Cradle to Cradle™ Certification Program

prepared
by MBDC
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Introduction

Cradle to Cradle Design™ is a revolutionary approach to the redesign of human industry based on the conviction that rigorous science and design can move human industry beyond simple concerns for "sustainability" (often seen as a form of maintenance of current levels of performance while limiting destruction) toward a new positive paradigm where growth is good – science provides the physical laws and the data and design serves as the signal of human intention - *Cradle to Cradle Design*™ mirrors the healthy, regenerative productivity of nature, and thereby creates industry that is continuously improving and sustaining life and growth.

Since 1995, McDonough Braungart Design Chemistry (MBDC) has been engaging with large and small companies with the challenge of industry to scientifically evaluate and design materials and products according to these principles. In response to industry demand, MBDC is now offering companies the chance to have their materials and products not only evaluated, but also certified according to the Cradle to Cradle Principles.

Companies receiving certification will have the opportunity to use the Cradle to Cradle branded trademark. This trademark will signify to customers that the company has chosen the chemicals, materials, and processes for health and perpetual recyclability, allowing them to purchase products that move us to a positive world of safe, healthy and fair economic enjoyment - worry and guilt-free - while meeting, and sometimes leading, the highest international regulatory and industry standards. Companies with Cradle to Cradle certified products will enjoy increased brand value by achieving product differentiation, building customer retention, facilitating transparency, reducing liability, and fostering innovation. In the US, these companies will also be able to offer their certified products as "environmentally-preferable," a current requirement for government purchases.[1] In the EU, products will meet the most rigorous upcoming standards for products yet produced on a global basis.

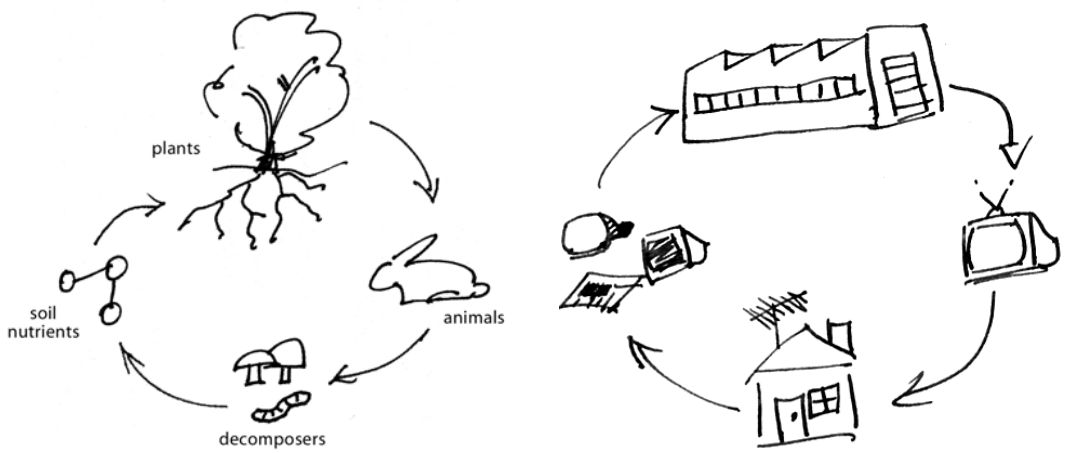
Cradle to Cradle Design™

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. Cradle to Cradle Design™ is based on the *Intelligent Product System* (IPS) pioneered by chemist Dr. Michael Braungart in 1986. In the early 1990's, Dr. Braungart and architect Mr. William McDonough expanded IPS by identifying the principles of Cradle to Cradle Design™.

Cradle to Cradle Design™ is a positive agenda, one that seeks a renewably powered world, full of safe and healthy materials that are economically, equitably, ecologically and elegantly deployed. It is an innovative approach to sustainability that models human industry on the integrated processes of nature's *biological metabolism* – its productive ecosystems – integrated with an equally effective *technical metabolism*, in which the materials of human industry safely and productively flow within the two metabolisms in a fully characterized and fully assessed way.

[1] On September 14, 1998 President Clinton signed Executive Order 13101 which outlined the Environmentally Preferable Purchasing (EPP) program for all Executive agencies. Under this program all Executive agencies are directed to purchase "Environmentally Preferable" products. "Environmentally Preferable" is defined in section 201 of EO 13101 as "products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose." Based on this definition, it is clear that a Cradle to Cradle certified product would qualify as "Environmentally Preferable" due to the fact that the Cradle to Cradle certification focuses in large part on optimizing the human and environmental health characteristics of the product requesting certification.

