.
7. Provide receipt of purchase for offsets and/or RECs as provided by the issuing body.
8. At re-application, indicate and make up for any differences between amounts of offsets and RECs purchased in the prior year as compared to actual emissions estimates for that year.

## 5.4 EMBODIED GHG EMISSIONS

### Standard Requirement

The embodied greenhouse gas (GHG) emissions associated with the product from Cradle to Gate (i.e., up to final manufacturing stage) are characterized and quantified, and a strategy to optimize is developed. At re-application, progress on the optimization plan is demonstrated.

### Applicable Levels of Certification

This requirement applies to the Platinum level only.

### Intent

The intent of this requirement is to assist a manufacturer with understanding the impacts of energy use associated with their supply chains, which can be significant in many cases. Also, the intent is to honor the importance of a product's GHG emissions throughout its lifecycle and encourage the development of a strategy to continuously improve beyond where a manufacturer has direct influence in the final manufacturing process.

### Methods

1. Inventory carbon equivalent GHG emissions from resource extraction to production (applicant's gate) using primary and/or secondary data for input materials. Primary data are defined as those collected directly from suppliers and secondary data are published data that are aggregated to the material level. The use of primary data is ideal because it creates the most accurate energy and emissions profile associated with a product, but it is more resource-intensive. Secondary data for material types are more readily available as part of life cycle analysis (LCA) software or other online

tools and datasets, but do not account for optimization efforts in a unique supply chain. Conducting a full life-cycle emissions inventory and analysis, including storage and transport, use, and recycling phases, is encouraged, but not required. Note that a variety of methods will be considered acceptable for fulfilling this requirement, as long as the methods are reported and described in detail. The importance is not on the detail of the study, but full disclosure of the methods used.

2. The inventory threshold is left to the applicant to determine and define as part of the boundary and scope decision; however, at a minimum, all inputs representing 1% or more of the product's total inputs must be included. Ideally, all inputs will be included, as it is difficult to know until data are gathered whether they will contribute significantly to total emissions or not. For guidance, refer to a widely recognized methodology such as the GHG Product Lifecycle Standard or PAS 2050.
3. The following should be included in a strategy to optimize the embodied energy of a product from Cradle to Gate.
  - a. Identify the highest-impact emissions sources in the supply chain and develop an outreach strategy to identify renewable electricity and carbon management strategies already in place and opportunities for optimization.
  - b. Methods that are and/or will be employed to use renewable electricity and manage GHG emissions among high-impact supply chain actors, including a description of whether the focus is on installation of renewables, absolute reductions (i.e., improved energy efficiency measures), and/or intensity initiatives (e.g., efficiency improvements defined as reductions in emissions normalized by total production), or carbon sequestration projects.
  - c. A timeline including dates that outreach activities or initiatives went or will go into effect.
  - d. Progress made to date and what change in absolute emissions can be attributed to integration of renewables or efficiency improvements. If no progress has been made, explain why.
  - e. Budget allocated to execution of the plan.

### Required Documentation

It is recommended to report the following information, at a minimum (taken from the GHG Protocol Product Standard, Chapter 14). Other product-relevant embodied energy standards may be used, as long as methodology, information source, scope, and boundary are reported.

1. Inventory Information (14.1.1)
  - a. Product name and description.
  - b. Goal of inventory.
  - c. Product rules or guidance that influenced boundary set methodology choice, allocation procedures, data collection sources, and software system used.
2. Scope (14.1.2)
  - a. Unit of analysis and reference flow.
  - b. Flow diagram.
3. Boundary of Inventory (14.1.3)
  - a. Assumptions made.
  - b. Methodology choice (i.e. Cradle to Gate, Use, End-of-Life, Cradle to Grave).

4. Allocation Method (14.1.4)
5. Data Information Used (14.1.6)
  - a. Primary data (% of total emissions).
  - b. Secondary data (% of total emissions).
  - c. Sources.
6. Inventory Results (14.1.7)
  - a. Total CO<sub>2</sub>e per unit of analysis.
  - b. Percent of total CO<sub>2</sub>e attributed to each life cycle stage (if applicable).
  - c. Global warming potential metric(s) used and description of the source.
7. Use of Results
  - a. Describe the significance of inventory results.
  - b. How will it be used to educate internal or external stakeholders appropriately?

## 5.5 ADDRESSING EMBODIED ENERGY USE WITH OFFSETS OR OTHER PROJECTS

### Standard Requirement

At least 5% of the embodied energy associated with the product from Cradle to Gate is covered by offsets or otherwise addressed (e.g., through projects with suppliers, product re-design, savings during the use phase, etc.).

### Applicable Levels of Certification

This requirement applies to the Platinum level only.

### Intent

The intent of this requirement is to begin to address embodied energy impacts of production that occur upstream of final manufacture, as these impacts may be significant sources of emissions.

### Methods

1. It is necessary to first estimate embodied energy from Cradle to Gate, as described in Section 5.4.
2. The most likely method of managing embodied energy emissions is through the purchase of offsets. Other project types that will be considered for this requirement include, but are not limited to, projects with suppliers, product re-design, and savings during the use phase.

### Required Documentation

1. Supporting documentation showing how total emissions were calculated (see the Required Documentation section in Section 5.4).
2. If carbon offsets are used, quantity of offsets purchased, name of offset registry and project, receipt of purchase, and certificate from the issuing body.
3. For project types other than offset purchase, documentation clearly showing reductions or sequestration should be provided.





# 6 WATER STEWARDSHIP

## Treating Clean Water as a Valuable Resource and Fundamental Human Right

Water stewardship creates awareness and drive towards the treatment of water as a valuable resource by encouraging effective management and use strategies. Every product manufacturer has an important responsibility to care for this vital resource, and would be wise to effectively manage water resources. These goals are addressed within the program by encouraging an understanding of, and responsibility for, water withdrawals, consumption, and releases within local ecosystem(s), and awarding innovation in the areas of conservation, quality, and social fairness.

lists each unique requirement within the Water Stewardship category. To achieve a given level, the requirements at all lower levels must be met as well. The sections to follow will provide interpretation and suggested methods for achievement.

Table 9 Water Stewardship Requirements

LEVEL	ACHIEVEMENT
<b>BASIC</b>	The manufacturer has not received a significant violation of their discharge permit within the last two years.
	Local- and business-specific water-related issues are characterized (e.g., the manufacturer will determine if water scarcity is an issue and/or if sensitive ecosystems are at risk due to direct operations).
	A statement of water stewardship intentions describing what action is being taken for mitigating the identified problems and concerns is provided. At re-application, progress on action plans is demonstrated.
<b>BRONZE</b>	A facility-wide water audit is completed.
<b>SILVER</b>	Product-related process chemicals in effluent are characterized and assessed.  OR
	Supply chain-relevant water issues for at least 20% of Tier 1 suppliers are characterized and a positive impact strategy is developed (required for facilities with no product-relevant effluent).
<b>GOLD</b>	Product-related process chemicals in effluent are optimized (chemicals identified as problematic are kept flowing in systems of nutrient recovery; effluents leaving facility do not contain chemicals assessed as problematic).  OR
	Demonstrated progress on the strategy developed for the Silver level requirements (required for facilities with no product relevant effluent).
<b>PLATINUM</b>	All water leaving the manufacturing facility meets drinking water quality standards.

## 6.1 REGULATORY COMPLIANCE FOR EFFLUENT

### Standard Requirement

The manufacturer has not received a significant violation of their discharge permit related to the final manufacturing stage of the applicant product within the last two years.

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to ensure, to the extent possible, that the product-relevant effluent discharged by manufacturing facilities does not degrade surface waters.

### Methods

1. If the applicant is subject to well-developed and enforced regulations pertaining to effluent quality, the requirement is fulfilled if their facility has not received a significant violation of their discharge permit (related to the applicant product's manufacture) within the last two years (provided appropriate documentation is provided; see below). In the U.S., a manufacturer must not have been in "Significant Noncompliance" as defined in Title 40 Part 403.8(f) (2) (viii) of the U.S. Code of Federal Regulations, unless the violation was administrative. In other countries, the manufacturer must be in compliance with the equivalent regulation applicable to industrial or manufacturing facilities.
2. If there are no local regulatory requirements or regulations are poorly enforced, and the applicant's facilities discharge either process or sanitary effluent to surface waters, the applicant must develop an effluent management system, including analytical testing protocols, to meet contaminant threshold requirements specific to their business. The management system should be in place and within developed threshold compliance prior to certification.

### Required Documentation

The following information must be provided to the assessor:

1. A qualitative description of how effluent is managed.
2. If applicable, a signed statement from the applicant stating that the facility or facilities at which the product is manufactured are subject to well-developed and enforced regulations pertaining to effluent quality and have not been subject to any significant product-relevant discharge violations in the past two years. If a significant discharge violation has occurred in the past two years at any final manufacturing stage facility, the applicant must demonstrate that it was due to processes unrelated to the final manufacture of the applicant product(s). This will require additional work to first document the reason for the violation, and then trace the source of that problem to show it was unrelated to the applicant product.
3. The required documentation to demonstrate regulatory compliance must be submitted with each application for certification, including recertifications. Note that an exception to this requirement is granted if the applicant provided a compliance statement to the assessor within the last 90 days (e.g., with a certification application for a different product manufactured at the same site).

If the final manufacturing stage of a product occurs at more than one facility, a regulatory compliance statement for each facility is required for certification. A single manufacturing site not meeting the requirement will result in the requirement not being met for the product applying for certification.

If the applicant is required to obtain permits and conduct periodic testing of effluent, the following may assist in determining if well-developed and enforced regulations pertaining to effluent cleanliness are in place:

- a. Results of any required tests for biological oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), total suspended solids (TSS), ammonia as N, temperature, and pH.
  - b. A list of all chemicals known to be released to the biosphere via effluent discharges by chemical name and Chemical Abstract Service Registry Number (CAS #), including maximum and average allowable release limits by concentration and mass. The assumption is that this list will primarily, if not only, represent chemicals that are declared and tracked under existing permitting processes.
  - c. Reasons for the presence of the contaminants, an indication of which contaminants are currently covered by any required permits, and which discharges must be remediated prior to release to the publicly owned treatment works (POTW) or open water.
  - d. A description of any pre-treatment methods used to manage these contaminants.
  - e. A description of the analytical testing performed on water discharges that is required or conducted on a voluntary basis, including sample collection methods and analytic test methods for each contaminant.
  - f. An indication of which effluent chemicals are related to production of the applicant product or products.
3. If untreated or unregulated process and/or sanitary water is released to open water, the applicant is required to develop an effluent management system prior to certification. Required documentation includes a description of the rationale behind the plan, the reasons for selecting particular contaminants of concern, complete analytical testing protocols used to meet contaminant thresholds, and references indicating the basis for the plan, so that the plan's comprehensiveness and effectiveness can be evaluated by the assessor.

