

ENVIRONMENTAL PRODUCT DECLARATION

WELLBAC™ COMFORT PLUS BACKING

PRINT WORKS NYLON 6,6



WellBAC™ Comfort Plus is Milliken's hard back modular tile. In addition to providing superior underfoot comfort and significantly improving the carpet's wear performance, WellBAC™ Comfort Plus also offers installation, ergonomic, acoustic, safety and environmental benefits.

Milliken™

Designing innovative products and solutions for our customers is the utmost importance. Through meaningful design, deep science and unique insights, we advance product development to the next level while supporting Milliken's efforts to increase sustainable results and minimize environmental impact of all products.

Milliken's holistic approach to innovation encompasses all stages of the life cycle – from material sourcing and manufacturing to end-of-life management. Our commitment to transparency, health, safety, quality and sustainability allows us to put our customers, associates and first.

For more information visit
www.millikencarpet.com



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Print Works– Nylon 6,6

According to ISO 14025,
EN 15804 and ISO21930:2017

| | | |
|---|---|--|
| EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE | UL Environment 333 Pfingsten Road Northbrook, IL 60611 | https://www.ul.com/ https://spot.ul.com/ |
| GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER | General Program Instructions v.2.4 July 2018 | |
| MANUFACTURER NAME AND ADDRESS | Milliken, 300 Lukken Industrial Dr., LaGrange GA 30240 | |
| DECLARATION NUMBER | 4787801051.107.1 | |
| DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT | WellBAC™ Comfort Plus Print Works Nylon 6,6; (1) m2 of floor covering | |
| REFERENCE PCR AND VERSION NUMBER | Part A: Life Cycle Assessment Calculation Rules and Report Requirements, (UL Environment, V3.2, 2018) and Part B: Flooring EPD Requirements (UL Environment V2.0, 2018) | |
| DESCRIPTION OF PRODUCT APPLICATION/USE | WellBac™ Comfort Plus Backed Carpet Tile manufactured in China floor coverings beautify offices, hotels, airports, homes, and commercial environments around the world | |
| PRODUCT RSL DESCRIPTION (IF APPL.) | 15 Years | |
| MARKETS OF APPLICABILITY | China | |
| DATE OF ISSUE | October 1, 2020 | |
| PERIOD OF VALIDITY | 5 Years | |
| EPD TYPE | Product-Specific | |
| EPD SCOPE | Cradle-to-Grave | |
| YEAR(S) OF REPORTED PRIMARY DATA | 2017 | |
| LCA SOFTWARE & VERSION NUMBER | GaBi v.8.7 | |
| LCI DATABASE(S) & VERSION NUMBER | GaBi v.8.7, Sevice Pack 35 | |
| LCIA METHODOLOGY & VERSION NUMBER | TRACI 2.1 | |
| This PCR Review was conducted by: | UL Environment | |
| | PCR Review Panel-Chair: Lindita Bushi, PhD | |
| | epd@ulenvironment.com | |
| This declaration was independently verified in accordance with ISO 14025: 2006. <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL | | |
| | Grant R. Martin, UL Environment | |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: | | |
| | Thomas P. Gloria, Industrial Ecology Consultants | |

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.



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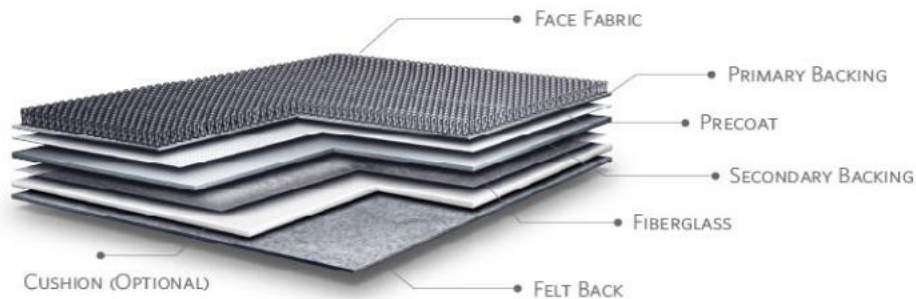
According to ISO 14025,
EN 15804 and ISO 21930:2017

1. Product Definition and Information

1.1. Description of Company/Organization

The Milliken Floor Covering division is part of Milliken & Company, an innovation company that has been exploring, discovering and creating ways to enhance people’s lives since 1865. The company is a privately held for-profit corporation. The company is headquartered in Spartanburg, South Carolina, and operates design and manufacturing facilities in the United States, United Kingdom, Australia and China. In 2017, Milliken was recognized as one of the world’s most ethical companies for the eleventh consecutive year.

1.2. Product Description



Product Identification

This EPD represents Milliken’s WellBac™ Comfort Plus Backed Carpet Tile manufactured in China. The face fiber used in the carpet is digital dyed injected nylon 6,6.

A carpet tile’s backing is critical to its performance, durability and appearance retention. The right backing will not only ensure the carpet tile remains dimensionally stable and flat on the floor, it can provide acoustic, insulation and sustainability benefits. In addition to providing superior underfoot comfort and significantly improving the carpet’s wear performance, WellBAC™ Comfort Plus also offers installation, ergonomic, acoustic, safety and environmental benefits.

