Higg Materials Sustainability Index (MSI)
Methodology

Last Edited: August 6, 2019
Contact: product@apparelcoalition.org
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SUSTAINABLE APPAREL COALITION OVERVIEW
The Sustainable Apparel Coalition (SAC) is the apparel, footwear and home textile industry’s foremost alliance for sustainable production. It was born from a dynamic and unconventional meeting of the minds when, in 2009, Walmart, America’s biggest retailer and Patagonia, one of the world’s most progressive brands, came together with a radical mission: Collect peers and competitors from across the apparel, footwear and textile sector and together, develop a universal approach to measuring sustainability performance.

Today the Coalition has more than 200 members and represents more than $500 billion in revenue of the global apparel supply chain. Its focus remains the same: develop a standardized supply chain measurement tool for all industry participants to understand the environmental, social and labor impacts of making and selling their products and services. By measuring sustainability performance, the industry can address inefficiencies, resolve damaging practices, and achieve the transparency that consumers increasingly demand. By joining forces in a Coalition, members can address the urgent, systemic challenges that are impossible to change alone.

For a comprehensive list of SAC Members visit: http://www.apparelcoalition.org/members

THE HIGG INDEX
The centerpiece of the SAC’s work is the Higg Index, a suite of assessment tools that empower brands, retailers, and manufacturers to measure their environmental, social and labor impacts at every stage of the product lifecycle. For those just starting to implement sustainable practices, the Higg Index guides their important first steps, helping to distinguish strengths and opportunities for improvement. For those already deeply engaged, it has more advanced potential, such as benchmarking sustainability performance of their supply chain partners and against industry peers, identifying risks and performing targeted research and analytics.

With the Higg Index, SAC aims to accomplish the following goals:
- Understand and quantify the sustainability impacts of apparel, footwear, and home textile products
- Reduce redundancy in measuring sustainability in apparel, footwear, and home textile industries
- Drive business value through reducing risk and uncovering improvement opportunities
- Create a common means and language to communicate sustainability to stakeholders

The Higg Index suite of tools is identified below. More information on each of these tools is available at http://apparelcoalition.org/the-higg-index/
HIGG INDEX PRODUCT TOOLS

The Higg Index Product Tools include those specifically tied to assessing impacts of products:

- **Higg Materials Sustainability Index (MSI):** a cradle-to-gate Material scoring tool informed by life cycle assessment (LCA) data and methodology to engage product design teams and our global value chain in environmental sustainability.

- **MSI Contributor:** a tool where anyone may submit material production data to be reviewed and used to score Materials in the Higg MSI.

- **Higg Design & Development Module (DDM):** a tool meant to be used early in the product creation process by designers and developers. The output is a design score that can be used for decision-making about different design scenarios.

- **Higg Product Module (PM):** a future tool to provide credible external communication to influence purchasing decisions and scale industry adoption of leading practices. It will be used by sustainability and communication experts to assess the full impacts of a finished product.

The focus of this document is the Higg MSI. Learn more about how Higg MSI methodology is used in other Higg Index Product Tools under *The Higg MSI Use in Other Higg Index Tools*.

HIGG MATERIALS SUSTAINABILITY INDEX

The Higg MSI is the quantitative underpinning of Higg Index Product Tools. It is a cradle-to-gate Material scoring tool that is meant to engage product design teams and the global supply chain in environmental sustainability. The Higg MSI was originally developed by Nike, and in 2012, it was adopted by the SAC and incorporated into the Higg Index. Since then, SAC has been working to expand this index into a tool that can provide value for the entire industry. See *Appendix A: Involved Parties*, for a list of people who have been involved in the evolution of the Higg MSI.
USE OF THE HIGG MSI WITHIN THE HIGG SUITE OF TOOLS

The Higg MSI is a cradle-to-gate Material scoring tool, which addresses impacts that range from the extraction or production of raw materials, through manufacture and finishing, to when the Material that is ready to be assembled into a final product (referred to as “Material” herein). The declared unit of the Higg MSI is one kilogram. Therefore, the Higg MSI allows the comparison of one kilogram of a specific Material to one kilogram of another Material. Examples of common Higg MSI Materials include cotton, nickel, or EVA foam. The Higg MSI alone does not address the impacts of complete apparel, footwear, or home textile products. The Higg Design & Development Module (DDM) and the Higg Product Module (expected to launch in mid-2019) will consider apparel, footwear, or home textile product lifecycles, including product manufacturing, consumer use, and end of use in addition to Material production. The Higg MSI informs the Higg DDM and the Higg Product Module Materials section only, in which users select Materials with associated Higg MSI scores. See more information below under The Higg MSI Use in Other Higg Index Tools.

HIGG MSI COMPONENTS

The Higg MSI has three key components (see sections below for more information):

1) **Taxonomy**: a way to collect and organize material production data.
2) **Materials data**: cradle-to-gate Material production or life cycle impact assessment (LCIA) data. The Higg MSI database holds verified data for raw materials, various Material production processes, and other Material specifications.
3) **Scoring methodology**: a way to interpret the data. The Higg MSI uses a scoring framework to turn data into a single environmental score for a Material.

HIGG MSI DATABASE TAXONOMY

The Higg MSI database holds Material production data that is third party reviewed, modeled to determine impacts, and scored according to the Higg MSI scoring framework (see below). This database is organized according to a very specific taxonomy determined by SAC members. This taxonomy defines the following:

- **Production Phases**: Material production steps for which various processed could be used. A specific set of Production Phases is associated with each Material Category. More than one Production Phase is used to create a finished Material.
- **Base Materials**: common, generic Materials commonly used in the apparel, footwear, and home textile industries. Base Materials are made up of multiple processes defined by SAC.
- Processes: actual production processes used to create Materials. Different processes could potentially be used within each Production Phase.

The Higg MSI Material Categories and their respective Production Phases are shown in Figure 2 below. Base Materials and Processes can be found in the Higg MSI at msi.higg.org.
Figure 2. Higg MSI Material Categories and Production Phases

Textile:

- Raw Materials Source → Yarn Formation → Textile Formation → Preparation → Coloration → Finishing

Leather:

- Country of Origin and Process → Tanning → Re-Tanning → Drying → Finishing

Synthetic Leather:

- Substrate Raw Material → Polyurethane Type → Substrate Formation → Production Processes → Specialty Application

Plastics:

- Raw Material Source → Mixing and Preparation → Molding and Curing

Rubber/Elastomer:

- Raw Materials Source → Mixing and Preparation → Molding and Curing → Finishing

Foam:

- Raw Materials Source → Mixing and Preparation → Foaming → Molding and Pouring
MATERIALS DATA
Secondary data sources (publicly or commercially available datasets) used for the Higg MSI launch include ecoinvent version 3, PlasticsEurope, GaBi, JRC European Commission, and literature. The background database used for modeling is ecoinvent v3.1.

Primary data (data collected from the site of production) is also collected from the industry for specific processes and raw materials. All data sources and metadata are visible to Higg MSI users.

The modeling principles used for the construction of this database are based on leading international standards, including:

- Ecoinvent data quality guidelines (Weidema et al. 2013)\(^1\)

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• ISO 14040\(^2\)/14044\(^3\)
• PEF Guide\(^4\)

Detailed information on each process in the database, including specific modeling approaches, allocation approaches, and other technical information can be found in the Higg MSI by clicking on individual processes.

The Higg MSI database holds data for individual production processes within each of the boxes above. The type of data associated with each process includes the following:

**Inputs:**
- Energy
- Water
- Materials and chemicals
- Agricultural Land

**Outputs:**
- Product (intermediate output) and amount
- Solid Waste
- Emissions
- Wastewater

Instead of aforementioned detailed data, industry stakeholders may submit independently reviewed LCIA results, or midpoints, that have previously been calculated according to specific requirement defined herein. See *Higg MSI Scoring Framework* below for information on what midpoints are included.

The SAC plans to collect more, higher quality data over time through the following means:
- Data Pull: SAC prioritizes and solicits data from the industry
- Data Push: industry stakeholders submit data to include specific raw materials, processes, or other Material specifications in the Higg MSI

The Higg MSI database is managed in an LCA software platform by a qualified Data Manager. As data is added or updated in the database, updates will be published quarterly in the Higg MSI. Maintaining a separate LCA database allows for proprietary information to be protected, for consistent modeling and selection of background data, and for flexibility as measurement, data, and impact methods evolve. All


of the datasets for the Higg MSI are assigned a data quality rating as defined in Appendix B: Higg MSI Data Submission Requirements and Guidelines.

The initial datasets used for the Higg MSI are based on best available data, and each dataset was modeled to be as representative of the process as possible. The electricity grid mix used for modeling of textile manufacturing steps (spinning through finished fabric) is based on a weighted average of major textile producing countries.\(^5\)

Consistency with the European Commission (EC) Product Environmental Footprint (PEF)\(^6\) is an important factor for this database. The EC has proposed the PEF as a common way of measuring environmental performance of products. This initiative is currently in a pilot phase, and is aimed to calculate products’ environmental impact from inception to end of life and then share those findings with consumers via labelling. Therefore, when possible, assumptions and approaches for modeling individual product categories in the Higg MSI were done to be consistent with the corresponding Category Rules from the PEF. All modeling details for individual processes are described in the metadata.

For more information on Higg MSI Data Submission, please review Appendix B: Higg MSI Data Submission Requirements and Guidelines.

**GENERAL ASSUMPTIONS**

A number of assumptions were used when constructing the base materials in the dataset. The table below lists the categories and/or processes and their corresponding assumptions. A number of assumptions that are specific to individual processes are listed in the meta-data descriptions of those processes.

As the database evolves, SAC plans to update the assumptions and the way that they are applied to each material.

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\(^6\) [ec.europa.eu/environment/eussd/smgp/index.htm](http://ec.europa.eu/environment/eussd/smgp/index.htm)
The data described above is translated into a single score through the Higg MSI Scoring Framework.

**LCIA Methodology**

In the Higg MSI scoring framework, the data is modeled using widely accepted LCIA methodology to calculate midpoints for the impacts listed below. Midpoints are calculated for a declared unit of one kilogram of Material.

**Table 1. Assumptions and Approaches**

<table>
<thead>
<tr>
<th>Material Category/Processes</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textiles</td>
<td>5% loss rate of raw material to account for losses material manufacturing</td>
</tr>
<tr>
<td>All raw materials</td>
<td>1000 km inbound transportation added to account for inbound logistics of raw material</td>
</tr>
<tr>
<td>Metals</td>
<td>2% loss rate of raw material to account for losses material manufacturing</td>
</tr>
<tr>
<td>Barriers, Foams, Plastics, Insulation Materials, Wood Products, Rubbers, and Synthetic Leather</td>
<td>10% loss rate of raw material to account for losses material manufacturing</td>
</tr>
<tr>
<td>Dyeing processes, wet bath, wet finish processes</td>
<td>15% loss of water used to account for evaporation losses from heating process</td>
</tr>
</tbody>
</table>

**HIGG MSI SCORING FRAMEWORK**

In the Higg MSI scoring framework, the data is modeled using widely accepted LCIA methodology to calculate midpoints for the impacts listed below. Midpoints are calculated for a declared unit of one kilogram of Material.