Products are developed for closed-loop systems in which every ingredient is 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. Utilizing *biological nutrient* and *technical nutrient* definition allows a company to virtually eliminate the concept of waste and recover value, rather than creating a future of solid waste liability and relinquishing material assets by simply delivering a physical product to a customer without a coherent relationship to the potential inherent in the product itself as a potential long term asset for the customer, nature, industry or the company itself. Cradle to Cradle Design™ turns contingent liabilities into assets.



Cradle to Cradle Design™ was founded on a recognition that a sustainable world cannot evolve from the minimizing approach of efficiency (less negative results - now "eco-efficiency") alone. Through intentional, effective decision making (more positive results - now "eco-effective" – a term characterized by MBDC) that focuses on the development of materials and products that are safe and suitable for recovery through technical or biological systems, many of the toxic legacies of the past designs can be transformed into healthful products and systems. Even rare and valuable, but toxic, materials such as cadmium, can be put into coherent technical flows in products that are infinitely characterized, designed to be safe and treated as a service that is in a defined chain of custody (eg. a solar collector vs. a small battery).

Cradle to Cradle Design™ is based on the living model for sustainability – nature. The flow and cycling of matter in nature does not lead to waste and pollution, but to a dynamic balance of growth and change within ecological systems. The fundamental elements of Cradle to Cradle Design™ are based on the principles that drive these systems in nature:

Waste equals food

- Design materials and products that are 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 life cycle leaves a beneficial legacy for human or ecological health.
- Create and participate in systems to collect and recover the value of these materials and products.

Use current solar income

- The quality of energy matters. Use renewable energy.

Celebrate diversity

- Water is vital for humans and all other organisms. Manage water use to maximize quality and promote healthy ecosystems while remaining respectful of the local impacts of water use.
- Use social responsibility to guide a company's operations and stakeholder relationships.

Unlike many other eco-efficiency oriented certification systems, Cradle to Cradle™ certification focuses on the characteristics of sustainable materials, products and systems. As a result, this process places a major emphasis on the human and ecological health impacts of a product's ingredients, 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 responsibility also are essential sustainability characteristics and focus areas in this certification process.

Certification Process

There are two tracks for certifying a product:

Cradle to Cradle™ Technical/Biological Nutrient Certification: a binary, pass-fail approach designed for those materials and simple products that are homogeneous in nature. This certification only encompasses the Material and Nutrient (Re)utilization criteria.

Cradle to Cradle™ Product Certification: a three-tiered approach consisting of Silver, Gold, and Platinum levels to reflect continuing improvement along the cradle-to-cradle trajectory. This certification contains the following five categories of metrics: Materials, Nutrient (Re)utilization, Energy, Water, and Social Responsibility (as seen below).

Both certifications apply to materials, sub-assemblies and finished products. Special considerations will be applied to certain classes of products (e.g., VOC emission standards will be applicable to indoor products only, reutilization criteria will be applied to the substrate, rather than the material, for paint and other coating products, etc.). In the case of technical nutrient products where a take back system is in effect and there is a well-defined chain of custody, certain rare, high value, but potentially toxic substances (e.g., cadmium, silver, etc.) may be appropriate and effective substances as defined in use.

1 Materials

1.1 All material components identified (down to the 100 ppm level)

All materials, sub-assemblies, components, etc. present in the finished product at 100 ppm (i.e. 0.01%) or higher are identified. All ingredients present in the materials sub-assemblies, components, etc at 100 ppm or higher are identified by their Chemical Abstract Service (CAS) number and by their relative concentration in the overall material formulation (MBDC will sign Non-Disclosure Agreements to protect any proprietary formulation information). Extremely toxic substances are reported and evaluated at any concentration. LCAs and other certification programs typically only examine ingredients present at 5% (i.e. 50,000 ppm) or higher.

1.2 Defined as a Biological or Technical Nutrient

The product is defined with respect to the appropriate cycle (i.e., technical or biological) and all components are defined as either biological or technical nutrients. If the product combines both technical and biological nutrients, they are clearly marked and easily separable. This is more of a strategic criterion and therefore there is no calculation or metric associated with it.

1.3 All ingredients characterized based on their impact on Human and Environmental Health.

The criteria listed on the next page are used in the evaluation of these two impact categories.