Product Specification

The product is described using the specifications outlined in Table 2. Additionally, the product has performance characteristics outlined in Table 1.

Table 1: Carpet Performance Testing

| NAME | VALUE | UNIT |
|---|--------------------|------|
| Static Electricity(AATCC 134) | ≤ 3.5 | kV |
| Flammability (ASTM E 648) | ≥0.45 (Class I) | - |
| Smoke Density (ASTM E 662) | ≤450 | - |
| Methenamine Pill Test (CPSC FF-1-70 or ASTM D 2859) | Self Extinguishing | - |



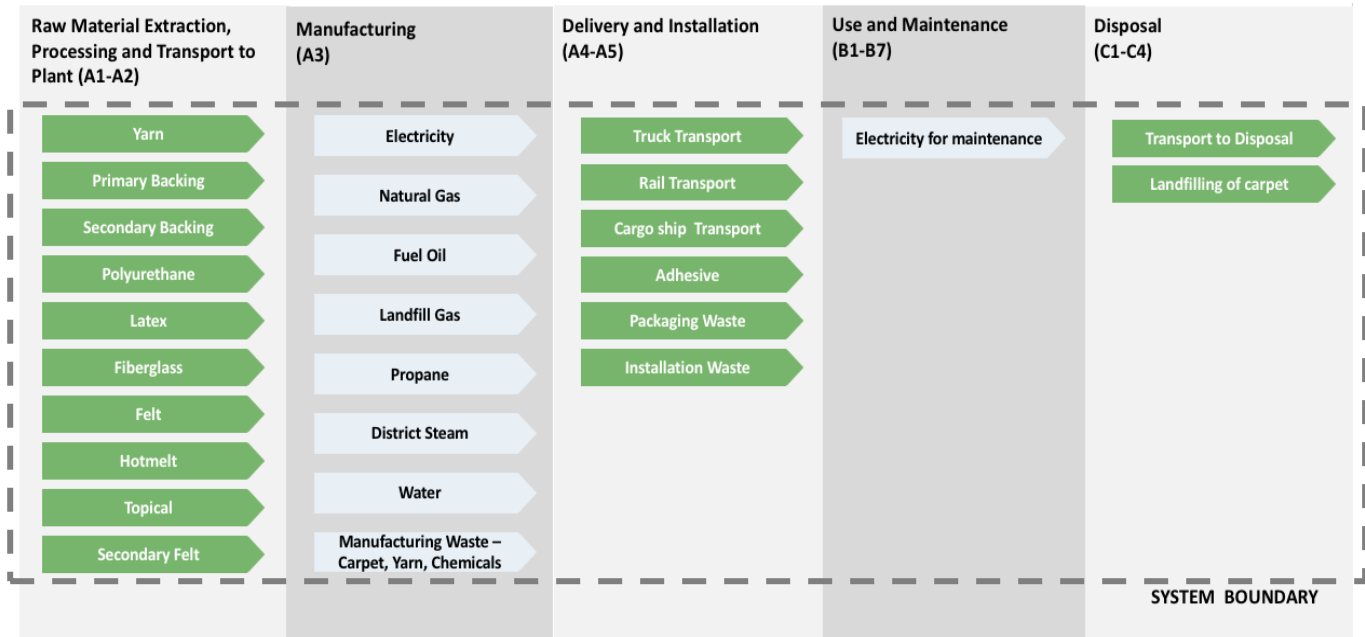
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Flow Diagram



Product Average

An average based on product construction was utilized for the life cycle assessment. The average was created by utilizing the standard formulation for the backing and the weighted sales average for the face fiber. This is deemed to be an accurate representation of an average flooring product.

1.3. Application

Milliken & Company's floor coverings beautify offices, hotels, airports, homes, and commercial environments around the world.

1.4. Declaration of Methodological Framework

This LCA is a cradle-to-grave study. A summary of the life cycle stages can be found in Table 18.

The reference service life is outlined in Table 10 and is only applicable if all manufacturing guidelines are followed regarding site-selection and installation, found online.

The cut-off criteria are described in Section 2.4 and allocation procedures are described in Section 2.8. No known flows are deliberately excluded from this EPD.



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1.5. Technical Requirements

The following technical data describe the product undergoing the life cycle assessment.

Table 2: Carpet Technical Data

| NAME | VALUE | UNIT |
|------------------------|---|-------------------|
| Product Form | Carpet tile | - |
| Type of Manufacturing | Digital Dyed Injected, Tufted Nylon 6,6 on coated backing | - |
| Yarn Type | Nylon 6,6 | - |
| Primary Backing Type | Polyester, Nylon 6 | - |
| Cushion Backing | Open cell polyurethane | - |
| Product Weight | 3.126 – 3.541 | kg/m ² |
| Surface Pile Thickness | 3.05-3.81 | mm |
| Surface Pile Weight | 0.578 – 0.580 | kg/m ² |

1.6. Properties of Declared Product as Delivered

WellBAC™ Comfort Plus backed modular carpet tiles come in sizes of 1mx1m and 50cmx50cm. The tiles are stacked and a cardboard wrapping is placed around the stack to protect the product. These are then stacked on pallets for shipment.