**Table 2. MSI LCIA Methods**

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>LCIA Method</th>
<th>Unit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>N/A – qualitative questions</td>
<td>points</td>
<td>SAC Chemicals Assessment Team. 2016. See Appendix D.</td>
</tr>
</tbody>
</table>

These LCIA methods were chosen by SAC members and LCA experts/consultants (see Appendix A: Involved Parties) based on the following criteria:

- Environmental Relevance/Importance
Scientific robustness
Completeness of scope
Transparency of data sources
Degree of acceptance in the LCA community
Data Availability

USEtox methodology was considered to assess Ecotoxicity and Human Toxicity impacts. There are significant methodological and scientific barriers to the application of general toxicity criteria within an LCIA. Currently, all methods evaluated in the ILCD handbook for the assessment of the fate and effects of metal and chemical compounds, including USEtox, suffer from a lack of precision (i.e. a large uncertainty of 2 to 3 orders of magnitude). Therefore, the USEtox characterization factors for metal and chemical compounds are rated as interim in the USEtox website and should only be used with caution and not for product comparison. It was decided to use qualitative questions to assess chemistry until USEtox proves more relevant for the apparel, footwear, and home textile industries. This methodology will continue to be considered as it matures. In the meantime, SAC will continue to gather chemicals data for materials.

Agricultural Land Occupation was originally considered to assess Land Use impacts. However, after further examination it was determined that this metric should not be included in MSI scores because it does not assess actual impact of that land occupation, such as a loss of biodiversity. Other LCIA methods were considered (such as Soil Organic Matter and Land Use Change), but it was confirmed that no method currently available meet all MSI requirements. SAC will continue to investigate Land Use LCIA methodologies as they are developed and will continue to collect relevant Land Occupation data.

Abiotic Resource Depletion, Minerals was also considered for inclusion in the Higg MSI. Abiotic Resource Depletion, Minerals is an approach that estimates the availability of mineral reserves, based on current technologies for extraction and the economic feasibility of extracting those reserves. There is a high level of uncertainty associated with this method, and interpretation of results is difficult. Additionally, because the MSI normalization is heavily focused on footwear and apparel textiles, including abiotic depletion, minerals leads to extremely high impacts for the precious metals that are included in the database (for example, the gold score when including this impact category is over 5,000,000). Given the uncertainty in the assessment and the score results, the results of this impact are considered misleading, which could reduce credibility of the tool. Therefore, it was removed and instead the MSI includes Abiotic Resource Depletion, Fossil Fuels.

Abiotic Resource Depletion, Fossil Fuels has a much more straightforward assessment methodology and considers fossil resources necessary to extract materials from the earth. Precious metals still have a large impact, but the environmental relevance, scientific robustness, completeness of scope, transparency of sources, degree of acceptance, and data availability for Fossil Fuels is much higher those that for Minerals.

The WSI Pfister et al. LCIA method will be replaced in 2020 with the AWARE model to reflect water scarcity.

See Appendix C: LCIA Method Criteria, for more information on why these methods were chosen. The LCIA methods used in the Higg MSI may be updated over time as new and improved methodologies are
developed and approved by SAC members. Please see Appendix D: Chemistry Qualitative Scoring Framework, for more information on the Higg MSI’s qualitative question regarding chemistry in Material production.

Normalization
Once midpoints have been calculated for each process using the methodologies mentioned above, the results must be normalized to create one common unit that can be added together. The purpose of normalization is to contextualize these scores. The reference for normalization is based on the volume of the Materials most used in the industry. This identifies the largest impacts from the apparel, footwear, and home textile industries, and then sets that as the reference. Therefore, scores are weighted to focus on the biggest impacts from apparel, footwear, and home textile Materials.

SAC members found useful resources and shared company information to determine the amounts of main materials used. Sources used to calculation the normalization factors are the following:

- Textile/Apparel volume information (assumed 50% of industry materials):
  - Food and Agricultural Organization, 2013

- Footwear volume information collected from SAC members in 2016 (equally weighted to total 50% of industry materials). Each organization listed the percentage of top materials used by volume (by mass) within their company:
  - Nike to represent athletic footwear
  - VF to represent work and casual footwear
  - Aldo to represent fashion footwear

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Midpoints calculated for Base Materials listed in Table 3 were multiplied by these weightings and added together to determine the weighted average. The normalization factors are 10/weighted average.

Midpoints were multiplied by their corresponding normalization factors to produce the number of points for each impact area. After the midpoints are normalized, each of the individual normalized scores are added together using equal weighting to produce a single MSI score that can be used for quick comparison and easy decision-making. Because weighting is subjective, SAC members determined that equal weighting for each impact area was the appropriate approach for the initial launch of the tool. SAC will remain active in the LCA community to learn if any normalization and weighting methodologies are developed that could be useful to the apparel, footwear, and home textile industries.

**HIGG MSI USE IN OTHER HIGG INDEX TOOLS**

The Higg MSI is meant to be used to differentiate Materials for design and sourcing, based on environmental impacts from cradle-to-gate production. The Higg MSI is accessible online at msi.higg.org to provide transparency to data, scores, and scoring methodology. This is where the public may learn about Material impacts, what is causing those impacts, and different production processes that can be used to reduce impacts. The Higg MSI allows users to “customize materials” by creating blends and swapping in/out different processes and Material specifications to see how Material scores change.

SAC members have the following benefits:
- Ability to save and compare custom Materials
- Ability to download Excel (and eventually XML) exports
- Access to LCIA (midpoint) results for each Process
- Ability to share custom materials between accounts (also available to non-member manufacturers)

**MSI Contributor**
Anyone may submit data to the Higg MSI, but the targeted audience for submission is material manufacturers, material trade organizations and academics willing to submit high quality data to SAC. Data is submitted via the MSI Contributor, reviewed, modeled, and scored for the Higg MSI. Using this process, anyone can share material sustainability information and encourage the value chain to use that information in decision-making around Materials. Please review Appendix B: Higg MSI Data Submission Requirements and Guidelines, for more information on data submission.

**Higg DDM**
The Higg MSI informs the Higg DDM. The Higg DDM is intended for use early in the product creation process by product designers and developers. Base Materials and/or customized Materials created by Higg MSI users can be selected in the Higg DDM to contribute to the overall design score. The Higg DDM’s output is a product design score that allows users to iterate on design choices.

**Higg Product Module**
In the future, the Higg MSI will be leveraged for the Higg Product Module. This tool will be used to calculate the environmental impact of a finished product. The goal of the tool will be to create a consumer-facing product score. It is expected to launch in 2020.

The table below illustrates how different audiences can use the various Higg Product Tools.

<table>
<thead>
<tr>
<th>Audience</th>
<th>Tool</th>
<th>Intended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>Higg MSI</td>
<td>This tool allows the public to view material scores, data source information, swap in/out processes, and create blends.</td>
</tr>
</tbody>
</table>
| Material Manufacturers  | Higg MSI Contributor         | **Higg MSI Contributor**: Manufacturers can submit materials data so that their materials can be included in the Higg MSI, Higg DDM, and future Higg PM.  
-------------------------------|-----------------------------|-------------------------------------------------------------------------------------|
|                         | Higg MSI                    | **Higg MSI**: Manufacturers can use this tool to view material scores and source information. Through this tool they can differentiate their materials for communication to customers, whether by submitting material specific data (via the MSI Contributor) or creating a representative Higg MSI score using current data which can be shared with other MSI accounts.  
-------------------------------|-----------------------------|-------------------------------------------------------------------------------------|
<p>| Product Design Teams    | Higg DDM                    | Members can build a Bill of Materials (leveraging Higg MSI scores) and answer qualitative questions about manufacturing, care and repair (product use), |</p>
<table>
<thead>
<tr>
<th>Sustainability Experts</th>
<th>Higg MSI</th>
<th>Higg Product Module (future)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Higg MSI</strong>: this tool allows users (including the public) to view material scores, source information, swap in/out processes, and create blends. Members will be able to save and compare their materials, and use their scores in the Higg DDM and future Higg PM.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Higg Product Module</strong>: This tool will allow a full impact assessment for a given product based on LCA methodology. This tool is expected to launch in mid-2019.</td>
<td></td>
</tr>
</tbody>
</table>
HIGG MSI TECHNICAL REVIEW

While developed by experts (refer to Appendix A: Involved Parties for list) over a 5-year process, it is important that the Higg MSI results generated in the tool’s first iteration be reviewed to ensure sound scoring algorithms were applied to best available data. To ensure this was the case, a Technical Review was conducted by Dr. Gregory Norris, Co-Director of the SHINE Initiative for Net Positive Enterprise within the Harvard T.H. Chan School of Public Health. The review focused on the LCIA data aspects of the Higg MSI, including choices of background, secondary, and proxy data; on the normalization and weighting approaches; and on the technical aspects of the LCIA data modeling. The report concluded sound approaches and decisions were used in each of these areas. Please see Appendix E: Higg MSI Technical Review Report for the full report.
APPENDIX A: INVOLVED PARTIES

Duke University Review Team: in 2011, a team of external parties critically reviewed the MSI. Their findings helped shape the direction of how it evolved for its re-release in 2016. The organizations listed are those that each individual represented at the time of the review.

- Jay Golden, Duke University
- Joost Vogtlander, Delft University of Technology
- Keith Weitz, RTI International
- Krishna Manda, Utrecht University
- Martin Patel, Utrecht University
- Neethi Rajagopalan, Duke University
- Richard Vendetti, North Carolina State University
- Roland Geyer, University of California, Santa Barbara

Consultants: consultants were hired to help evolve Higg MSI methodology for the 2016 launch.

- Cashion East, PRe Consultants
- Gregory Norris, Harvard T.H. Chan School of Public Health
- John Jewell, thinkstep
- Krishna Manda, Utrecht University
- Rita Schenck, IERE
- Thomas Gloria, Industrial Ecology Consultants and Harvard University

Materials Core Team: The “heavy lifters”. This is a team of SAC members who conduct life cycle assessment or product measurement within their organizations and were actively engaged in developing Higg MSI.

- Adam Brundage, Nike
- Allan Williams, CRDC
- Barruch Ben-Zekry, VF Corporation
- Ben Bowers, Timberland
- Beverley Henry, IWTO
- Francis Mason, INVISTA
- Joël Mertens, MEC
- Kevin McMullan, Toray
- Krishna Manda, Lenzing
- Michele Wallace, Cotton Incorporated
- Stewart Sheppard, WL Gore
- Jeremy Lardeau, Nike

Higg MSI Extended Team: These SAC Members provided feedback valuable feedback on Higg MSI.

- Abi Rushton, Aid by Trade Foundation
- Anna Karlsson Ellison, Cotton Connect
- Bob Buck, Chemours
- Catherine Newman, Nike
- Christian Schuster, Lenzing
- Daniela Koelsch, Bayer Material Science
- Darlene Sharkey, WL Gore
- Elissa Loughman, Patagonia
- Greg Scott, MEC
- Jana Stadler, Adidas
- Jeff Wilson, Textile Exchange
- Les Jacques, INVISTA
- Louisa Holbrook, Burberry
- Rohan Batra, Birla Cellulose
- Shannon Avison, Better Cotton Initiative

**Chemicals Assessment Team:** These SAC members developed and/or continue to develop the methodology for assessing chemical impacts of materials and material production in Higg Product Tools.

