Overview of the Cradle to Cradle Certified^{CM} Product Standard

Version 3.0

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This document provides an overview of the Cradle to Cradle Certified^{CM} Product Standard (Version 3.0). 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 Cradle to Cradle Certified^{CM} Product 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 Cradle to Cradle 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

Since 1995, MBDC has been consulting with clients to integrate the Cradle to Cradle® framework and optimize products, operations, and organizational culture. 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)

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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^{CM} Product Standard:

- *Cradle to Cradle Certified^{CM} Product Standard, Version 3.0.*
- *Cradle to Cradle Certified^{CM} Product Material Health Assessment Methodology, Version 3.0.*
- *Cradle to Cradle Certified^{CM} Policies and Procedures.*

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

1 Introduction to Cradle to Cradle®

Cradle to Cradle® was developed by Michael Braungart and William McDonough, 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, including safe materials, continuous reclamation and re-use of materials, clean water, renewable energy, and social fairness.

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.

At the same time, William McDonough was working 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, 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 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).

Braungart and McDonough met in 1991 and began to share ideas. Together they merged the concept of materials as nutrients within biological and technical cycles and the concept of intentional design. This later would become the Cradle to Cradle design framework, which presents all of human creation within biological/technical cycles, continuous reuse, renewable power, and clean water—all celebrated as a human right.

At the suggestion of Braungart, McDonough was commissioned in 1992 by the city of Hannover, Germany to prepare the 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 a representative of the American Institute of Architects and the International Institute of Architects. In 1995, Braungart and McDonough 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 introduced 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 has grown worldwide, the desire for an independent review and issuance of certificates was identified to bring the program into the global mainstream. 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

Cradle to Cradle certification 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.

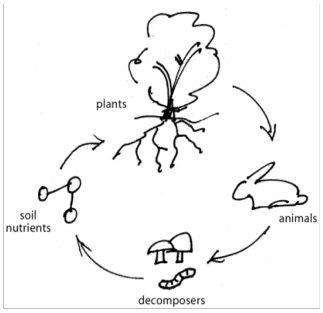
Cradle to Cradle is an innovative approach that models human industry on the processes of nature's *biological nutrient metabolism* integrated with an equally effective *technical nutrient metabolism*, in which the materials of human industry safely and productively flow within the two metabolisms in 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.

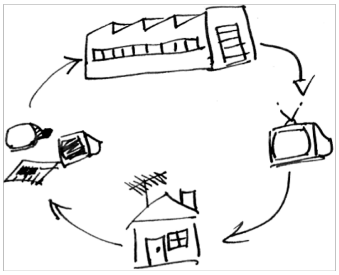
Products that have achieved positive design milestones along the continuum of improvement are shown to be suitable for cycling perpetually on Earth, using ingredients that are safe and beneficial – either to biodegrade naturally and restore the soil, or to be fully recycled into high-quality materials 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.

Depiction of Biological and Technological Nutrient Cycles



Biological Nutrients



Technical Nutrients

1.3.1 Effective Material Cycles

1.3.1.1 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.

1.3.1.2 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.

1.3.1.3 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:

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. This guarantee may be provided via a Cradle to Cradle certification (Gold level or higher) of the EMC, or other appropriate evidence.

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. 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 Cradle to Cradle certification. 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 Cradle to Cradle Certification 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 below.

