4 Material Health

4.1 Material Transparency

Required for Basic, Silver, Gold, and Platinum certification levels.

Applicant shall identify all homogeneous materials present in the finished product. This is typically done by breaking the product down into assemblies, then sub-assemblies, then components, and finally into pure homogeneous materials. Any homogeneous material present at 100 ppm or higher in the finished product must be reported. PVC present at ANY level in the finished product must be reported.

For wood based products, or for products that use wood as a component, the source of that wood must be identified and it should be noted as to whether that source is an endangered forest.

Example – Office chair is first broken down into back assembly, seat assembly, tilt mechanism, pneumatic cylinder, base, and casters. Each assembly must then be further broken down into sub-assemblies or materials. Casters would be broken down into nylon wheel, steel axle, steel pintle, etc. Painted 5 star base would be broken down into cast aluminum and powdercoat. Finally, each material must be broken down into its constituent ingredients.

Since material formulations are often proprietary to the supplier, the certifying body will enter into a Non-Disclosure agreement and will allow the supplier to submit the ingredient information directly to the certifying body. Material formulations must be reported down to the 100 ppm level, however the following substances must be reported at any level:

- Toxic heavy metals such as lead, mercury, hexavalent chrome, and cadmium
- Pigments, dyes, or other colorants
- Phthalates
- Halogenated organics

For products that contain recycled content as an input it is often difficult, if not impossible, to completely characterize the chemical content of the recyclate. In the case of metals, this is easier as a basic elemental analysis will show what contaminants, if any, are present. In the case of recycled plastics, the base resin must be identified and analytical testing must be done to determine the presence of any heavy metals or organohalogens. For paper products, recyclate must be tested (on a quarterly basis at a minimum) for the presence of heavy metals, organohalogens, and chlorine/chloride. The results of these tests will be used in lieu of actual chemical composition.

4.2 Defined as a Biological or Technical Nutrient

Required for Basic, Silver, Gold, and Platinum certification levels.

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

4.3 Ingredient Characterization.

Required for Basic, Silver, Gold, and Platinum certification levels.

All materials shall be characterized based on their impact on Human and Environmental Health. The certifying body will perform this evaluation once all ingredients in all materials have been identified. 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 LD_{50} value less than 200 mg/kg (rat, mouse, guinea pig, etc) will be considered acutely toxic.

At the Basic and Silver levels, 5% by weight of Grey assessed materials are allowed. However, those Grey materials must be fully assessed within six (6) months of certificate issuance or they will be considered Red.

4.3.1 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

4.3.2 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

4.3.3 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.)

4.4 Material Avoidance

The following tables list substances that will impact a product's ability to receive certification:

Substance Name	Silver Level	Basic Level	Prohibited for Certification
Halogenated hydrocarbons	Halogenated hydrocarbon content less than 1000 ppm, or presence of non-PBDE based brominated flame retardants that are required to meet current flammability standards and for which there are NO available alternatives.	Halogenated hydrocarbons present at 1000 ppm or higher	PVC or other substances from the PVC family tree at any concentration.
Lead, Mercury, Cadmium, Chrome VI	Unintentional or "background contamination" allowed as long as total concentration of these 4 substances does not exceed 100 ppm. No single substance can exceed 50 ppm. (For metals, this limit is 100 ppm) Intentionally added substances are allowed where needed for technical performance and for which there is a system in place to keep the material in a closed loop.	Total background contamination of all 4 can exceed 100 ppm as long as no single substance exceeds 100 ppm. (For metal alloys, this limit is 1000 ppm). Intentionally added substances are allowed where needed for technical performance and for which there is no readily apparent route of exposure.	Total background contamination of any single substance in excess of 100 ppm. (or 1000 ppm for metals). Any intentionally added amount that is not needed for technical performance.

NOTE – Testing for heavy metals will be required for all materials coming from regions of the world shown to have heavy metal contamination issues or concerns.

4.5 Optimization Strategy

Required for Basic and Silver.

Once all problematic components have been identified (i.e. those substances assessed RED based on the criteria listed previously), the applicant must commit to the eventual phase-out/replacement of these substances. Applicant will have six (6) weeks to develop a strategy (in conjunction with the certifying body or independently), complete with budget and timeline, for the phase out/optimization of these inputs. The implementation of this plan will be subject to an annual review to judge whether or not sufficient progress has been made to merit continued Cradle to Cradle® certification.

For products containing wood, if that wood is sourced from an endangered forest there must be a strategy developed for sourcing that wood from a non-endangered forest.

4.6 Product Formulation Optimized

Required for Gold and Platinum.

Applicant must demonstrate that all Red assessed materials/chemicals have been phased out of the formulation.

For products containing wood this means that none of the wood can be sourced from an endangered forest.

4.7 Cradle to Cradle® Emission Standards

Required for Gold and Platinum.

Applicant shall demonstrate compliance with the Cradle to Cradle® emission standards, which are defined as the following:

- TVOC < 0.5 mg/m^3
- Individual VOCs < 0.01 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$\mu g/m^3$. However, in the case of formaldehyde, it is virtually impossible to achieve this level as ambient air tends to have concentrations higher than this. Therefore we have adopted the California 01350 standard of one-half the REL of 33$\mu g/m^3$ or 16.5$\mu g/m^3$ as the threshold limit.
- Time Points – 7 days for TVOCs and IVOCs
- Loading Scenarios – BIFMA M 7.1 for office furniture and California Department of Health Services (section 01350) for everything else.

Labs approved for testing include Berkeley Analytical Associates, MAS, AQS, Forintek, and Syracuse University. All testing is done according to ASTM D5116 for small chamber, ASTM D6670 for large chamber, and BIFMA M 7.1 for office furniture.

4.8 Percentage of "Green" Components

Required for Platinum certification only

Applicant shall demonstrate that material/product seeking certification is comprised of at least 50% "Green" assessed components.

All wood must be FSC certified.