- Anne-Laure Demarcy, TAL Apparel
- Bernhard Kiehl, WL Gore
- Beth Jensen, OIA
- Beverley Henry, IWTO
- Bob Buck, Chemours
- Crispin Wong, Nike
- Greg Scott, MEC
- James Carnahan, Archroma
- Jamie Bainbridge, Bolt Threads
- Jeff Wilson, Textile Exchange
- Joël Mertens, MEC
- John Easton, Dystar
- Kevin Myette, Bluesign
- Libby Sommer, Nike
- Mike Cheek, Huntsman
- Peter Gregory, Huntsman
- Susan Sanchez, Disney
- Todd Copeland, Patagonia

**SAC Staff:** SAC Staff is responsible for ensuring all data supporting Higg methodology is underpinned by best available technical expertise. This includes materials assessment (e.g. chemistry), database development, quality assurance, and data collection, modeling and analysis.

- Betsy Blaisdell, VP, Higg Index
- Julie M.H. Brown, Director, Higg Index
APPENDIX B. HIGG MSI DATA SUBMISSION REQUIREMENTS AND GUIDELINES

Introduction
These Higg MSI Data Submission Requirements and Guidelines define the approach, methods and workflow to be used for the submission and review of data meant to change or create Higg MSI scores. Data submissions must adhere to the requirements detailed herein. Reviews will determine if new and/or updated data may be incorporated into the Higg MSI.

Process Summary
Data is to be submitted via the MSI Contributor, a Higg Index Product Tool that is publicly accessible at msicontributor.higg.org. Once data is submitted via the MSI Contributor, an MSI Gatekeeper will be responsible for conducting a review of submitted Material production data. Review of Material data will enhance quality and credibility of Higg Index Product Tools by helping to avoid errors and ensuring all method requirements have been appropriately taken into account. If a large number of data sets are submitted, the Gatekeeper will prioritize review by the completeness of the data and if the data will have a large impact on the industry. Order of receipt will then be considered. Based on this review, the Gatekeeper will decide if data meets MSI methodology and quality requirements, and hence may be entered into the Higg MSI. Upon approval by the Gatekeeper, a final review is conducted by the Data Manager to ensure full compatibility with the Higg MSI scoring framework. The Data Manager will also calculate and communicate a final MSI score to the submitting entity (referred to as “Data Submitter” herein) to confirm that the Data Submitter is comfortable publishing that score in Higg Index Product Tools. Upon confirmation, the MSI results and metadata will be published in the Higg MSI.

Note that new production processes that are unique to the MSI (use technology or equipment not already captured) will be prioritized for review, scoring, and addition to the tool.

The Higg MSI Gatekeeper
The MSI Gatekeeper, Tom Gloria, is Managing Director at Industrial Ecology Consultants. The MSI Gatekeeper is responsible for critically reviewing data to ensure that methods used to carry out the data submission are consistent with these Higg MSI Data Submission Requirements and Guidelines, and that the data is scientifically and technically valid.

The Gatekeeper will be responsible for the following:

- Ensuring data submitted follows accepted methodology
- Ensuring data assumptions and limitations are consistent with data submission guidelines
- Determining if calculations are accurate and correctly reflect specified sources
- Confirming data accurately down the supply chain to a practical and possible extent
- Ensuring data reflects the accurate scope, temporal coverage, geographical coverage, and technological coverage as specified in the data submission guidelines
- Confirming the data quality meets specified requirements
- Completing reviews in a reasonable amount of time
- Deciding what is and is not approved for entry into the MSI
- Communicating findings to SAC personnel
- Ensuring data is correctly entered and presented in the MSI Contributor

The Gatekeeper must obtain the following qualifications:
- Knowledge of life cycle assessment (LCA) methodology, LCA for product design and practical experience
- Knowledge of and experience with peer review, verification and audit practice
- Knowledge of and experience with relevant standards (e.g. ISO 14040, 14044, 14025)
- Understanding of environmental impact category indicators
- Has apparel/footwear supply chain experience and an understanding of/appreciation for business decision-making realities
- Demonstrates understanding of/alignment with SAC and Materials Task Team vision, goals and existing structure/operating norms
- Be self-sufficient and able to commit to review schedule and dedicate sufficient critical review time to each submitted data set.
- Will accept reasonable compensation clearly in-line with deliverables
- Strong communication skills, able to explain complex concepts in easy-to-understand terms, and must regularly update the applicant and the SAC on progress
- The Gatekeeper should not have any conflicts of interest in their support of the vision and goals of the Materials Task Team

To avoid conflicts of interest, it is necessary that the MSI Gatekeeper does not consult with parties submitting data for inclusion in the MSI. Also during this time, the Gatekeeper may not recuse him/herself. Data generated by the Gatekeeper prior to his/her role as the Gatekeeper may be allowed in data sets if this data was published, peer reviewed, and is approved by the SAC. The Gatekeeper may not assist parties prepare previously collected data for submission via the MSI Contributor. However, the Gatekeeper may inform the Data submitter how to fix incorrect data. This incorrect data must be corrected by the original party and resubmitted. The Gatekeeper may determine his/her review schedule to align with his/her schedule with the understanding that all reviews must be completed by a specific deadline. This deadline will be communicated between the Gatekeeper, the SAC, and the party submitting data. A list of Materials pending review will be published in the MSI.

**Higg MSI Data Manager**

The Higg MSI Data Manager is Cashion East, Technical Specialist at PRé Sustainability. After data is approved by the MSI Gatekeeper, the Data Manager will conduct a final review of the data and calculate MSI scores.

The Data Manager will be responsible for the following:
- Supporting Data Submitters during the data submission process
- Modeling the data according to the requirements detailed in this appendix (if the submitted data hasn’t already been modeled)
- Conducting a final review of the data and communicate any mistakes or inconsistencies to the MSI Gatekeeper, SAC staff, and Data Submitter
- Calculating midpoints and MSI scores
- Once payment for the quality assurance process is processed, communicating MSI scores to Data Submitter to confirm permission to publish scores in the Higg MSI.
- Transferring midpoints, MSI scores, and metadata to the Higg MSI to be published in a quarterly update
• Ensuring all new MSI data meets a “fair” or better data quality rating
• Ensuring data and MSI scores are aligned with current MSI methodology, even if the methodology changes

The Data Manager must obtain the following qualifications:
• Knowledge of LCA and MSI methodology and taxonomy
• Knowledge of and experience with relevant standards (e.g. ISO 14040, 14044, 14025)
• Understanding of environmental impact category indicators
• Experience conducting LCAs and peer reviews of LCAs
• Demonstrates understanding of/alignment with SAC and Materials Task Team vision, goals and existing structure/operating norms
• Strong communication skills, able to explain complex concepts in easy-to-understand terms, and must regularly update the applicant and the SAC on progress
• The Data Manager should not have any conflicts of interest in their support of the vision and goals of the Materials Task Team. They can consult with Data Submitters outside of this data submission process.

Review Information
Data submitted may be for the addition of a new raw material, production process, or Material specification into the Higg MSI. It is important that the data be as complete as possible, and have consistent accounting for each input and output submitted. Although it is strongly preferred that data submitted to the Higg MSI be for basic input and output material, energy, and emission flows, submission of existing life cycle impact assessment (LCIA) characterized results, or midpoints, may be acceptable, provided that the Data Submitter can demonstrate that the data meets all of the requirements outlined below under Higg MSI Requirements for Submission Types 1 and 2.

Data Security and Confidentiality
SAC agrees to: (a) hold the submitted data in strict trust and confidence; (b) refrain from using or permitting others to use the submitted data in any manner or for any purpose not expressly permitted by the Terms of Use, accessible in the MSI Contributor at msicontributor.higg.org; (c) refrain from disclosing or permitting others to disclose unit process level data to any third party without obtaining your express prior written consent on a case by case basis. Notwithstanding the foregoing, SAC may disclose unit process level to, and authorize use of such unit process level consistent with the Terms of Use by, contractors and service providers who have executed an agreement imposing on the contractor obligations of confidentiality consistent with this provision. SAC will protect the unit process level data from unauthorized use, access, or disclosure in the same manner as SAC protects its own confidential or proprietary information of a similar nature, and with no less than the greater of reasonable care and industry standard care. Each Data Submitter will utilize an individual account for the MSI Contributor and is the only authorized individual for that account. The Data Submitter can belong to an organization and can only access his/her own personal and organizational data. While individuals have restricted access, SAC staff can access the full dataset in order to support users and derive anonymized insights across the larger platform. No entities outside of SAC staff and approved organizational users will be able to view or alter submitted data. SAC staff and approved organizational users (Gatekeeper and modelers) can alter data of a submitted process after having a discussion with and approval from the original Data Submitter. The platform is hosted at a secure
hosting facility and utilizes best practices in network, operating system and application security including, but not limited to, user session logging, suspicious application activity monitoring, proactive file system monitoring, proactive network intrusion detection/management and limited VPN only access to the hosting facility. Minimal PII data is maintained online and passwords are securely salted and hashed.

**Acceptance Criteria**

The methods used to collect and report data must be consistent with the following data submission requirements:

- The data were correctly entered into the online platform
- Explanations of material production are clear and relevant production processes are accounted for
- The scope of the data is consistent with the defined boundary conditions
- Sources, vintage of the data (timeframe represented), source types, and methods for data collection are documented
- Methods used for data collection and decision making are scientifically and technically valid Assumptions and limitations are identified and plausible
- All calculations are correct
- All data are verifiable and reproducible
- The data submission is approved by the MSI Gatekeeper
- The processes are organized into the life cycle stages in the Higg MSI taxonomy
- The data quality is at a minimum “fair” or higher quality rated (see Table B3 Quality level and rating for the data quality criteria)
- If an LCIA Submission, data and midpoints must have been previously reviewed by an independent external expert. This expert must not be or have been employed in a full-time or part-time role by submitting organization or the practitioner of the study. This person also must not have been involved in defining the scope or conducting the LCIA. A review report must be submitted along with the results.

If there are any issues with the data submission, the Gatekeeper will communicate any outstanding issues with the Data Submitter, who may choose to update or revise the data.

**The Higg MSI Data Submission Types**

The MSI Contributor contains a flexible template that allows Data Submitters to provide data and calculate impacts according to the methodologies adopted by SAC. The basic structure of this data is to match the inputs to the product or process to the output(s). It is important that the data be as complete as possible, and have consistent accounting for each input and output submitted. Typically, inputs are based on a “per unit” (1 kg, m2, or other standard metric). This level of detail is required to calculate the score for Processes and Materials. This level of data will not be made available to the public or any other users of the data.

Every submission must appropriately fit into the MSI taxonomy, which separates Production Phases. Submissions may be applicable to more than one Base Material (e.g. a spinning process may be possible for various textiles), but they must fit within the boundaries of one
Production Phase. Any submission that covers more than one Production Phase must be split into separate submissions. See more information under Scope of Data.

Data may be submitted in the two following forms in order of preference:
- Type 1: data inputs/outputs at the process level (Figure B1); (Material inputs may be in the form of unit process outputs, not just elementary flows)
- Type 2: characterized results life cycle impact assessment (LCIA) of the inputs at the process level (Figure B2); LCIA methodologies must match MSI LCIA methodologies exactly (see more information under Additional Requirements for Submission Type 2).