Example Product Scorecard

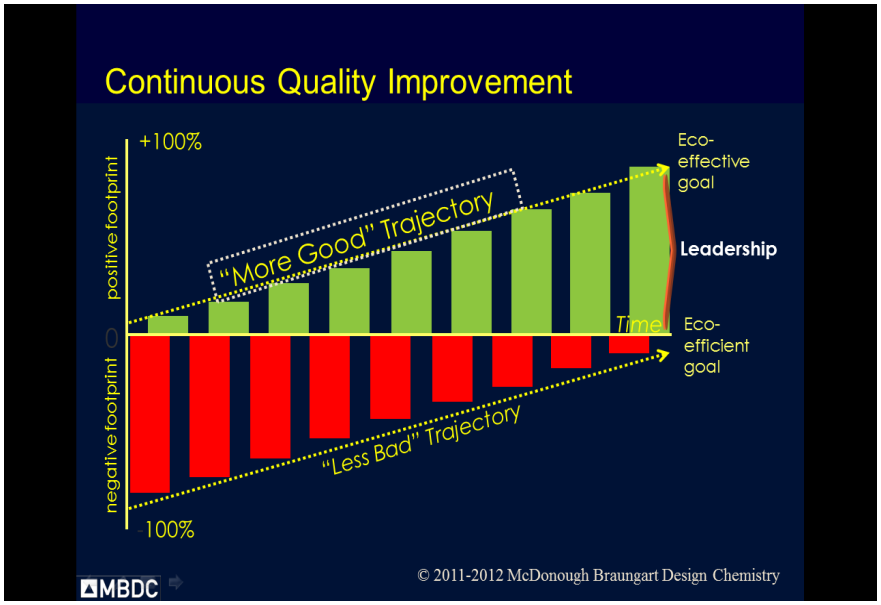
SILVER	Certification Level				
Program Category	**BASIC**	**BRONZE**	**SILVER**	**GOLD**	**PLATINUM**
Material Health			√		
Material Reutilization			√		
Renewable Energy and Carbon Management			√		
Water Stewardship				√	
Social Fairness					√
Overall Certification Level			**√**		

2.4 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 below 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.

Continuous Improvement Chart



2.5 Certification Marks

Companies receiving certification will have the opportunity to license the Cradle to Cradle brand Certification Mark. 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.

Cradle to Cradle® Certification 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.

The table below 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.

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 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 and a banned list of chemicals for biological nutrients. 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.

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	

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

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	

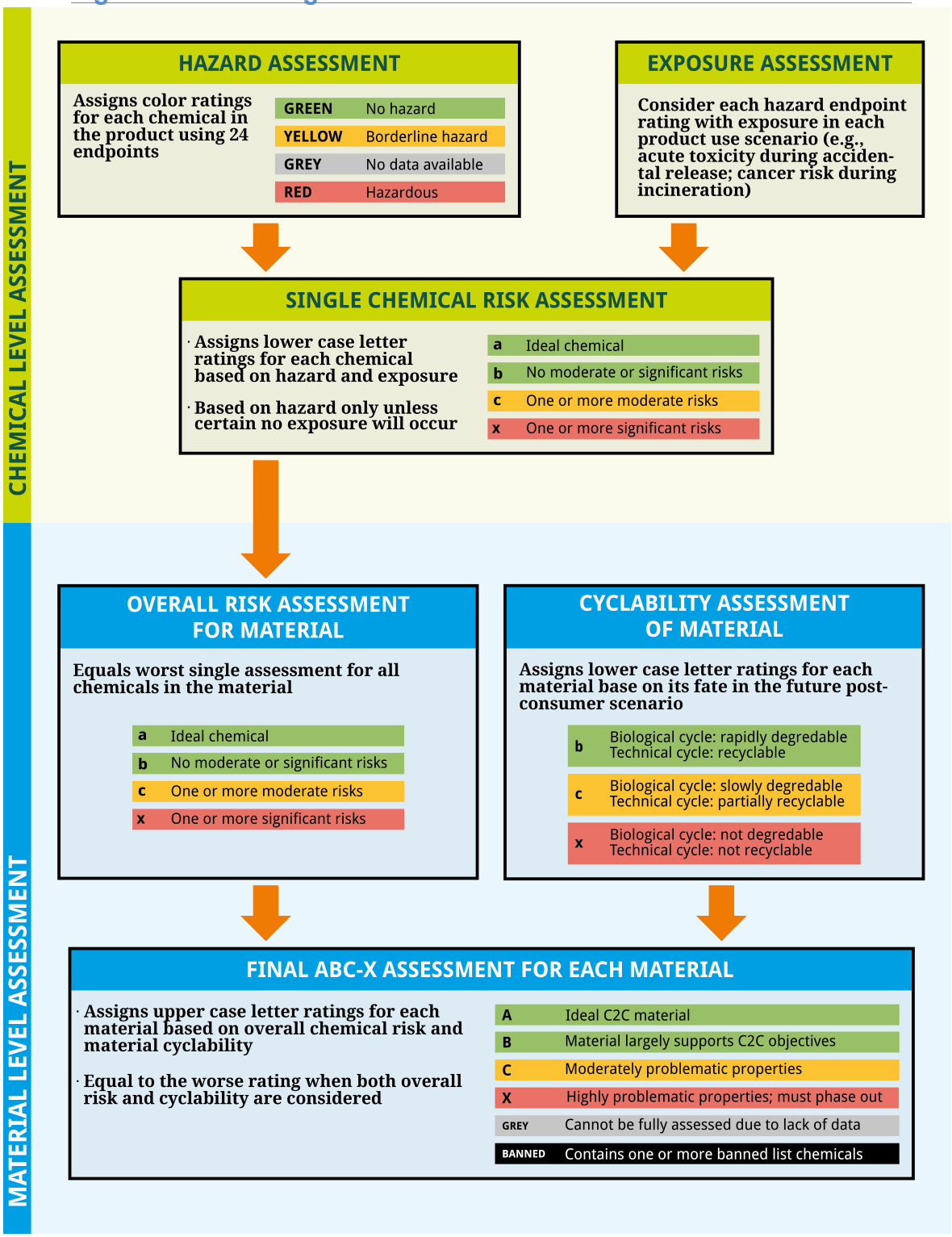
SUBSTANCE	CAS #	COMMENTS
Chlorinated polyvinyl chloride (CPVC)	68648-82-8	
Polychloroprene	9010-98-4	
Polytetrafluoroethylene (PTFE)*	9002-84-0	
Chlorinated Hydrocarbons		
1,2-Dichlorobenzene	95-50-1	
1,3-Dichlorobenzene	541-73-1	
1,4-Dichlorobenzene	106-46-7	
1,2,4-Trichlorobenzene	120-82-1	
1,2,4,5-Tetrachlorobenzene	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	
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	