## 6.2 LOCAL AND BUSINESS-SPECIFIC WATER ISSUES

### Standard Requirement

Local and business-specific water-related issues are characterized (e.g., the manufacturer will determine if water scarcity is an issue and/or if sensitive ecosystems are at risk due to direct operations).

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to assist the manufacturer with understanding the water-related issues near their facility and encouraging them to consider their potential impact on these issues.

## Methods

1. Identify the watershed, drainage basin, or catchment in which relevant facilities are located, and list the major demands and stressors on water sources within the catchment (e.g., industrial, agriculture, ecosystems, municipal). Suggested references for finding this information include U.S. EPA Surf Your Watershed, World Business Council for Sustainable Development (WBCSD) Global Water Tool, and local governmental and non-governmental organizations focusing on water.
2. Determine if relevant facilities are located in areas where water resources are scarce or stressed. Suggested references include the WBCSD Global Water Tool and scarcity/stress categories therein and UN Aquastat.
3. Determine if relevant facilities are located in areas where significant portions of the population (i.e., greater than 10%) do not have access to fresh or clean water and improved sanitation. Suggested references for finding this information include the WBCSD Global Water Tool and access categories therein, UN Aquastat, WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, and the Social Hotspots Database.
4. Determine if relevant facilities are adjacent to impaired waterways, endangered wetlands, or water bodies seriously impacted by eutrophication (i.e., a process where water bodies receive excess nutrients that stimulate excessive plant growth). Suggested references for this information include the U.S. EPA list of impaired waterways, WRI interactive global map of eutrophication and hypoxia, and Ramsar Listed wetlands.
5. Describe any additional water-related issues that are relevant to the applicant's industry, business, or location and are not covered above. This should include both direct and indirect impacts, such as problems with POTW overflow or specific effluent quality issues relevant to the industry. References for this information include local government and non-governmental organizations focusing on water, and industry associations.

## Required Documentation

The information listed below, including the data sources used, must be provided to the assessor. Include ratings where applicable (e.g., the Global Water tool provides red to green ratings for access to improved sanitation). The Global Water Tool may be provided as supporting documentation.

1. Watershed or catchment name.
2. Major water sources within the catchment.
3. Major demands on sources.
4. Scarcity/stress level.
5. Access to improved water (% of population) and risk category (SHdb) or rating (WBCSD).
6. Access to improved sanitation (% of population) and risk category (SHdb) or rating (WBCSD).
7. Impaired waterway, endangered wetland, or water bodies impacted by eutrophication, if any.
8. Other issues.

## 6.3 WATER STEWARDSHIP INTENTIONS

### Standard Requirement

A statement of water stewardship intentions describing actions being taken for mitigating identified problems and concerns is provided. At re-application, progress on any action plans is demonstrated.

Note: the “identified problems and concerns” mentioned here are those identified in the section above covering Local and Business-Specific Water Issues.

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to challenge manufacturers to develop an innovative plan for mitigating the water-related issues previously identified.

### Methods

The following must be provided to the assessor for each local and business-specific water issue identified:

1. A description of what is already being done toward mitigating the identified issue.
2. An action plan for how each issue will be addressed in the future, including:
  - a. A statement of intent and commitment.
  - b. Measurable goals and timeline.
  - c. A plan to address high or very high risk/opportunity categories (Social Hotspot Database) and red ratings (WBCSD Global Water Tool).
3. At re-application, a report on progress made against the action plan(s) developed at the initial certification. Progress on the plan(s) is required if local and business-specific issues that had not already been fully addressed were identified at the initial certification.

### Required Documentation

Provide a strategy outline and narrative addressing the points listed above.

At re-application, provide the original plan and report progress on each individual action item.

## 6.4 WATER AUDIT

### Standard Requirement

A facility-wide water audit is completed.

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to assist manufacturers with understanding the amount of water used to manufacture the product and identifying opportunities for reduction in use.

### Methods

Conduct a facility-wide water audit that includes the following information:

1. Total withdrawals by source, including water body type and name. Include all direct withdrawals and purchased municipal water. Be sure to include all water inputs, including those used in support of the

facility (e.g., landscaping, sanitary use). Report each input and withdrawal in units of total volume per year. If possible, identify the ultimate sources of purchased municipal water.

2. Rainwater collection systems (total annual volume and percentage of total withdrawals).
3. Water recycling and reclamation systems (total annual volume and percentage of total withdrawals).
4. Quantification of effluent discharge into receiving water body or POTW.
5. Flow diagram illustrating facility inputs and outputs.
6. Total consumption per year due to evaporation and/or incorporation into the product.

Consumption = Total Withdrawals – Total Discharge (include units/year)

Consumption includes all water that evaporates during production processes, is incorporated into products, or is not returned to the source catchment.

7. Detail regarding use (e.g., process, cooling, landscaping, sanitary, etc.). A breakdown by specific use within the facility is not required, although it is encouraged.
8. **Optional** - Identification of areas in which water of lower quality could be used, with the goal of increasing recycling, is encouraged.
9. **Optional** - Allocate facility-level data to the applicant product or products using the most appropriate method. For example, if products are of similar weight across SKUs, a weight allocation is appropriate. If products are not of similar weight across SKUs, product value or volume may be appropriate. Indicate the method used to allocate water use to the production of the applicant product.

Useful references for obtaining the above information include the WBCSD Global Water Tool, GEMI, Carbon Disclosure Project – Water, and GRI water indicators.

### Required Documentation

Provide facility-level data as outlined above for the most recent calendar or fiscal year. If the product is produced in multiple facilities, including contract manufacturing facilities, provide data separately for each facility. An applicant must work with their accredited assessment body to obtain the appropriate template for conducting the water audit. Many of the required data fields are also contained within the WBCSD Global Water Tool. A completed WBCSD workbook may be provided as backup documentation.

Add rows to the table if relevant source and receiving water bodies are not included. For example, if water is withdrawn and/or discharged to more than one surface water body, add an additional row and collect data for each water body separately. The addition of rows to break out totals by use (e.g., process, cooling, etc.) may also be useful. It may be preferable to transfer the table into an Excel spreadsheet so that calculations can be automated.

## 6.5 CHARACTERIZING AND ASSESSING PRODUCT-RELATED PROCESS CHEMICALS IN EFFLUENT

### Standard Requirement

Product-related process chemicals in effluent are characterized and assessed, or product-related process chemicals are not discharged to water systems because wastewater is kept flowing in systems of nutrient recovery.

## Applicable Levels of Certification

This requirement applies to the Silver level of certification and above (Silver, Gold, and Platinum) and is one of two options at the Silver level. To reach the Silver level or higher, applicants with product-relevant wastewater must pursue this requirement, with two exceptions: (1) If water is only used to rinse the product, and product residue is not expected in the effluent, or (2) If product-relevant wastewater is produced, but no effluent is discharged from the facility, because any waste is shipped and treated as chemical waste off site. In these two cases, the applicant may choose whether to characterize and assess product-related process effluent chemicals as described here or whether to pursue the supply chain-related water requirements (Sections 6.6 & 6.8) instead. Note that this requirement partially fulfills the Platinum requirement for Material Health.

## Intent

The intent of this requirement is not to require analytical testing beyond what is required by a manufacturer's regulatory permit or to identify all chemicals present in the effluent. The intent is for a manufacturer to understand the chemicals used in the manufacturing process and their potential concentrations in effluent. The requirement does not apply to chemicals in the influent to the manufacturing facility.

## Methods

1. Determine whether a closed-loop water recycling system is in place and there is therefore no product-relevant effluent leaving the facility. If wastewater would have ordinarily been discharged to water systems without this water recycling system, no further assessment or optimization of process chemicals is necessary. If there is product-relevant effluent leaving the facility, proceed to item 2.
2. Identify the process chemicals used in the final manufacturing stage of the applicant product that are potentially entering effluent leaving the manufacturing facility through the process water, cooling system, input materials, and pipes by chemical name and CAS #. Process chemicals are defined in the Terms and Definitions section. At a minimum, include chemicals that are known or expected to be introduced into water intentionally or unintentionally. If chemical substances that are also part of the finished product are expected to be present in the effluent, these substances also need to be assessed as part of this requirement. It is not expected that analytical testing beyond what is already required for regulatory purposes will be conducted. If the facility has its own wastewater treatment system, the effluent subject to review is the effluent post-treatment, prior to any off-site treatment (e.g., by a municipal wastewater treatment facility). If the final manufacturing stage of a product occurs at more than one facility, chemicals in the effluent must be identified and assessed at each facility.
3. Determine the single chemical risk rating for all chemicals identified in #1 above as described in the *C2C Material Health Assessment Methodology*. The assessment is to be conducted on the primary hydrolyzed or reacted form of the parent chemical that would appear in the effluent.
4. Use the information above to create an effluent optimization plan including measurable goals, timeline, and budget. Detail the actions to be taken to either phase out each x-assessed chemical or keep it sequestered in nutrient recovery systems. The applicant may also wish to include plans to optimize c chemicals to b or a; however, if all chemicals are assessed as c or above, the applicant has already met the effluent optimization requirement for the Gold level (see Section 6.7).

## Required Documentation

The following information is required:

1. In the case of a closed-loop water recycling system: A description of the system, confirmation that no product-relevant effluent leaves the facility, and confirmation that wastewater captured by the recycling system would have ordinarily been discharged to water systems. In this case, ignore items 2-6 below.
2. If product-relevant effluent leaves the facility: A list of the chemicals identified in the first step of the Methods section above, including name and CAS #.
3. For each chemical, identify the point in the manufacturing process at which the chemical is likely entering effluent (e.g., used in the process water or cooling system, or are input materials at a particular point in the manufacturing process).
4. Identify the single chemical risk rating (as a, b, c, or x) for each chemical identified. The single chemical risk rating considers the chemical's hazards and exposure to the chemical via the effluent. GREY single chemical risk ratings are permissible if the GREY rating is due to missing toxicity data rather than missing formulation information.
5. A description of the current management strategy, if any, and its effectiveness.
6. An optimization plan including the elements listed in the Methods section above.