Figure B1: Data Submission Type 1 - data inputs/outputs at the unit process level

Note: This is an example for Textiles only.
Figure B2: Data Submission Type 2 - characterized results life cycle impact assessment (LCIA) of the inputs at the process level

Notes:
All production phases could produce midpoint results.
This is an example for Textiles only.
Land Use, Human Toxicity, and Ecotoxicity are not currently included in the MSI score. However, results are still modeled and available to SAC members upon request. Calculating these impacts now will also ease the process of adding them to the MSI score in the future.
### Table 1: Benefits of Data Submission Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Type 1 (unit process level data)        | • If data was not specifically solicited by SAC, you will only need to pay a submission fee to cover the quality assurance process once  
• SAC will be responsible for modeling data (cost effective for Data Submitter)  
• SAC will be responsible for maintenance of the data if methodology changes  
• SAC will determine alignment with PEF and other relevant regulations  
• Detailed product data will be accessible only to contractors and service providers who have executed an agreement imposing on the contractor obligations of confidentiality.  
• Midpoints and final scores will be shown to the public upon approval by the Data Submitter.                                                                                                            |
| Type 2 (midpoint results)               | • It will not be necessary to provide detailed production data with the MSI Gatekeeper, Data Manager, or SAC administrator, only characterized LCIA results.                                                                                                                                                                               |

### Table 2: Cons of Data Submission Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 (unit process level data)</td>
<td>• Data submissions are more detailed and confidential to the Data Submitter (although SAC will protect data and make it available to only consultants involved with data review and modeling)</td>
</tr>
</tbody>
</table>
| Type 2 (midpoint results)               | • Supporting documentation of data must be made available to and reviewed by an independent third party. A review report must be submitted along with the LCIA results.  
• LCIA methodologies must match MSI LCIA methodologies exactly (see more information under Scoring Framework)  
• If the Higg MSI Scoring framework changes (e.g., for reasons to maintain consistency with the EU-PEF LCIA methods), updated data must be re-submitted. The fee for covering the quality assurance process will need to be paid each time. |
Unique Processes and Manufacturer-Specific Processes

Submissions may be of a Unique Process or a Manufacturer-Specific Process. A Unique Process is an industry average production process that is fundamentally different from other processes in the MSI. It is different because it uses completely different equipment or technology from anything listed. Branded materials are also usually unique. Higg MSI users can see Unique Process in the tool automatically see when the click on Base Materials and swap processes.

Figure B3. Industry Average Unique Processes

A Manufacturer-Specific Process is not unique (it already lives in the MSI), but uses primary data to represent a specific facility or manufacturer rather than representing an industry average. Since Manufacturer-Specific Processes could potentially be submitted for very many facilities, they are not automatically showed to Higg MSI users to keep the user interface simple and easy to navigate. If users are interested in seeing these processes, they may click on a button that says “Show/Hide Manufacturer Processes”.

Figure B4. Manufacturer-Specific Processes
Higg MSI Requirements for Submission Types 1 and 2

Submissions must include information for each of the items listed below.

**Metadata and descriptive information**
General information about the submission, additional details about the raw material or production process, and any supporting documentation, must be provided. A description of the source and year of the data, and how the data was gathered, must also be included. Descriptive information is important to ensure a complete understanding of the data in the Higg MSI, and to ensure compatibility and comparability with other materials and processes in the database and other Higg Index Product Tools.

**Production outputs**
The primary product (or product being submitted) and any co- and by-products from the production process (See Scope of Data below for further details on allocation) must be provided.

**Material Inputs**
Inputs from the Bill of Materials (BOM), recipe, or product design parameters must be provided. Inputs may be in the form of unit process outputs from upstream processes. Please include the total amount of inputs used, including any losses during the production process. Any material inputs that are greater than 1% of the total mass of the finished product must be included. This includes any packaging, chemical, or intermediary inputs into the product system.

**Transportation of Materials**
Transportation must include the inbound transportation required to move the materials to the manufacturing location.

**Energy Inputs**
Include all energy used for manufacturing or processing, plus any energy used as feedstock, as inputs to this process. All energy inputs over 1% of total energy inputs must be provided. Electricity use must be identified by wattage (high, medium, or low voltage) and must also be identified by geography.

**Water Inputs**
Include total water inputs to the process. The total amount of water inputs must be included; water that is returned to the system or discharged will be accounted for in the water outputs section.

**Direct Emissions**
Direct Emissions to air, water, or soil from the process, with the exception of emissions related to combustion of energy (these are counted in the energy inputs) must be provided.

**Waste Products**
All wastes or non-valuable by-products must be provided, by type of waste and by type of waste disposal method. This includes packaging and any materials sent to recycling.
**Water Outputs**
Include any water discharged from the process. This includes any water that is discharged directly to the environment, back to the municipality or is treated onsite. The net difference between inputs and outputs will be used to calculate total water consumption.

**Scope of Data**
This section details the scope of the data requirements for submission to the Higg MSI. The Higg MSI includes Processes in the following Production Phases for each Material Category. The figure below shows the Production Phases for each Material Category.
Figure B5. Higg MSI Material Categories and Production Phases

Textile:
- Raw Materials Source → Yarn Formation → Textile Formation → Preparation → Coloration → Finishing

Leather:
- Country of Origin and Process → Tanning → Re-Tanning → Drying → Finishing

Synthetic Leather:
- Substrate Raw Material → Polyurethane Type → Substrate Formation → Production Processes → Specialty Application

Plastics:
- Raw Material Source → Mixing and Preparation → Molding and Curing

Rubber/Elastomer:
- Raw Materials Source → Mixing and Preparation → Molding and Curing → Finishing

Foam:
- Raw Materials Source → Mixing and Preparation → Foaming → Molding and Pouring
Inclusion of data
All known inputs should be included. Minor inputs (accounting for less than 1% of total material or energy inputs or outputs) may be excluded. Any exclusions must be noted and justified. Total exclusions may not exceed 5% of total energy and material inputs or outputs. Additionally, the following inputs can be excluded:
- Labor, commuting and travels of employees and seasonal workers
- Administrative overhead
- Processes that can reasonably be assumed to contribute to less than 1% of the environmental impact (cut-off criterion), when no data are available.

Multiple output processes
For processes that produce multiple valuable outputs, the total amount of each output, using the same units for each output stream, must be provided.

Handling multi-functional processes
The following multi-functional decision hierarchy shall be applied for resolving all multi-functional problems:

1. Subdivision or system boundary expansion
2. Allocation based on a relevant underlying physical relationship (substitution may apply here);
3. Allocation based on some other relationship.

The specific allocation method used should be documented and Data Submitters must justify their chosen allocation method if not a prescribed method.

**Carbon Storage and Sequestration**
Results from carbon sequestration or storage modeling cannot be included in the data submissions, unless the models can clearly demonstrate that carbon is permanently removed from the atmosphere for a minimum of 100 years. If carbon sequestration or storage is claimed, detailed documentation must be provided.

**Recovered and Recycled Wastes**
Wastes that are reused or recycled back into the process should not be counted as an input. In such cases, include only the net additions to the process. For example, the total amount of a catalyst used in a production process should not be reported, only the portion that is depleted by that process. Another example would be excess product material that can be directly used as an input to the next process. For the two examples above, include only the additional amounts needed for the process, and not the total reused portion.

**Cutoff at Recycling**
The Higg MSI utilizes the recycling cut-off approach. For recycled products, the transportation of the waste product to the recycling facility, and burdens of the recycling process, must be provided. No other upstream inputs are included. The chart below demonstrates this cut-off procedure.

**Figure B6: Recycling Cut-off Rules**

Definitions of Recycled Content, Pre-Consumer (Post-Industrial) and Post-Consumer materials:

---

9 ISO 14021 Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling), section 7.8.1.1
• **Recycled Content**: Proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content, consistent with the following usage of terms.

• **Pre-Consumer Material**: Material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

• **Post-Consumer Material**: Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

**Agricultural Land Occupation**
Agricultural or forest land occupation must be provided if the product being submitted includes agricultural materials (on field, farm, or forest). This impact is not included in the Higg MSI scoring or tool interface at this time, but it is available in the SAC database for future addition to the tool if appropriate.

**List of Data Entries**
Submissions are made using the MSI Contributor, accessible at msicontributor.higg.org. The platform includes entry fields for the following:

**General Information:**

- Submission Type (raw material or process)
- Submission Name
- Brand
- Material Category
- Base Material
- Production Phase
- Facility
- Reporting Period (start and end dates of data collection period)
- Supporting documents
- Image
- General Description
- Energy use allocation

**Materials, Energy, and Transport:**

- Name and amount of product/process
- Energy inputs, amounts, and measurement approaches
- Material inputs, amounts, and measurement approaches
- Agricultural land inputs, amounts, and measurement approaches
- Packaging inputs, amounts, and measurement approaches

**Self-produced Energy:**

- Output types and amounts
- Fuel sources and amounts
- Emissions specific to on-site energy production
- Amount exported to grid or sold

Water Use and Treatment:
- Total water use for reporting period per kg of product
- Total amount of water discharged per kg of product
- Total amount of water treated on-site per kg of product
- Total amount of water returned to municipal source per kg of product

Emissions:
- Air emissions type and amount per kg of product
- Water emissions type and amount per kg of product
- Soil emissions type and amount per kg of product

Solid Waste and Recycling:
- Materials sent to landfill and their amounts
- Materials sent to incineration and their amounts
- Recycled materials and their amounts
- Hazardous materials and their amounts

Data Quality (ranking from very poor to very good):
- Technological Representativeness
- Temporal Representativeness
- Geographical Representativeness
- Parameter Uncertainty

**Data quality criteria and scores**
The dataset quality shall be calculated based on the six quality criteria described below as consistent with the EU PEF data quality requirements. A semi-quantitative assessment of the overall data quality of the dataset shall be calculated summing up the achieved quality rating for each of the quality criteria, divided by the total number of criteria. The Data Quality Rating (DQR) result is used to identify the corresponding quality level. The semi-quantitative assessment of the overall data quality of the dataset requires the evaluation (and provision as metadata) of each single quality indicator. This evaluation shall be done according to Table B3 and formula [1]:

\[
DQR = \frac{TiR + TeR + GR + C + P + EoL}{6} \quad [1]
\]

<table>
<thead>
<tr>
<th>DQR:</th>
<th>DATA QUALITY RATING OF THE DATASET</th>
</tr>
</thead>
<tbody>
<tr>
<td>TER:</td>
<td>Technological Representativeness</td>
</tr>
<tr>
<td>GR:</td>
<td>Geographical Representativeness</td>
</tr>
<tr>
<td>TIR:</td>
<td>Time-related Representativeness</td>
</tr>
<tr>
<td>C:</td>
<td>Completeness</td>
</tr>
<tr>
<td>P:</td>
<td>Parameter Uncertainty</td>
</tr>
</tbody>
</table>
**EOL: Implementation of the End of Life baseline formula**
*(optional future measure)*

Note that Completeness (C), and End of Life (EoL) will not be included in the data quality assessment of material production data at this time. The Higg MSI scoring methodology promotes the reporting of unit process life cycle inventory data as opposed to LCIA results, and contains only a cradle-to-gate boundary that does not consider impacts beyond the final Material factory gate. As such, the denominator of formula [1] is 4. As data becomes more out of date, the DQR will change. The Material score will not change. The DQR helps SAC prioritize data needs for future solicitation. Only submitted data with a DQR of “Fair” (3) or better will be included in the Higg MSI.

