CRADLE TO CRADLE CERTIFIED^{CM}

PRODUCT STANDARD

VERSION 3.0

PROGRAM ADMINISTERED BY:

CRADLE TO CRADLE
PRODUCTS
INNOVATION
INSTITUTE

DOCUMENTS PREPARED BY:

MBDC
McDonough Braungart Design Chemistry

FOREWORD

This version of the Cradle to Cradle Certified[CM] Product Standard (Version 3.0) replaces Version 2.1.1. The Cradle to Cradle Products Innovation Institute™ will begin certifying products using Version 3.0 of the Standard on January 1, 2013.

Suggestions for improvement of this standard should be directed to The Cradle to Cradle Products Innovation Institute™ which took over the administration of the seven-year-old Product Certification Program in 2012.

The Cradle to Cradle Products Innovation Institute™
The Cradle to Cradle Products Innovation Institute administers the Cradle to Cradle Certified[CM] 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[CM] Product Standard and ensuring continuous improvement of products based upon five attributes: material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness. Products that meet the transparent criteria of this rating system will receive the Cradle to Cradle Certified[CM] certification mark for one of five levels. (http://c2ccertified.org)

McDonough Braungart Design Chemistry, LLC
MBDC originated the Cradle to Cradle® design framework and has over 17 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 Assessor for the Cradle to Cradle Certified[CM] Product 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 Assessor for the Cradle to Cradle Certified[CM] Product Program. (http://epea-hamburg.org)

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

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SUPPORTING DOCUMENTS

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

- *Supplemental Guidance for the Cradle to Cradle Certified™ Product Standard, Version 3.0*
- *Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.0.*
- *Supplemental Guidance for the Cradle to Cradle Certified™ Material Health Assessment Methodology, Version 3.0*
- *Any additional supporting documents and guidance posted on the C2CPII website*

Visit the Cradle to Cradle Products Innovation Institute website to download the standard documents and obtain the most current information regarding the product standard (http://www.c2ccertified.org/product_certification/c2ccertified_product_standard).

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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 contraindication to "cradle to grave,"[1] 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[2] 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*[3] 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).[4]

The Atlantic magazine published an article by McDonough and Braungart entitled "The Next Industrial Revolution"[5] 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.[6] 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.[7]

MBDC launched the Cradle to Cradle Certified^{CM} Program[8] 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 Product Innovation Institute[9] as a third party not-for-profit organization to manage the certification program.

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_2) 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[CM] 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.

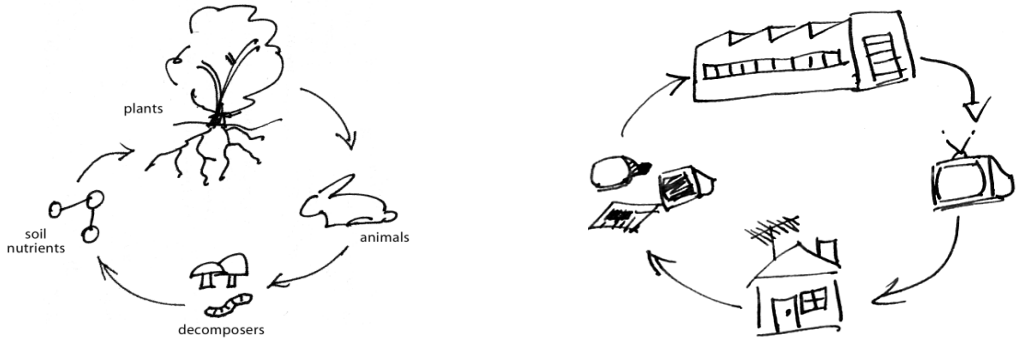
Cradle to Cradle design draws on knowledge from the fields of environmental chemistry and material flows management (broadly termed Industrial Ecology), and the fields of industrial and architectural design. It includes the *Intelligent Product System* (IPS) pioneered by chemist Dr. Michael Braungart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



Biological Nutrients **Technical Nutrients**

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^{CM} (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 chemical's 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^{CM} 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® 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^{CM} 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 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^{CM} "Banned List" (See Appendix for lists).
- Processes in and of themselves.
- Food or beverages.
- 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.
- Companies involved in rain forest damage, child labor, blood metals, or blood diamonds.
- Applicant involved in terror support, racism/discrimination, or weapon production or connection.
- Nuclear power and/or products used to produce nuclear power.
- Products that may be contrary to the intent of the Cradle to Cradle principles.

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 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 includes some measures of general

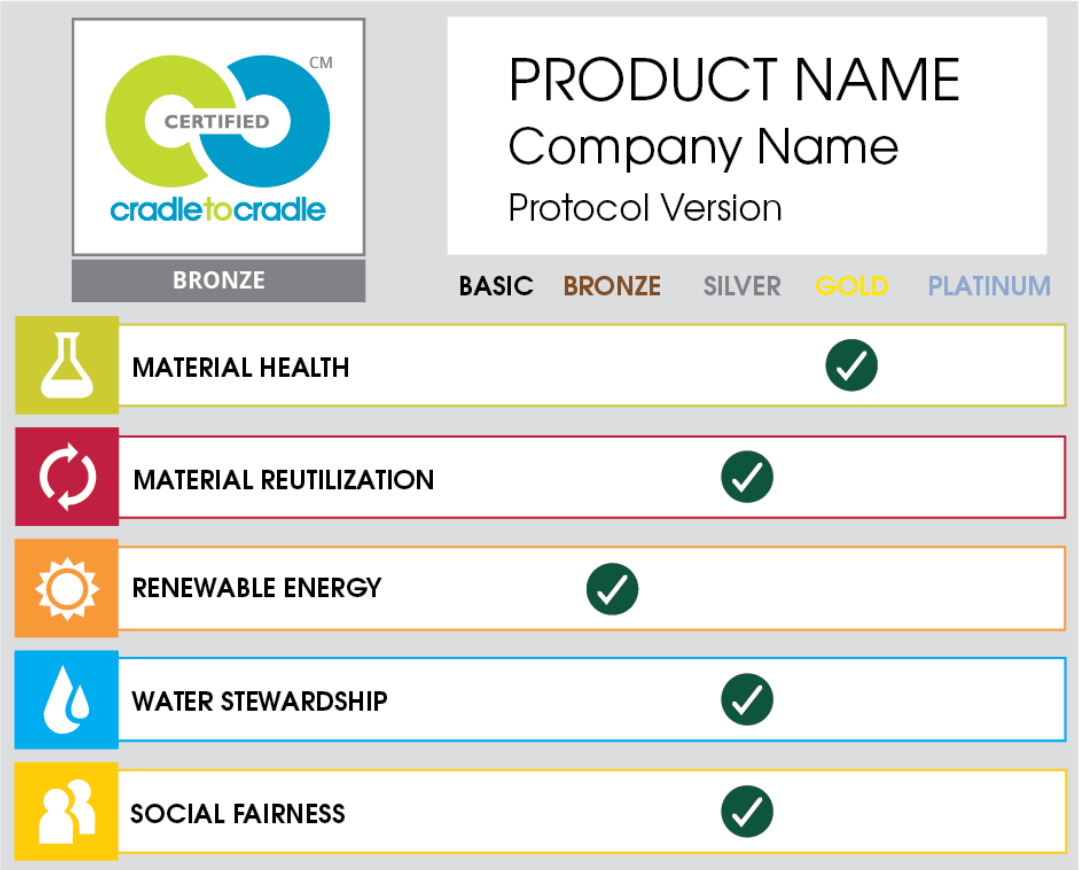
environmental impacts. Requirements apply to the facility or facilities where final product is manufactured unless otherwise noted.

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



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^{CM} Product Standard, Version 3.0

1. MATERIAL HEALTH	Basic	Bronze	Silver	Gold	Platinum
No Banned List chemicals are present above thresholds.	●	●	●	●	●
Materials defined as biological or technical nutrient.	●	●	●	●	●
100% "characterized" (i.e., all generic materials listed).	●	●	●	●	●
Strategy developed to optimize all remaining X-assessed chemicals.		●	●	●	●
At least 75% assessed by weight (100% for BN products).		●	●	●	●
At least 95% assessed by weight (100% for BN products).			●	●	●
Assessed materials do not contain any carcinogenic, mutagenic, or reproductively toxic (CMR) chemicals.			●	●	●
100% assessed by weight.				●	●
Formulation optimized (i.e., all X-assessed chemicals replaced or phased out).				●	●
Meets Cradle to Cradle emission standards.				●	●
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 ≥ 35.		●	●	●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score ≥ 50.			●	●	●
Designed or manufactured for the technical or biological cycle and has a material (re)utilization score				●	●

≥ 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.					●
3. RENEWABLE ENERGY AND CARBON MANAGEMENT	**Basic**	**Bronze**	**Silver**	**Gold**	**Platinum**
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.).					●
4. WATER STEWARDSHIP	**Basic**	**Bronze**	**Silver**	**Gold**	**Platinum**
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 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 no 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). OR				●	●

Demonstrated progress against the strategy developed for the Silver level requirements (required for facilities with no 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 reasonability 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 employee's 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.				●	●

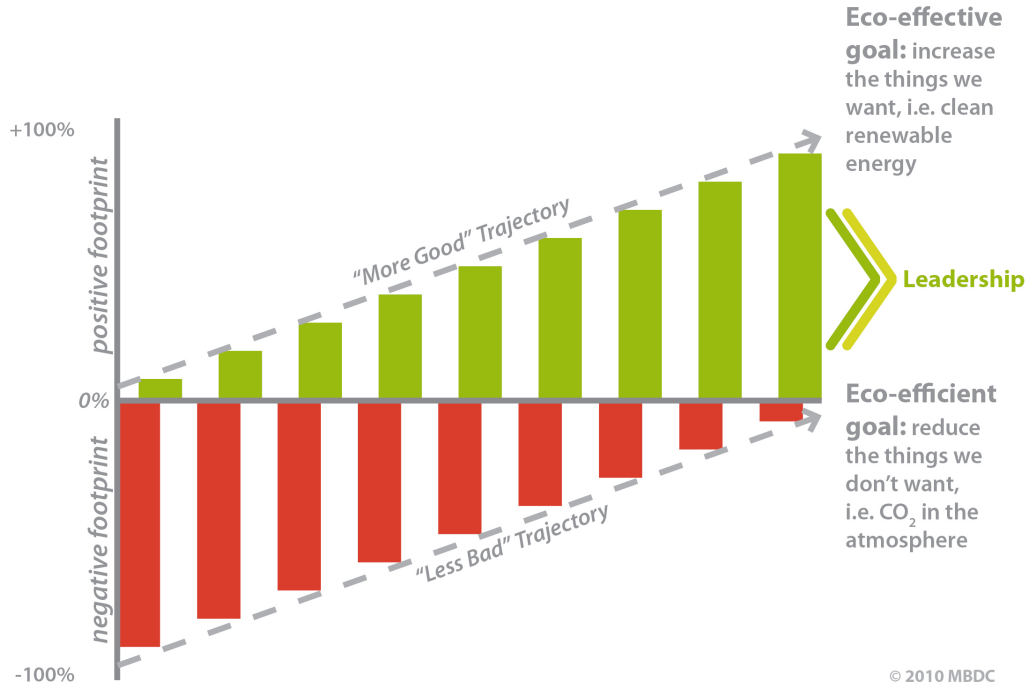
All three Silver-Level requirements are complete.					●
A facility-level audit is completed by a third party against an internationally recognized social responsibility program (e.g., SA8000 standard or B-Corp).					●