The products declared in this document complies with the following codes or regulations:

- ASTM E 648-17 Radiant Panel
- ASTM E 662-17a Smoke Density
- ASTM D2859 Pill Test
- AATCC 134-2011 GSA Static
- ASTM D5848 Pile weight
- ASTM D5848 Pile Density
- ASTM D6859 Pile Thickness
- ASTM D5793 Stitches
- ASTM D5793 Gauge
- ASTM D7570 AACHEN/ISO 2551 Aachen
- ASTM D1335 Tuft Bind
- AATCC 16.3 Lightfastness

1.7. Material Composition

The materials that make up the flooring product are indicated in Table 3.

Table 3: Material Composition

| COMPONENT | MATERIAL | MASS % |
|-----------------|----------------------------------|--------|
| Face fiber | Nylon 6 / Nylon 6,6 | 14-22% |
| Primary backing | Polyester, Nylon 6 | 3-4% |
| Latex | VAE, Limestone | 13-14% |
| Hotmelt | Limestone, proprietary materials | 35-46% |



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| COMPONENT | MATERIAL | MASS % |
|------------|---|--------|
| Cushion | Polyurethane foam | 15-20% |
| Fiberglass | E-glass | 1-2% |
| Felt | Polypropylene, Polyethylene terephthalate | 3-4% |
| Topical | Water, Proprietary materials | 3-5% |

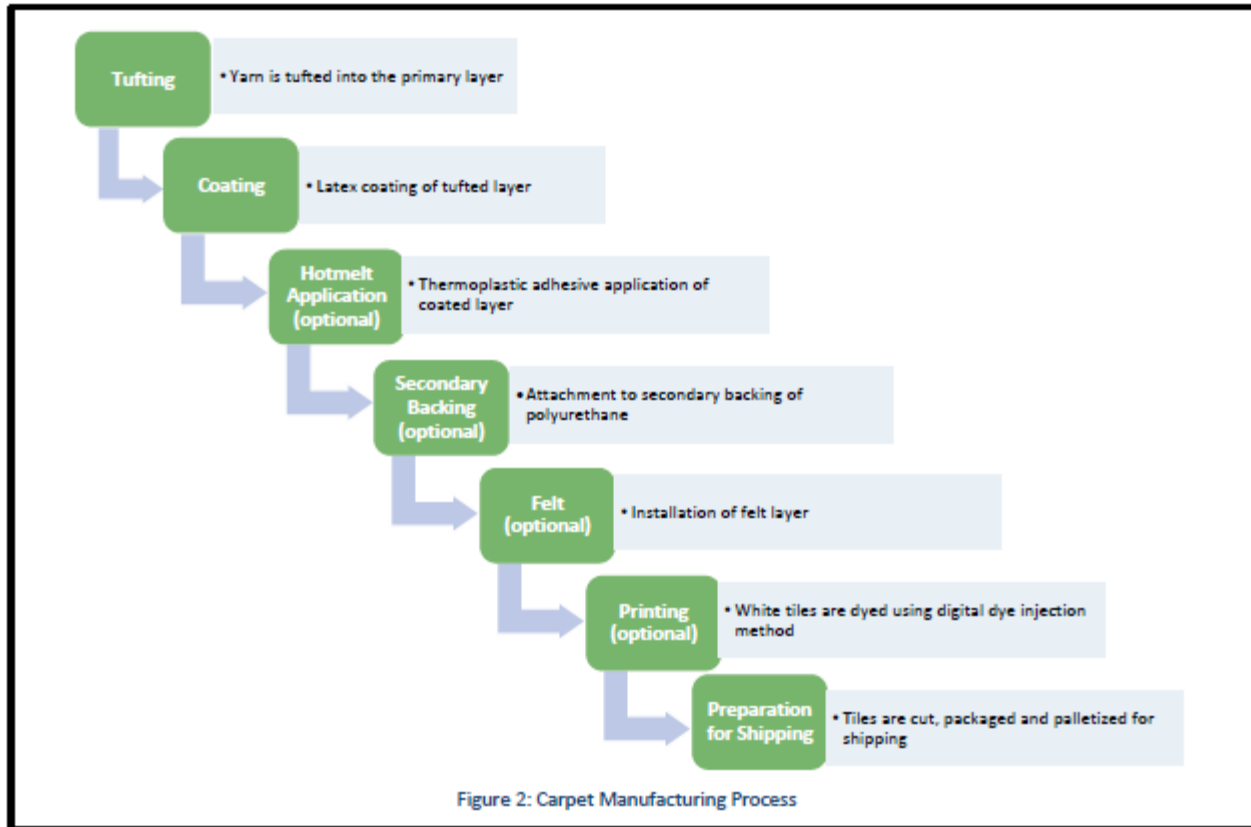
The product does not contain hazardous substances per the applicable regional-specific legislation, as indicated in Section 2.8.6 of *Part A: Life Cycle Assessment Calculation Rules and Report Requirements* from UL Environment.

1.8. Manufacturing

WellBAC™ Comfort Plus backed, digital dyed injected nylon modular tiles are manufactured at the Milliken Zhangjiagang facility in the China. The nylon 6,6 fiber is printed in-house. Tufting is the process of affixing face fiber to a primary backing system. Application of latex backing, hotmelt, polyurethane backing, glass fiber scrim and a felt to the tufted primary backing is called coating. The hotmelt layer is primarily composed of limestone and proprietary materials. The polyurethane foam backing is a cushion backing that is a rebond foam. The mixing of these layers occurs in batch containers and is then applied to the primary backing. The method adding design for aesthetic appeal is printing or digital dye injection where the carpet fibers are dyed after the face fiber has been tufted.