The Criteria for the semi-quantitative assessment of overall data quality of the submitted datasets are the following:

- **Time Representativeness**: Degree to which the dataset reflects the specific conditions of the system being considered regarding the time / age of the data, and including background datasets, if any.
- **Technological Representativeness**: Degree to which the dataset reflects the true population of interest regarding technology, including for included background datasets, if any. Comment: i.e. of the technological characteristics including operating conditions.
- **Geographical Representativeness**: Degree to which the dataset reflects the true population of interest regarding geography, including background datasets, if any. Comment: i.e. of the given location / site, region, country, market, continent, etc.
- **Parameter Uncertainty**: Qualitative expert judgement or relative standard deviation as a % if a Monte Carlo simulation is used.
<table>
<thead>
<tr>
<th>Quality level</th>
<th>Quality rating</th>
<th>C (Future Measure)</th>
<th>TiR</th>
<th>P</th>
<th>TeR</th>
<th>GR</th>
<th>EoL (Future Measure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good¹⁰</td>
<td>1</td>
<td>15 PEF Impact Categories</td>
<td>Data¹¹ are not older than 4 years with respect to the release date or latest review date</td>
<td>≤ 10%</td>
<td>The technologies covered in the dataset are exactly the one(s)modeled</td>
<td>The processes included in the dataset are fully representative for the geography stated in the title and metadata</td>
<td>The EoL formula [2] is implemented in the entire dataset (foreground and all background processes)</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>14 PEF Impact Categories (and all 10 categories classified I or II in ILCD are included¹²)</td>
<td>Data are not older than 6 years with respect to the release date or latest review date</td>
<td>10% to 20%</td>
<td>The technologies modeled are included in the mix of technologies covered by the dataset</td>
<td>The processes included in the dataset are well representative for the geography stated in the title and metadata</td>
<td>The EoL formula [2] is implemented in foreground level-1 + level-2 disaggregated processes (see Figures E.2 and E.3)</td>
</tr>
<tr>
<td>Fair</td>
<td>3</td>
<td>12-13 PEF Impact Categories (and all 10 categories classified I or II in ILCD are included)</td>
<td>Data are not older than 8 years with respect to the release date or latest review date</td>
<td>20% to 30%</td>
<td>The technologies modeled are representative of the average technology used for similar processes</td>
<td>The processes included in the dataset are sufficiently representative for the geography stated in the title and metadata</td>
<td>The EoL formula [2] is implemented in foreground at level-1 disaggregated processes (see Figure E.2)</td>
</tr>
</tbody>
</table>

¹⁰In some cases referred to as “excellent”
¹¹The reference time is the one when data have been originally collected and not the publication/calculation date. In case there are multiple data, the oldest is the one against which the calculation should be made.
¹²The 10 impact categories classified in ILCD Handbook as category I or II are: Climate change, Ozone depletion, particulate matter, ionizing radiation human health, photochemical ozone formation, acidification, eutrophication terrestrial, eutrophication freshwater, eutrophication marine water, resource depletion mineral fossil and renewable.
<table>
<thead>
<tr>
<th>Poor</th>
<th>4</th>
<th>10-11 PEF Impact Categories (and all those covered are classified I or II in ILCD)</th>
<th>Data are not older than 10 years with respect to the release date or latest review date</th>
<th>30% to 50%</th>
<th>Technology aspects are different from what described in the title and metadata</th>
<th>The processes included in the dataset are only partly representative for the geography stated in the title and metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>5</td>
<td>Less than 10 PEF Impact Categories (and all those covered are classified I or II in ILCD)</td>
<td>Data are older than 10 years with respect to the release date or latest review date</td>
<td>&gt; 50%</td>
<td>Technology aspects are completely different from what described in the title and metadata</td>
<td>The processes included in the dataset are not representative for the geography stated in the title and metadata</td>
</tr>
</tbody>
</table>

\[
\left(1 - \frac{R_1}{2}\right) \times E_v + \frac{R_1}{2} \times E_{recycled} + \frac{R_2}{2} \times \left( E_{recycling_fd} - E_v \times \frac{Q_v}{Q_r} \right) + R_3 \times \left( E_{E_{\text{LHV}}} - LHV \times X_{E_{\text{LHV,heat}}} \times E_{SE,heat} - LHV \times X_{E_{\text{LHV,recycled}}} \times E_{SE,recycled} \right) + \left(1 - \frac{R_2}{2} - R_3\right) E_D = \frac{R_2}{2} \times E'_D \quad [2]
\]

Additional Requirements for Submission Type 2

If input and output data are not available, LCIA (midpoint) results may be submitted instead. The midpoints submitted must use the listed LCIA methods and the prescribed version listed in Table B4. Since data is less transparent for review, Type 2 data submissions must be independently reviewed prior to submission, and a review report must also be submitted to the Gatekeeper.

Please remember that every submission must appropriately fit into the MSI taxonomy, which separates Production Phases. Submissions may be applicable to more than one Base Material (e.g. a spinning process may be possible for various textiles), but they must fit within the boundaries of one Production Phase. Any submission that covers more than one Production Phase must be split into separate submissions.

Midpoint Categories
Impacts for products and processes are first calculated from a “midpoint” methodology. These approaches come directly from LCIA. The individual impact categories listed in Table B4 are calculated based on methodologies currently available and widely used by the LCA community. These impact categories chosen were based on their scientific accuracy, their applicability to the apparel, footwear and home textile industries, and their compatibility with other global product sustainability programs.

### Table B4: Higg MSI Midpoints

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>LCIA Method</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change</td>
<td>Baseline model of 100 years of the IPCC (based on IPCC 2013)</td>
<td>kg CO₂ eq</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>CML-IA baseline 2013 v3.03</td>
<td>kg PO₄eq</td>
</tr>
<tr>
<td>Abiotic Resource Depletion, Fossils</td>
<td>CML 2002 (Guinée et al., 2002) and van Oers et al. 2002</td>
<td>MJ</td>
</tr>
<tr>
<td>Water Use</td>
<td>Available Water Remaining (AWARE) as recommended by UNEP, 2016 and Consumption</td>
<td>m³ world eq (for both)</td>
</tr>
<tr>
<td>Human Toxicity</td>
<td>USEtox model (Rosenbaum et al, 2008)</td>
<td>CTUh</td>
</tr>
<tr>
<td>Ecotoxicity</td>
<td>USEtox model (Rosenbaum et al, 2008)</td>
<td>CTUe</td>
</tr>
<tr>
<td>Land Occupation</td>
<td>ReCiPe v1.10</td>
<td>M²a (annual occupation)</td>
</tr>
</tbody>
</table>

In an attempt to not require more frequent data updates from the Data Submitter, we recommend the following midpoints also be submitted. These are the additional categories required for Product Environmental Footprinting to date.

### Table B5: Additional Optional Midpoints

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Method</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone depletion</td>
<td>ILCD</td>
<td>kg CFC-11 eq</td>
</tr>
<tr>
<td>Particulate matter</td>
<td>ILCD</td>
<td>kg PM2.5 eq</td>
</tr>
<tr>
<td>Ionizing radiation HH</td>
<td>ILCD</td>
<td>kBq U235 eq</td>
</tr>
</tbody>
</table>
Required Impact Categories and LCIA Methods will be reassessed every two years by SAC membership to ensure that the most important impacts to the apparel, footwear, or home textile industries are captured credibly. Human Toxicity, Ecotoxicity, and Agricultural Land Occupation impact results are still required through data submission, even though those impacts are not included in the Higg MSI score or tool interface. This is required to make sure relevant data will be available when more relevant and accepted toxicity or land use assessment methodologies can be implemented.

**Review Protocol**

Once data is submitted through the MSI Contributor, data must go through a quality assurance process before it is incorporated to the Higg MSI. The review is completed by the MSI Gatekeeper to ensure that the data meets all acceptance criteria. The following review protocol describes the basic steps and actors involved in submitting and approving a dataset for use in the Higg MSI.

**STEP 1: Data Submission**

In this step, the Data Submitter completes the data entry using the MSI Contributor to meet the submission requirements to the extent possible. See above under List of Data Entries to see what information is required. An initial submission notification is sent to the SAC and MSI Gatekeeper by completing the “General Information” section of the data submission form. This informs SAC if a submission has been started and allows the MSI Gatekeeper to plan for a review.

**STEP 2: Gatekeeper Review**

Once the submission has been completed, the MSI Gatekeeper reviews the data including the material and energy flows, outputs and metadata. A review check list is used for both Type 1 and Type 2 data submissions cataloging all requirements to achieve conformance. The review cycle will loop until the data set is determined to conform or the Gatekeeper rejects the submission in total.

**STEP 3: Final Review and Modeling**

The data submission undergoes a final review to ensure complete integration into the Higg MSI. If there are any issues found during this final review, revisions are to be made by the Data Submitter and re-approved by the Gatekeeper. During this step, the Higg MSI scoring framework will be applied to calculate a final Material score. After payment by the Data Submitter for this quality assurance process, this MSI score will be communicated to the Data Submitter for final permission to publish the information in Higg Index Product Tools.
STEP 4: Publishing
Once the data passes the final review process it is then published and available for access by users of Higg Index Product Tools.

Figure B7: Data Submission and Review Process
Data Uses

Material scores and metadata will be available to the public through the Higg MSI. In addition, the Higg MSI will make midpoint data available to SAC members. MSI scores will also be available for use in the Higg DDM. Eventually, data can be leveraged for the Higg Product Module (expected 2019), which will calculate the environmental impacts of finished products.

Metadata to be included in the Higg MSI includes the following:

- Modeling notes
- Primary source
- Timeframe (data age)
- Source description
- Geography
- Applicable materials (base materials that the submitted process/raw material is applicable to)
- Data quality
- Uncertainty Score (to be determined during review)
## APPENDIX C: LCIA METHOD CRITERIA