Based on the interpretation of the data for all criteria, chemicals and materials are “scored” for their impact upon human and environmental health. A key factor in this evaluation is the risk presented by the component/chemical, which is a combined measure of identified hazards and routes of exposure for specific chemicals and materials, and their intended use in the finished product. The “score” is illustrated by the following color scheme:

GREEN (A-B)	Little to no risk associated with this substance. Preferred for use in its intended application.
YELLOW (C)	Low to moderate risk associated with this substance. Acceptable for continued use unless a GREEN alternative is available.
RED (X)	High hazard and risk associated with the use of this substance. Develop strategy for phase out.
GREY	Incomplete data. Cannot be characterized.

For both the human and environmental health criteria, there are firmly established cutoff values for determining hazards. For example, in the case of Acute Toxicity (human health) any substance with an oral LD50 value less than 200 mg/kg (rat, mouse, guinea pig, etc) will be considered acutely toxic.

1.3.1 Human Health Criteria

The following is a list of the human health criteria used for substance evaluation by the MBDC Cradle to Cradle Design Protocol. The criteria are subdivided into Priority Criteria (most important from a toxicological and public perception perspective) and other Additional Criteria. Substances that do not pass the Priority criteria are automatically scored RED and recommended for phase-out/replacement.

Criteria	Description
PRIORITY	
Carcinogenicity	Potential to cause cancer
Endocrine Disruption	Potential to negatively effect hormone function and impact development
Mutagenicity	Potential to damage DNA
Teratogenicity	Potential to harm fetus
Reproductive Toxicity	Potential to negatively impact reproductive system

ADDITIONAL	
Acute Toxicity	Potential to cause harm upon initial, short term exposure
Chronic Toxicity	Potential to cause harm upon repeated, long-term exposures
Irritation of Skin and Mucous Membranes	Potential to irritate eyes, skin, and respiratory system
Sensitization	Potential to cause allergic reaction upon exposure to skin or airways
Other	Any additional characteristic (e.g., flammability, skin penetration potential, etc.) relevant to the overall evaluation but not included in the previous criteria

1.3.2 Environmental Health Criteria

The following is a list of the environmental health criteria used for substance evaluation by the MBDC Cradle to Cradle Design Protocol.

Criteria	Description
Fish Toxicity	Measure of the acute toxicity to fish (both saltwater and freshwater)
Daphnia Toxicity	Measure of the acute toxicity to Daphnia (invertebrate aquatic organisms)
Algae Toxicity	Measure of the acute toxicity to aquatic plants
Persistence/ Biodegradation	Rate of degradation for a substance in the environment (air, soil, or water)
Bioaccumulation	Potential for a substance to accumulate in fatty tissue and magnify 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 (e.g., soil organism toxicity, WGK water classification, etc.) relevant to the overall evaluation but not included in the previous criteria

1.3.3 Material Class Criteria

The following material classes are scored RED due to the concern that at some point in their life cycle they 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.

Criteria	Description
Organohalogen Content	Presence of a carbon – halogen (i.e., chlorine, bromine, or fluorine) bond
Heavy Metal Content	Presence of a toxic heavy metal (e.g., Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, Nickel, etc.)

1.4 Strategy developed to optimize all remaining problematic components

Once all problematic components have been identified (i.e. those substances assessed RED based on the criteria listed previously), the manufacturer commits to the eventual phase-out/replacement of these substances. A strategic plan is developed, complete with budget and timeline, for the optimization of these inputs. The implementation of this plan is subject to an annual review to judge whether or not sufficient progress has been made to merit continued Cradle to Cradle certification. However, if a product contains PVC at above 100 ppm the manufacturer must phase out or replace this material before Silver certification can be granted.

1.5 Product formulation optimized

The complete phase-out of all RED components is necessary to achieve a Gold or Platinum product certification.

1.6 Meets Cradle to Cradle™ emission standards

For interior products to achieve Gold or Platinum certification, they must meet the Cradle to Cradle emission standards which are defined as the following:

- TVOC < 0.5 mg/m^3
- Individual VOCs < 0.1 TLV or MAK values (whichever is lower)
- No detectable VOCs that are considered known or suspected carcinogens, endocrine disruptors, mutagens, reproductive toxins, or teratogens. Based on the lab chosen to do the work what is considered “non-detect” may vary. For the purposes of this certification, anything below 2$\mu g/m^3$.

Labs approved for testing include Berkley Analytical, MAS, AQS, and Syracuse University. All testing is done according to ASTM D5116 for small chamber and ASTM D6670 for large chamber.