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 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[CM] 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[CM] Marks

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
BASIC	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 product does not contain any Banned List chemicals based on supplier declarations.
BRONZE	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. Products that are entirely BN in nature (e.g., cosmetics, personal care, soaps, detergents, etc.) are 100% assessed. A phase-out or optimization strategy has been developed for those materials with an X rating.
SILVER	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. Products that are entirely BN in nature (e.g., cosmetics, personal care, soaps, detergents, etc.) are 100% assessed. The product contains no substances known or suspected to cause cancer, birth defects, genetic damage, or reproductive harm (CMRs) after the A, B, C, X assessment has been carried out.
GOLD	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 emissions standards.
PLATINUM	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. An example template for a Bill of Materials is available on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org); however, the applicant may also use their own template. 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, whether or not the materials are separable. 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 ≥0.01% (≥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 ≥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 ≥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 product does not contain any Banned List chemicals 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 Certified^{CM} 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 List of Chemicals for the Cradle to Cradle Certified^{CM} Products Program (Appendix). 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* at >0.1% (>1000 ppm). 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. There are some slight differences between the Banned Lists for BNs and TNs, as follows:
        i. PTFE is banned in TNs if it is the primary component of the product or material. PTFE is banned in BNs above the 1000 ppm threshold.
        ii. The threshold for metals in BNs is equal to the maximum background concentrations found in soils. Sources of information on background levels of metals include the United States Geological Survey (Shacklette & Boerngen, 1984) and the European Commission Joint Research Center, Soil and Waste Unit (see for example: Houskova & Montanarella, 2007). Please contact the Cradle to Cradle Products Innovation Institute for additional references. The following values are published in the references above:
            - European Union (natural background) – cadmium <0.8 ppm; lead <85 ppm; chromium <130 ppm; mercury <0.3 ppm; arsenic <29 ppm.
            - United States (average) – cadmium was not measured; lead = 19 ppm; chromium = 54 ppm; mercury = 0.09 ppm; arsenic = 5.2 ppm.
    c. EMCs are not exempt from Banned List declarations.
    d. 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. 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
Metals: Lead, cadmium, chromium VI, mercury	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.
Metals: Arsenic	Alloying agent and/or impurity of copper, brass and bronze, wood preservative (chromated copper arsenate).	Carcinogenic to humans (IARC).
Flame Retardants	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).
Phthalates	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.

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
Halogenated Polymers	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. 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. PTFE (Teflon) is used in a wide range of products where low friction and/or scratch resistance is required, including cookware, inks, paints, coatings, textiles (Gore-Tex), etc.	Production and release of potent toxins including dioxins, furans, and hydrogen chloride upon combustion. Vinyl chloride monomer is carcinogenic to humans (IARC). Chloroprene monomer is possibly carcinogenic to humans (IARC) and a known carcinogen (CA Prop. 65). 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. Additives such as phthalates used widely in halogenated polymers are also problematic.

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
Chlorinated Hydrocarbons	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. Secondary uses of some compounds are solvents for waxes, gums, resins, tars, rubbers, oils, asphalts, dyes and intermediates. Hexachlorobenzene is used in the manufacture of synthetic rubber and as a plasticizing agent in PVC. SCCPs are used in lubricants, plasticizers, flame retardants. (Note: It is currently unlikely to find these as intentional inputs to consumer products.)	Toxicity concerns vary depending on the chemical and include carcinogenicity, reproductive toxicity, endocrine disruption, persistence, bioaccumulation, and aquatic toxicity at low concentrations.
Polycyclic aromatic hydrocarbons (PAHs)	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.	Some are known carcinogens, mutagens, and reproductive toxins.
Pentachlorophenol (PCP)	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.	Known carcinogen (CA Prop 65).
Octylphenol, Octylphenol ethoxylates; Nonylphenol, Nonylphenol ethoxylates	Surfactants and wetting agents used in cleaning products, paints, inks, adhesives, pesticides, textile, and paper processing. Canada and the EU have restricted the use of NPEs.	Persistent in the aquatic environment, moderately bioaccumulative, extremely toxic to aquatic organisms, endocrine disruption.

Banned List Category	Major Uses and Contamination Concerns	Primary Issues
Triorganotin compounds (-butyl, -octyl, -phenyl)	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
Perfluorooctane-sulfonate (PFOS), Perfluorooctanoic acid (PFOA)	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, www.efunda.com, and 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)
Metals: chromium VI, mercury	All materials.	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. Mercury: ICP or CVAA/direct mercury analysis with detection limits in the low ppm range.
Metals: lead, cadmium	All materials identified as biological nutrients, or in technical nutrients with no guaranteed management plan.	Same as above for chromium VI.
Metals: arsenic	Copper, brass, bronze, recycled wood where full data cannot be gathered.	Same as above for chromium VI.
Halogenated Flame Retardants (refers only to those on the Banned List)	Polymers sourced from electronic, appliance, and automotive sources, recycled carpet, upholstery foam, and textiles.	GC/MS; Detection limit <0.1% for Basic level and the Banned List chemicals; Detection limit <0.01% (100 ppm) for Bronze level and above. 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.

Banned List Category	Recycled Material Types to Test	Method (suggested)
Phthalates: DEHP, BBP, DBP	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).
Halogenated Polymers: PVC, PVDC, CPVC, Polychloroprene, PTFE	All polymers	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. If flame retardants or other halogens are expected to be present: GC/MS; detection limit <0.1% for Basic level and the Banned List chemicals; detection limit <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). 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.

Banned List Category	Recycled Material Types to Test	Method (suggested)
Chlorinated Hydrocarbons (refers only to those on the Banned List)	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).
Polycyclic aromatic hydrocarbons (PAHs)	Testing is not required.	Not applicable.
Pentachlorophenol (PCP)	Recycled wood from heavy-duty applications such as utility poles, rail road 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.
Octylphenol, Octylphenol ethoxylates; Nonylphenol, Nonylphenol ethoxylates	Recycled textiles, reclaimed fibers, recycled leather.	LC/MS; detection limit <0.1% (1000 ppm).
Triorganotin compounds (-butyl, -octyl, -phenyl)	Recycled wood, carpet, textiles.	GC/MS; detection limit <0.1% (1000 ppm).
Perfluorooctanesulfonate (PFOS) Perfluorooctanoic acid (PFOA)	Recycled textiles, reclaimed fiber.	LC/MS; detection <0.1% (1000 ppm).

Testing Intervals

Testing of recycled content for Banned List chemicals 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 which case testing is required on a semi-annual basis. All test results are to be provided at the time of re-application. 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 at re-application (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.

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 is important to ensure 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 <1000 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 INGREDIENT 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 product has been assessed. It will often be necessary to collect data from multiple sequential tiers of a supply chain to identify all chemicals present at 0.01% or greater in each homogeneous material. Request the following information at each tier as necessary to identify all chemicals present at 0.01% or greater in each homogeneous material (but see exceptions below):
    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 specified in the *Material Health Assessment Methodology* document (i.e., rare earth elements such as indium, gold, diamond, etc.) at any level.
    g. Process chemicals for metal plating agents (i.e., hexavalent chromium), textile auxiliaries (i.e., process chemicals), blowing agents, and paper bleaching agents. Note that for paper,

manufacturers may not know if process chemicals remain in the final product at ≥100ppm. 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 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.
4. There are analytical testing and other requirements for EMCs and materials containing recycled content. See Sections 3.4.1 and 3.4.2 for further information on these material types.
5. 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. For soft and hard black polymers containing carbon black, what are the PAH concentrations?
    d. 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.

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
Adhesives	Glues, tapes, binders, etc.	Resins, fillers, antioxidants, catalysts, film backers, preservatives, solvents, tackifiers, defoamers, etc.
Adhesives – Formaldehyde-based Binders	Melamine-Formaldehyde (MF), Phenol-Formaldehyde (PF), Urea-Formaldehyde (UF), Wet Strength, M-UF, P-UF, Non-Scavenged UF, etc.	Base resin, residuals, etc.
Fabric	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.
Fasteners (metal)	Screws, bolts, washers, rivets, etc.	Base metal alloy, recycled content, coatings or paint, trace contamination, waxes, lubricants/plating/finishes.
Finishes	Most metal (structural and fasteners) will have a finish: Zinc oxide, oil, chrome, etc.	Hexavalent chromium finishes, cadmium plating, etc.

Polyurethane Foam	Cushions, padding, insulation, etc.	Polyol and isocyanate, blowing agent, catalyst, additives, colorants, flame retardants, etc.
Glass, Fiberglass, Clay	Tempered glass, fiberglass.	Glass, colorants, recycled content, trace heavy metal contamination, other additives for fiberglass reinforcements such as sizing and coatings.
Inks, Dyes, Colorants, Pigments	Paper inks, fabric dyes, plastics and paint colorants, printing inks for paper, fabric, labels, etc.	Colorants, biocides, solvents, polymers, minerals, fillers, resins, etc.
Laminates	High pressure or low pressure decorative laminate.	Adhesive, kraft paper, wetting agents, resins, residuals from resins, abrasion additives, decorative paper, backers, etc.
Metal (not fasteners)	Table legs, arms, etc. Steel, aluminum, etc.	Base metal alloy, recycled content, coatings or paint, trace contamination.
Paints	Coatings on a variety of substrates.	Colorants, biocides, solvents, polymers, minerals, fillers, waxes, resins, etc.
Paper and Pulp	Labels, packaging, envelopes, etc.	Pulp, paper, biocides, inks, bleaching agents, residual process chemicals, recycled content, trace contamination, aluminum sulfate, etc.
Polymers	Including copolymers, nylon, ABS, polypropylene, polyethylene, PET, PU, PC, acetals, PVC, etc	Base resins, colorants, catalysts, fillers, recycled content, trace contamination, flame retardants, additives such as UV stabilizers, antioxidants, recycled content, trace, residual monomers (common problematic monomers: styrene, butadiene, acrylonitrile, bisphenol A, etc.).
Wood, Natural Fibers (treated or untreated)	Plywood, particleboard, veneers, oriented strand board, solid wood, jute fiber, etc.	Base material, adhesives, preservatives, flame retardants, etc.