## 6.6 SUPPLY CHAIN WATER ISSUES AND STRATEGY

### Standard Requirement

Supply chain-relevant water issues for at least 20% of the total number of Tier 1 suppliers are characterized and a positive impact strategy is developed (required for facilities with no product-relevant effluent).

### Applicable Levels of Certification

This requirement applies to the Silver level of certification and above (Silver, Gold, and Platinum) and is one of two options at the Silver level.

### Intent

The intent of this requirement is to assist the manufacturer with understanding water-related issues in the supply chain and to challenge them to develop an innovative strategy for positively impacting the issues identified.

### Methods

1. To fulfill the water issues characterization part of the requirement, the applicant can perform one or more of the following for at least 20% of the total number of Tier 1 suppliers: (1) characterize the local and business-specific water issues identified in Section 6.2; (2) characterize and quantify water use; and/or (3) determine whether or not a significant violation of their discharge permit has been received within the last two years. This requirement applies regardless of whether or not the Tier 1 suppliers use any process water.
  - a. Local and business-specific water issues – follow the methods used in Section 6.2.



- b. Characterize and quantify water use – characterize and quantify water use and/or discharge to water attributable to the product using primary and/or available secondary data. Follow the methods used in Section 6.4.
  - c. Determine whether or not a significant violation of their discharge permit has been received within the last two years – follow the methods used in Section 6.1.
2. Develop a positive impact strategy based on the issues identified, including quantitative targets, a timeline, and budget. Example strategies include working with the supply chain to effectively manage water use, particularly for water input and impact intensive materials, consideration of supplier’s local water issues as a part of purchasing decisions, and material substitution. A positive impact strategy is required from the applicant regardless of whether any issues are identified during the supply chain water issues characterization. The strategy may include a plan to fulfill more of the investigation options for the same suppliers and/or a plan to increase the percentage of Tier 1 suppliers for which the investigation is conducted over time.

### Required Documentation

1. For characterization of local and business-specific water issues, follow the “Required Documentation” in Section 6.2.
2. For characterization of the quantity of water use, provide a report detailing the methods used, the results, and data sources. Follow the “Required Documentation” in Section 6.4. Describe the significance of the results.
3. For determination of whether or not a significant violation of a supplier’s discharge permit has been received within the last two years, follow the “Required Documentation” in Section 6.1.
4. Provide a positive impact strategy as follows for each option:
  - a. For local and business-specific water issues, follow the “Required Documentation” listed in Section 6.3.
  - b. For characterization of the quantity of water use, include a description of the strategy, quantitative targets, a timeline, and budget.
  - c. For determination of whether or not a significant violation of a supplier’s discharge permit has been received within the last two years, include a description of the strategy, quantitative targets, a timeline, and budget.

## 6.7 OPTIMIZING PROCESS-RELATED CHEMICALS IN EFFLUENT

### Standard Requirement

Process-related chemicals in effluent are optimized. Chemicals identified as problematic are kept flowing in systems of nutrient recovery, and effluents leaving the facility do not contain chemicals assessed as problematic.

### Applicable Levels of Certification

This requirement applies to the Gold level of certification and above (Gold and Platinum) and is one of two options at the Gold level. Note that this requirement partially fulfills the Platinum-level requirement for Material Health.

### Intent

The intent of this requirement is to ensure that chemicals used in the product manufacturing process do not adversely impact human or environmental health.

### Methods

See Section 6.5 for methods. "Optimized" in this case is defined as effluent containing only process-related chemicals that have single chemical risk ratings of a, b, or c (no x or GREY chemicals). See Section 6.5 of this document for more information. The applicable chemicals are those identified in Section 6.5 and any additional process-related chemicals that are currently used in the manufacturing process and are likely to be present in effluent, but that were not previously identified when effluent was initially characterized.

### Required Documentation

The documentation required is the same as the documentation required in Section 6.5, with the exception of an optimization plan, which is not required.

## 6.8 ADDRESSING SUPPLY CHAIN WATER ISSUES

### Standard Requirement

Demonstrated progress on the strategy developed for addressing supply chain-relevant water issues at the Silver level (required for facilities with no product-relevant effluent).

### Applicable Levels of Certification

This requirement applies to the Gold level of certification and above (Gold and Platinum) and is one of two options at the Gold level.

### Intent

The intent of this requirement is to challenge manufacturers to positively impact water issues in their supply chain.

### Methods

Demonstrate progress made against the impact strategy/plan developed for the Silver-level requirement (see Section 6.6).

### Required Documentation

Provide the original strategy/plan and report progress on each individual action item.

## 6.9 DRINKING WATER QUALITY

### Standard Requirement

All water leaving the manufacturing facility meets drinking water quality standards.

### Applicable Levels of Certification

This requirement applies to the Platinum level of certification only.

## Intent

The intent of this requirement is to ensure, to the extent possible, that water leaving the manufacturing facility is safe for drinking.

## Methods

1. Identify all process-related chemicals potentially entering effluent through the process water, cooling system, input materials, and pipes as a result of the product manufacturing process by chemical name and CAS # (use same method described in Section 6.5).
2. Determine the single chemical risk rating for all chemicals identified in #1 above as described in the *Cradle to Cradle Certified™ Material Health Assessment Methodology*. The assessment is to be conducted on the primary hydrolyzed or reacted form of the parent chemical that would appear in the effluent.
3. All chemicals must have single chemical risk ratings of a, b, or c (no x or GREY) in order to fulfill this requirement.
4. Gather documentation detailing local drinking water standards and conduct analytical testing to demonstrate compliance to those standards. Such standards should be at least as rigorous as the most recent international standard set by the World Health Organization.

## Required Documentation

The following information is required:

1. A list of the chemicals identified in the first step of the Methods section above, including name and CAS #.
2. For each chemical, identify the point in the manufacturing process at which the chemical is likely entering effluent (e.g., used in process water or cooling system, or are input materials at a particular point in the manufacturing process).
3. Provide the single chemical risk rating for each chemical identified (must be a, b, or c).
4. Provide documentation on local drinking water standards.
5. Provide a description of the analytical test methods used, test results, and testing laboratory name and contact information.

# 7 SOCIAL FAIRNESS

## Positive Support for Social Systems

Social Fairness ensures that progress is made towards sustaining business operations that protect the value chain and contribute to all stakeholder interests, including employees, customers, community members, and the environment. It is important for business ethics to go beyond the confines of the corporate office and permeate the supply chain, engaging it in responsible manufacturing, enforcing fair treatment of workers, and reinvesting in natural capital.

Table 10 highlights each unique requirement within the Social Fairness category across all levels. In general, to achieve a given level, the requirements at all lower levels are to be met as well. The sections to follow will provide interpretation and suggested methods for achievement.

Table 10 Social Fairness Requirements

LEVEL	ACHIEVEMENT
<b>BASIC</b>	A streamlined self-audit is conducted to assess protection of fundamental human rights.  Management procedures aiming to address any identified issues are provided. Demonstration of progress on the management plan is required for re-application.
<b>BRONZE</b>	A full social responsibility self-audit is complete and a positive impact strategy is developed (based on UN Global Compact Tool or B-Corp).
<b>SILVER</b>	COMPLETE ONE OF THE FOLLOWING:  Material-specific and/or issue-related audit or certification relevant to a minimum of 25% of the product material by weight is complete (FSC Certified, Fair Trade, etc.).  OR  Supply chain-relevant social issues are fully investigated and a positive impact strategy is developed.  OR  The company is actively conducting an innovative social project that positively impacts employees' lives, the local community, global community, social aspects of the product's supply chain, or recycling/reuse.
<b>GOLD</b>	Two of the Silver-level requirements are complete.
<b>PLATINUM</b>	A facility-level audit is completed by a third party against an internationally recognized social responsibility program (e.g., SA8000 standard or B-Corp).  All Silver-level requirements are complete.

## 7.1 STREAMLINED SELF-AUDIT

### Standard Requirement

A streamlined self-audit is conducted to assess protection of fundamental human rights.

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to determine if any final manufacturing facilities, contract manufacturing facilities, or tier one supplier facilities are operating in countries and/or industries identified as having high or very high potential for issues with any of the following themes, per the Social Hotspots database (<http://socialhotspot.org/>):

1. Child labor.
2. Forced labor.
3. Excessive work time.
4. Provision of a living wage.
5. Worker health and safety.
6. Wage Assessment; Issue: Potential of Average wage being < non-poverty guideline.
7. Accidents and death in workplace.
8. Toxicity or chemical exposure in workplace (if data are available).

### Methods

1. List final manufacturing and tier one facilities relevant to the product by name, location (i.e., country), and industry sector if available. Note that this has likely already been completed for the Material Health requirements. Commodity-type materials purchased from many and frequently changing locations, such as fasteners or other hardware and post-consumer recycled content paper and pulp, may be excluded.
2. Determine risk or opportunity level (as defined by the Social Hotspots database (SHdb); <http://socialhotspot.org>) for each location and/or sector. The SHdb is highly recommended for fulfilling this requirement because it contains both country and industry sector-specific information for each issue that needs to be addressed. Once a SHdb account is active, view the themes listed above within the category "Labor Rights & Decent Work" and determine the appropriate risk/opportunity levels. If SHdb provides a risk rating for the applicable industry sector, report that preferentially to the overall country rating. If not, refer to the additional references provided below to explore the applicability of the risk or opportunity level to specific industry sector(s) (although this is not required).

Alternative references for exploring the applicability of the risk or opportunity level to specific industry sector(s) may be used. Recommendations include UNICEF, U.S. Department of Labor, List of Goods Produced by Child Labor (U.S. Dept. of Labor, 2009), International Labour Organization

(ILO) country reports, World Bank poverty data, UN Human Development reports, U.S. Department of State Human Rights reports, sweatfree.org non-poverty wages, the U.S. Bureau of Labor Statistics, AFL-CIO, International Trade Union Confederation country profiles, and the World Health Organization.

Regardless of the information source used, how the required information was identified for each issue needs to be specified. In the SHDB, the risk themes listed may not correspond directly to the issues listed in the requirement. The applicant must work with their assessor to select the most relevant categories and risk themes for their operations in each region.

A company that has received SA8000 certification or is a certified B Corporation will still need to fulfill the self-audit requirement for the Basic level and may have to do additional work for other social fairness requirements depending on the work conducted to receive the certification. Applicants will need to work with their assessor to determine which additional steps beyond the facility-level, third party audit are required.

### Required Documentation

An applicant must work with their accredited assessment body to obtain the appropriate template for conducting the streamlined self-audit.