2 Material Reutilization/Design for Environment

2.1 Defined the appropriate cycle (i.e., Technical or Biological) for the product and developing a plan for product recovery and reutilization

For all certifications, the product has successfully been designed as either a Technical or Biological Nutrient (or both if materials are easily separable); hence, the appropriate materials and chemical inputs have been intentionally selected to support the metabolism for which the product was designed. In addition, the manufacturer is in the process of developing a plan for end of life product recovery.

2.2 Well-defined plan (including scope and budget) for developing the logistics and recovery systems for this class of product

For Gold and Platinum certifications, there is also a well-defined logistics and recovery system plan for this class of product. The elements of the plan include:

- Scope: how extensive the recovery effort will be
- Timeline: when the actual recovery will begin
- Budget: commitment of resources (e.g., dollars, labor, equipment, etc.)

The plan can include partners outside the traditional supply chain (e.g., recycling partners, recovery/transportation partners, etc.). This does not necessarily mean a product take-back program. That is one potential strategy for closing the loop on the materials/product but there are several other legitimate strategies as well. For example, utilizing design for disassembly (DfD) strategies along with third party regional recyclers may be more effective in recovering and reutilizing materials than a product take back program that requires potentially very disperse products to be sent back to the manufacturer.

2.3 Recovering, remanufacturing or recycling the product into new product of equal or higher value

For Platinum certification, the plan developed in 2.2 above has been implemented. As each manufacturing system varies, MBDC will judge the validity and efficacy of each applicants program on a case-by-case basis.

2.4 Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score $\geq$ 50

For Technical/Biological Nutrient and Silver certifications, the Nutrient (Re)utilization Score is 50 or higher.

The **Nutrient (Re)utilization Score** is a combination of the recyclability/compostability and recycled/renewable content of the product and is calculated as follows:

$$\frac{(\%\text{ of the product considered Recyclable or Compostable}) * 3 + (\%\text{ Recycled or Recyclable content}) * 1}{4}$$

Example – Product X is made up of components that are 80% recyclable and it contains 40% recycled content

$$\text{Nutrient (Re)utilization Score} = \frac{[(80) * 3] + [(40) * 1]}{4} = 70$$

Note: For the purposes of this certification, recycled content is only counted if it positively defined (e.g., recycled content PVC will not count).

In view of the global nature of this certification program, specific methodological adaptations in other countries might be applicable.

2.5 Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score ≥70

For Gold certification, the Nutrient (Re)utilization Score (as calculated above) is 70 or higher.

2.6 Product has been designed/manufactured for the technical or biological cycle and has a nutrient (re)utilization score ≥85

For Platinum certification, the Nutrient (Re)utilization Score (as calculated above) is 85 or higher.

3 Energy

3.1 Characterized energy use and source(s) for product manufacture/assembly

For Silver, Gold, and Platinum certifications, a general understanding of the energy quantity and quality for product manufacture/assembly is required. To meet this requirement the amount of energy used per unit product is calculated along with the energy mix, or sources, for that energy (i.e. what percent comes from renewable vs. non-renewable sources).

3.2 Develop strategy to use current solar income for product manufacture/assembly

The ultimate goal of Cradle to Cradle Design is to have all energy inputs come from what we term "current solar income". Forms of current solar income include wind, biomass, hydro (in certain circumstances – to be determined on a case-by-case basis) and of course solar. Once the manufacturing/assembly energy has been quantified in 3.1 above, a strategy is developed to supply that energy via current solar income. The strategy contains a timeline as well as measurable goals and milestones.

3.3 Use current solar income for product manufacture/assembly

For Gold certification, the strategy developed in 3.2 is fully implemented. In other words, all of the energy required to manufacture/assemble the product comes from current solar income. This is accomplished through the active use of energy sources derived from current solar income (as listed above) or through the purchase of Green-e certified renewable energy certificates to offset the energy used to manufacture/assemble the product. Examples of organizations offering Green-e certified renewable energy certificates include: Sterling Planet, Wind Current, Bonneville Environmental Trust, 3 Phases Energy Services, and EAD Environmental**.** Note: Only Green-e certified (or equivalent in other countries) renewable energy certificates will be accepted.

3.4 Use current solar income for entire product

For Platinum certification, the energy required to manufacture the entire product comes from current solar income. This includes not only the energy used to manufacture/assemble the final product, but the energy used to manufacture the components as well. Once again this is accomplished through the supply chain's active use of current solar income, the supply chain's purchase of renewable energy credits, or through the purchase of renewable energy credits by the final manufacturer/assembler equal to the total energy used to produce the components.