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>LCIA Method</th>
<th>Environmental Relevance/Imp.</th>
<th>Scientific Robustness</th>
<th>Completeness of Scope</th>
<th>Transparency of sources</th>
<th>Degree of Acceptance</th>
<th>Data availability</th>
<th>Decision for Inclusion in MSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abiotic Resource Depletion, Fossil Fuels</td>
<td>CLM, 2013 v4.2</td>
<td>High: Global. Energy use is a major driver of environmental impacts, and depletion of global resources is a widely recognized concern.</td>
<td>High: very measurable.</td>
<td>High: assess the extraction and use of fossil fuel resources based on availability and access.</td>
<td>High: underlying data model clearly documented</td>
<td>High: often used.</td>
<td>High</td>
<td>Included</td>
</tr>
<tr>
<td>Abiotic Resource Depletion, Fossils and Minerals</td>
<td>CML, 2013 v4.2</td>
<td>Moderate-High: Global. Energy use is a major driver of environmental impacts, and depletion of global resources is a widely recognized concern.</td>
<td>Moderate-low: these metrics are based on the depletion of known reserves and must be constantly update and revised based on depletion, exploration, and identification of reserves. Estimation of resource availability is highly uncertain.</td>
<td>Moderate-High: characterization factors must be continually updated. Limited by temporal relevance.</td>
<td>Moderate-High: sources are transparent but difficult to interpret.</td>
<td>High-Low: general agreement that resource depletion is an important impact to measure. High by LCA practitioners, Low for extraction industry.</td>
<td>High-Low: measurements based on known reserves and depletions and must be continually updated based on extraction and new technology.</td>
<td>Not included due to uncertainty in the mineral assessment, which was magnified with MSI normalization methodology. See Abiotic Resource Depletion, Fossil Fuels.</td>
</tr>
<tr>
<td>Blue Water Consumption</td>
<td>Not an LCIA method (looking at amount of water)</td>
<td>Moderate-Low: water use is a globally recognized impact but it</td>
<td>Moderate-Low: while conceptually simple, data for water use/</td>
<td>Low: Global, but does not take water scarcity into consideration.</td>
<td>Moderate: sources are transparent as they are estimates that</td>
<td>Moderate: Water consumption is generally accepted as</td>
<td>Moderate: removed complexity of regional water availability, but</td>
<td>Included but not part of MSI score.</td>
</tr>
<tr>
<td>Climate Change</td>
<td>IPCC GWP over a 100-year time horizon v1.02</td>
<td>High: Global. Widely recognized global impact.</td>
<td>High: 100-year time horizon widely accepted as appropriate metric</td>
<td>High: Global. GWP of individual emissions are based on consensus of scientific community</td>
<td>High: based on IPCC published values</td>
<td>High: one of the most widely tracked environmental metrics globally.</td>
<td>Included</td>
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</tr>
<tr>
<td>Cumulative Energy Demand</td>
<td>CED</td>
<td>High: Global. Energy use is a major driver of environmental impacts, and depletion of global resources is a widely recognized concern.</td>
<td>High: very measurable</td>
<td>High: can be subdivided into different types of energy demand (renewable/non-renewable)</td>
<td>High: very transparent</td>
<td>High: often used</td>
<td>High: one of the highest</td>
<td>Not included: Used Abiotic Resource Depletion, Fossil Fuels instead.</td>
</tr>
<tr>
<td>Ecotoxicity</td>
<td>USEtox model</td>
<td>Moderate-High: Europe and N. America</td>
<td>Moderate-Low: each species and individual will react differently to different levels of exposure to hazardous chemicals, making a general predictive</td>
<td>Moderate-Low: very few of the known global chemicals have been assessed for toxicity, and LCIA models are based on extrapolations of limited studies.</td>
<td>Moderate-High: sources are transparent but difficult to interpret.</td>
<td>Moderate-Low: hazard vs risk approaches are often at odds and there is significant disagreement on the appropriate approach.</td>
<td>Moderate-Low: substances are often assessed using equivalent/proxy chemicals, and eco-responses vary widely.</td>
<td>Not included: SAC is collecting chemicals data and is planning to add this assessment in the future. Assessment results may be requested by SAC members.</td>
</tr>
<tr>
<td>Eutrophication</td>
<td>CML-IA baseline 2013 v3.03</td>
<td>High: direct impact on water quality with visible impacts on bodies of water. Western Europe.</td>
<td>Moderate-High: Eutrophication is the result of nutrient loading, and is measured in Nitrogen and Phosphorous equivalents. Each waterway will respond differently to different nutrient loads.</td>
<td>Moderate: measurements are based on P and N limited streams, and there is limited data for each waterway. Limited in geography.</td>
<td>Moderate-High</td>
<td>Moderate-High: &quot;dead&quot; zones are evident in many areas across the world, however the causes of these zones are often disputed. Often used as a proxy for Water Quality. High in Europe.</td>
<td>High-Low: data for specific releases to specific waterways is difficult to gather, and averaging does not accurately assess acute impacts. High for Europe.</td>
<td>Included</td>
</tr>
<tr>
<td>Human Toxicity</td>
<td>USEtox model</td>
<td>Moderate-High: Human toxicity is a highly tracked metric and many brands are particularly concerned with their impacts on the population</td>
<td>Moderate-Low: dose response curves are very difficult to model and broad metrics may not identify specific threats in specific situations. High uncertainty.</td>
<td>Moderate-Low: very few of the known global chemicals have been assessed for toxicity, and LCIA models are based on extrapolations of limited studies.</td>
<td>Moderate-High</td>
<td>Moderate-High: sources are transparent but difficult to interpret.</td>
<td>High-Low: hazard vs risk approaches are often at odds and there is significant disagreement on the appropriate approach.</td>
<td>Not included. SAC is collecting chemicals data and is planning to add this assessment in the future. Assessment results may be requested by SAC members.</td>
</tr>
<tr>
<td>Land Use</td>
<td>Land Occupation</td>
<td>Moderate-High: Global. Land occupation is most relevant in agricultural and forestry based products</td>
<td>Moderate-Low: this is an aggregated inventory metrics that sums up occupation, but does not assess</td>
<td>High: Global. Metric only tracks occupation, and data is not difficult to gather</td>
<td>High</td>
<td>Moderate: only assess occupation, and not impacts.</td>
<td>Moderate-High: data is generally available and can be estimated. Data availability is lower for</td>
<td>Not included. SAC is collection land occupation data and will investigate alternative methodologies. Assessment</td>
</tr>
<tr>
<td>Land Use</td>
<td>Land Use Change</td>
<td>Moderate-Low: measuring what happened, but not the effects of those practices</td>
<td>Moderate-High: measures inventory of what’s being transformed</td>
<td>Moderate: Lack of land types, good coverage of change and footprint.</td>
<td>High: methodology is transparency</td>
<td>Low: no authoritative bodies that have accepted it</td>
<td>Moderate-Low: available in databases to an extent</td>
<td>Not included. SAC is collecting land occupation data and will investigate alternative methodologies.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Land Use</td>
<td>SOM</td>
<td>Moderate: only considers one indicator (organic matter)&gt; Is very localized.</td>
<td>Moderate: measure of soil health for agriculture and forestry systems by looking at land occupation/transformation.</td>
<td>Moderate: must have good data (difficult in practice). Uses occupation and transformation to calculate carbon.</td>
<td>Moderate: well documented but characterisation factors need to be developed by the user.</td>
<td>High: accepted by ILCD</td>
<td>Low: need case-specific characterisation factors</td>
<td>Not included. SAC is collecting land occupation data and will investigate alternative methodologies.</td>
</tr>
<tr>
<td>Water Footprint</td>
<td>Hoekstra, 2012</td>
<td>Moderate: Global. Water use and availability is a globally recognized impact. Takes a product system approach.</td>
<td>Moderate-Low: does not consider water stress, but does include green water and water quality impact</td>
<td>Low: Global, but does not take water scarcity into consideration.</td>
<td>Moderate-High: method and sources are transparent and published in peer reviewed literature.</td>
<td>Moderate-Low: generally accepted and implemented by non-LCA practitioners. Green and grey water methods typically not included in LCA.</td>
<td>Low: removed complexity of regional water availability, but consumption values (blue and green) and water discharge (grey) still necessary and difficult to gather.</td>
<td>Not included. Using AWARE instead to calculate water impacts.</td>
</tr>
<tr>
<td>Water Resource Depletion/Scarcity</td>
<td>Pfister et al. 2009</td>
<td>High: Global. Water use and availability is a globally recognized impact.</td>
<td>Moderate-Low: while conceptually simple, data for water use/consumption is notoriously difficult to gather. Method is at the country level.</td>
<td>High-Low: Global. Water scarcity is a regionally specific impact, and data is limited on the scale needed for meaningful assessments</td>
<td>Moderate-High: sources are transparent but often built on extrapolations of older models.</td>
<td>Moderate-High: general agreement that water depletion is an important impact to measure.</td>
<td>Moderate-Low: data for globally sensitive regions is very difficult to gather and often unreliable. Need to have geographical water extraction info.</td>
<td>Not included. Using AWARE instead to calculate water impacts.</td>
</tr>
<tr>
<td>---------------------------------</td>
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</tr>
<tr>
<td>Water Use</td>
<td>Available WAter REMaining (AWARE)</td>
<td>Moderate-High: Global applicability with regional differentiation.</td>
<td>Moderate-High: more complex model, data for water use/consumption is relevant at watershed spatially specific level, country level. Water availability varies over time and needs to be periodically updated in order to be accurate.</td>
<td>Moderate-High: Global. Water availability is assessed at regionally specific levels.</td>
<td>Moderate-High: method and sources are transparent and published in peer reviewed literature.</td>
<td>Moderate-High: Developed in a consensus method. Chosen to be the PEF method.</td>
<td>Moderate-Low: primary data for globally sensitive regions is very difficult to gather and often unreliable. Need to have geographical water extraction information and input data with spatial resolution.</td>
<td>Included.</td>
</tr>
<tr>
<td>Water withdrawal</td>
<td>Not an LCIA method (just a measure of water volume use)</td>
<td>Moderate-Low: water use does not directly correlate to impacts.</td>
<td>Low: water use does not directly correlate to impacts.</td>
<td>Low: does not take water scarcity into consideration</td>
<td>Low: data is often proprietary</td>
<td>Low: Not an LCIA method</td>
<td>High: Easiest to measure</td>
<td>Not included. Using AWARE instead to calculate water impacts.</td>
</tr>
</tbody>
</table>
APPENDIX D: CHEMISTRY QUALITATIVE SCORING FRAMEWORK

Introduction
Although we collect life cycle inventory (LCI) data to assess Ecotoxicity and Human Toxicity quantitatively in the Higg MSI in the future, SAC members have elected to wait to incorporate Toxicity modeling until the methodology has matured and more data has been collected. SAC’s Chemicals Assessment Team created a Chemistry Qualitative Scoring Framework described in this appendix to assess chemistry of Materials. This Framework for assessing chemistry through a qualitative indicator will be used until a comprehensive quantitative data and an accompanying assessment methodology for chemistry are accessible to give a satisfactory level of confidence.

There are two parts to this qualitative assessment:
1. **Finishes scoring**: extra impact was given to chemical-based finishes
2. **Chemical certifications/standards/programs**: the chemistry score could improve if specific chemistry-related certifications/standards/programs are met by the material

Higg MSI Climate Change, Eutrophication, Abiotic Resource Depletion – Fossil Fuels, and Water Scarcity impacts are normalized to have an average score of ten points. All Base Materials are assumed to have a chemistry impact of fifteen points, or 1.5 times the average. This is a conservative worse-than-average assumption. Higg MSI users can add to this impact by adding chemical finishes, or reduce this impact by adding chemistry-related certifications/standards/programs. The best possible score for the Chemistry impact area is Five (or half the average). This is also conservative because the score is not calculated using actual quantitative data.

**Approach 1: Chemical Finishes**
Chemical finishes can increase the durability of a material, thus giving it potential to be more sustainable from a lifecycle perspective. However, the Higg MSI considers the impacts from material production, and adding chemical finishes increases the chemical impact of a material. This impact must be reflected in the Higg MSI.

To reflect this impact, additional points are added to a material score when chemical finishes are selected. Specifically, one point is added to the chemistry impact for each chemical finish selected, up to a maximum of five points. A maximum of five points is selected because it is unlikely that more than five chemical finishes would be added to a material.

**Approach 2: Chemical Certifications/Programs/Standards**

**Overview**
To provide a level of objectivity, Qualifiers (certifications, programs, and other tools) are assessed against six areas of chemical impact: Worker Occupational Health & Safety, Chemical Use Efficiency, Chemical Emissions Reduction, Consumer Safety, Preferred Chemistry, and Chemical Manufacturing
Stewardship. This framework allows for easy management of any future expansions to the list by assessing proposed Qualifiers against a set of criteria. Supporting documentation must be provided to comply with the specific criteria and become a Qualifier.

**Scope:**
The chemical management indicator is derived from the Outdoor Industry Association's Chemicals Management Module (CMM)\(^\text{13}\) for Brands, Suppliers and Chemical Suppliers. The indicator considers chemicals used in the manufacture of and/or residing in Product, with improved scoring for greater knowledge of chemicals used and increased performance.