## 7.2 MANAGEMENT PROCEDURES TO ADDRESS HIGH RISK ISSUES AND OPPORTUNITIES

### Standard Requirement

Management procedures aiming to address any high or very high risk or opportunity issues that were identified in the streamlined self-audit are provided. Demonstration of progress against the management plan is required for re-application.

### Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is to develop a plan for addressing the high or very high risk or opportunity issues that were identified in the streamlined self-audit in an effort to protect basic human rights of workers within the company's supply chain.

### Methods

1. Were any final manufacturing or tier one facilities identified as having high or very high risk or opportunity upon conducting the streamlined self-audit? If yes, please continue to the next question. If not, no further action is required (i.e., the requirement to provide or develop management procedures does not apply).
2. Do those facilities identified as having high or very high risk or opportunity provide  $\leq 1\%$  of the value of the product combined? If yes, no further action is required (i.e., the requirement to provide or

develop management procedures does not apply). If no (i.e., facilities provide >1%), please continue as stated below.

3. If required (see #2 above), provide one of the following:
  - a. Existing audit, remediation, and management procedures designed to identify and protect basic human rights of workers within the company's supply chain.OR
  - b. A proposed plan for monitoring and addressing potential issues if the applicant does not have an existing audit and management process.
4. At a minimum, the management procedures must include a draft supply chain code of conduct to be integrated into supplier contracts, that prohibits child and forced labor, requires that a living wage be paid, and allows for unannounced audits. Child labor and living wage are to be defined according to the ILO and UN. Ideally, the plan will include all major points of the UN Declaration of Human Rights, UN Global Compact, and the ILO Core Conventions and Recommendations.
5. In cases where the final manufacturing facility (including contract manufacturing) is of high or very high risk or opportunity, management and self-auditing procedures must also be documented and provided. A third party audit according to SA8000 is a preferred alternative in this case (which would fulfill one Platinum-level requirement).
6. At re-application, a listing of actions taken in carrying out the plan since the initial certification or prior renewal is to be compiled. Examples of the type of information to include are monitoring activities that have been carried out and where they were carried out, identification of new or recurring issues, and results of any self-audits.

### Required Documentation

The following information must be provided to the assessor:

1. If applicable, a signed statement indicating that the final manufacturing and tier-one facilities identified as having high or very high risk or opportunity provide  $\leq 1\%$  of the value of the product combined (as described in the Methods section above).
2. A list of facilities included in the plan/procedures, if required.
3. Management plan and procedures, if required. Include self-audit procedure where final manufacturing facility or contract facility is of high or very high risk/opportunity.
4. Example of applicant's supplier contract with integrated code of conduct.
5. Social responsibility report, if available.
6. A list of actions taken and results/findings since initial certification or prior re-application (see Methods).

## 7.3 FULL SELF-AUDIT

### Standard Requirement

A full social responsibility self-audit is complete and a positive impact strategy is developed (based on UN Global Compact Tool or B-Corp).

### Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

### Intent

The intent of this requirement is for the applicant to continue to gather data about the social impacts of the final manufacturing process.

### Methods

1. Conduct a social responsibility self-audit using the UN Global Compact Self-Assessment Tool (<http://www.globalcompactselfassessment.org/>) or B Impact Assessment. If the final manufacturing or contract manufacturing facility is found to be located in areas with high or very high potential for fundamental human rights issues (as required to be identified at the Basic level), it is recommended that the UN tool be employed.
2. Develop a positive impact strategy based on audit results, including a statement of intent and commitment, measurable goals, and timeline. If using the UN Global Compact Tool, include items in the strategy where answers are NO.

### Required Documentation

The following information must be provided to the assessor:

1. The UN Global Compact (Excel spreadsheet) or B Corp survey results.
2. The impact strategy, including those points listed in the Methods section above.

## 7.4 MATERIAL-SPECIFIC OR ISSUE-SPECIFIC AUDIT

### Standard Requirement

Material-specific and/or issue-related audit or certification relevant to a minimum of 25% of the product material by weight is complete (e.g., FSC Certified, Fair Trade, etc.).

### Applicable Levels of Certification

This requirement applies to the Silver, Gold, or Platinum levels of certification.

### Intent

The intent of this requirement is to encourage the use of materials that are produced and managed to high environmental and social standards.

### Methods

1. Material- or supplier-specific certifications must apply to a minimum of 25% of the product material(s) by weight. However, if the certifying body has its own requirements, those will take precedence.
2. Input materials or manufacturers of input materials are certified and/or verified compliant (as appropriate) by an external party according to one or more of the following pre-approved programs:
  - B Corporation



- Blue Angel (when human rights issues are addressed as part of the Standard, such as in RAL-UZ 154 Textile)
- Business Social Compliance Initiative (BSCI) code of conduct
- CarbonNeutral product certification
- Certified Organic (US Department of Agriculture or Quality Assurance International)
- Conflict-free (third-party verified)
- Cotton made in Africa
- Cradle to Cradle Certified
- Electronic Industry Citizenship Coalition (EICC) code of best practice
- Ethical Trading Initiative base code
- Fair for Life
- FairTrade
- Forest Stewardship Council (FSC) Forest Management & Chain of Custody
- Global Organic Textile Standard (GOTS)
- Global Social Compliance Programme Reference Code
- Initiative Clause Sociale (ICS)
- International Council of Toy Industries (ICTI) code of business conduct
- ISCC PLUS
- Leaping Bunny
- Nordic Swan/Nordic Ecolabel for Textiles, hides/skins and leather
- NSF/ANSI 336 Sustainability Assessment for Commercial Furnishings Fabric
- Oeko-Tex Standard 1000 or 100plus
- Responsible Source - Scientific Certification Systems (SCS)
- RSPO Certified Sustainable Palm Oil tracked through the Identity Preserved, Segregated, or Mass Balance supply chain certification systems
- SA8000
- UTZ Certified
- Worldwide Responsible Accredited Production (WRAP)

Pre-approved programs are primarily, with some exceptions, those that are:

1. Focused on fundamental human rights issues, in particular fair labor practices, or on animal rights issues, or
2. Multi-attribute programs that address fair labor practices along with other issues (with social criteria relevant to fundamental human rights, in particular labor practices, required).

Programs that apply only to final consumer products as opposed to potential input materials may fit into the categories above but have not been included because such programs will not likely be relevant to product input materials and/or suppliers as required for this criterion.

The eco-label and verification/auditing environment continues to evolve and additional programs may apply as they become available. Assessors may request an addition to the list by providing C2CPII ([certification@c2ccertified.org](mailto:certification@c2ccertified.org)) with the name of the proposed program and the following details:

- a. A summary of the program and how it addresses fundamental human rights and other social fairness issues;
  - b. A list of any ecolabels/standards (other than C2C) or government programs that reward for use of materials certified under the program; and
  - c. A summary of any major criticism the program has received from NGOs or governments.
3. Certifications are to be current (unexpired). Audits against programs that do not have expiration dates are eligible if they have been completed within the last three years.
  4. Water weight may be excluded from the product weight when calculating the weight fraction of materials with material-specific and/or issue-related certifications/audits.

### Required Documentation

The following information must be provided to the assessor:

1. A copy of the certification certificate or similar, signed and dated by the certifying or verifying body.
2. Calculations within the original Bill of Material (used for complying with the Material Health category requirements) showing that at least 25% of the product by weight is covered by the audit or certification.

## 7.5 SUPPLY CHAIN SOCIAL ISSUES AND IMPACT STRATEGY

### Standard Requirement

Supply chain-relevant social issues are fully investigated and a positive impact strategy is developed.

### Applicable Levels of Certification

This requirement applies to the Silver, Gold, or Platinum levels of certification.

### Intent

The intent of this requirement is to challenge manufacturers to positively impact social issues throughout their supply chain.

### Methods

1. Characterize and quantify social issues throughout the supply chain attributable to the product from resource extraction to production (applicant's gate) using primary data wherever possible. At a minimum, applicants must investigate the following:
  - a) At least one relevant 'material-specific issue' related to initial resource extraction (palm oil, bauxite mining, etc.).
  - b) Tier 1 suppliers' social issues (using primary data collected from their suppliers) or social issues pertaining to all or most of their Tier 2 suppliers at the same level of rigor required at the Basic level for the Tier 1 suppliers.
2. The inventory threshold is left to the applicant to determine and define as part of the boundary and scope decision; however, it is recommended that suppliers of all materials that are 1% or more of the product's total inputs by weight be investigated. Ideally all inputs will be included to identify as many social issues associated with the product as possible.

3. If primary data are not available or accessible, knowledge of industry type, supplier location data, and available data and information relevant to those locations and industries may be used instead. The SHdb and other references listed in Section 7.1 will be useful. This requirement may be seen as a continuation of the requirements set out in Section 7.1. The methods described there may be applied to the entire supply chain.
4. Social LCA methods should be consulted.
5. Develop a positive impact strategy based on the results. Include a statement of intent and commitment, quantitative targets, timeline, and budget.

### Required Documentation

The following information must be included in a report to the assessor:

1. Inventory results.
  - a. Description of at least one relevant 'material-specific issue' related to initial resource extraction.
  - b. Description of the method used to investigate social issues among Tier 1 or Tier 2 suppliers and a summary of the issues identified.
2. Use of results.
  - a. Provide a positive impact strategy that addresses the inventory results in 1a and 1b, including those points listed in the Methods section above.

## 7.6 INNOVATIVE SOCIAL PROJECT

### Standard Requirement

The company is actively conducting an innovative social project that positively impacts employees' lives, the local community, the global community, the social aspects of the product's supply chain, or recycling/reuse.

### Applicable Levels of Certification

This requirement applies to the Silver, Gold, or Platinum levels of certification.

### Intent

The intent of the innovative social project requirement is to develop and implement a company program that positively impacts social issues and implements the Cradle to Cradle principles. The key aspect of this requirement is that the program or project is an integrated part of company strategy.

### Methods

Completion of this requirement involves the development of an innovative company program, as an integrated part of company strategy, that includes communication, education, traineeships, communities of practice, purchasing, and/or political engagement that actively supports (local, national, continental or global) implementation of the Cradle to Cradle principles.

Projects that seek to address all three Cradle to Cradle principles simultaneously are encouraged. Set social responsibility targets and initiatives in a variety of areas, and use these to strategize which innovative social projects to pursue.

The criteria provided for the requirement are broad-based to allow for the development of a wide variety of program types. Because there is a wide range in social fairness policies and practices around the world, the definition of innovative may vary.