4 Water

4.1 Create or adopt water stewardship principles/guidelines

For Silver, Gold, and Platinum certifications, create or adopt a set of principles or guidelines that will inform your facility's future strategies for protecting and preserving the quality and supply of water resources. Examples include:

- World Business Council for Sustainable Development – Water Principles (http://www.wbcsd.ch/web/publications/sinkorswim.pdf) pg 11
- Hannover Principles: Design for Sustainability – Water (http://www.gemi.org/water/resources/hannover.htm)
- Water Management Principles of the Ministry of Water, Land and Air Protection from the Government of British Columbia (http://wlapwww.gov.bc.ca/wat/wtr_cons_strategy/basics.html)

4.2 Characterize water flows associated with product manufacture

For Gold and Platinum certifications, all water flows associated with product manufacture/assembly are fully characterized. This includes characterizing water source(s), water usage, and quality of water discharges according to the following:

Water Source(s):

- Describe the types of water sources the facility(ies) relies upon.
- Determine whether or not the facility is located within or adjacent to a RAMSAR listed wetland (http://www.ramsar.org/index_list.htm).
- Define the watershed. Locate and report the watershed within which the facility operates (http://cfpub.epa.gov/surf/locate/index.cfm). Document the following information:
  - See "Assessment of Watershed Health." Does the facility withdraw or discharge effluent to a water source that is listed as impaired by the EPA, state or local authorities? What are the water concerns for the area and how does the facility impact these concerns? For more information on Source Water, see the EPA website: http://www.epa.gov/safewater/protect/sitemap.html.
  - Ask the local or regional water authority whether the facility is considered a major or minor user of water relative to other users in the watershed region.
- In view of the global nature of this certification program, specific methodological adaptations in other countries might be applicable.

Water Usage:

- How much water is used per unit product produced?
- What measures have been taken to conserve water resources?

Water Discharges:

- Meets or exceeds EPA and state water quality regulations as required under EPA's National Pollution Discharge Elimination System (NPDES).

  - Major facilities: Cannot be listed as being in Significant Noncompliance (SNC).
  - Minor facility(ies): Cannot be listed by states as being in violation of NPDES permits using the same definition as that of SNC violators. (each state will use its own term for "non-major' violators).
  - Any facility(ies) documents that they have not been designated as SNC or as a non-major chronic violator by its state for a period of two years prior to application date.
- List permit # and name of designated water coordinator for the facility(ies).
- List SIC/NAICS – both primary and secondary.
- In view of the global nature of this certification program, specific methodological adaptations in other countries might be applicable.

4.3 Implement water conservation measures

For Platinum certification, the facility responsible for final assembly/manufacture has implemented and provided documentation of conservation measures taken in last five years to reduce consumption of domestic and sanitary water (express as units liters/kg or gal/lb of all finished product).

4.4 Implement innovative measures to improve quality of water discharges

For Platinum certification, the facility responsible for final assembly/manufacture has implemented innovative projects for reclaiming, recycling or preserving the quality of water resources. Document any novel methods or processes employed for improving the quality of water resources (e.g., constructed wetlands, green roofs, and composting toilets).

5 Social Responsibility

5.1 Publicly available corporate ethics and fair labor statement(s), adopted across the entire company

For Silver, Gold, and Platinum certifications, the organization has adopted and made publicly available one or more statements regarding their social and ethical performance goals, which have the following characteristics:

- Addresses fair labor practices, corporate and personal ethics (e.g., supplier relationships, competitive behavior, integrity), customer service, and local community.
- Signed by the Chairman/CEO, either formally or in effect.
- Internally developed within the company or adopted as a set of principles from another organization, such as the UN Global Compact (www.unglobalcompact.org) or Global Sullivan Principles (www.thegsp.org).

5.2 Identify third party assessment, certification, or accreditation system and begin to collect data for that system

For Gold certification, the organization begins its self-assessment by internally collecting data for workplace certification criteria adopted from a third party assessment, certification, or accreditation system with the following attributes:

- Internationally accepted.
- Intra-industry or inter-industry framework.
- At a minimum, the following components of labor practices are evaluated using explicit criteria:
  - Child labor
  - Forced labor
  - Health and safety
  - Freedom of association and collective bargaining
  - Discrimination
  - Discipline/harassment
  - Working hours
  - Compensation

Suggested certification systems include, but are not limited to, the following:

- SA8000 (Social Accountability International) (www.cepaa.org)
- Fair Labor Association (www.fairlabor.org)
- WRAP (Worldwide Responsible Apparel Production) (www.wrapapparel.org)

Report existing data to MBDC. Note that data is tracked for all facilities in which the finished product seeking MBDC Cradle to Cradle certification is manufactured or assembled.