The scope of the consideration is from wellhead or farm to finished Material in addition to consumer safety in the use phase. Not considered are the environmental impacts during the consumer use phase or end of life (disposal) due to the limited control and influence that brands have over these areas.

This indicator is intended as “guidance” for product designers and developers to help educate and support more informed selections of Materials environmental performance. This is not a compliance tool or verification scheme; just directional guidance to improve decision-making until more quantitative methods can be developed, tested, and implemented.

**Qualifier:**
A Qualifier is any certification, program, or tool that can be assessed against the individual criteria of the desired outcomes in an objective manner.

A “Qualifier” must be specific to a Material or product, with a claim or certification that can be supported through documentation. Note: Internal chemical management programs are scored as part of the Higg Brand Module.

Each Qualifier must meet the following requirements:
- Relevant to User
  - End user has access to necessary information to make selection
  - End user can influence change
- Can/Must be attributed directly to a material and/or product level (e.g. relevant to a material and/or product “claim”).
- Credible:
  - Based on best available science
  - Targets most critical impacts
  - Drives improvement
- Value Add:
  - Drives action and education

**Desired Outcome:** Each qualifier must meet at least one of six specific Desired Outcomes. Desired Outcomes are output categories from the qualitative scoring framework tied back to areas of impact that

\(^{13}\) https://outdoorindustry.org/advocacy/corporate-responsibility/chemicals-management-module
can have improved outcomes. Each Desired Outcome contains a set of criteria to provide context for evaluating Qualifiers in a consistent manner, as detailed below. The defined Desired Outcomes are:

- Worker Occupational Health & Safety
- Chemical Use Efficiency
- Chemical Emissions Reduction
- Consumer Safety
- Preferred Chemistry
- Chemical Manufacturing Stewardship

**Phase 1/Phase 2:** To better differentiate the chemical management efforts that occur at different stages of the supply chain, a “Phase 1/Phase 2” approach is incorporated to recognize distinct impact areas.

- Phase 1: Captures impacts from the origin of raw material to the yarn formation stage (for textiles) or basic material (for other components). The maximum impact reduction for Phase 1 certifications is -12 points. Normalized, this is a maximum of a -3.5 point reduction.
- Phase 2: Captures impacts from yarn to finished textile (for textiles) or the additional processing required to transform a basic material into the components shipped to an assembly facility (for other components). The maximum impact reduction for Phase 2 certifications is -18 points. Normalized, this is a maximum of a -5.2 point reduction.

The number of points awarded depends on 1) how well they meet (in full, part, or not at all) specified criteria and 2) the degree of verification, as described below:

- Third party: Verification can be tied back to the Qualifier, allowing the Qualifier to continually refine and improve their processes and ensure it is driven down to the manufacturer. Ex: Manufacturer self-declared they are meeting a Qualifier. This is verified by a certification body. The certification body is accredited or otherwise approved by the Qualifier. A relationship exists between the Qualifier and the manufacturer.
- Self-declared: The manufacturer self-declares that they meet a Qualifier’s criteria – no further assessments are done.

As stated above, the number of points is dictated by how well they meet specific criteria. One point will be given for self-declaring (and supporting through documentation) that all criteria are met for a given Desired Outcome. If all the criteria are third party verified, then three points will be given. For desired outcomes where partial points are possible, the number of points for the section will be divided by a further factor of three and rounded to the nearest whole number. Note: for self-declared criteria this means the points for that outcome will round down to zero. The maximum point reduction possible for a given Desired Outcome is -3.

Specific scoring spreadsheets for each Qualifier will be made available to SAC members through the collaboration platform iMeet Central. This will provide transparency to where Qualifiers may try to address a specific Desired Outcome, even if the thresholds for points have not yet been met. Specific documented rationale must be provided in support of all declarations in consideration of scoring. This supporting documentation is also available to SAC members.
Desired Outcomes and Criteria

The following outline the desired “primary outcomes” of acceptable chemicals management practices as defined by individual criteria. The intention is to ensure these desired outcomes and defining criteria reconcile well with the CMM objectives and indicators.

**Worker Occupational Health & Safety:** Worker safety is achieved by reducing chemical exposure and/or by using less hazardous chemicals at production sites (e.g., Chemical exposure reduced from working conditions in material production; Chemical hazard reduced by using less hazardous chemicals).

- **Qualifying Criteria:**
  - Phase 1 and 2
    - i. The Qualifier requires production sites to know and have a documented Occupational Health and Safety (OH&S) program, which includes documentation of employee training, and a named company representative who is responsible for site OH&S.
    - ii. The Qualifier has an audit protocol in place to assess and verify that all chemicals used on site have a current Safety Data Sheet (SDS).
    - iii. The Qualifier has a protocol for on-site audits that includes the assessment of the production site’s ability to demonstrate safe chemical handling, use, and disposal practices in manufacturing.

**Chemical Use Efficiency (partial points possible for Phase 1):** Chemical toxicity impacts are reduced through the use of “best available” chemistry types and processes that are optimized to have the lowest chemical hazard with maximized productivity and minimized waste.

- **Qualifying Criteria:**
  - Phase 1
    - i. The Qualifier has an audit protocol to determine that a production site is using documented programs and systems that identify and result in the use of chemistries that are considered “best available” in terms of reducing hazards both human / eco toxicity as part of optimizing chemical efficiency. For agricultural processes, this may take the form of a prohibited substances list that includes agrochemicals such as fertilizers, pesticides, and herbicides.
  - Phase 2
    - i. The Qualifier has a protocol to determine that a Production site has documented and is using programs and systems that identify and result in the use of chemistries that are considered "best available" in terms of reducing hazards, both human and eco toxicity as part of optimizing chemical efficiency.
    - ii. The Qualifier has an audit protocol in place to verify that production sites have documented and are using programs and systems that maximize the efficient use of chemicals.
    - iii. The Qualifier has an audit protocol in place to verify Production sites have documented and is using programs and systems that optimize processes in order to realize the chemical use efficiencies.
Chemical Emissions Reduction (partial points possible): Emissions and discharges are managed to best practices to further reduce environmental emissions of chemicals through VOCs, wastewater, etc.

- **Qualifying Criteria:**
  - **Phase 1**
    - i. TheQualifier has an audit protocol in place to verify that production sites have documented and is using programs and systems that maximize the efficient use of chemicals in order to reduce chemical emissions and exposure. For agricultural processes, this may include documented training programs around the application of agrochemicals.
    - ii. TheQualifier is able to determine if the production site knows and measures its chemical consumption at the production site on a regular basis, in addition to tracking the raw material yield.
    - iii. TheQualifier has a means to understand if the production site is continuously improving in its ‘per unit’ chemical consumption.
  - **Phase 2**
    - i. TheQualifier knows and understands emission reduction best practice requirements for production sites around environmental emissions, including water, air, and solid waste emissions and has in practice a means to audit and document these emissions.
    - ii. TheQualifier is able to determine if the production site knows and measures its emissions and discharges exiting the production site on a regular basis.
    - iii. TheQualifier understands the unit processes and controls in place at each production site and has a means to assess emissions against best practices.
    - iv. TheQualifier has a means to understand if the production site is continuously improving.

Consumer Safety: Improved consumer safety through reduced risks from chemical exposure during product use and handling.

- **Qualifying Criteria:**
  - **Phase 2 only**
    - i. TheQualifier knows and understands requirements for restrictions and/or bans on chemical substances of concern, including understanding of compliance with global regulations.
    - ii. TheQualifier assesses compliance with restricted substance list (RSL) requirements and compliance with global regulations.
    - iii. TheQualifier has a process through which they audit their own assessment procedure to ensure conformity to any restrictions/bans of chemical substances. Corrective actions are taken when cases of non-compliance are found.

Preferred Chemistry (partial points possible): Preferred Chemistry: A preferred substances list of input chemical formulations pre-screened and approved for use in the manufacturing of materials and/or product as a means to proactively manage to “restricted lists” for both consumer safety (RSL) and EHS in manufacturing (MRSL).

- **Qualifying Criteria:**
  - **Phase 1 and 2**
i. The Qualifier knows, maintains and regularly updates a preferred substances list of pre-screened chemical formulations that represent best available technologies. (addition for Phase 2 only: This includes vetting and verification against both consumer and manufacturing chemical restrictions.)

ii. The Qualifier can demonstrate their rationale / criteria as to how the “preferred list” is created and made “transparent” to credible oversight bodies.

iii. The Qualifier has a system in place to evaluate and update their criteria of what represents best available technology, including the ability to continually improve upon the list of preferred substances through the addition / phase-out of chemical formulations.

iv. The Qualifier has a system in place to ensure accessibility to the list of preferred substances in order to effectively operationalize their use.

v. The Qualifier has a means to verify compliance against the use of the preferred substances list.

Chemical Manufacturing Stewardship: The manufacture of the chemical formulations that make up a preferred substances list is audited to ensure consistent formulation quality and site stewardship.

- Qualifying Criteria:
  - Phase 2 only
  i. The Qualifier, as part of their screening process for a preferred substances list, requires chemical suppliers and chemical manufacturing sites to demonstrate they can consistently manage the quality of their chemical formulations and understand the expected levels of impurities.

  ii. The Qualifier has an audit protocol in place to assess these chemical suppliers and chemical manufacturing sites to verify that analytical quality control procedures are in place to monitor chemical formulation quality and that these procedures adhere to internationally recognized laboratory management principles.

  iii. The Qualifier has an audit protocol in place to assess these chemical suppliers and chemical manufacturing sites to ensure site stewardship practices are in place, including that they know and measure their water, air, and solid waste emissions and discharges on a regular basis.

Indicator “Qualifier” Programs

The following are program qualifiers that meet one or more of the primary objectives stated above. Each “Qualifier Program” can be screened against the stated criteria for each primary objective to determine “scope” and overall “verification confidence level”. A “Qualifier Program” must be specific to a Material or product, a claim or certification that “can” be verified by a third party, 2nd party, self-declaration (i.e. high, moderate, low confidence indicator). This needs to consider a continuum of performance (reflected in points allocated). Qualifiers and scores currently listed in the Higg MSI are shown in the Table below.
<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better Cotton Initiative (BCI)</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Bluesign®</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Cotton made in Africa (CmiA)</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>OEKO-TEX® Made-in-Green</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>OEKO-TEX® Standard 100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Organic Content Standard (OCS)</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Global Recycled Standard (GRS)</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Fairtrade</td>
<td>-3</td>
<td>-3</td>
</tr>
</tbody>
</table>

Additional Qualifiers may be added to the Higg MSI during regular quarterly updates. Please send suggestions to product@apparelcoalition.org.
INTRODUCTION

This report summarizes findings of a critical/peer review of the July 20, 2016 version of “The Higg Materials Sustainability Index Methodology” report; an Excel workbook titled “Process Review July 2016t.xls”; and other details of the method and approach as communicated via web meetings with Cash East, of Pre Sustainability. The findings reported here represent the independent judgment of the reviewer.

While the topics under consideration in this review tend to focus on life cycle assessment (LCA) data sources and modeling choices, this is a review of an LCA-based assessment methodology and tool, rather than a single LCA study. As such, this report does not constitute a conventional “critical review” of an LCA study for conformance with the ISO 14044 standard for LCAs. Consideration will be given to several topics also addressed by the ISO 14044 standard, but this review is both broader and less particular than a conventional 14044-style review.