SUBSTANCE	CAS #	COMMENTS
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,I)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	

SUBSTANCE	CAS #	COMMENTS
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

3.2 Figure Summarizing the Material Health ABC-X Assessment Process



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.

The table below 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.

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.

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.

The table below 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.

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.).

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.

The table below 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.

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.

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.

The table below 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.

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.

8 References

1. The term "cradle to cradle" was used in the 1980's by Walter Stahel and Dr. Michael Braungart. The term was first used in a limited way to counter the prevailing "cradle to grave" paradigm in Germany related to manufacturing processes. Braungart and McDonough expanded this to a more holistic, design led framework.

2. Braungart's organization Environmental Protection and Encouragement Agency (EPEA) Internationale Umweltforschung GmbH was formed in 1987 and subsequently created the "Intelligent Products System" which described materials as nutrients flowing in either biological or technical cycles. (*An "Intelligent Product System" to replace "Waste Management".* In: Fresenius Envir Bulletin 1, 1992, p. 613-619. Braungart, M.; Engelfried, J.:) (http://epea.com)

3. "*The Hannover Principles – Design for Sustainability"* was first published in 1992 and republished as a 10th Anniversary edition in 2002 and a 20th Anniversary edition in 2012. (http://www.mcdonough.com/principles.pdf)

4. Dr. Braungart and William McDonough co-founded McDonough Braungart Design Chemistry, LLC (MBDC) in the United States in 1995 to help companies learn and implement the Cradle to Cradle design framework. (http://MBDC.com)

5. In October 1998 the Atlantic magazine published an article entitled *"The NEXT Industrial Revolution"*. This article posited the idea that humans could incorporate positive intentions for equity, economy and ecology though product design. (http://www.theatlantic.com/magazine/archive/1998/10/the-next-industrial-revolution/4695/)

6. In 2001 the documentary film *"The Next Industrial Revolution"* was released by Earthome Productions. This chronicled several active Cradle to Cradle projects. (http://www.earthome.org/designfuture.html)

7. In 2002 the book *"Cradle to Cradle: Remaking The Way We Make Things"* was published in the United States of America by Farrar, Straus and Giroux.

8. In October 2005 MBDC launched the Cradle to Cradle Certified[CM] Program. By 2010, over 400 products from over 100 companies had achieved certification.

9. In August 2010 The Green Products Innovation Institute (the original name of the Cradle to Cradle Products Innovation Institute) was granted a free, exclusive worldwide license by MBDC to independently manage the product certification program Version 2.1.1.