Required Documentation

A Bill of Material 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^{CM} (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 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.

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^{CM} (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 at >1000 ppm (0.1%), determine whether metals and halogens are present at ≤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: Obtain the alloy grade and look up standard composition in the available databases, obtain mill certificate with full composition, or conduct analytical testing with detection limits that are ≤100ppm (0.01%) for lead, mercury, cadmium and chromium VI.

    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, www.efunda.com, and www.copper.org.

    b. Glass: Obtain ingredient disclosures and/or conduct analytical testing with detection limits that are ≤100ppm (0.01%). XRF methods may be used for elemental analysis of glass.

c. Paper: Identify chemicals that are present at concentrations ≥100 ppm and pulp bleaching agent data at any concentration. Data are to cover final product composition as opposed to input composition if possible. However, 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 the metals (excluding arsenic) will still be required for the assessment of paper containing recycled content.

d. Polymers: When material comes from just one or two known sources, it may be possible to go back to the original manufacturer to gather full data, as for virgin materials. Otherwise, if an X or grey material assessment is acceptable, it is only necessary to conduct the standard testing as described in the sections to follow. Polymers must be from relatively consistent recycling streams in order to complete 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 standard testing (see below), 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 >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 halogens are greater than 100 ppm based on the standard screening test, it will be necessary to determine the actual source. Note that the total halogen test will also pick up inorganic halides such as chloride salts, which may not be problematic.

3. Materials subject to analytical testing are those containing post-consumer recycled content from undefined sources (i.e., most post-consumer sources) for which full data cannot be gathered and/or contamination is suspected. Testing is to be done as described in Section 3.3.1.

4. Note that it may not be possible to gather full data on materials that contain recycled content from undefined sources. Recycled content that has passed testing for Banned List chemicals and contaminants and meets the thresholds for metals and halogens listed below, 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.

5. The threshold concentrations of metals and halogens in recycled content are listed below.

   a. Lead, mercury, cadmium, and chromium must each be <1000ppm (less for BNs, see Banned List).

   b. Halogens (chlorine, fluorine and bromine) must each be <100ppm (determined based on the screening test method using oxygen par bomb sample preparation and ion chromatography).

Required Documentation
See Section 3.3.1 for required documentation.

3.5 CHEMICAL HAZARD PROFILING & 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
Note: An abbreviated summary of the chemical hazard profiling is provided in this section. For more information, please see the document entitled "Material Health Assessment Methodology" (available for download on the Cradle to Cradle Products Innovation Institute website at www.c2ccertified.org).

1. Chemical Hazard Profiling
   Hazard rating profiles must be completed for each chemical in each homogeneous material subject to review (as determined in Section 3.1). The chemical hazard ratings are then used in conjunction with the specific product use scenario, related routes of exposure, and cyclability information to generate a single ABC-X assessment for each material. See #2 in this section for more information on the material assessment methodology.

   The Cradle to Cradle chemical hazard profiling methodology uses 24 human health, environmental health, and chemical class endpoints for the basis of a chemical's evaluation. The rating scheme used for this methodology follows a "traffic-light" hierarchy where the chemical's hazard is communicated by a GREEN, YELLOW, RED, or GREY rating for each endpoint (Table 7). The "traffic-light" rating for each chemical is based on the criteria for each hazard endpoint (see hazard endpoint criteria in the *Material Health Assessment Methodology* document*).* Table 8, Table 9, and Table 10 list the hazard endpoints used for the evaluation of chemicals.

Table 7 Chemical Hazard Rating System for the Cradle to Cradle Certified^{CM} Chemical Profiling Methodology

GREEN	No hazard identified for the given endpoint.
YELLOW	Borderline hazard identified for the given endpoint.
GREY	No data available to determine hazard level for this endpoint.
RED	Considered hazardous for this specific endpoint.

Table 8 Environmental Health Endpoints Used for Chemical Profile Evaluation

HUMAN HEALTH ENDPOINTS	DESCRIPTION
Carcinogenicity	Potential to cause cancer.
Endocrine Disruption	Potential to negatively affect hormone function and impact organism development.
Mutagenicity	Potential to alter DNA.
Reproductive Toxicity	Potential to negatively impact reproductive system as well as the potential to affect pre- and post-natal offspring development.
Oral Toxicity	Potential to cause harm via oral exposure. Both short-term (acute) and longer-term (chronic) exposures are considered here.
Dermal Toxicity	Potential to cause harm via dermal exposure. Both short-term (acute) and longer term (chronic) exposures are considered here.
Inhalative Toxicity	Potential to cause harm via inhalative exposure. Both short-term (acute) and longer term (chronic) exposures are considered here.
Single Organ Toxicity	Potential to cause organ specific damage upon initial, short-term exposure.
Neurotoxicity	Potential to cause an adverse change in the structure or function of the central and/ or peripheral nervous system.
Sensitization of Skin and Airways	Potential to cause an allergic reaction upon exposure to skin or via inhalation.
Other	Any additional characteristic (e.g. flammability, skin penetration potential, etc.) relevant to the overall evaluation but not included in the previous criteria.

Table 9 Environmental Health Endpoints Used for Chemical Profile Evaluation

ENVIRONMENTAL HEALTH ENDPOINTS	DESCRIPTION
Acute Fish Toxicity	Measure of toxicity to fish (both saltwater and freshwater) from single, short-term exposure.
Acute Daphnia Toxicity	Measure of toxicity to Daphnia (or other aquatic invertebrates) from single, short-term exposure.
Acute Algae Toxicity	Measure of toxicity to algae from single, short-term exposure.
Chronic Fish Toxicity	Measure of toxicity to fish (both saltwater and freshwater) from multiple, longer term exposures.
Chronic Daphnia Toxicity	Measure of toxicity to Daphnia (or other aquatic invertebrates) from multiple, longer term exposures.
Chronic Algae Toxicity	Measure of toxicity to algae from multiple, longer term exposures.
Terrestrial Toxicity	Acute toxicity to avian species and soil organisms.
Persistence	Measure of how long a substance will exist in air, soil, or water. Can be biotic or abiotic.
Bioaccumulation	Potential for a substance to accumulate in fatty tissue and magnify as you move up the food chain.
Climatic Relevance	Measure of the impact a substance has on the climate (e.g., ozone depletion, global warming, etc.).
Other	Any additional characteristic relevant to the overall evaluation but not included in the other endpoints.

Table 10 lists the chemical classes that are always rated RED if shown to be greater than 100 ppm in the material. This is due to the concern that at some point in the product life cycle these chemical classes may have negative impacts on human and environmental health. In the case of organohalogens, they tend to be persistent, bioaccumulative, and toxic, or can form toxic by-products if incinerated.

Table 10 Chemical Class Endpoints Used for Chemical Profile Evaluation

CHEMICAL CLASS ENDPOINTS	DESCRIPTION
Organohalogens	Presence of a non-hydrolysable carbon-halogen (i.e., fluorine, chlorine, bromine, or iodine) bond.
Toxic Metals	Presence of a toxic heavy metal compound (e.g., antimony, arsenic, cadmium, chromium VI, cobalt, lead, mercury, nickel, tin (organotins only), radioactive elements, and vanadium.

2. Material Assessments

   Material assessments combine chemical hazard ratings, potential exposure information, and material cyclability information into a single ABC-X assessment for each material in the product (Figure 4). Material assessments must be completed for each homogeneous material subject to review with the exception of products that are themselves homogeneous materials. In this

case, each chemical ingredient in the product receives an individual assessment. Also remember that some process chemicals are to be examined (see Section 3.4).

Descriptions of the chemical hazard endpoints and the criteria are provided in the *Material Health Assessment Methodology* document and are summarized above. Consideration of exposure and cyclability are described below.

a. **Exposure Assessment -** Exposure assessment includes definition of product interaction scenarios and characterization of environmental fate.

i. Define product interaction scenarios: The following questions related to different possible exposure scenarios are to be answered about the product overall. Consider all possible relevant routes of exposure including inhalation, oral, and dermal/membranes. In general, upstream exposure issues (i.e., those occurring before the final manufacturing facility) are not considered.

   a) Production scenario: How are workers exposed to production inputs?

   b) Use scenario: How does the product interact with the user and what is the user exposed to?

   c) "Highly likely unintended use scenarios": Are there any highly likely unintended uses of the product that would expose the user to product inputs?

   d) Standard post-consumer scenario: What is the most likely end-of-use scenario(s) for the product?

   e) Additional disposal scenario: Usually incineration or landfill.

   Information regarding probable routes of human exposure and occupational exposure concerns may be found in several of the resources listed in the *Material Health Assessment Methodology* document.

ii. Characterize Environmental Fate: The base material matrix (i.e., base polymer, metal alloy, natural fiber, etc.) is used to judge whether chemical additives and/or components are able to freely migrate into external systems. For example, it has been shown that lead in cast aluminum is bound in the metal matrix and poses little to no risk. Also, natural materials in indoor use application often release volatiles contributing to compromised indoor air quality.

b. **Hazard x Exposure = Single Risk Assessment** - Combine chemical hazard information with exposure information for those scenarios in which exposure is determined to be of concern to complete a risk assessment for each homogenous material and/or first tier input (note that if the input is a homogenous material, risk assessments are conducted for each chemical ingredient in the material). For example, consider the following (note this is an incomplete list):

i. Acute toxicity risk during current production.
ii. Acute toxicity risk during future production.
iii. Acute toxicity risk during current use.
iv. Sensitization risk during current use.
v. Cancer risk during production.
vi. Cancer risk during use.

vii. Cancer risk during incineration.

viii. Aquatic risk after accidental release.

Unless there is good reason to expect that exposure will not occur during the product interaction scenarios, the single risk assessment ratings are not altered from those based only on hazard identification. If sufficient information exists to determine that exposure is highly unlikely to occur, risk assessment ratings may reflect that. Note that if a chemical is of regulatory concern, the assessment will not be altered regardless of the exposure assessment. The risk assessment rating system is shown in Table 11. Note that a designation of "a" is considered to be ideal and is highly unlikely to occur at present.