Finally the carpet is cut and packaged for shipping.





Packaging

Packaging utilized in the shipment of the product is described in Table 4.

Table 4: Packaging

| PACKAGING TYPE | MATERIAL | AMOUNT (KG) | DISPOSAL PATHWAY |
|----------------|----------------------|-------------|---------------------------------|
| Box | Corrugated Cardboard | 0.066 | Landfill, incineration, recycle |
| Pallet | Wood | 0.161 | Landfill |

1.9. Transportation

It is assumed that all raw materials are distributed by truck, ship and rail, based on global region. An average distance using this information was calculated and used in the model. Transport of raw material from supplier to the manufacturing facility was calculated for each raw material but only an average has been listed here due to simplicity.

An average shipping distance from the manufacturing location to the customer was utilized and was calculated from sales records. The transportation distance for all waste flows is assumed to be 161 km based on best available data.



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1.10. Product Installation

While installation equipment is required to install the flooring product, it is not included in the study as these are multi-use tools and the impacts per declared unit is considered negligible. All waste generated during installation, including packaging waste, is disposed of according to the tables found in Section 2.8.5 of *Part A: Life Cycle Assessment Calculation Rules and Report Requirements* from UL Environment.

Except where exceeded or modified by Milliken Carpet Installation Instructions, Milliken recognizes the CRI Carpet Installation Standard 2011 as the minimum acceptable standard for the installation of its carpet products, for more information, visit our website, www.millikencarpet.com.

Sub floor moisture: Milliken warrants that our modular carpet will withstand vapor emission from the slab for the lifetime of the original carpet installation. Technically speaking, we guarantee our carpet tile and adhesive will form a bond that provides tack and resistance to lateral movement while the pressure sensitive adhesive will allow for the removal of the modular carpet allowing for maintenance of the space throughout the life of the carpet.

Adhesive: Milliken modular carpet is designed for installation without permanent adhesives. This allows easy removal and reinstallation. Milliken recommends TractionBack® for all carpet tiles adhesive. If TractionBack® is not available; Milliken recommends Milliken Non-Reactive Standard Adhesive or Milliken Moisture Extreme Spray Adhesive.

1.11. Use

The method of maintenance is using a vacuum cleaner to remove dust and debris from carpet. To calculate the use phase energy, three different types of traffic on carpet were modeled, high, medium and low. High traffic areas are vacuumed every work day. Medium traffic areas are vacuumed on alternative work days while low traffic areas are vacuumed once a week.

Table 5: Use Phase Assumptions

| TYPE | VALUE | UNIT |
|--|-------|------|
| Cleaning per Week | 5 | # |
| Weeks per Year Where Cleaning Occurred | 50 | # |

Carpet products are traditionally not repaired or refurbished. If a single carpet tile gets stained or damaged, it can be removed and replaced with a new tile assuming the correct installation method was used per the manufacturer’s instructions. Detailed maintenance instructions are provided online at [Milliken Flooring Covering’s technical documentation webpage](#).

1.12. Reference Service Life and Estimated Building Service Life

The reference service life of the product is 15 years. For a building’s estimated service life of 75 years, this means the carpet will be replaced 4 times, meaning 5 m² of tile is needed over the full life of the building. The reference service life assumes the product was installed according to the manufacturer’s recommendations.

1.13. Reuse, Recycling, and Energy Recovery

Milliken’s modular carpet tiles are 100% recyclable. Keeping unnecessary waste out of landfill is a key part of Milliken’s environmental commitment. The Milliken Carpet Take Back program provides a non-landfill disposal solution and ensures that used carpet is recovered and managed in the most environmentally, socially and financially responsible





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way. In other cases, carpet is downcycled into construction products and plastic composites. Another option, to further reduce global fossil fuel consumption, is to convert the carpet into a fuel source for use in other industries.

1.14. Disposal

Disposal pathways in the EPD are modeled in accordance with disposal routes and waste classification referenced in Sections 2.8.5 and 2.8.6 of *Part A: Life Cycle Assessment Calculation Rules and Report Requirements* from UL Environment. This indicates an end-of-life split amongst landfill, recycling, and incineration pathways.

2. Life Cycle Assessment Background Information

2.1. Functional Unit

The functional unit of the flooring product is one (1) m² of floor covering, as indicated in Table 6.