The innovative social project can be new to the company, the country, or the world. There may be programs or activities that a company is already engaging in for compliance purposes that would fulfill this requirement; however, basic compliance is not the intent.

The following are examples of applicable goals, targets, and initiatives.

1. Increasing the diversity of the workforce.
2. Creation of programs to engage special needs groups in the local community.
3. Decreasing the wage disparity between upper management and the workforce.
4. Increasing employee involvement in positive community service activities.
5. Actively encouraging staff participation in creative Cradle to Cradle<sup>®</sup> design and research projects as an integrated part of company strategy.
6. Improvements on the positive impact on all people, places, and things that are indirectly or directly involved in the making or remaking and/or use of the products.
7. Company programs as an integrated part of company strategy that actively support the quality of life of its employees (i.e., health, satisfaction, happiness, enjoyment).
8. Development and implementation of a company-wide Cradle to Cradle “roadmap” including:
  - a. Creation of a Cradle to Cradle team with representatives in each operational unit and local markets.
  - b. The development of Cradle to Cradle tools and resources.
  - c. Company purchasing programs that actively support the purchasing of Cradle to Cradle Certified<sup>™</sup> products. This might include a public list of “approved” vendors and venues and a public statement on company purchasing.
9. Taking an active role in organizing workshops, facilitating traineeships, generating public debate, etc. This might include checklists for client-facing teams to create experiences and events that implement the use of exhibits and mobile tours based on the Cradle to Cradle principles, and/or thought leadership blogs, articles, and speakerships on Cradle to Cradle events.
10. Researching successful government or trade association sustainability programs and actively engaging in helping to support those.

### Required Documentation

A detailed description of the program or project, including goals and progress made to date, is required.

## 7.7 FACILITY-LEVEL THIRD PARTY AUDIT OR CERTIFICATION

### Standard Requirement

An internationally recognized social responsibility certification (e.g., SA8000 or B-Corp) is obtained, or a facility-level audit is completed by a third party against an internationally recognized social responsibility program.

### Applicable Levels of Certification

This requirement applies to the Platinum level of certification only.

### Intent

The intent of this requirement is to ensure that manufacturers have adopted policies and procedures that protect the basic human rights of workers.

### Methods

1. The applicant must receive certification or be audited at the facility level by a third party against an internationally recognized social responsibility program. The following programs are pre-approved:
  - a. B Corp Certification.
  - b. Business Social Compliance Initiative (BSCI) audit.
  - c. Global Social Compliance Program (GSCP) audit.
  - d. SA8000 certified (Social Accountability International).
  - e. Worldwide Responsible Apparel Production (WRAP).

Please contact an assessor or the Cradle to Cradle Products Innovation Institute regarding the applicability and approval of other audits and certifications that fulfill this requirement. At a minimum, other programs are to be internationally accepted and address child labor, forced labor, health and safety, freedom of association and collective bargaining, discrimination, discipline/harassment, working hours, and compensation.

2. Certifications are to be current (unexpired). Audits against programs that do not have expiration dates are eligible if they have been completed within the last three years.

### Required Documentation

A copy of the certification certificate or similar, signed and dated by the certifying or verifying body, is required.

# 8 CONTINUOUS IMPROVEMENT AND OPTIMIZATION

## Standard Requirement

Certification holders are required to make a good faith effort toward materials optimization at each recertification period, unless optimization is already complete or is incomplete due to technological constraints. Progress on materials optimization includes both demonstrated progress on eliminating X-assessed materials or x-assessed chemicals in those materials and work toward increasing the percentage of the product assessed as A, B, C, or X at each recertification period.

## Applicable Levels of Certification

This requirement applies to the Basic level of certification and above (Basic, Bronze, Silver, Gold, and Platinum).

## Intent

The intent of this requirement is to ensure that manufacturers are committed to making a good faith effort toward optimization of their product.

## Methods

1. If an applicant has completed their materials optimization work, or if they have reached a point where they cannot go further with materials optimization due to technology constraints, it is required that progress is made in some other program category or categories.
2. In addition to materials optimization, there are several other cases where progress on optimization strategies or plans may be required at re-application (see Table 11 below).
3. An alternative compliance pathway exists for companies that have several certified products and where it is extremely challenging to make progress on each individual product at each recertification. The continuous improvement and optimization requirement can be met by demonstrating significant optimization at the corporate level that impacts many products, but perhaps not all certified products. A clear explanation of the progress that has been made on optimization of other Cradle to Cradle Certified™ products at recertification is required in such cases.

Table 11 Progress on Optimization Strategies or Plans Required Throughout the Program

Strategy/Plan	Levels	Re-application Requirement
<b>Materials Optimization</b>	Bronze and above	Progress required at re-application unless complete or incomplete due to technology constraints.
<b>Nutrient Management</b>	Gold	No specific requirement.
<b>Renewable Energy and Carbon Management (facility level)</b>	Bronze and above	No specific requirement.
<b>Water Stewardship Intentions</b>	Basic and above	Progress may be required at re-application depending on outcome of the local and business-specific water issues investigation.
<b>Supply Chain Water Issues Strategy</b>	Silver and above	No specific requirement.
<b>Social Responsibility Management Procedures</b>	Basic and above	Progress may be required at re-application depending on outcome of the streamlined self-audit.
<b>Positive impact strategy based on Full Social Responsibility Self-Audit</b>	Bronze and above	No specific requirement.
<b>Positive impact strategy based on Supply Chain Social Issues investigation</b>	Silver and above	No specific requirement.

### Required Documentation

The original action plan or strategy and a report on the progress against each individual action item are required.

# 9 SITE VISIT OF PRODUCTION FACILITY

## Standard Requirement

A site visit of the final manufacturing facility or facilities is completed.

## Applicable Levels of Certification

This requirement applies to the Bronze level of certification and above (Bronze, Silver, Gold, and Platinum).

## Intent

The intent of the site visit is to focus on verifying the manufacturing process, the product materials, and the process chemicals used in the final manufacturing step for the finished product that is being assessed for certification. A site visit is also used by the assessment body to verify the product's bill of materials, and, to the extent possible, it serves as quality assurance that the applicant has reported accurate information. It can also be used to increase the percentage of the product that is inventoried and therefore the percentage of the product that is considered assessed (i.e., chemicals identified and evaluated for their material health following the Standard's material health assessment process). The purpose of the site visit is not to verify the specific details regarding the social fairness criteria at the facility or the supplier facilities.

## Methods

It is necessary for the assessor assisting with each project to tour the production/assembly process for the applicant product(s) to see how suppliers' components come together to make the finished product and understand some basics on process steps and process chemicals. All parts of the plant involved in the manufacturing of the applicant product(s), including raw material storage, manufacturing processes, and waste streams will need to be shown to the certification assessor. Questions may be asked about process times, process temperatures, pollution controls, and personal protective equipment. Energy use and emissions, water, and social fairness data may also be discussed and reviewed.

The assessor would like to meet with someone who can give them a tour of the manufacturing facility, the contact person at the applicant company that will be responsible for day-to-day data needs for the project, and someone with knowledge of the procurement of purchased materials that go into the product in order to discuss the project's data needs. This may be a group of people or it may be one person, depending on the company. The applicant should be prepared to discuss their manufacturing flow, including inputs and outputs. It is preferred that the applicant also have an outline of the supply chain for the applicant product(s) to review during the site visit meetings. The applicant should also have reviewed the Cradle to Cradle Certified™ application and program documents prior to the arrival of the auditors, so that they can address any questions.

A site visit is required once per product or product group at the time of initial certification. An additional site visit is required if the manufacturing process changes significantly. More than one site visit may be necessary for the same facility if applicants choose to certify multiple products over time. The product must be on the production line during the site visit in order to be valid.



A site visit is required for the main final manufacturing facility and any other facilities involved in select manufacturing processes for which exposure concerns are considered exceptionally high. These select manufacturing processes are marked with a '\*' in the [Final Manufacturing Stage Guidance](#). If there is more than one final manufacturing facility, the assessor determines which facility is the "main" facility to be visited based on which one performs the most significant manufacturing processes.

Unless the product's final manufacture involves a process marked with a '\*' in the [Final Manufacturing Stage Guidance](#), only one site visit is required, regardless of how many individual facilities are included in the final manufacturing stage. For example, if five facilities are involved in the final manufacturing stage, and none of them performs a process marked with a '\*', only one of them needs to be visited.

### Required Documentation

A statement confirming that the site visit was conducted by a representative from an accredited assessment body is required. If there is more than one final manufacturing facility, an explanation of how the assessor determined which facility is the "main" facility to be visited is also required.

## 10 CERTIFICATION DISCLAIMER

The Cradle to Cradle Products Innovation Institute warrants only that any product which has been certified as Basic, Bronze, Silver, Gold or Platinum meets the Institute's Cradle to Cradle Certified™ Product Standard criteria for such certification and except as expressly set forth herein.

- (A) The Cradle to Cradle Products Innovation Institute makes no warranty, express or implied as to any product which has been certified under the Institute's Cradle to Cradle Certified Product Standard, including any warranty as to merchantability or fitness for a particular purpose and the Institute hereby expressly disclaims all other warranties;
- (B) The Cradle to Cradle Products Innovation Institute shall not be liable for any loss, injury, claim, liability, or damage of any kind resulting in any way from any errors, omissions, content, information, opinions or assessments contained in the Institute's Cradle to Cradle Certified Product Standard; and,
- (C) The Cradle to Cradle Products Innovation Institute shall not be liable, in any event, for any incidental, consequential, special, exemplary or punitive damages (including without limitation for lost data, lost profits or loss of goodwill) of any kind or nature arising out of the certification of any product under the Institute's Cradle to Cradle Certified Product Standard, whether such a liability is asserted on the basis of contract, tort, or otherwise, even if the Institute has been made aware of the possibility of such loss or damage in advance.