Table 11 Risk Assessment Rating System

A	This material is ideal from a human and environmental health perspective for the defined product scenarios in which it exists.
B	No moderate or significant risks identified for the given use scenarios.
C	One or more moderate risks identified for the material and/or one or more process chemicals where evaluated.
X	One or more significant risks identified for the material and/or one or more process chemicals subject to review at any level.

c. Cyclability Assessment – Using the definitions below, describe the fate of each homogenous material and/or first tier input (as required) in the product use scenario context for the future standard post-consumer scenario (Cradle to Cradle® scenario), and rate as listed in Table 12.

Table 12 Cyclability Rating System

B	Biological cycle: rapidly degradable. Technical cycle: recyclable.
C	Biological cycle: slowly degradable. Technical cycle: partially recyclable.
X	Biological cycle: not degradable. Technical cycle: not recyclable.

Recyclable: A material that may be recycled into a material of similar quality and/or value. In the case of coatings, their effect on the recyclability of the substrate material is of primary concern as these generally would not be recyclable themselves.

Partially Recyclable: A material that is only downcyclable. Resulting material is of lower quality and/or value; resulting material will most likely be landfilled at the end of use. For example, the options for recycling of thermosets are very limited.

Not Recyclable: Material is not downcyclable. Materials that cannot be separated may not be recyclable. For example, in the case of foam glued to a fabric, each may be recyclable on their own. However, because they cannot be separated, neither is recyclable.

Rapidly degradable: Readily biodegradable based on OECD guidelines (301). In cases where materials are not generally known to be inherently biodegradable, testing may be required to receive this designation.

Slowly degradable: Inherently biodegradable based on OECD guidelines (302, 304A). In cases where materials are not generally known to be inherently biodegradable, testing may be required to receive this designation. Materials that come from the earth and may be returned to the earth but are not biodegradable may receive this designation (e.g., clay, natural stone, etc.).

Not degradable: Material is not rapidly or inherently biodegradable and cannot be returned safely to the biosphere.

The Final ABC-X Material Assessment – The final ABC-X Assessment for each material is a combination of the Single Risk Assessments and Cyclability Assessments, equaling the worse category of both. In other words, if the worst case Single Risk Assessment is x, and the cyclability assessment is b, then the final ABC-X assessment = X (note use of capital letters here and lower case letters above) (Table 13). Again, the A designation is unlikely to occur at present.

Table 13 Final ABC-X Material Assessment Rating System

A	The material is ideal from a Cradle to Cradle® perspective for the product in question.
B	The material largely supports Cradle to Cradle objectives for the product.
C	Moderately problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The ingredient is still acceptable for use.
X	Highly problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The optimization of the product requires phasing out this ingredient.
GREY	This material cannot be fully assessed due to either lack of complete ingredient formulation, or lack of toxicological information for one or more ingredients.
BANNED	BANNED FOR USE IN CERTIFIED PRODUCTS This material contains one or more chemicals from the Banned List and cannot be used in a Cradle to Cradle Certified^{CM} product.

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.

3.5.1 Externally Managed Components (EMCs)

The manufacturer must be able to document that there is no interaction between the EMC and human or ecological systems. This can be done via analytical test results as mentioned earlier in this document.

Also note that if any part of an EMC actually interacts with the user or biological systems during use, it should be assessed and inventoried like the other materials. The EMC designation and process is for those components that do not directly interact with the user or the environment.

Examples of an EMC are a pneumatic cylinder in an office chair, the motherboard in a computer, and the electric motor inside an automated window shade product.

3.5.2 Recycled Content

The information below will aid in the assessment of recycled content in a material or product. Recycled content will receive the material assessment ratings as detailed in Table 14.

1. **Fully defined recycled content -** If a material containing recycled content is fully defined as detailed in Section 3.4.2, testing is not required, and the material is to be assessed in the same manner as virgin homogeneous materials. Full data may be gathered on most metals, glass, paper containing recycled content, and polymers from single stream sources, in which case testing would not be required.
2. **Recycled content from an undefined source -** Recycled content that cannot be characterized by ingredient formulations must undergo analytical testing and be free of chemicals on the Banned List. Note the following regarding analytical testing:
    a. Testing and reporting of results are required as set out in Section 3.4.2 and in the *Material Health Assessment Methodology* document.
    b. When interpreting laboratory reports, remember to:
        i. Check that the detection limits are low enough to ensure absence of chemicals on the Banned List at the listed thresholds.
        ii. Review the sample preparation methods used to ensure that adequate extraction methods were used. For example, extractions commonly used for soil samples may not be sufficient if analyzing polymers.

For all recycled content, note the concentration thresholds for the Banned List chemicals below.

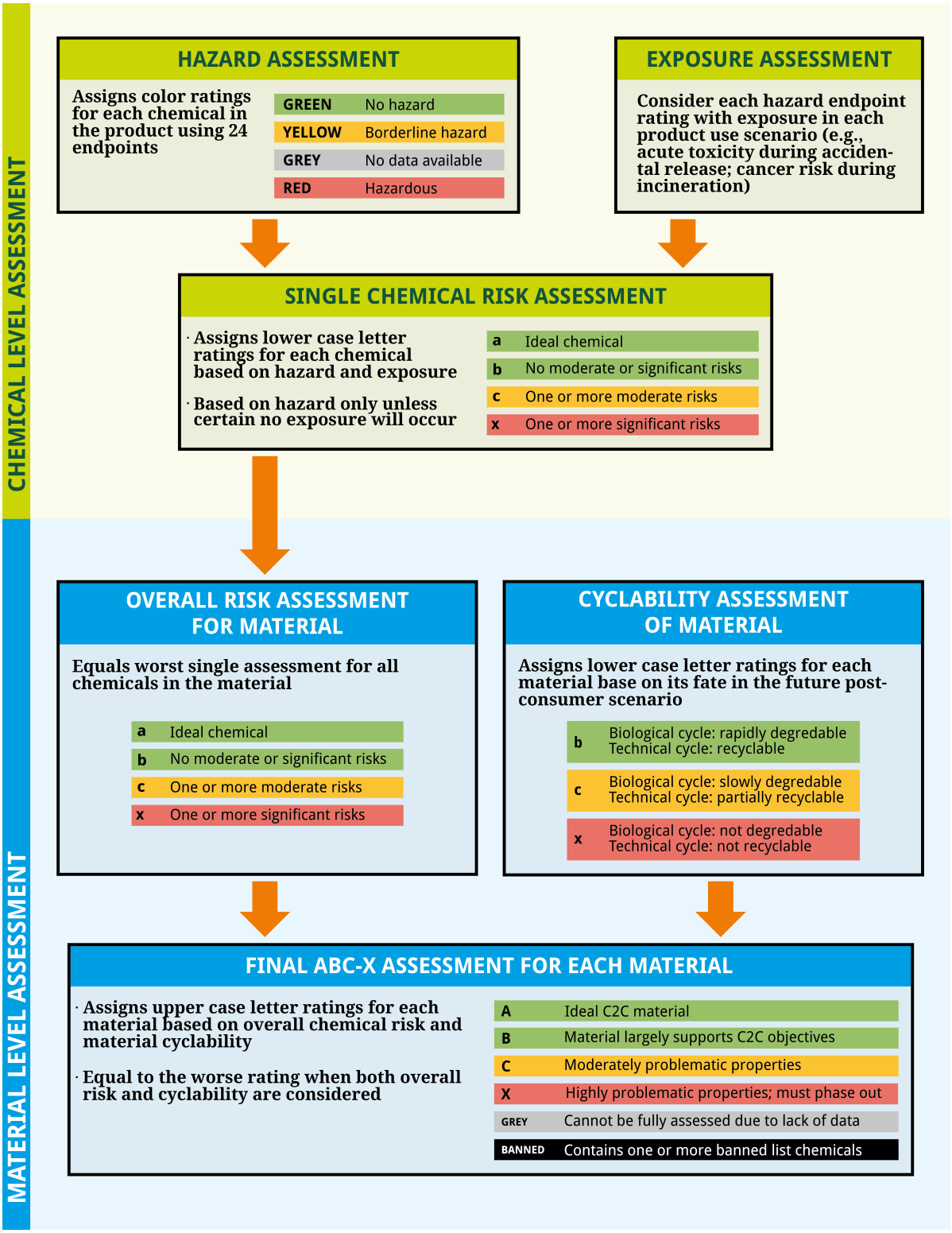
1. Metals: Lead, mercury, cadmium, and chromium VI are banned at concentrations >1000 ppm each, but receive an X assessment if present from 100-1000 ppm.
2. Organohalogens: The organohalogens must each be present at <100 ppm. This means that bromide, chloride and fluoride are to each be present at <100 ppm based on the screening test method. The screening method is slightly problematic in that it detects both elemental and organic halogens. This issue may lead to overestimates of content. If the results show halogen content to be above the 100 ppm threshold, it may be desirable to conduct further testing to determine the exact source (organic or inorganic and exact identity of halogenated organics). The exact source may be difficult to determine, however, as there are multiple possible sources and many different halogenated organics.

If recycled content from variable and mixed sources does not contain Banned List chemicals or X assessed items above the thresholds listed in Table 14, it will be assessed as Grey and thus will not count toward the total percentage assessed. NOTE – this is assuming the requirements listed in section 3.4.2 for recycled content are not met.

Table 14 Assessment Scale for Recycled Content

A/B	Recycled content (Post-consumer recycled (PCR) or post-industrial (PI)) is highly defined to exact chemical composition and meets requirements of the A or B assessment rating.
C	Recycled content (PCR or PI) is highly defined to exact chemical composition and meets requirements of the C assessment rating OR recycled content meets the testing requirements as listed in section 3.4.2.
GREY	Cannot determine composition enough to generate an assessment rating: Mixed and varied PCR Content. Untreated PCR paper.
X	PCR content shown to contain problematic chemistry. Heavy Metals Lead, Mercury, Cadmium, and Chromium VI 100-1000 ppm each (all material types). Organohalogens Organohalogens > 100 ppm each.
BANNED	PCR content containing Banned List chemicals cannot be included in certified products.