Table 6: Functional Unit

| NAME | VALUE | UNIT |
|-----------------|-------|----------------|
| Functional Unit | 1 | m ² |
| Mass | 3.118 | kg |

2.2. System Boundary

The type of EPD is cradle-to-grave. All LCA modules are included and are summarized in Table 7

Table 7: System Boundary

| MODULE NAME | DESCRIPTION | ANALYSIS PERIOD | SUMMARY OF INCLUDED ELEMENTS |
|-------------|--|-----------------|---|
| A1 | Product Stage: Raw Material Supply | 2017 | Raw Material sourcing and processing as defined by secondary data. |
| A2 | Product Stage: Transport | 2017 | Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and estimated distance. |
| A3 | Product Stage: Manufacturing | 2017 | Energy, water and material inputs required for manufacturing products from raw materials. Packaging materials and manufacturing waste are included as well. |
| A4 | Construction Process Stage: Transport | 2017 | Shipping from manufacturing site to project site. Fuel use requirements estimated based on product weights and mapped distance. |
| A5 | Construction Process Stage: Installation | 2017 | Installation adhesives, installation waste and packaging material waste. |
| B1 | Use Stage: Use | 2017 | Use of the product. |
| B2 | Use Stage: Maintenance | 2017 | Cleaning energy, water, and materials, including refinishing the product. |
| B3 | Use Stage: Repair | 2017 | Materials and energy required to repair the product. |
| B4 | Use Stage: Replacement | 2017 | Total materials and energy required to manufacture a replacement. |





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| MODULE NAME | DESCRIPTION | ANALYSIS PERIOD | SUMMARY OF INCLUDED ELEMENTS |
|-------------|--------------------------|-----------------|--|
| B5 | Use Stage: Refurbishment | 2017 | Materials and energy required to refurbish the product. |
| B6 | Operational Energy Use | 2017 | Operational Energy Use of Building Integrated System During Product Use |
| B7 | Operational Water Use | 2017 | Operational Water Use of Building Integrated System During Product Use |
| C1 | EOL: Deconstruction | 2017 | No inputs required for deconstruction. |
| C2 | EOL: Transport | 2017 | Shipping from project site to landfill. Fuel use requirements estimated based on product weight and mapped distance. |
| C3 | EOL: Waste Processing | 2017 | Waste processing not required. All waste can be processed as is. |
| C4 | EOL: Disposal | 2017 | Assumes all products are sent to landfill. Landfill impacts modeled based on secondary data. |
| D | Benefits beyond system | 2017 | Credits from energy or material capture. |

2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. The primary data was collected as annual totals including all utility usage and production information. For the LCA, the usage information was divided by the production to create an energy and water use per square meter. Another assumption is that the installation tools are used enough times that the per square meter impacts are negligible.

2.4. Cut-off Criteria

All inputs in which data was available were included. Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. The excluded materials include:

- Spot cleaning chemicals are not included due to the infrequency of the activity during use phase
- Raw materials below 5% by mass of the total product weight was excluded. Each of the excluded raw materials is not listed here due to the proprietary nature of some of the ingredients in the product.

2.5. Data Sources

Primary data were collected by facility personnel and from utility bills and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from GaBi Database Version 8.7, Service Pack 35.

2.6. Data Quality

The geographical scope of the manufacturing portion of the life cycle is Milliken Zhangjiagang facility in the China. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. The primary data provided by the manufacturer represent all information for calendar year 2017. Using this data meets the PCR requirements. Time coverage of this data is considered very good. Primary data provided by the manufacturer is specific to the technology that Milliken uses in manufacturing their product. It is site-specific and considered of good quality. It is worth noting that the energy and water used in manufacturing the product includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering would improve the technological





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coverage of data quality. Data necessary to model cradle-to-gate unit processes was sourced from GaBi LCI datasets. Improved life cycle data from suppliers would improve technological coverage.

2.7. Period under Review

The period under review is calendar year 2017.

2.8. Allocation

General principles of allocation were based on ISO 14040/44. Where possible, allocation was avoided. When allocation was necessary it was done on a physical mass basis. Allocation was most prevalent in the secondary GaBi datasets used to represent upstream processes. As a default, GaBi datasets use a physical mass basis for allocation.

3. Life Cycle Assessment Scenarios

Table 8. Transport to the building site (A4)

| NAME | VALUE | UNIT |
|---------------------------------------|---|-------------------|
| Fuel type | Diesel | - |
| Liters of fuel | 39.0625 | l/100km |
| Vehicle type | Truck – Trailer, basic enclosed/ 45,000 lb payload, ship and rail | - |
| Transport distance | 32574.06 | km |
| Capacity utilization | 0.78 | % |
| Gross density of products transported | 175.75 | kg/m ³ |
| Capacity utilization volume factor | 0.85 | - |

Table 9. Installation into the building (A5)

| NAME | VALUE | UNIT |
|---|--------|--------|
| Adhesive | 0.097 | kg |
| Product loss per functional unit | 0.1559 | kg |
| Waste materials at the construction site before waste processing, generated by product installation | 0.4139 | kg |
| Output materials resulting from on-site waste processing | 0 | kg |
| Biogenic carbon contained in cardboard packaging | 0.237 | kg CO2 |
| Biogenic carbon contained in wooden pallet | 0.289 | kg CO2 |
| Direct emissions to ambient air, soil and water | - | kg |
| VOC content of flooring | <0.5 | µg/m3 |



Table 10. Reference Service Life

| NAME | VALUE | UNIT |
|---|---|-------|
| RSL | 15 | years |
| Declared product properties (at the gate) and finishes, etc. | See Table 1 | - |
| Design application parameters | Installation per recommendation by manufacturer | - |
| An assumed quality of work, when installed in accordance with the manufacturer's instructions | Accepted industry standard | - |
| Indoor environment (if relevant for indoor applications) | Normal building operating conditions | - |
| Use conditions, e.g. frequency of use, mechanical exposure | Normal building operating conditions | - |