# 11 ACRONYMS

<b>ABS</b>	acrylonitrile butadiene styrene
<b>BBP</b>	benzyl butyl phthalate
<b>BOD</b>	Biological oxygen demand
<b>BOF</b>	basic oxygen furnace
<b>BSCI</b>	Business Social Compliance Initiative
<b>CAS</b>	Chemical Abstract Service
<b>CMR</b>	carcinogenic, mutagenic, or reproductively toxic
<b>CO<sub>2</sub></b>	carbon dioxide
<b>COD</b>	chemical oxygen demand
<b>CONEG</b>	Coalition of Northeastern Governors
<b>COTE</b>	Committee on the Environment
<b>CPVC</b>	chlorinated Polyvinyl chloride
<b>DBP</b>	dibutyl phthalate
<b>DEHP</b>	di(2-ethylhexyl)phthalate
<b>EAF</b>	electric arc furnace
<b>EMC</b>	externally managed component
<b>EPEA</b>	Environmental Protection Encouragement Agency
<b>FSC</b>	Forestry Stewardship Council
<b>FTC</b>	Federal Trade Commission
<b>GHG</b>	greenhouse gas
<b>GSCP</b>	Global Social Compliance Program
<b>HDPE</b>	high density polyethylene
<b>IARC</b>	International Agency for Research on Cancer
<b>ICP/AES</b>	inductively coupled plasma/atomic emission spectroscopy
<b>ICP/MS</b>	inductively coupled plasma/mass spectroscopy
<b>ILO</b>	International Labour Organization
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IPS</b>	Intelligent Products System
<b>LCA</b>	life cycle assessment
<b>MBDC</b>	McDonough Braungart Design Chemistry, LLC
<b>MSDA</b>	material safety data sheets
<b>MWh</b>	megawatt hours
<b>PAHs</b>	polycyclic aromatic hydrocarbons
<b>PC</b>	polycarbonate
<b>PCP</b>	pentachlorophenol
<b>PET</b>	polyethylene terephthalate

<b>PFOA</b>	perfluorooctanoic acid
<b>PFOS</b>	perfluorooctanesulfonic acid
<b>POTW</b>	publicly owned treatment works
<b>PP</b>	polypropylene
<b>PTFE</b>	polytetrafluoroethylene
<b>PU</b>	polyurethane
<b>PVC</b>	polyvinyl chloride
<b>PVDC</b>	polyvinylidene chloride
<b>REC</b>	renewable energy credit
<b>RECs</b>	renewable energy certificates
<b>RoHS</b>	restriction of hazardous substances
<b>SCCP</b>	short chain chlorinated paraffin
<b>SHdb</b>	Social Hotspots database
<b>SKU</b>	stock keeping unit
<b>TOC</b>	total organic carbon
<b>UNCED</b>	World Urban Forum of the Rio Earth Summit
<b>U.S. EPA</b>	United States Environmental Protection Agency
<b>WBCSD</b>	World Business Council for Sustainable Development
<b>WRAP</b>	Worldwide Responsible Apparel Production
<b>XRF</b>	X-ray fluorescence

# 12 TERMS AND DEFINITIONS

TERM	DEFINITION
<b>ACRYLONITRILE BUTADIENE STYRENE</b>	A common thermoplastic.
<b>ASTM D6400-04</b>	Standard specification for compostable plastics.
<b>BIODEGRADABLE</b>	The process by which a substance or material is broken down or decomposed by microorganisms and reduced to organic or inorganic molecules which can be further utilized by living systems. Biodegradation can be aerobic, if oxygen is present, or anaerobic, if oxygen is not present. The OECD defines the appropriate testing methods for ready and inherent biodegradability. If making biodegradability claims for materials that are not commonly known to be biodegradable, testing should be done according to these (or comparable) methods.
<b>BIOLOGICAL METABOLISM</b>	The cycle in which biological nutrients flow. Any material that comes into intentional or likely unintentional contact with the biological metabolism should be designed to safely come into contact with living organisms.
<b>BIOLOGICAL NUTRIENT</b>	<p>A product usable by defined living organisms to carry on life processes such as growth, cell division, synthesis of carbohydrates, energy management, and other complex functions. Any material emanating from product consumption that comes into intentional or likely unintentional and uncontrolled contact with biological systems is assessed for its capacity to support their metabolism. Metabolic pathways consist of catabolism (degradation, decrease in complexity) and anabolism (construction, increase in complexity), both occurring generally in a coupled manner. The status of products as a biological nutrient (or source of nutrients) depends on the biological systems that meet them. They can be more or less complex along the following organizational hierarchy:</p> <ul style="list-style-type: none"> <li>• Organisms (nutrients for predators)</li> <li>• Organic macromolecules (and combinations thereof) (nutrients for fungi, microorganisms, vegetarian animals; oral, dermal or olfactory nutrients)</li> <li>• Minerals (nutrients for autotrophic plants)</li> </ul> <p>Generally, products as biological nutrients fit in with the two last levels.</p>
<b>BIOMASS</b>	Organic, non-fossil material that is available on a renewable basis. Biomass includes all biological organisms, dead or alive, and their metabolic by-products that have not been transformed by geological processes into substances such as coal or petroleum. Examples of biomass are forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, and some municipal and industrial wastes.
<b>CA PROPOSITION 65</b>	A list of substances known by the state of California to cause cancer or reproductive harm.
<b>CARBON DISCLOSURE PROJECT</b>	Organization that helps companies voluntarily disclose greenhouse gas emission accounting.

TERM	DEFINITION
<b>CARBON OFFSET</b>	Reduction of greenhouse gas emissions to compensate for the release/production of emissions from another source.
<b>CARCINOGEN - KNOWN</b>	A causal relationship has been established between exposure to the agent and human cancer (MAK 1 or TLV A1 or IARC Group 1).
<b>CARCINOGEN - POSSIBLE, OR SUSPECTED</b>	A known animal carcinogen, but evidence of carcinogenicity in humans is non-existent, or there is limited evidence of carcinogenicity in humans and insufficient evidence of carcinogenicity in animals (MAK 3 or TLV A3 or IARC Group 2B).
<b>CARCINOGEN - PROBABLE</b>	A known animal carcinogen, but carcinogenicity in humans has not been definitely proven (MAK 2 or TLV A2 or IARC Group 2A).
<b>CAS NUMBER</b>	Chemical Abstract Service number. This number uniquely identifies each pure chemical compound. This is also designated as Chemical Abstract Service Registry Number (CASRN).
<b>CEN</b>	CEN is a major provider of European Standards and technical specifications. It is the only recognized European organization according to Directive 98/34/EC for the planning, drafting, and adoption of European Standards in all areas of economic activity with the exception of electrotechnology (CENELEC) and telecommunication (ETSI).
<b>CHEMICAL SUBSTANCE</b>	A substance represented by a single Chemical Abstract Service Registry Number (CAS #).
<b>CHEMICAL</b>	AKA chemical substance.
<b>CHEMICAL CLASS</b>	Grouping of elements or compounds according to certain chemical functional or structural properties.
<b>CHEMICAL PROFILE</b>	The process of using human and environmental health endpoints and their associated criteria to determine the inherent hazards of a single chemical.
<b>CHLORINATED POLYVINYL CHLORIDE</b>	A chlorinated version of PVC used for temperature stability.

TERM	DEFINITION
<b>CHILD LABOR</b>	<p>UNICEF definition: work that exceeds a minimum number of hours, depending on the age of a child and on the type of work. Such work is considered harmful to the child and should therefore be eliminated. <a href="http://www.unicef.org/protection/index_childlabour.html">http://www.unicef.org/protection/index_childlabour.html</a></p> <ul style="list-style-type: none"> <li>• Ages 5-11: At least one hour of economic work or 28 hours of domestic work per week.</li> <li>• Ages 12-14: At least 14 hours of economic work or 28 hours of domestic work per week.</li> <li>• Ages 15-17: At least 43 hours of economic or domestic work per week.</li> </ul> <p>International Labour Organization (ILO) definition: The minimum age at which children can start work (with some possible exceptions for developing countries): <a href="http://www.ilo.org/ipec/facts/ILOconventionsonchildlabour/lang-en/index.htm">http://www.ilo.org/ipec/facts/ILOconventionsonchildlabour/lang-en/index.htm</a></p> <ul style="list-style-type: none"> <li>• Ages 13-15: May perform light work that does not threaten health and safety, or hinder education or vocation orientation and training.</li> <li>• Age 15: The age at which compulsory schooling in generally finished; may begin to work</li> </ul> <p>Age 18: May perform hazardous work (that which may jeopardize physical, mental or moral health, safety or morals)</p>
<b>CLEAN DEVELOPMENT MECHANISM</b>	Stimulates sustainable development by allowing emission reduction projects in developing countries while allowing industrialized nations to meet emission reduction targets.
<b>CLEARANCE TIME (CT)</b>	The CT indicates the time needed to eliminate or biodegrade a substance to a certain percentage in an organism. For example, the CT50 indicates the time needed to eliminate 50% of a certain substance, analogous to the half-life time measure $t_{1/2}$ .
<b>CLIMATE ACTION RESERVE</b>	National offset program founded to guarantee transparency, integrity, and financial value of voluntary U.S. carbon market.
<b>CLIMATE, COMMUNITY, AND BIODIVERSITY ALLIANCE, THE</b>	Partnership organization comprised of corporations, international non-government organizations, and research institutions that supports and promotes GHG emission mitigation and removal projects that are "land-based."
<b>CLIMATIC RELEVANCE</b>	This is a measure of the climate-influencing characteristics of the substance. All compounds that contribute to global warming are listed here. Examples include carbon dioxide, methane, CFCs, and sulfur hexafluoride.
<b>CO2 EQUIVALENTS (CO2e)</b>	A quantity that describes the amount of CO2 for a particular greenhouse gas that has the same Global Warming Potential when measured for a specific timescale.
<b>COLORANT</b>	Any chemical or substance used to impart color to matter, such as a pigment or dye.