Finally, the organization trains all company employees and workers in any contract assembly plants on the company's standards for corporate and personal ethics.

5.3 Acceptable third party social responsibility assessment, certification, or accreditation

For Platinum certification, the organization satisfies certification requirements for the program identified in the previous step at all facilities where the finished product seeking MBDC Cradle to Cradle certification is manufactured or assembled. In addition, company suppliers adopt statements regarding their social and ethical performance goals, as well as implement any necessary workplace improvements. This is the equivalent of all members of the supply chain meeting the Silver criteria for social responsibility.

Certification Disclaimer

MBDC WARRANTS ONLY THAT ANY PRODUCT WHICH HAS BEEN CERTIFIED AS A TECHNICAL OR BIOLOGICAL NUTRIENT, SILVER, GOLD OR PLATINUM MEETS MBDC CRADLE TO CRADLE ™ CERTIFICATION PROGRAM CRITERIA FOR SUCH CERTIFICATION AND EXCEPT AS EXPRESSLY SET FORTH HEREIN:

(A) MBDC MAKES NO WARRANTY, EXPRESS OR IMPLIED AS TO ANY PRODUCT WHICH HAS BEEN CERTIFIED UNDER THE MBDC CRADLE TO CRADLE ™ CERTIFICATION PROGRAM, **INCLUDING ANY WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE** AND MBDC HEREBY EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES;

(B) MBDC 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 MBDC CRADLE TO CRADLE ™ CERTIFICATION PROGRAM; AND,

(C) MBDC 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 MBDC CRADLE TO CRADLE ™ CERTIFICATION PROGRAM, WHETHER SUCH LIABILITY IS ASSERTED ON THE BASIS OF CONTRACT, TORT, OR OTHERWISE, EVEN IF MBDC HAS BEEN MADE AWARE OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE IN ADVANCE.

Glossary of Terms

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.

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).

BIODEGRADATION
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 no oxygen is present.

BIOLOGICAL NUTRIENT
A material used by living organisms or cells to carry on life processes such as growth, cell division, synthesis of carbohydrates and other complex functions. Biological Nutrients are usually carbon-based compounds that can be safely composted and return to soil.

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).

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).

CAS NUMBER
Chemical Abstract Service number. This number uniquely identifies each pure chemical compound.

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 CT_{50} indicates the time needed to eliminate 50% of a certain substance, analogous to the half-life time measure $t_{1/2}$.

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.

CONTENT OF 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).

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 EC_{50} ("effective concentration"), which is the concentration of a substance in the water required to immobilize 50 percent of the test animals. If EC_{50}<10 mg/liter, the substance is named daphnia toxic.

DOWNCYCLING
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 life cycle and the related material flows.

EFFECT CONCENTRATION 50 (EC_{50})
The median exposure concentration (EC_{50}) 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.

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.

HALF-LIFE (T1/2)
The amount of time it takes half of an initial concentration of substance to degrade in the environment.

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.

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.

GLOBAL WARMING POTENTIAL
A scale used to relate a compound to the CO2 equivalents to measure the potential heating effects on the atmosphere.

LETHAL CONCENTRATION 50 (LC_{50})
The inhalative median lethal concentration (LC_{50}) is the median concentration of a substance that causes death in 50 percent of the test animals.

LETHAL DOSE 50 (LD_{50})
The median lethal dose (LD_{50}) is the statistically derived median dose of a substance that can be expected to cause death in 50 percent of the test animals.

MATERIAL
A group of one or more chemicals that together comprise a component or input to a finished product.

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.

OCTANOL-WATER PARTITIONING COEFFICIENT (P_{ow})
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.

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.

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.

SKIN PENETRATION POTENTIAL
A measure of the ability of a compound to assist in the absorption of chemicals into the skin.

SENSITIZATION
The ability of a substance to induce an immunologically-mediated (allergic) response.

TECHNICAL NUTRIENT
A material of human artifice designed to circulate within technical metabolism (industrial cycles)—forever.

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).

TOXICITY - ACUTE
A measure of how poisonous or "deadly" a substance is during initial exposure. A common measuring tool for acute toxicity is LD_{50} ("lethal dose"), which is the dose required to kill 50 percent of the test animals. If LD_{50}<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.