Table 11. Maintenance (B2)

| NAME | VALUE | UNIT |
|---|--|-----------------------------|
| Maintenance process information | Manufacturer recommended | - |
| Maintenance cycle | 3,750 | Number/ RSL |
| Maintenance cycle | 18,750 | Number/ ESL |
| Electricity for vacuuming | 0.975 | kWh/m ² floor/yr |
| Power output of equipment | 1.4 | kW |
| Direct emissions to ambient air, soil and water | - | kg |
| Further assumptions for scenario development | 3 passes per tile, 50 work weeks in a year considered with 5 working days each | |

Table 12. Repair (B3)

| NAME | VALUE | UNIT |
|---|---|----------------|
| Repair process information | Product typically not repaired during use | |
| Repair cycle | 0 | Number/ RSL |
| Repair cycle | 0 | Number/ ESL |
| Net freshwater consumption specified by water source and fate | 0 | m ³ |
| Ancillary materials specified by type (e.g. cleaning agent) | 0 | kg |
| Energy input, specified by activity, type and amount | 0 | kWh |
| Waste materials from repair | 0 | kg |
| Direct emissions to ambient air, soil and water | 0 | kg |

Table 13. Replacement (B4)

| NAME | VALUE | UNIT |
|---|-------|-----------------|
| Replacement cycle | 0 | Number/ RSL |
| Replacement cycle | 4 | Number/ ESL |
| Energy input, specified by activity, type and amount | 0 | kWh |
| Net freshwater consumption specified by water source and fate | 0 | m ³ |
| Adhesive | 0.115 | kg/ replacement |
| Direct emissions to ambient air, soil and water | - | kg |
| Further assumptions for scenario development, e.g. frequency and time period of use | | As appropriate |

Table 14. Refurbishment (B5)

| NAME | VALUE | UNIT |
|---|--|----------------|
| Refurbishment process description | Product typically not refurbished during use | |
| Replacement cycle | 0 | Number/ RSL |
| Replacement cycle | 0 | Number/ ESL |
| Energy input, specified by activity, type and amount | 0 | kWh |
| Net freshwater consumption specified by water source and fate | 0 | m ³ |
| Material input for refurbishment, including ancillary materials specified by type (e.g. cleaning agent) | 0 | kg |
| Waste material(s), specified by material | 0 | kg |
| Direct emissions to ambient air, soil and water | 0 | kg |

Table 15: Operational Energy Use (B6) and Operational Water Use (B7)

| NAME | VALUE | UNIT |
|---|-------|----------------------|
| Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer) | 0 | m ³ |
| Ancillary materials | 0 | kg |
| Energy input, specified by activity, type and amount | 0 | kWh |
| Equipment power output | 0 | kW |
| Characteristic performance (e.g. energy efficiency, variation of performance with capacity utilization) | 0 | Units as appropriate |
| Direct emissions to ambient air, soil and water | 0 | kg |
| Further assumptions for scenario development (e.g. frequency and time period of use, number of occupants) | 0 | As appropriate |

Table 16: End of life (C1-C4)

| NAME | | VALUE | UNIT |
|---|--|--|--------------------|
| Assumptions for scenario development | | Product is either disposed of with the underlying floor or manually removed via scraping | |
| Collection process | Collected separately | 0 | kg |
| | Collected with mixed construction waste | 3.231 | kg |
| Recovery | Reuse | 0 | kg |
| | Recycling | 0 | kg |
| | Landfill | 3.231 | kg |
| | Incineration | 0 | kg |
| | Incineration with energy recovery | 0 | kg |
| | Energy conversion efficiency rate | 84-94 | % |
| Disposal | Product or material for final deposition | 3.231 | kg |
| Removals of biogenic carbon (excluding packaging) | | 0.137 | kg CO ₂ |

Table 17. Reuse, recovery and/or recycling potentials (D), relevant scenario information

| NAME | VALUE | UNIT |
|--|-------|------|
| Net energy benefit from energy recovery from waste treatment declared as exported energy in C3 (R>0.6) | 0 | MJ |
| Process and conversion efficiencies | 84-94 | % |

4. Life Cycle Assessment Results

Table 18. Description of the system boundary modules

| EPD Type | PRODUCT STAGE | | | CONSTRUCTION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY |
|----------|---------------------|-----------|---------------|----------------------------|-----------------------|-----------|-------------|--------|-------------|---------------|---------------------------------|--------------------------------|-------------------|-----------|------------------|----------|---|
| | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| | Raw material supply | Transport | Manufacturing | Transport from gate to | Assembly/Installation | Use | Maintenance | Repair | Replacement | Refurbishment | Building Operational Energy Use | Building Operational Water Use | Deconstruction | Transport | Waste processing | Disposal | Reuse, Recovery, Recycling Potential |
| | X | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

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4.1. Life Cycle Impact Assessment Results