OVERVIEW

The following topics are addressed in this review of the Higg Material Sustainability Index (Higg MSI):

- Major data selection decisions
- Normalization
- Selected modeling decisions

Data Selection Decisions

The first major choice necessary in rendering the Higg MSI operational is how to source the extensive “background data” needed to complete the numerous material and processing supply chain models. The methodology employed by the Higg MSI is LCA, so life cycle inventory (LCI) data are needed to complete the supply chain and life cycle models.

As specified on page 7 of the report, the choice has been made to use the following secondary sources for the Higg MSI launch: Ecoinvent versions 3, PlasicsEurope, GaBi, JRC European Commission, and literature. In general these choices are strongly supported by this review.

Delving into the Process Review spreadsheet, we note that among these sources, the Ecoinvent version 3 database plays a major role. This choice is sound and supported by the following considerations:
• This database provides unit process transparency, meaning that the thousands of unit processes which comprise supply chain models are individually specified and visible for scrutiny by any interested party, and what’s more, their importance and individual contributions to the final results can be quantitatively assessed using all standard LCA software packages. Such scrutiny supports continuous improvement and refinement of the data, including support of prioritization of such refinement.

• Version 3 of the Ecoinvent database includes regionalization and global markets. Research in LCA increasingly shows the importance of regionalization in assessing impacts, and clearly apparel supply chains span the globe and involve significant contributions from countries outside of zones where the bulk of LCI data have historically been developed (Europe and North America). Explicit modeling of markets and the locations of supply chain processes adds to the ability of future enhancements of the Higg MSI data.

Next, we note that extensive use has also been made of a recent published benchmarking study of textiles, to provide a consistent and transparent basis for estimating energy use for a wide set of textile production steps. This choice too appears sound and supported by the following considerations:

• The source is transparent and was peer-reviewed prior to being published in the International Journal of LCA

• The source provides a single consistent basis for these estimates.

Finally, in relation to secondary data selection in general, we note that in the development of supply chain models for what turn out to be hundreds of material/process combinations, there are numerous cases where data that provides an imperfect match in terms of the specific material, technology, and country(s) of origin for which data were sought. This obviates the use of “proxy” or “best available substitute” data. Such a fallback is common practice when the data scope is as large as is the case in this project. It is supported by the considerations that:

• The choices are all transparently documented in the spreadsheet noted, which has supported internal scrutiny and cross-checking by a group of experts this far in the process, and can be further subject to scrutiny and to refinement wherever better data can be immediately obtained;

• By keeping the choices transparent at a unit process level, uncertainties introduced by the use of proxy data can be assessed and compared in the future to prioritize which data choices warrant refinement because of the possible sensitivity of final results and conclusions to these uncertainties.

Normalization

As noted on pages 9 and 10 of the report, if a final score is to be obtained (as is the case in the Higg MSI) then the step of “normalization” is needed prior to weighting (or summing of un-weighted results) by impact category. An interesting approach has been taken in the development of the Higg MSI in the selection of what is called the “reference system” for normalization – the system whose impacts are used as the denominator in calculating normalized results for a given material, process, or product.

It is common practice in LCA to use as a reference system the sum total of all processes and activities within all sectors of the economy for a given country or continental region. The results of normalization then indicate the relative share of contribution to total impacts from this reference system (region) that are due to the product being studied. This approach has the advantage that it can be applied widely across applications in all sectors.
The Higg MSI is a methodology that is designed to support decision making by users within a specific sector: apparel. In such an instance, use is sometimes made of sector-specific reference systems for normalization. For example, decision makers may wish to know, and take into account: how influential is a given product design or material selection decision, compared with or in the context of, the total impacts of our sector (the apparel industry including its supply chains).

This is the approach that has been taken in developing the Higg MSI. The normalization basis used is the weighted average of impacts for a representative set of the most-often-used materials for footwear and for apparel. These materials were weighted in terms of percentage of usage by volume, based on data provided by member companies and trade associations.

The approach is defensible and sound, and will provide a stable basis for normalization results (and thus final Higg MSI scores). In future versions of the method and tool, it might be considered to test the influence of adopting an all-sector reference system perspective for a large region or for the globe. Doing so would, for example, give higher relative importance (than found in the current version of the Higg MSI) to those impact categories on which the apparel sector makes a higher-than-average contribution compared with the rest of the economy, and likewise would give lower relative importance (than found in the current version) to those impact categories on which the apparel sector makes a lower-than-average contribution. That said, it must be also recognized that publicly available normalization datasets suffer from their own incompleteness, which has the impact of biasing results in giving higher importance to impact categories for which global or national emissions inventories are more incomplete. The normalization reference system selected in the development of the Higg MSI circumvents this problem, based as it is on the life cycle inventories calculated directly from the datasets used.

**Selected Modeling Decisions: Foreground Transportation**

In order to create a set of results that is usable at a high level without needing to use life cycle assessment software, one simplification which has been made is to not include explicit modeling of transportation within “foreground” systems. Transportation impacts are included within the “background” systems farther upstream. It is considered relatively likely that this exclusion of foreground system transport modeling will not strongly affect the conclusions or results. Inclusion of foreground modeling of transportation would have significantly increased the complexity of the user experience and back-end database modeling.

For a future version of the Higg MSI system, sensitivity calculations might be advisable, to test whether – and for which specific materials or decision types) foreground transportation can make a significant impact in the final results and swing a decision or choice. If it is found that foreground transport does not in fact tip the decision scales in general, knowing this would add user confidence in the final results.
APPENDIX F: GLOSSARY

Allocation: partitioning the input and/or output flows of a process to the product system under study (ISO). This is necessary when more than one product is produced (joint production), and environmental impacts need to be divided between the product systems.

Characterization: substances that contribute to an impact category are multiplied by a characterization factor that expresses the relative contribution of the substance.

Chemical Emissions Reduction: Emissions and discharges are managed to best practices to further reduce environmental emissions of chemicals through VOCs, wastewater, etc.

Chemical Manufacturing Stewardship: The manufacture of the chemical formulations that make up a preferred substances list is audited to ensure consistent formulation quality and site stewardship.

Chemical Use Efficiency: Chemical eco-toxicity impacts are reduced through the use of “best available” chemistry types and processes that are optimized to have the lowest chemical hazard with maximized productivity and minimized waste.

Climate Change: a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Consumer Safety: Improved consumer safety through reduced risks from chemical exposure during product use and handling.

Cradle-to-gate: The cradle-to-gate life cycle spans the origin of raw materials to a finished textile or component part, ready to be shipped to a product manufacturing facility.

Ecotoxicity: the potential for biological, chemical or physical stressors to affect ecosystems.

Eutrophication: excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.

Higg Design & Development Module (DDM): A tool meant to be used early in the product creation process by designers and developers. The output is a design score that can be used for decision-making about different design scenarios.

Higg Index Product Tools: Higg Index Product Tools include the Higg MSI, the MSI Contributor, and the Higg DDM. The Higg Product Footprint Module is a future Higg Index Product Tool.

Higg Product Footprint Module: a future Higg Tool to provide credible external communication to influence purchasing decisions and scale industry adoption of leading practices. It will be used by sustainability and communication experts to assess the full impacts of a finished product. Methodology
will be aligned with life cycle assessment (LCA) methodology, particularly that of the Product Environmental Footprint (PEF).

**Higg Materials Sustainability Index (MSI):** cradle-to-gate material scoring tool informed by life cycle assessment (LCA) data and methodology to engage product design teams and our global value chain in environmental sustainability. Through this tool, users can view material scores, processes, and metadata. Users can also swap in and our different production processes to see score changes and create blends. SAC members can also access LCA midpoints for each process.

**Human Toxicity:** The Human Toxicity Potential (HTP) is a quantitative toxic equivalency potential (TEP) that has been introduced previously to express the potential harm of a unit of chemical released into the environment. HTP includes both inherent toxicity and generic source-to-dose relationships for pollutant emissions.

**Land Occupation:** the amount of land necessary to be used specifically for production of the material.

**Life Cycle Assessment (LCA):** Life-cycle assessment is a technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).

**Life Cycle Impact Assessment (LCIA):** Phase of Life Cycle Assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product.

**Material:** a finished material, ready to be shipped to a product manufacturing facility and assembled into a product. It is made up a chain of individual processes that illustrate full cradle-to-gate material production. It will have an associated score reflected in the Higg DDM and Higg MSI.

**Material Category:** a generic material type (ex: textile, foam, metal).

**Materials Sustainability Index (MSI):** cradle-to-gate index informed by life cycle assessment (LCA) data to engage product design teams and our global value chain in environmental sustainability. Through this tool, users can view material scores, processes, and metadata. Users can also swap in and our different production processes to see score changes and create blends. SAC members can also access LCA midpoints for each process.

**Materials Task Team:** a team of SAC members (brands, retailers, manufacturers, and service providers in the apparel, footwear, and home textile industries) with the goal of creating content and scoring methodology for the Higg MSI.

**Midpoint:** an impact category that translates impacts into environmental themes such as climate change, eutrophication, ecotoxicity, etc.
Preferred Chemistry: A preferred substances list of input chemical formulations pre-screened and approved for use in the manufacturing of materials and/or product as a means to proactively manage to “restricted lists” for both consumer safety (RSL) and EHS in manufacturing (MRSL).

Process (also called Unit Process): an individual production process used in the cradle-to-gate lifecycle of a material. A process in the Higg MSI is associated with specific inputs and outputs from/to the environment. A chain of processes makes up a Material.

Production Phase: a material production step for which various processed could be used. More than on Production Phases are used to create a finished material.

Product Environmental Footprint (PEF): harmonized methodology for the calculation of the environmental footprint of products (including carbon). It has been spearheaded by the European Commission and DG Environment.

Resource Depletion, Fossils and Minerals: Resource depletion is the consumption of a resource faster than it can be replenished. This impact area model is based on available fossil fuel reserves and the technology available to access those reserves.

Sustainable Apparel Coalition: The Sustainable Apparel Coalition is the apparel, footwear and home textile industry’s foremost alliance for sustainable production. The Coalition’s main focus is on building the Higg Index, a standardized supply chain measurement tool for all industry participants to understand the environmental and social and labor impacts of making and selling their products and services. By measuring sustainability performance, the industry can address inefficiencies, resolve damaging practices, and achieve the environmental and social transparency that consumers are starting to demand.

USEtox: a scientific consensus model endorsed by the UNEP/SETAC Life Cycle Initiative for characterizing human and ecotoxicological impacts of chemicals. Main output is a database of recommended and interim characterization factors including fate, exposure, and effect parameters.

Water resources depletion/scarcity: a means to measure potential environmental damages of water use for three areas: human health, ecosystem quality, and resources.

Worker Occupational Health & Safety: Worker safety is achieved by reducing chemical exposure and/or by using less hazardous chemicals at production sites. (i.e. Chemical exposure reduced from working conditions in material production; Chemical hazard reduced by using less hazardous chemicals).
APPENDIX G: INITIALISMS

**BOM**: Bill of Materials

**CED**: Cumulative Energy Demand

**CML**: Centre of Environmental Science – Leiden University

**DDM**: Design & Development Module

**ILCD**: International Reference Life Cycle Data System

**IPCC**: International Panel on Climate Change

**GWP**: Global Warming Potential

**MSI**: Materials Sustainability Index

**PEFCR**: Product Environmental Footprint Category Rules

**SAC**: Sustainable Apparel Coalition

**SOM**: Soil Organic Matter

**WSI**: Water Stress Indicator