Figure 4 Summary of the Material Health Assessment Process



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:

Bronze level	TNs are at least 75% assessed as A, B, C, or X. BNs are 100% assessed as A, B, C, or X.
Silver level	TNs are at least 95% assessed as A, B, C, or X. BNs are 100% assessed as A, B, C, or X.
Gold level	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 homogenous material subject to review to be counted as "assessed," the following must be true:
    a. The material does not contain any chemicals on the Banned List.
    b. Chemicals present in concentrations ≥ 0.01% (100 ppm) have been gathered for materials assessed as A, B, or C. Chemical ingredient data may be incomplete in cases where it becomes clear during the assessment process that a material will be assessed as X.
    c. 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., rare earth elements such as indium and gold).
        ii. Process chemicals: metal plating agents (i.e., hexavalent chromium), textile auxiliaries, blowing agents, and paper bleaching agents.
    d. 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.
    e. 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 for each homogeneous material that meet the requirements listed above, with

one exception as follows. In the case that the finished product is a homogeneous material, then the percentages for each input product/mixture and/or chemical are used in determining the percentage of the product assessed.

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) ingredients are to be included in the optimization plan (Grey assessed items will eventually be assumed to be X unless missing data can be collected). 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 chemicals known or suspected to be carcinogenic, mutagenic, or reproductive toxins (CMRs) after the A, B, C, X assessment has been carried out.

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 chemicals included in the product are not carcinogenic, mutagenic, or reproductive toxins (CMRs). 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^{CM} 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

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. BIFMA M7.1 for office furniture or equivalent EU standard.
2. One of the following loading scenarios to quantify emissions has been used:
    a. BIFMA M7.1 for office furniture.

b. California Department of Health Services section 01350 for all other products.

3. Emissions results

   a. Individually detected chemicals must not be detectable (detection limits must be < 9.0 µg/m^3 for formaldehyde and <2µg/m^3 for all other chemicals).

   b. TVOC must be < 0.5 mg/m^3.

   c. Individual VOCs < (0.01) x [the lower of the TLV or MAK value].

   d. VOCs that are considered known carcinogens, endocrine disruptors, mutagens, reproductive toxins, or teratogens must not be detectable (using same detection limits as above).

   e. The time point used is 7 days for VOCs and IVOCs.

   f. The analytical laboratory used must be ISO 17025 certified.

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 are assessed and none are assessed with an X rating.

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 manufacturing stages of product development that are not present in the final product above 100 ppm (0.01%) are considered for this requirement. The requirement applies only to those process chemicals directly relevant to manufacture of the product(s) under review.

The same methodology is applied in assessing process chemicals as for product inputs, although different exposure scenarios will be important to consider. See the *Material Health Assessment Methodology* document for further details.

Required Documentation

If applying for 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 assessment results 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 15 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 15 Material Reutilization Requirements

LEVEL	ACHIEVEMENT
BASIC	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).
BRONZE	The product has a Material Reutilization Score that is ≥ 35.
SILVER	The product has a Material Reutilization Score that is ≥ 50.
GOLD	The product has a Material Reutilization Score that is ≥ 65. The manufacturer has completed a "nutrient management" strategy for the product including scope, timeline, and budget.
PLATINUM	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: ≥ 35
Silver level: ≥ 50
Gold level: ≥ 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 Nutrient Reutilization Scoring method described below.

Methods

1. For the homogeneous materials subject to review (as determined according to the process described in Section 3.1), indicate the recyclable, compostable, and recycled content as percentages. Note that it is not absolutely 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, 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. Note that X assessed materials do not count as recyclable material. In addition, parts are to be separable under normal recycling conditions and/or by the consumer if this would be necessary in order for recycling to occur. The portion of an EMC that is recyclable once take back has occurred applies.

    b. 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).

    c. 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.

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; 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 compostable materials. This sum equals "% of the product considered recyclable or 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 Nutrient Reutilization Score as follows with percentages entered as proportions:

$$\frac{(\%\text{ of the product considered recyclable or compostable}) * 2 + (\%\text{ of recycled or rapidly renewable content in the product})}{3} \times 100$$

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

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

Required Documentation

For tracking and reporting of recyclable, compostable, recycled and rapidly renewable content, it is recommended that additional columns be added to the original Bill of Material 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 for 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 16 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 16 Renewable Energy and Carbon Management Requirements

LEVEL	ACHIEVEMENT
BASIC	Annual purchased electricity and direct on-site emissions associated with the final manufacturing stage of the product are quantified.
BRONZE	A renewable energy use and carbon management strategy is developed.
SILVER	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.
GOLD	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.
PLATINUM	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. At re-application, progress on the optimization plan is demonstrated. ≥ 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.).

5.1 QUANTIFYING PURCHASED ENERGY USE AND EMISSIONS

Standard Requirement

Annual purchased electricity and direct on-site 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 purchased electricity and direct on-site 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 energy use and emissions.

Methods

1. Conduct a facility level audit of energy use and emissions as follows:

    a. The energy use and 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 energy used for similar processes. Processes that are considered to represent the final manufacturing stage may be further clarified on an industry-specific basis in the future, but initially the applicant, together with the assessor, will define the scope.

    b. Calculate the amount of purchased electricity used, including the percent on-site renewables and the percent renewables purchased from the grid and/or compliant renewable energy certificates (REC) sources. Note that if heat is purchased directly from a utility, include it in the calculations for direct on-site 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. Purchased energy must be reported in terms of megawatt hours (MWh).

    c. Calculate total carbon equivalent emissions from direct on-site emissions associated with the final manufacturing stage of the product. Be sure to include all on-site fuel uses such as gasoline for company owned vehicles, propane, etc. when attributable to the product. Also be sure to include any relevant product-attributable, non-energy 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). Direct on-site emissions must be reported in terms of carbon dioxide equivalents (tCO_2e).

    d. Allocate energy and emissions to the applicant product(s). 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. Allocate energy and emissions to the final manufacturing stage for the applicant product(s).

f. The energy data template provided on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org) may be used as a guide for reporting energy and emissions information.

2. In addition to the requirements and questions described above and below, the following questions will help in evaluating whether all relevant emissions sources have been accounted for and aid in making relative 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 is it expected that this estimate compares 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 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). Please see the example data templates on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org).

1. Facility name.
2. Country and region.
3. Purchased electricity utility name.
4. Renewable energy purchased (delivered) through utility.
5. Note: This may not be the same as the average utility or regional grid mix. Applicant may only claim renewable energy for that which is delivered to them through renewable energy pricing programs, or assurance that claims to the use of renewable energy in the utility mix may be made by customers of the utility.
6. Total amount of purchased energy required for the final manufacturing stage of the product in terms of MWh.
7. Total amount of direct on-site emissions generated for the final manufacturing stage of the product in terms of tCO_2e.
8. Total amount of renewable energy generated on-site for the final manufacturing stage of the product in terms of MWh.
9. Date range of data (calendar or fiscal year are acceptable).
10. Data source (e.g., energy bills and receipts; if other data source, please describe).

11. Indicate the greenhouse gases that are included in this inventory. Note that carbon dioxide is to be included at a minimum when all energy comes from on-site fuels and purchased electricity. The widely used GHG Protocol stationary combustion tool also includes methane and nitrous oxide in totals.
12. Indicate and describe the method used to allocate energy use and emissions to the production of the applicant product (e.g., percentage of total production weight or volume).
13. Indicate and describe the method used to allocate energy use and emissions to the final manufacturing stage of the product.
14. Indicate guidance and/or tools used (e.g., GHG Protocol, Stationary Combustion Tool, etc.).
15. Supporting documents such as Excel worksheets from the GHG Protocol and energy use bills may be provided and/or requested as well. These will allow the assessor to evaluate data quality and completeness.

5.2 RENEWABLE ENERGY AND CARBON MANAGEMENT STRATEGY

Standard Requirement

A renewable energy 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 energy use and reduces carbon emissions, but also achieves the ultimate goal of using > 100% renewable energy in the final manufacturing stages of the product.

Methods

1. The strategy must cover facility level energy use and direct on-site emissions for at least the final manufacturing stage of the product.
2. The following should be included in a renewable energy and carbon management strategy:
    a. Methods that are and/or will be employed to use renewable energy and manage carbon, 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 ENERGY AND ADDRESSING ON-SITE EMISSIONS

Standard Requirement

A percentage of the purchased energy is renewably sourced or offset with renewable energy projects, and the same percentage of direct on-site greenhouse gas emissions are offset. This requirement applies only to the energy use and 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 energy with the goal of producing > 100% renewable energy for a product. With only a baseline investment in renewable energy, subsequent energy efficiency measures may increase the percentage of overall renewable energy use, thereby incentivizing efficiency as a path to effectiveness. The intent of the following methods are to designate appropriate strategies for making valid claims to renewable energy generation, and appropriately managing direct on-site emissions.

Methods

Using Renewable Energy

1. Calculate the annual purchased electricity associated with the final manufacturing stage of the product based on data from the previous year. If there is reason to expect that emissions will be much higher in the subsequent year or in new products, somewhat 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 emissions and production volume estimates should be employed to estimate total emissions for the coming year. Estimates for new products may be based on allocated emissions estimates for existing products of similar type.
2. Note that renewable energy that is already a standard part of the grid mix does not count toward the renewable energy requirement unless the applicant is participating in a voluntary green pricing program or the applicant has verified that their utility is delivering renewable energy which may be claimed by the utility customer without being double counted elsewhere in the system.
3. *On Site Renewables:* Calculate the percentage of on-site renewable energy generation as a proportion of the overall purchased electricity attributed to the final manufacturing stage of

the product based on data from the previous year. To meet the renewable energy use requirement for a particular level, the remaining percentage of renewable energy must be compensated for by the purchase of RECs or offsets.

4. *Renewable Energy Credits (RECs)***:** If purchasing RECs to compensate for the percent of renewable energy 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 energy attribute provided.

5. *Offsets supporting Renewable Energy***:** Registered carbon offsets that support renewable energy projects may be used in place of RECs for purchased electricity; however, in this case the electricity needs to be converted to metric tons CO_2 equivalents (tCO_2e) using the utility or regional grid energy mix. Renewable energy in a grid or regional mix will result in lower emissions overall, so that the amounts of offsets are less than if energy was produced from fossil fuel sources.

    a. NUCLEAR POWER: For all electrical sources, calculate the amount of CO_2e attributed to nuclear power by using the average CO_2 emissions from coal. Nuclear power does not contribute significantly to purchased energy. This is due to the fact that, as compared to energy from petroleum sources, nuclear power is responsible for very low to zero greenhouse gas emissions, particularly when the supply chain is not considered. This 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 purchased energy prior to offset purchase.

        i. Using Table 17, look up the country where the company is located, percent of nuclear power in the grid mix, and the multiplier.

        ii. Add this to the total *product* allocated CO_2e, making sure all units are in metric tons. It is necessary to add the nuclear carbon conversion to total emissions calculated prior to any adjustments made for offset or REC purchase. See example data templates on the Cradle to Cradle Products Innovation Institute website for more information (http://c2ccertified.org).

        iii. Optional: It is allowable to use more local electricity mix information than what is provided in Table 17. Instead of using the multiplier below, calculate a new multiplier by plugging the local percent nuclear share of electricity production into the following formula: (Percent of Nuclear*891 grams CO_2e/kWh)/(1,000,000 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://www.world-nuclear.org/education/comparativeco2.html).

        iv. Multiply total metric tons CO_2e, including nuclear carbon conversion, by the desired offset percentage to determine the amount of offsets that should be purchased.