TERM	DEFINITION
<b>COMPOSTABLE</b>	A material capable of undergoing biological decomposition in a compost site as part of an available program, such that the material is not visually distinguishable and breaks down into carbon dioxide, water, inorganic compounds, and biomass at a rate consistent with known compostable materials. If making claims on the compostable nature of materials that are not commonly known to be compostable, testing should be done according to the appropriate ASTM, ISO, CEN, or DIN standard (for example, ASTM D6400-04 for plastics).
<b>DEGRADATION</b>	Decomposition of a compound by stages, exhibiting well-defined intermediate products.
<b>DIN</b>	The German Institute for Standardization. By agreement with the German Federal Government, DIN is the acknowledged national standards body that represents German interests in European and international standards organizations.
<b>DOWNCYCLING</b>	Consequences of design failures to provide products a status as defined biological nutrients or technical nutrients. It is the name for the practice of recycling a material in such a way that much of its inherent value is degraded (e.g. recycling plastic into park benches), revealing poor design of a lifecycle and the related material flows.
<b>EARTHSTER</b>	A free open-source platform for assessing and reporting a product's social and environmental impact.
<b>EFFECT CONCENTRATION 50 (EC50)</b>	The median exposure concentration (EC50) is the median concentration of a substance that causes some effect in 50 percent of the test animals.
<b>EXCESSIVE WORK TIME</b>	ILO definition: More than 48 hours/week; more than 8 hours/day <a href="http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/working-time/lang--en/index.htm">http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/working-time/lang--en/index.htm</a> .
<b>EXTERNALLY MANAGED COMPONENT (EMC)</b>	<p>An Externally Managed Component is a sub-assembly, component, or material within a product that is exempt from the general requirement of full characterization to the 100 ppm level because it is managed in a technical nutrient cycle as part of a supplier or manufacturer commercialized nutrient management program. To be considered an EMC, the sub-assembly, component, or material within a product must meet the following criteria:</p> <ul style="list-style-type: none"> <li>i. The supplier of the EMC has provided the applicant with a guarantee for take back and appropriate nutrient management. The supplier may designate a third party or parties for implementation.</li> <li>ii. The supplier has signed a declaration that chemicals in the EMC will not negatively impact humans or the natural environment during the intended and unintended but highly likely use of the product for which the EMC is a component.</li> </ul> <p>The EMC has undergone testing by an accredited analytical laboratory to ensure that harmful substances are not being emitted from the EMC above the chemicals' analytical detection limits.</p>



<b>TERM</b>	<b>DEFINITION</b>
<b>FACILITY</b>	A facility is termed as the final step of the manufacturing process before distribution to the end-user market.
<b>FINISH (noun)</b>	A surface pretreatment or coating for a variety of materials.
<b>FORCED LABOR</b>	UN Global Compact definition: work or service which is exacted from any person under the menace of a penalty and which the person has not entered into of his or her own free will.
<b>FUNDAMENTAL HUMAN RIGHTS</b>	Please refer to The Universal Declaration of Human Rights, (United Nations, 1948) <a href="http://www.un.org/en/documents/udhr/index.shtml">http://www.un.org/en/documents/udhr/index.shtml</a> .
<b>GHG PROTOCOL CORPORATE ACCOUNTING AND REPORTING STANDARD,THE</b>	International accounting tool to quantify, manage, and report greenhouse gas emissions.
<b>GHG PROTOCOL PRODUCT STANDARD</b>	Standardized methodology for quantifying, managing, and reporting greenhouse gas emissions throughout a product's life-cycle.
<b>GLOBAL WARMING POTENTIAL (GWP)</b>	A scale used to relate a compound to the CO <sub>2</sub> equivalents to measure the potential heating effects on the atmosphere. The GWP of a gas is the warming potential caused by the emission of one ton of the gas relative to the warming caused by the emission of one ton of CO <sub>2</sub> , for the same time period.
<b>GOLD STANDARD, THE</b>	International organization that provides transparency in carbon offset projects and awards projects that are driving sustainable development and local benefits.
<b>HALF-LIFE (T1/2)</b>	The amount of time it takes half of an initial concentration of substance to degrade in the environment.
<b>HALOGENATED ORGANIC COMPOUNDS</b>	The column in the periodic chart of the elements that begins with Fluorine contains the halogens. These elements, when combined with organic compounds, form halogenated organic compounds. Most of these compounds are toxic, carcinogenic, persistent, ozone-depleting, bioaccumulative, or form hazardous substances during production and disposal (e.g., PVC).
<b>HAZARD ENDPOINT</b>	For the purposes of the Cradle to Cradle® Chemical Profiling Methodology, this term refers to the list of human and environmental health endpoints that are reviewed for each chemical in the chemical hazard assessment process.
<b>HAZARD RATING</b>	The traffic light system that assigns a GREEN, YELLOW, RED, or GREY rating to each hazard endpoint based on the hazard criteria. The hazard criteria are based on available toxicity and fate information for each chemical.

TERM	DEFINITION
<b>HOMOGENEOUS MATERIAL</b>	A material of uniform composition throughout that cannot be mechanically disjointed, in principle, into different materials (RoHS definition). A homogenous material is composed of one or more chemical substances.
<b>INPUT</b>	Inputs refer to the chemicals, mixtures, simple and complex materials, assemblies, or sub-assemblies that make up a product.
<b>INSEPARABLE COMPONENT</b>	Smallest unit of an object that is either not designed to or cannot be readily disassembled by the end user into individual materials.
<b>ISO</b>	The International Organization for Standardization is the world's largest developer and publisher of International Standards.
<b>LETHAL CONCENTRATION 50 (LC50)</b>	The inhalative median lethal concentration (LC50) is the median concentration of a substance that causes death in 50 percent of the test animals.
<b>LIVING WAGE</b>	The ILO defines a living wage as that "sufficient to meet the basic living needs of an average-sized family in a particular economy." Living wage is not covered by the ILO conventions.
<b>MATERIAL</b>	AKA homogenous material.
<b>MATERIAL ASSESSMENT</b>	A modified risk assessment process for rating materials based on the intrinsic human and environmental health hazards posed by their ingredients as well as the relevant routes of exposure for those ingredients in the material and in the finished product. This analysis takes into account the intended use of the material/product as well as highly likely unintended uses, throughout the product's lifecycle.
<b>MIXTURE</b>	AKA homogenous material.
<b>PAS 2050</b>	Method designed by Publicly Available Specification (PAS) to assess life-cycle emissions of goods and services.
<b>PART</b>	A vended component or input to a product that is made of only one specific type of material.
<b>PERSISTENCE</b>	This is a measure of a substance's ability to remain as a discrete chemical entity in the environment for a prolonged period of time. A common measuring tool for persistence is "half-life" ( $t_{1/2}$ ), which is the amount of time required for half of the substance to break down. If half-life is greater than 30 days in the air, or if half-life is greater than 50 days in soil, water, or any other media, the substance is considered to be persistent.
<b>POST-CONSUMER RECYCLED CONTENT</b>	Materials that have been collected for recycling after consumer use.
<b>PRECAUTIONARY PRINCIPLE</b>	The precautionary principle states that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is not harmful falls on those taking the action.

TERM	DEFINITION
<b>PRE-CONSUMER RECYCLED CONTENT</b>	Material collected for recycling prior to consumer use, comes from sources outside of the applicant manufacturer's facility, and has been modified before being suitable for recycling back into a manufacturing process. Waste materials directly incorporated back into the manufacturing process within the applicant facility do not apply.
<b>PRIMARY DATA</b>	Observed process data specific to the given processes owned and operated by the reporting company, such as direct emissions, energy, or physical data.
<b>PROCESS CHEMICAL</b>	A process chemical is defined as any substance that comes into direct contact with the product or any of its material constituents during any of processes that constitute the final manufacturing stage of the product. It is used as an intentional part of any of these processes to fulfill a specific function or achieve a specific effect in the product or any of its material constituents. Within this definition, process chemicals are limited to pure chemical substances and chemical substances present in a mixture at a concentration of 1,000 ppm or above. Mixtures include liquids, sprays, gases, aerosols, solids, etc. The concentration threshold applies to process mixtures directly as received by the supplier and prior to any dilution that may take place at the manufacturing site. This definition does not include maintenance agents for machinery, effluent or wastewater treatment chemicals, chemicals used in steam boilers, or cleaning agents used for the production area, offices, and/or lavatories. Distilled water, tap water, and ambient air in their unaltered state are excluded from the assessment.
<b>PRODUCT</b>	A product is a finished good as sold by one entity to another (can be business-to-business or business-to-consumer). It is composed of parts, assemblies, sub-assemblies, materials, and/or chemicals. In addition, a product is the result of design decisions of its producer. The design encompasses the functional use of the product, the post-use handling, the fate of supplied ingredients used to produce it, and decisions made (or not made) for a contribution to success (or failure) of the product to be beneficial under all these circumstances.
<b>PROGRAM CATEGORY</b>	The term "CATEGORIES" in this context will refer to the five program attributes in which products are rated: material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness.
<b>RAPIDLY RENEWABLE RESOURCE</b>	A material that is able to grow back in 10 years. See also RENEWABLE RESOURCE.
<b>READILY DISASSEMBLED</b>	Capable of being deconstructed with the use of common hand tools (i.e. wrench, screw driver, pliers, scissors, etc.).

TERM	DEFINITION
<b>RECYCLABLE MATERIAL</b>	<p>A material that can technically be recycled at least once after its initial use phase. At a minimum, the material's physical and mechanical properties allow it to be re-melted or size-reduced and used as filler with similar or dissimilar materials (downcycled). It is preferable to select materials that may be recycled into like or higher-value products when possible. However, it is understood that this is difficult to define, as the collection infrastructure and recycling technologies are still in the early stages of development and the economic value of materials will change in the future.</p> <p>Unless there is an automated process for disassembling and reducing size of materials with adequate identification and sorting technologies to produce the highest quality recycle possible, then attention must be paid to the design and construction of products so that dissimilar materials can be economically separated for recycling. Ideally, disassembly instructions are provided to the end user and/or recycling facilities, recyclable parts are marked, and disassembly is possible using commonly available tools. If the product is too complex for the consumer or third parties to disassemble and/or is designed as a Managed Nutrient, the consumer should be provided with instructions on where to send the product after use.</p> <p>The Cradle to Cradle definition of "recyclable" is different from the U.S. Federal Trade Commission (FTC) definition. While the intentions of the FTC to protect consumers from deceptive marketing claims is logical and laudable, it may also be unintentionally creating disincentives for manufacturers because it limits their ability to use the diversity of materials whose physical properties are very recyclable, but that are not actually recycled, due to the lack of economically profitable collection and recycling systems.</p>
<b>RECYCLED CONTENT</b>	<p>Proportion, by mass, of recycled material within a product that has been recovered or diverted from the solid waste stream, either during the manufacturing process (pre-consumer/post-industrial) or after consumer use (post-consumer).</p>
<b>RENEWABLE ENERGY CREDIT</b>	<p>Tradable certificates produced by an authorized body that verifies electricity was generated from an eligible renewable energy resource.</p>
<b>RENEWABLE RESOURCE</b>	<p>A material from an agricultural source. See also RAPIDLY RENEWABLE RESOURCE.</p>
<b>SECONDARY DATA</b>	<p>Generic or industry average data from published sources that are representative of a company's operations, activities, or products.</p>
<b>SOLAR INCOME</b>	<p>The ultimate goal of Cradle to Cradle® Design is to have all energy inputs come from "current solar income." Forms of current solar income include geothermal, wind, biomass, hydro (in certain circumstances – to be determined on a case-by-case basis) and photovoltaic.</p>
<b>SUB-ASSEMBLY</b>	<p>A unit assembled separately but designed to fit with other units in a manufactured product. It is composed of different materials and makes up an inseparable component of the product.</p>
<b>SUBSTANCE</b>	<p>AKA chemical substance.</p>