Table 19. North American Impact Assessment Results

| TRACI v2.1 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| AP [kg SO ₂ eq] | 3.73E-02 | 5.17E-02 | 1.59E-03 | 0.00E+00 | 3.63E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.38E-04 | 8.93E-06 | 3.15E-04 | 0.00E+00 |
| EP [kg N eq] | 2.19E-03 | 1.75E-03 | 3.46E-04 | 0.00E+00 | 1.30E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 8.29E-06 | 7.38E-07 | 2.61E-05 | 0.00E+00 |
| GWP 100 [kg CO ₂ eq] | 1.78E+01 | 1.75E+00 | 3.72E-01 | 0.00E+00 | 8.79E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.56E-02 | 2.06E-03 | 1.44E-01 | 0.00E+00 |
| ODP [kg CFC-11 eq] | 7.25E-09 | 2.93E-15 | 5.45E-13 | 0.00E+00 | 1.98E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.83E-16 | 7.08E-17 | 1.04E-14 | 0.00E+00 |
| Resources [MJ, LHV] | 3.84E+01 | 3.17E+00 | 5.00E-01 | 0.00E+00 | 1.70E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.95E-02 | 3.90E-03 | 7.87E-02 | 0.00E+00 |
| POCP [kg O ₃ eq] | 6.16E-01 | 9.71E-01 | 8.96E-03 | 0.00E+00 | 4.74E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.03E-03 | 2.93E-04 | 6.02E-03 | 0.00E+00 |

Table 20. EU Impact Assessment Results

| CML v4.2 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|----------|----------|
| ADPelement [kg Sb-eq] | 1.13E-05 | 2.40E-08 | 9.80E-08 | 0.00E+00 | 5.98E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.16E-10 | 3.77E-10 | 1.77E-08 | 0.00E+00 |
| ADPfossil [MJ, LHV] | 2.95E+02 | 2.21E+01 | 3.65E+00 | 0.00E+00 | 8.84E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.49E-01 | 2.91E-02 | 6.32E-01 | 0.00E+00 |
| AP [kg SO ₂ eq] | 3.53E-02 | 4.87E-02 | 7.93E-04 | 0.00E+00 | 3.71E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.04E-04 | 6.66E-06 | 2.89E-04 | 0.00E+00 |
| EP [kg PO ₄ -3 eq] | 5.75E-03 | 5.10E-03 | 4.37E-04 | 0.00E+00 | 2.68E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.39E-05 | 1.79E-06 | 4.15E-05 | 0.00E+00 |
| GWP 100 [kg CO ₂ eq] | 1.77E+01 | 1.75E+00 | 3.94E-01 | 0.00E+00 | 8.86E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.57E-02 | 2.07E-03 | 1.55E-01 | 0.00E+00 |
| ODP [kg CFC-11 eq] | 5.46E-09 | 2.93E-15 | 5.14E-13 | 0.00E+00 | 1.95E-13 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.83E-16 | 7.08E-17 | 1.04E-14 | 0.00E+00 |
| POCP [kg ethene eq] | 4.30E-03 | 2.59E-03 | 1.76E-04 | 0.00E+00 | 3.51E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | -4.07E-05 | 6.76E-07 | 4.62E-05 | 0.00E+00 |



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4.2. Life Cycle Inventory Results

Table 21. Resource Use

| PARAMETER | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| RPRE [MJ, LHV] | 1.07E+01 | 6.43E-02 | 7.33E-02 | 0.00E+00 | 1.23E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.93E-03 | 7.24E-04 | 7.18E-02 | 0.00E+00 |
| RPRM [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RPRT [MJ, LHV] | 1.07E+01 | 6.43E-02 | 7.33E-02 | 0.00E+00 | 1.23E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.93E-03 | 7.24E-04 | 7.18E-02 | 0.00E+00 |
| NRPRE [MJ, LHV] | 3.08E+02 | 2.21E+01 | 3.74E+00 | 0.00E+00 | 9.07E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.49E-01 | 2.93E-02 | 6.55E-01 | 0.00E+00 |
| NRPRM [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRT [MJ, LHV] | 3.08E+02 | 2.21E+01 | 3.74E+00 | 0.00E+00 | 9.07E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.49E-01 | 2.93E-02 | 6.55E-01 | 0.00E+00 |
| SM [kg] | 9.43E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ, LHV] | 2.27E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 1.13E-01 | 1.65E-04 | 7.16E-04 | 0.00E+00 | 7.04E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.74E-06 | 3.52E-06 | 1.10E-04 | 0.00E+00 |

Table 22. Output Flows and Waste Categories

| PARAMETER | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| HWD [kg] | 1.58E-07 | 1.63E-09 | 2.46E-09 | 0.00E+00 | 7.37E-09 | 0.00E+00 | 8.02E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.88E-11 | 2.28E-10 | 1.12E-09 | 0.00E+00 |
| NHWD [kg] | 2.98E-01 | 2.15E-04 | 3.11E-01 | 0.00E+00 | 3.29E-03 | 0.00E+00 | 1.35E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.13E-06 | 1.10E-06 | 3.04E+00 | 0.00E+00 |
| HLRW [kg] or [m3] | 6.31E-06 | 2.41E-09 | 4.61E-08 | 0.00E+00 | 1.08E-07 | 0.00E+00 | 2.73E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.32E-10 | 7.76E-11 | 1.16E-08 | 0.00E+00 |
| ILLRW [kg] or [m3] | 5.10E-03 | 1.87E-06 | 3.83E-05 | 0.00E+00 | 8.96E-05 | 0.00E+00 | 2.21E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.08E-07 | 6.43E-08 | 9.02E-06 | 0.00E+00 |
| CRU [kg] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR [kg] | 0.00E+00 | 0.00E+00 | 8.23E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.01E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.61E-01 | 0.00E+00 | 0.00E+00 |