Table 17 Nuclear Power Conversion Using CO_2e Emissions Derived from Coal

Country	Nuclear share of electricity production	Multiplier

Country	Nuclear share of electricity production	Multiplier
Argentina	5.9%	0.00005257
Belgium	51.1%	0.00045530
Brazil	3.1%	0.00002762
Canada	15.1%	0.00013454
People's Republic of China (PRC)	1.8%	0.000016038
Czech Republic	33.3%	0.000296703
Finland	28.4%	0.000253044
France	74.1%	0.000660231
Germany	28.4%	0.000253044
India	2.9%	0.000025839
Japan	29.2%	0.000260172
Korea, South (ROK)	32.2%	0.000286902
Mexico	3.6%	0.000032076
Netherlands	3.4%	0.000030294
Pakistan	2.6%	0.000023166
Russia	17.1%	0.000152361
South Africa	5.2%	0.000046332
Spain	20.1%	0.000179091
Sweden	38.1%	0.000339471
Switzerland	38.0%	0.00033858
Republic of China Taiwan (ROC)	19.3%	0.000171963
United Kingdom	15.7%	0.000139887
United States	19.6%	0.000174636

Data were taken from world-nuclear.org (2010).

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 On-site 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 direct on-site 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_2e and based on the emissions factor of the purchased fuel. To meet the offset requirement for a particular level, the given percentage of on-site emissions must be compensated for by the purchase of offsets or via use of renewables such as biomass on-site that results in avoided emissions from non-renewable sources.
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^{CM} 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 energy and emissions is compensated for with renewable energy use or offsets, that percentage may be claimed for all certified products produced at that facility. If renewable energy 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 example data templates provided on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org) to calculate purchased electricity and emissions, and to track on-site renewable energy, RECs purchases and offsets. GHG protocol worksheets or similar energy and emissions accounting worksheets may be provided instead of the example tables, as long as all information indicated below is included, and accounting methodologies are explained.

1. Update energy and emissions calculations performed at the Basic level with most current prior year data, include energy and emissions estimates for the upcoming two years.
2. If converting purchased electricity to CO_2e, report country, nuclear share, multiplier, nuclear carbon conversion, and total CO_2e, (nuclear carbon conversion + total product allocated CO_2e calculated initially).
3. Report sources of on-site renewable energy and annual generation attributable to the final manufacture stage of the product.
4. Indicate the amount and percentage of RECs purchased, including registry and/or retailer.
5. If converting purchased electricity to CO_2e, indicate the amount and percentage of carbon offsets purchased to offset purchased electricity. Provide the name of the offset registry, project, and project description.
6. Indicate the amount and percentage of carbon offsets purchased to offset onsite 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 off-sets and RECs purchased in the prior year as compared to actual emissions estimates for that year.

5.4 EMBODIED ENERGY USE

Standard Requirement

The embodied energy associated with the product from Cradle to Gate (i.e., up to final manufacture stage) is 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 energy impacts associated with their supply chains, which can be significant in many cases. Also, the intent is to honor the importance of a product's 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 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 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 energy and carbon management strategies already in place, and opportunities for optimization.
    b. Methods that are and/or will be employed to use renewable energy and manage carbon 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_2e per unit of analysis.
   b. Percent of total CO_2e attributed to each life cycle stage (if applicable).
   c. Global warming potential metric(s) used and describe 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 Suggested 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.

Table 18 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 18 Water Stewardship Requirements

LEVEL	ACHIEVEMENT
BASIC	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.
BRONZE	A facility-wide water audit is completed.
SILVER	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).
GOLD	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).
PLATINUM	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 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 effluent discharged by manufacturing facilities does not degrade surface waters.

Methods

1. If the applicant is subjected 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 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. 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 and an effluent management plan.
2. If applicable, a signed statement from the applicant stating that the facility at which the product is manufactured is subject to well-developed and enforced regulations pertaining to effluent quality and has not been subject to any significant discharge violations in the past two years.

   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.). Break out 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. Examples of an acceptable format for providing the requested data are available on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org). 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.

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. 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. Identify the chemicals used in the manufacturing of the applicant product that are potentially entering effluent through the process water, cooling system, input materials, and pipes by chemical name and CAS #. At a minimum include chemicals that are known or expected to be introduced into water intentionally or unintentionally. It is not expected that analytical testing beyond what is already required for regulatory purposes will be conducted.
    a. Threshold: all chemicals expected to be present in the effluent from the manufacturing process, excluding water.
    b. Timeframe: consider emissions to effluent on an annual basis.
2. For each chemical that enters effluent, calculate the maximum daily value (concentration in effluent and total mass), average daily value (concentration in effluent and total mass) and total mass across the chosen time period. These values can be calculated using a mass balance approach or the results of analytical testing can be used where possible.
3. Assess the hazard of all chemicals that may be present in the effluent, as described in the C2C *Material Health Assessment Methodology* document and Section 3.5 of this document.
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. 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 the process water or cooling system, or are input materials at a particular point in the manufacturing process).
3. The maximum daily value (concentration and mass), average daily value (concentration and mass), and total mass across the chosen time period for each chemical in the effluent. Report the units and date range of the chosen time period (i.e., annual, calendar, or fiscal year).
4. The final assessment for each chemical identified A, B, C, or X.
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 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 challenging 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 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.
    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.

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 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 process-related chemicals that are A, B, or C assessed. 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. Quantify the total amount of all chemicals entering the effluent during the prior year (use same method described in Section 6.5).
3. Assess the hazard of all chemicals as described in the *Material Health Assessment Methodology* document and Section 3.5 of this document.
4. All chemicals are to be either A, B, or C assessed in order to fulfill this requirement.

5. 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. The maximum daily value (concentration and mass), average daily value (concentration and mass), and total mass across the chosen time period for each chemical in the effluent. Report the units and date range of the chosen time period (i.e., annual, calendar, or fiscal year).
4. Provide the final assessment for each chemical (must be A, B, or C).
5. Provide documentation on local drinking water standards.
6. 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 responsible manufacturing, enforcing fair treatment of workers, and reinvesting in natural capital.

Table 19 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 19 Social Fairness Requirements

LEVEL	ACHIEVEMENT
BASIC	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.
BRONZE	A full social responsibility self-audit is complete and a positive impact strategy is developed (based on UN Global Compact Tool or B-Corp).
SILVER	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 employee's lives, the local community, global community, social aspects of the product's supply chain, or recycling/reuse.
GOLD	Two of the Silver-Level requirements are complete.
PLATINUM	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)) for each location and/or sector. The SHdb is highly recommended for fulfilling this requirement. The necessary portion of SHdb is freely available through registration on their website (http://socialhotspot.org). 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).

Additional references for exploring the applicability of the risk or opportunity level to specific industry sector(s) 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, U.S. Bureau of Labor Statistics, AFL-CIO, International Trade Union Confederation country profiles, and the World Health Organization.

Required Documentation

An example data template for reporting results is available on the Cradle to Cradle Products Innovation Institute website (http://c2ccertified.org).

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 do not apply).
2. Do those facilities identified as having high or very high risk or opportunity provide ≤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, identification of new or recurring issues, and results of any self-audits.

Required Documentation

The following information must be provided to the assessor:

1. A signed statement indicating that ≤1% of final manufacturing and tier-one facilities combined were found to be located in countries and/or sectors with high or very high risk/opportunity levels, if not required to provide management procedures (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 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 by weight. However, if the certifying body has its own requirements, those will take precedence.
2. It is encouraged to select programs that address both social and environmental issues; however, programs that address only one of these may apply. The following programs are pre-approved:
   a. FSC-certified wood.
   b. Conflict-free (third-party verified).
   c. Fair Trade certified.
   d. UTZ Certified.
   e. Certified organic.

   This is not an exhaustive list. 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.
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.

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.
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 at a minimum, all inputs representing 1% or more of the product's total inputs be included if possible. 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.
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. Product inventory information.
    a. Product name and description.
    b. Goal of the inventory.
    c. Guidance that influenced the boundary set and other methodology choices, data collection sources, and the software system used.

2. Scope of inventory, including the unit of analysis.
3. Boundary of inventory.
    a. Assumptions made.
    b. Methodology choice (i.e., Cradle to Gate or other).
4. Allocation method (estimate of total worker hours or other).
5. Type of data used.
    a. Primary data (% of total worker hours).
    b. Secondary data (% of total worker hours).
    c. Data sources.
6. Inventory results.
    a. A list of the metrics considered and risk/opportunity level by total worker hours for each by the unit of analysis (see SHdb documentation).
7. Use of results.
    a. Describe the significance of inventory results.
    b. Provide a positive impact strategy 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 employee's 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 this requirement is to challenge manufacturers to develop an innovative company program that positively impacts social issues and implements the Cradle to Cradle® principles.

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 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 local community.
3. Decreasing 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® 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™ 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

Standard Requirement

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

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 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 / B Impact Assessment with third-party audit.

   b. Business Social Compliance Initiative (BSCI) audit.

   c. Global Social Compliance Program (GSCP) audit.

   d. SA 8000 certified (Social Accountability International).

   e. Worldwide Responsible Apparel Production (WRAP).

   This is not an exhaustive list. 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

It is expected that certification holders will make a good faith effort toward optimization in all five categories of the Standard. 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 poor ratings) as part of certification.

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 in all five categories of the standard.

Methods

1. Material optimization is generally given precedence over other types of improvements in the program. 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 may be required at re-application (see below).
3. In areas where progress is not specifically required, the applicant may select which area to work on in order to show at least some improvement across the entire program upon re-application.
4. Table 20 provides a list of optimization strategies or plans required throughout the entire program. Optimization and improvement in other areas may also apply.

Table 20 Optimization Strategies or Plans Required Throughout the Program

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

Required Documentation

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

9 SITE VISIT OF PRODUCTION FACILITY

Standard Requirement

A site visit of the final manufacturing facility or facilities is to be completed to verify the data submitted for assessment.

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 validate the information and data submitted to the assessor for product certification.