TERM	DEFINITION
<b>TECHNICAL METABOLISM</b>	The cycle that technical nutrients flow in. Materials potentially hazardous to life and health may be used in a technical metabolism, if they are sequestered from uncontrolled contact with life. Note that biological nutrients may flow in technical cycles (e.g., paper and bio-based polymers).
<b>TECHNICAL NUTRIENT</b>	<p>A product capable of “feeding” technical systems. Any material that cannot be processed by biological systems is assessed for its capacity to be processed as a resource in systems of human artifice (“Technical Organisms”). In homology to biological nutrients, technical nutrients are catabolized (deconstruction) and anabolized (construction) according to the following hierarchy:</p> <ul style="list-style-type: none"> <li>• (Dismantle and) Reuse</li> <li>• (Dismantle and) Physical transformation (e.g. plastic remolding)</li> <li>• (Dismantle and) Chemical transformation (e.g. plastic depolymerization, pyrolysis, gasification)</li> </ul> <p>The management of technical nutrients occurs by transferring ownership to the users of only the service, not the materials. It is the service offering side that manages materials as technical nutrients, once the phase of functional use is over.</p>
<b>TERATOGEN</b>	A substance shown to cause damage to the embryo or fetus through exposure by the mother (MAK-list: Pregnancy risk group, category A).
<b>TERATOGEN - SUSPECTED</b>	Currently available information indicates that a risk of damage to the embryo or fetus can be considered probable when the mother is exposed to this substance (MAK-list: Pregnancy risk group, category B).
<b>THIRD PARTY AUDIT</b>	An assessment of an organization's conformance to a standard, regulation, or other set of criteria, by an outside auditor. The auditor is to be independent of the organization being audited.
<b>TOXICOLOGICAL ENDPOINT</b>	Also referred to as "endpoint" or "hazard endpoint."
<b>UPCYCLING</b>	Any measure and activity in the design phase targeting optimal handling of products as nutrients.
<b>UTZ CERTIFIED</b>	UTZ Certified is a label and program for sustainable farming of agricultural products launched in 2002, which claims to be the largest program for coffee in the world.
<b>VERIFIED CARBON STANDARD</b>	Provides a framework for developing a project for quantification, reduction, and removal of GHG emissions.

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<http://www.wri.org/project/eutrophication/map>.
81. Worldwide Responsible Apparel Production <http://www.wrapcompliance.org/>.

# 15 APPENDIX: BANNED LISTS OF CHEMICALS

The following lists contain the chemicals and substances that are banned for use in Cradle to Cradle Certified™ products as intentional inputs above the applicable threshold in any homogeneous material subject to review in the product (1000ppm in most cases, see below and Section 3.3). These substances were selected for inclusion on the Banned Lists due to their tendency to accumulate in the biosphere and lead to irreversible negative human health effects. In addition, several substances were selected due to hazardous characteristics associated with their manufacture, use, and disposal.

See Section 3.3 for complete details regarding the banned list chemical requirement. The applicable threshold is 1000ppm, with exceptions for metals in biological nutrients. Lead, PTFE, and PAHs are not banned in technological nutrients, except for as noted in Section 3.3.

There are two Banned Lists provided: a banned list of chemicals for technical nutrients (Table A-1) and a banned list of chemicals for biological nutrients (Table A-2). A key component of Cradle to Cradle® design is the recognition of and design for the two nested cycles – biological and technical. Banned Lists were thus created separately for biological and technological nutrients to allow for the use of some substances like lead or cadmium in materials where exposure to humans or the environment is unlikely to occur. Lead, for example, is often used in cast aluminum, from which it does not migrate out of the material and can therefore be managed in safe technical cycles. However, lead should not be used in biological nutrients, which ultimately cycle into the biosphere. On the other hand, mercury is not suitable for either type of nutrient cycles due to its ability to easily migrate out of materials. The overall intention is to inspire and promote innovation in quality products in a way that supports 10 billion people on earth without increasing the natural background level of materials or harming people or the environment.

The intention for the “Banned Lists” is not to simply provide a checklist to eliminate chemicals of concern. Rather, it should be viewed as specific examples that may also be used to guide substitution. There may be chemicals similar in structure that are not on the list but exhibit similar properties to the listed chemical. Thoughtful substitutions using the intentional design approach of Cradle to Cradle would suggest that chemicals with similar properties would not be a good substitution choice.

Table A-1 Banned List of Chemicals for Technical Nutrients

SUBSTANCE	CAS #	COMMENTS
<b>Metals</b>		
Arsenic	7440-38-2	
Cadmium	7440-43-9	Banned only for products with no guaranteed nutrient management.
Chromium VI	18540-29-9	
Mercury	7439-97-6	
<b>Flame Retardants</b>		
Hexabromocyclododecane	3194-55-6; 25637-99-4	
Penta-BDE	32534-81-9	
Octa-BDE	32536-52-0	
Deca-BDE	1163-19-5	
Polybrominated Diphenyl Ethers (PBDEs)	Several	
Tetrabromobisphenol A	79-94-7	
Tris(1,3-dichloro-2-propyl)phosphate	13674-87-8	
<b>Phthalates</b>		
Bis(2-ethylhexyl)phthalate	117-81-7	
Butyl benzyl phthalate	85-68-7	
Dibutyl phthalate	84-74-2	
<b>Halogenated Polymers</b>		
Polyvinyl chloride (PVC)	9002-86-2	
Polyvinylidenechloride (PVDC)	9002-85-1	
Chlorinated polyvinyl chloride (CPVC)	68648-82-8	
Polychloroprene	9010-98-4	
<b>Chlorinated Hydrocarbons</b>		
1,2-Dichlorobenzene	95-50-1	
1,3-Dichlorobenzene	541-73-1	
1,4-Dichlorobenzene	106-46-7	
1,2,4-Trichlorobenzene	120-82-1	
1,2,4,5-Tetrachlorobenzene	95-94-3	
Pentachlorobenzene	608-93-5	
Hexachlorobenzene	118-74-1	
PCB and Ugilec	Several	
Short-chain chlorinated paraffins	Several	
<b>Others</b>		
Pentachlorophenol	87-86-5	
Nonylphenol	104-40-5, 84852-15-3	
Octylphenol	27193-28-8	
Nonylphenol ethoxylates	Several	
Octylphenol ethoxylates	Several	
Tributyltin	688-73-3	
Trioctyltin	869-59-0	

SUBSTANCE	CAS #	COMMENTS
Triphenyltin	892-20-6	
Perfluorooctane sulfonic acid	1763-23-1	
Perfluorooctanoic acid	335-67-1	

Table A-2 Banned List of Chemicals for Biological Nutrients

SUBSTANCE	CAS #	COMMENTS
<b>Metals</b>		
Arsenic	7440-38-2	Restricted to 10 ppm
Chromium	18540-29-9	Restricted to 100 ppm
Mercury	7439-97-6	Restricted to 1 ppm
Cadmium	7440-43-9	Restricted to 2 ppm
Lead*	7439-92-1	Restricted to 90 ppm
<b>Flame Retardants</b>		
Hexabromocyclododecane	3194-55-6; 25637-99-4	
Penta-BDE	32534-81-9	
Octa-BDE	32536-52-0	
Deca-BDE	1163-19-5	
Polybrominated Diphenyl Ethers (PBDEs)	Several	
Tetrabromobisphenol A	79-94-7	
Tris(1,3-dichloro-2-propyl)phosphate	13674-87-8	
<b>Phthalates</b>		
Bis(2-ethylhexyl)phthalate	117-81-7	
Butyl benzyl phthalate	85-68-7	
Dibutyl phthalate	84-74-2	
<b>Halogenated Polymers</b>		
Polyvinyl chloride (PVC)	9002-86-2	
Polyvinylidenechloride (PVDC)	9002-85-1	
Chlorinated polyvinyl chloride (CPVC)	68648-82-8	
Polychloroprene	9010-98-4	
Polytetrafluoroethylene (PTFE)*	9002-84-0	
<b>Chlorinated Hydrocarbons</b>		
1,2-Dichlorobenzene	95-50-1	
1,3-Dichlorobenzene	541-73-1	
1,4-Dichlorobenzene	106-46-7	
1,2,4-Trichlorobenzene	120-82-1	
1,2,4,5-Tetrachlorobenzene	95-94-3	
Pentachlorobenzene	608-93-5	
Hexachlorobenzene	118-74-1	
PCB and Ugilec	Several	
Short-chain chlorinated paraffins	Several	
<b>Other</b>		
Pentachlorophenol	87-86-5	

SUBSTANCE	CAS #	COMMENTS
Nonylphenol	104-40-5, 84852-15-3	
Octylphenol	27193-28-8	
Nonylphenol ethoxylates	Several	
Octylphenol ethoxylates	Several	
Tributyltin	688-73-3	
Trioctyltin	869-59-0	
Triphenyltin	892-20-6	
Perfluorooctane sulfonic acid	1763-23-1	
Perfluorooctanoic acid	335-67-1	
<b>Polycyclic Aromatic Hydrocarbons*</b>		
PAH group (as defined in TRI)	Not applicable	
Benzo(a)pyrene	50-32-8	
5-Methylchrysene	3697-24-3	
Acenaphthene	83-32-9	
Anthracene	120-12-7	
Benz(a)anthracene	56-55-3	
Benzo(j)aceanthrylene	202-33-5	
Benzo(b)fluoranthene	205-99-2	
Benzo(c)phenanthrene	195-19-7	
Benzo(g,h,l)perylene	191-24-2	
Benzo(j)fluoranthene	205-82-3	
Benzo(k)fluoranthrene	207-08-9	
Chrysene	218-01-9	
Cyclopenta(c,d)pyrene	27208-37-3	
Dibenzo(a,h)anthracene	53-70-3	
Dibenzo(a,h)pyrene	189-64-0	
Dibenzo(a,i)pyrene	189-55-9	
Dibenzo(a,l)pyrene	191-30-0	
Fluoranthene	206-44-0	
Fluorene	86-73-7	
Indeno(1,2,3,c,d)pyrene	193-39-5	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

\* Note these chemicals are on the Banned List for Biological Nutrients only