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| PARAMETER | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| MER [kg] | 0.00E+0 0 | 0.00E+0 0 | 0.00E+0 0 | 0.00E +00 | 0.00E+0 0 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E+ 00 | 0.00E +00 | 0.00E+ 00 | 0.00E +00 |
| EE [MJ, LHV] | 0.00E+0 0 | 0.00E+0 0 | 0.00E+0 0 | 0.00E +00 | 0.00E+0 0 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E +00 | 0.00E+ 00 | 0.00E +00 | 0.00E+ 00 | 0.00E +00 |

Table 23. Carbon Emissions and Removals

| PARAMETER | PARAMETER | WELLBAC COMFORT PLUS DDI, N6,6 | UNIT |
|-----------|---|--------------------------------|--------------------|
| BCRP | Biogenic Carbon Removal from Product | 0.137 | kg CO ₂ |
| BCEP | Biogenic Carbon Emission from Product | 0.159 | kg CO ₂ |
| BCRK | Biogenic Carbon Removal from Packaging | 0.526 | kg CO ₂ |
| BCEK | Biogenic Carbon Emission from Packaging | 0.111 | kg CO ₂ |

5. LCA Interpretation

Overall for Milliken’s carpet product, both broadloom and carpet tile, Global Warming and Abiotic Depletion of fossil fuels are seen to be the largest impact categories. Within the impact categories, the vast majority of impacts are aggregated in the A1-A3 phase of the life cycle of the product. A1-A3 includes raw material sourcing, transportation and manufacturing. The second largest life cycle stage is B2 which is the maintenance of the product over a year.

In the sourcing, extraction and manufacturing stage, yarn contributes to around 54.4% of the overall GWP impacts. The second highest contributor is manufacturing electricity (8.9%) and thermal energy (10.4%) of impacts. Apart from yarn, polyurethane (7.2%) and primary backing (4.6%) have highest impacts. Besides manufacturing inputs, manufacturing waste at the US manufacturing locations contribute 0.7% of total impacts. Finally, use phase contributes 2.9% of life cycle impacts.

6. Additional Environmental Information

6.1. Environment and Health During Manufacturing

Information on Milliken’s sustainability programs, “No Carpet to Landfill” pledge and other sustainability resources can be found [Milliken Floor Covering’s sustainability website](#).

6.2. Environment and Health During Installation

All recommended personal protective equipment (PPE) should be utilized during installation, as indicated on the SDS and installation guidelines, found online.

6.3. Extraordinary Effects





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Fire

The product’s fire performance can be found in the technical specifications found in Table 1.

Water

Should the product become flooded, the water should be removed through means of extraction and drying and the product should behave as originally intended. There are no environmental impacts associated with the product being flooded.

Mechanical Destruction

If the product is mechanically destroyed, it should be disposed of using standard procedures and replaced in a timely manner.

6.4. Environmental Activities and Certifications

All Environmental certifications can be found on [Milliken Floor Covering’s sustainability website](#). Select certifications are also presented on [mindful Materials](#).

7. Supporting Documentation

The full text of the acronyms found in Section 4.1 are found in Table 24

Table 24. Acronym Key

| ACRONYM | TEXT | ACRONYM | TEXT |
|----------------|---|-----------|---|
| LCA Indicators | | | |
| ADP-elements | Abiotic depletion potential for non-fossil resources | GWP | Global warming potential |
| ADP-fossil | Abiotic depletion potential for fossil resources | OPD | Depletion of stratospheric ozone layer |
| AP | Acidification potential of soil and water | POCP | Photochemical ozone creation potential |
| EP | Eutrophication potential | Resources | Depletion of non-renewable fossil fuels |
| LCI Indicators | | | |
| PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials | PENRT | Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) |
| PERM | Use of renewable primary energy resources used as raw materials | SM | Use of secondary materials |
| PERT | Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) | RSF | Use of renewable secondary fuels |
| PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | NRSF | Use of non-renewable secondary fuels |
| PENRM | Use of non-renewable primary energy resources used as raw materials | FW | Net use of fresh water |
| HWD | Disposed-of-hazardous waste | MFR | Materials for recycling |





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| ACRONYM | TEXT | ACRONYM | TEXT |
|---------|---------------------------------|---------|-------------------------------|
| NHWD | Disposed-of non-hazardous waste | MET | Materials for energy recovery |
| RWD | Disposed-of Radioactive waste | EEE | Exported electrical energy |
| CRU | Components for reuse | EET | Exported thermal energy |

8. References

1. Life Cycle Assessment, LCA Report for Milliken & Company. WAP Sustainability Consulting. November 2018.
2. Product Category Rule (PCR) for Building-Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL 10010. Version 3.2, September 18th, 2018.
3. Part B: Flooring EPD Requirements. UL Environment V2.0, 2018.
4. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
5. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
6. ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
7. European Standard DIN EN 15804: 2012.04+A1 2013. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products (includes Amendment A1:2013)