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 your 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^{CM} application and program documents prior to the arrival of the auditors, so that they can address any questions.

A site visit is required for each distinct product undergoing review. More than one site visit may be necessary for the same facility if applicants choose to certify multiple products over time. In addition, the product must be on the production line during the site visit in order to be valid.

Required Documentation

Completion of a site visit checklist based on each certification level's data requirements is 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[CM] 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[CM] 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[CM] 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[CM] 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

ABS	acrylonitrile butadiene styrene
BBP	benzyl butyl phthalate
BOD	Biological oxygen demand
BOF	basic oxygen furnace
BSCI	Business Social Compliance Initiative
CAS	Chemical Abstract Service
CMR	carcinogenic, mutagenic, or reproductively toxic
CO_2	carbon dioxide
COD	chemical oxygen demand
CONEG	Coalition of Northeastern Governors
COTE	Committee on the Environment
CPVC	chlorinated Polyvinyl chloride
DBP	dibutyl phthalate
DEHP	di(2-ethylhexyl)phthalate
EAF	electric arc furnace
EMC	externally managed component
EPEA	Environmental Protection Encouragement Agency
FSC	Forestry Stewardship Council
FTC	Federal Trade Commission
GHG	greenhouse gas
GSCP	Global Social Compliance Program
HDPE	high density polyethylene
IARC	International Agency for Research on Cancer
ICP/AES	inductively coupled plasma/atomic emission spectroscopy
ICP/MS	inductively coupled plasma/mass spectroscopy
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IPS	Intelligent Products System
LCA	life cycle assessment
MBDC	McDonough Braungart Design Chemistry, LLC
MSDA	material safety data sheets
MWh	megawatt hours
PAHs	polycyclic aromatic hydrocarbons
PC	polycarbonate
PCP	pentachlorophenol
PET	polyethylene terephthalate

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

12 TERMS AND DEFINITIONS

TERM	DEFINITION
ACRYLONITRILE BUTADIENE STYRENE	A common thermoplastic.
ALGAE TOXICITY	Several genera and species of green algae found in lakes, ponds, and streams that are responsible for aquatic oxygen balance and food sources for fish are tested for their reaction to chemical exposure. Chemicals that kill algae are considered dangerous to aquatic eco-systems due to the possible food chain effects and food source depletion. Algae toxicity is a measure of a substance's toxicity when consumed by these various types of algae. A common measuring tool is LC50 ("lethal concentration"), which is the concentration of a substance in the water required to kill fifty (50) percent of the algae test population. If LC50 < 10 mg/L, the substance is considered algae toxic.
ANDROGEN	Any natural or synthetic compound, usually a steroid hormone that stimulates or controls the development and maintenance of male characteristics in vertebrates by binding to androgen receptors.
ASTM D6400-04	Standard specification for compostable plastics.
BIOACCUMULATION	The process by which substances are stored and accumulated in the tissue or organs of humans or animals.
BIOCONCENTRATION FACTOR (BCF)	A measure of the tendency for a chemical to accumulate. The ratio of the concentration of a substance in a living organism (mg/kg) to the concentration of that substance in the surrounding environment (mg/l for aquatic systems).
BIODEGRADABLE	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 not oxygen is 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 methods.
BIOLOGICAL METABOLISM	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.

TERM	DEFINITION
BIOLOGICAL NUTRIENT	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: • 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) Generally, products as biological nutrients fit in with the two last levels.
BIOMASS	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.
CA PROPOSITION 65	A list of substances known by the state of California to cause cancer or reproductive harm.
CARBON DISCLOSURE PROJECT	Organization that helps companies voluntarily disclose greenhouse gas emission accounting.
CARBON OFFSET	Reduction of greenhouse gas emissions to compensate for the release/production of emissions from another source.
CARCINOGEN - KNOWN	A causal relationship has been established between exposure to the agent and human cancer (MAK 1 or TLV A1 or IARC Group 1).
CARCINOGEN - POSSIBLE, OR SUSPECTED	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).
CARCINOGEN - PROBABLE	A known animal carcinogen, but carcinogenicity in humans has not been definitely proven (MAK 2 or TLV A2 or IARC Group 2A).
CAS NUMBER	Chemical Abstract Service number. This number uniquely identifies each pure chemical compound. This is also designated as Chemical Abstract Service Registry Number (CASRN) as well.

TERM	DEFINITION
CEN	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).
CHEMICAL	A substance represented by a single Chemical Abstract Service Registry Number (CAS #).
CHEMICAL CLASS	Grouping of elements or compounds according to certain chemical functional or structural properties.
CHEMICAL PROFILE	The process of using the 24 human and environmental health endpoints and their associated criteria to determine the inherent hazards of a single chemical.
CHEMICAL PROFILES DATABASE	A database set up to house the color-coded rating of chemicals based on their hazards to human and environmental health.
CHLORINATED POLYVINYL CHLORIDE	A chlorinated version of PVC used for temperature stability.
CHILD LABOR	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. http://www.unicef.org/protection/index_childlabour.html • Ages 5-11: At least one hour of economic work or 28 hours of domestic work per week. • Ages 12-14: At least 14 hours of economic work or 28 hours of domestic work per week. • Ages 15-17: At least 43 hours of economic or domestic work per week. International Labour Organization (ILO) definition: The minimum age at which children can start work (with some possible exceptions for developing countries): http://www.ilo.org/ipec/facts/ILOconventionsonchildlabour/lang--en/index.htm • Ages 13-15: May perform light work that does not threaten health and safety, or hinder education or vocation orientation and training. • Age 15: The age at which compulsory schooling in generally finished; may begin to work • Age 18: May perform hazardous work (that which may jeopardize physical, mental or moral health, safety or morals)
CLEAN DEVELOPMENT MECHANISM	Stimulates sustainable development by allowing emission reduction projects in developing countries while allowing industrialized nations to meet emission reduction targets.

TERM	DEFINITION
CLEARANCE TIME (CT)	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 t1/2.
CLIMATE ACTION RESERVE	National offset program founded to guarantee transparency, integrity, and financial value of voluntary U.S. carbon market.
CLIMATE, COMMUNITY, AND BIODIVERSITY ALLIANCE, THE	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."
CLIMATIC RELEVANCE	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.
CO2 EQUIVALENTS (CO2e)	A quantity that describes the amount of CO2 for a particular greenhouse that has the same Global Warming Potential when measured for a specific timescale.
COLORANT	Any chemical or substance used to impart color to matter, such as a pigment or dye.
COMPOSTABLE	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.
DAPHNIA TOXICITY	Water fleas of the genus Daphnia can be found in most ponds and streams. They feed upon microscopic particles of organic matter and are in turn food for fish and other aquatic organisms. Daphnia Toxicity is a measure of a substance's toxicity when consumed by these water fleas. A common measuring tool for daphnia toxicity is EC50 ("effective concentration"), which is the concentration of a substance in the water required to immobilize 50 percent of the test animals. If EC50<10 mg/liter, the substance is named daphnia toxic.
DEGRADATION	Decomposition of a compound by stages, exhibiting well-defined intermediate products.
DIN	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.

TERM	DEFINITION
DOWNCYCLING	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.
EARTHSTER	A free open source platform for assessing and reporting a product's social and environmental impact.
EFFECT CONCENTRATION 50 (EC50)	The median exposure concentration (EC50) is the median concentration of a substance that causes some effect in 50 percent of the test animals.
ENDOCRINE DISRUPTOR	A substance that mimics, blocks, or interferes with hormones and their production, metabolism, and excretion causing malfunction of the endocrine system which can lead to malfunction of the reproductive, nervous, and immune systems.
EXCESSIVE WORK TIME	ILO definition: More than 48 hours/week; more than 8 hours/day http://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/working-time/lang--en/index.htm .
EXTERNALLY MANAGED COMPONENT (EMC)	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: 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. 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. iii. The EMC has undergone testing by an accredited analytical laboratory to ensure that harmful substances are not being emitted from the EMC above the chemical's analytical detection limits.
FACILITY	A facility is termed as the final step of the manufacturing process before distribution to end-user market.
FINISH (noun)	A surface pretreatment or coating for a variety of materials.

TERM	DEFINITION
FISH TOXICITY	Several genera and species of fish found in lakes, ponds, and streams that are part of the food chain are tested for their reaction to chemical exposure. Chemicals that kill fish are considered dangerous to aquatic eco-systems due to the possible food chain effects and food source depletion. Fish toxicity is a measure of a substance's toxicity when consumed by these various types of fish. A common measuring tool is LC50 ("lethal concentration"), which is the concentration of a substance in the water required to kill fifty (50) percent of the fish test population. If LC50 < 10 mg/L, the substance is considered fish toxic.
FORCED LABOR	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.
FUNDAMENTAL HUMAN RIGHTS	Please refer to The Universal Declaration of Human Rights, (United Nations, 1948) http://www.un.org/en/documents/udhr/index.shtml .
GaBi	Life-cycle assessment tool for modeling social, environmental, and economic impacts of products and systems attributed to material flows and processes.
GHG PROTOCOL CORPORATE ACCOUNTING AND REPORTING STANDARD,THE	International accounting tool to quantify, manage, and report greenhouse gas emissions.
GHG PROTOCOL PRODUCT STANDARD	Standardized methodology for quantifying, managing, and reporting greenhouse gas emissions throughout a product's life-cycle.
GLOBAL WARMING POTENTIAL (GWP)	A scale used to relate a compound to the CO2 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 CO2, for the same time period.
GOLD STANDARD, THE	International organization that provides transparency in carbon offset projects and awards projects that are driving sustainable development and local benefits.
HALF-LIFE (T1/2)	The amount of time it takes half of an initial concentration of substance to degrade in the environment.
HALOGENATED ORGANIC COMPOUNDS	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 or bioaccumulative, or form hazardous substances during production and disposal (e.g., PVC).
HAZARD ENDPOINT	For the purposes of the Cradle to Cradle® Chemical Profiling Methodology, this term refers to the list of 24 human and environmental health endpoints that are reviewed for each chemical in the chemical hazard assessment process.

TERM	DEFINITION
HAZARD RATING	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.
HEAVY METAL	The term "Heavy Metals" is generally interpreted to include those metals from periodic table groups IIA through VIA. The semi-metallic elements: boron, arsenic, selenium, and tellurium are often included in this classification.
HETEROGENOUS MATERIAL	Any material that does not fit within the definition of a homogeneous material.
HOMOGENEOUS MATERIAL	A material of uniform composition throughout that cannot be mechanically disjointed, in principal, into different materials (RoHS definition).
HYBRID PRODUCTS	Goods that are composed of both biological nutrients and technical nutrients. Certain components are designed to biodegrade, and therefore return to natural systems, while others can remain in a nutrient recovery system of manufacture, use and recovery.
INDUCTIVELY COUPLED PLASMA/ ATOMIC EMISSION SPECTROSCOPY	A method to determine the presence of metals in a sample. Also applies to "Inductively coupled plasma/mass spectroscopy."
INDUSTRIAL METABOLISM	Transformations that one and the same material may experience for successive reoccurrence on the market in form of new products. A product with a potential as biological nutrient may be managed as technical nutrient (e.g. management of cellulose fibers in a cascade starting with wood furniture products and ending as toilette paper). In contrast, a product without potential as biological nutrient must be able to be managed as technical nutrient. Industrial metabolism targets assurance of renewal of biological resources at least at the rate they are processed industrially.
INPUT	Inputs refer to the chemicals, mixtures, simple and complex materials, assemblies or sub-assemblies that make up a product.
INSEPARABLE COMPONENT	Smallest unit of an object that is either not designed to or cannot be readily disassembled by the end user into individual materials.
IRRITATION OF SKIN/MUCOUS MEMBRANES	For the testing of skin irritation with the standard Draize test, rabbits are used. The chemical is applied to the rabbit skin and usually kept in contact for 4 h. The degree of skin irritation is scored for erythema, eschar and edema formation and corrosive action. These dermal irritation observations are repeated at various intervals after the chemical has been removed. Mucous membrane irritation is measured in a similar manner. Site-specific mechanical responses within the respiratory tract and eyes are measured, and a chemical is classified as an irritant based on the conclusions of these tests.
ISO	The International Organization for Standardization is the world's largest developer and publisher of International Standards.

TERM	DEFINITION
LETHAL CONCENTRATION 50 (LC50)	The inhalative median lethal concentration (LC50) is the median concentration of a substance that causes death in 50 percent of the test animals.
LETHAL DOSE 50 (LD50)	The median lethal dose (LD50) is the statistically derived median dose of a substance that can be expected to cause death in 50 percent of the test animals.
LIVING WAGE	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.
LOAEL	The lowest-observed-adverse-effect level is the lowest concentration or amount of a substance found by experiment or observation which causes an adverse alteration of morphology, function, capacity, growth, development or life span of a target organism distinguished from normal organisms of the same species under defined conditions of exposure.
MATERIAL	A group of one or more chemicals that together comprise a component or input to a finished product.
MATERIAL ASSESSMENT	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.
MIXTURE	Two or more substances, which have been combined such that each substance retains its own chemical identity.
MODE OF ACTION	Mode of action refers to the specific biochemical interaction of a drug or chemical through which an adverse health effect is produced. A mode of action includes specific molecular targets to which a chemical will bind.
MUTAGEN	This is a substance that may cause hereditary disorders in the offspring due to mutations in the chromosomes of the male or female reproductive cells. These mutations can be alterations in the structure or number of chromosomes, or nucleotide substitutions known as point mutations.
NOAEL	(No observed adverse effect level) denotes the level of exposure of an organism, found by experiment or observation, at which there is no biologically or statistically significant (e.g. alteration of morphology, functional capacity, growth, development or life span) increase in the frequency or severity of any adverse effects in the exposed population when compared to its appropriate control.
OCTANOL-WATER PARTITIONING COEFFICIENT (Pow or Kow)	A measure of the tendency of a chemical to partition between an aliphatic hydrocarbon system and an aqueous system. Often used as a predictor for bioaccumulation potential.

TERM	DEFINITION
OZONE DEPLETION POTENTIAL	This is the measure of the ozone depleting characteristics of the substance. Ozone depletion in the upper atmosphere leads to an increase of UV-radiation on the earth and as a result, an increase in skin cancer. CFCs are included here.
PAS 2050	Method designed by Publicly Available Specification (PAS) to assess life-cycle emissions of goods and services.
PART	A vended component or input to a product that is made of only one specific type of material.
PERSISTENCE	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" (t1/2), which is the amount of time required for half of the substance to breakdown. 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.
PHYSICO-CHEMICAL CLASSIFICATION	Chemical classification by properties such as molecular weight, electrical charge: uncharged, positively, negatively, partially charged, formal charge, oxidation state, solubility , and pH value.
POST-CONSUMER RECYCLED CONTENT	Materials that have been collected for recycling after consumer use.
PRECAUTIONARY PRINCIPLE	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.
PRE-CONSUMER RECYCLED CONTENT	Materials 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.
PRIMARY DATA	Observed process data are specific to the given processes owned and operated by the reporting company. Such as direct emissions, energy, or physical data.
PROCESS CHEMICAL	Chemicals used during the manufacturing stages of product development.
PRODUCT	A product is a finished good, under review for Cradle to Cradle Certified^{CM} Product Program, composed of parts, assemblies, sub-assemblies, materials, 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.

TERM	DEFINITION
PROGRAM CATEGORY	The term "CATEGORIES" in this context will refer to the five program attributes which products are scored against. These include material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness.
QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIP ANALYSIS (QSAR)	Technique for comparing molecular structure and physicochemical properties of a chemical having unknown hazards with molecular structures and physiochemical properties of other similar chemicals having known toxic or carcinogenic effects.
RAPIDLY RENEWABLE RESOURCE	A material that is able to grow back in 10 years. See also RENEWABLE RESOURCE.
RATING	Chemical Profiles and Material Assessments are given a GREEN, YELLOW, RED, or GREY rating based on inherent hazards.
READILY DISASSEMBLED	Capable of being deconstructed with the use of common hand tools (i.e. wrench, screw driver, pliers, scissors, etc.).
RECYCLABLE	A material 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. Unless there is an automated process for disassembling and reducing size of materials with adequate identification and sorting technologies to produce the highest quality recyclate 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. 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.
RECYCLED CONTENT	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).

TERM	DEFINITION
RENEWABLE ENERGY CREDIT	Tradable certificates produced by an authorized body that verifies electricity was generated from an eligible renewable energy resource.
RENEWABLE RESOURCE	A material from an agricultural source. See also RAPIDLY RENEWABLE RESOURCE.
SECONDARY DATA	Generic or industry average data from published sources that are representative of a company's operations, activities, or products.
SENSITIZATION	The ability of a substance to induce an immunologically-mediated (allergic) response. An eczematous skin reaction that resulting from hypersensitivity upon secondary skin or inhalation contact by an allergen. A skin sensitizer is a substance that will lead to an allergic response following skin contact, and a respiratory sensitizer is a substance that will lead to hypersensitivity of the airways following inhalation.
SIGMAPRO	Life-cycle assessment tool that allows the user to calculate carbon footprints, quantify environmental impacts of products and services, design eco-friendly products, determine key performance indicators, and report findings.
SKIN PENETRATION POTENTIAL	A measure of the ability of a compound to assist in the absorption of chemicals into the skin.
SOLAR INCOME	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.
SUB-ASSEMBLY	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.
TECHNICAL METABOLISM	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).

TERM	DEFINITION
TECHNICAL NUTRIENT	A product capable to "feed" 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: • (Dismantle and) Reuse • (Dismantle and) Physical transformation (e.g. plastic remolding) • (Dismantle and) Chemical transformation (e.g. plastic depolymerization, pyrolysis, gasification) The management of technical nutrients occurs by transferring ownership to the users of only the service, not of materials. It is the service offering side that manages materials as technical nutrients, once the phase of functional use is over.
TERATOGEN	A substance shown to cause damage to the embryo or fetus through exposure by the mother (MAK-list: Pregnancy risk group, category A).
TERATOGEN - SUSPECTED	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).
THIRD PARTY AUDIT	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 both the organization being audited, and the organization administering the standard, regulation or criteria.
TOXICITY - ACUTE	A measure of how poisonous or "deadly" a substance is during initial exposure. A common measuring tool for acute toxicity is LD50 ("lethal dose"), which is the dose required to kill 50 percent of the test animals. If LD50<200 mg/kg, the substance is named acutely toxic.
TOXICITY - CHRONIC	This is a measure of how poisonous a substance can become over time with repeated exposure. A substance may have low acute toxicity (i.e., little harmful effects from the initial exposure) but may become poisonous over time with repeated exposure. This may be due to accumulation of the substance or due to repeated minor damaging of target organs.
TOXICOLOGICAL ENDPOINT	Also referred to as "endpoint" or "hazard endpoint."
UPCYCLING	Any measure and activity in the design phase targeting at optimal handling of products as nutrients.

TERM	DEFINITION
UTZ CERTIFIED	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.
VERIFIED CARBON STANDARD	Provides a framework for developing a project for quantification, reduction, and removal of GHG emissions.

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15 APPENDIX: BANNED LISTS OF CHEMICALS

These following lists contain those chemicals and substances that are banned for use in Cradle to Cradle Certified^{CM} products as **intentional inputs above 1000 ppm**. 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.

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.

There are two 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 highly 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 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.

Note that lead, PTFE, and polycyclic aromatic hydrocarbons (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. Therefore, despite not being present on the Technical Nutrient Banned List (with the exception of cadmium), lead, cadmium, PTFE, and PAHs are banned for use in materials where 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. Relevant material use scenarios will be determined and evaluated by the assessor. Note also that PTFE is banned in Technical Nutrients if it is the primary component of the product or material.

Table A-1 Banned List of Chemicals for Technical Nutrients

SUBSTANCE	CAS #	COMMENTS
Metals		
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	
Flame Retardants		
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	
Phthalates		
Bis(2-ethylhexyl)phthalate	117-81-7	
Butyl benzyl phthalate	85-68-7	
Dibutyl phthalate	84-74-2	
Halogenated Polymers		
Polyvinyl chloride (PVC)	9002-86-2	
Polyvinylidenechloride (PVDC)	9002-85-1	
Chlorinated polyvinyl chloride (CPVC)	68648-82-8	
Polychloroprene	9010-98-4	
Chlorinated Hydrocarbons		
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	
Others		
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
Metals		
Arsenic	7440-38-2	Restricted to maximum background concentration in soils
Chromium VI	18540-29-9	
Mercury	7439-97-6	
Cadmium	7440-43-9	
Lead*	7439-92-1	
Flame Retardants		
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	
Phthalates		
Bis(2-ethylhexyl)phthalate	117-81-7	
Butyl benzyl phthalate	85-68-7	
Dibutyl phthalate	84-74-2	
Halogenated Polymers		
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	
Chlorinated Hydrocarbons		
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	
Other		
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	
Polycyclic Aromatic Hydrocarbons*		
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	
Benz(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*