

**Declaration Owner**

Action Floor Systems, LLC

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Product

Maple Sports Flooring

(25/32" and 33/32" thicknesses)

(UNSPSC Code 30161702; CSI Code 09 64 00)

Functional Unit

The functional unit is one square meter of floor covering provided and maintained for a period of 75 years.

EPD Number and Period of Validity

SCS-EPD-08861

EPD Valid April 11, 2023 through April 10, 2028

Product Category Rule

PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018.

PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. May 2018.

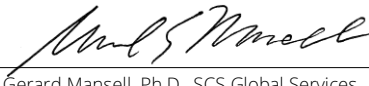

Program Operator

SCS Global Services

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Program Operator:	SCS Global Services																
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide																
LCA Practitioner:	Sevda Alanya Rosenbaum, Ph.D., SCS Global Services																
LCA Software and LCI database:	OpenLCA v1.11 software and the Ecoinvent v3.8 database																
Product RSL:	75 years																
Markets of Applicability:	Global																
EPD Type:	Product-Specific																
EPD Scope:	Cradle-to-Grave																
LCIA Method and Version:	CML-IA and TRACI 2.1																
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	<input checked="" type="checkbox"/> internal <input type="checkbox"/> external																
LCA Reviewer:	 Gerard Mansell, Ph.D., SCS Global Services																
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018																
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig																
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Flooring EPD Requirements. Version 2. UL Environment. May 2018.																
Part B PCR Review conducted by:	Jack Geibig (chair), Ecoform; Thomas Gloria, Industrial Ecology Consultants; Thaddeus Owen																
Independent verification of the declaration and data, according to ISO 14025 and the PCR	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external																
EPD Verifier:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants																
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<p>Disclaimers: This EPD conforms to ISO 14025, 14040, 14044, and 21930.</p> <p>Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.</p> <p>Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.</p> <p>Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.</p> <p>In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.</p>																	

1. Action Floor Systems

Since its inception in 1988, Action Floor Systems LLC has worked to bring premium, maple hardwood floors to our customers. Travel the world, and you'll find an Action Floor surface on every continent except Antarctica. From our headquarters in Mercer, Wisconsin, we supply premium flooring systems that are respected worldwide.

Our premium, solid maple permanent and portable floor systems are preferred and installed in numerous sports facilities, schools and theatres. The quality and performance of our floor systems is confirmed by independent laboratory tests in accordance with EN 14904, DIN 18032 Part-2, and FIBA criteria.

To lead environmental efforts in any industry requires complete commitment. Action Floors lives and breathes sustainability on every level: offering environmentally friendly products; conserving energy; maximizing resource yield with full utilization of all raw materials; joining global initiatives; ensuring the well-being of our people.

2. Product

2.1. PRODUCT DESCRIPTION

Maple sports flooring is manufactured at the Action Floor Systems' facility in Mercer, Wisconsin. The hardwood flooring product is available in thicknesses of 25/32" or 33/32" and width of 2-1/4". The maple sports flooring is used as floor covering in Action Floor Systems' anchored resilient and floating floor systems. For additional information regarding these maple sports floor systems, please visit: <http://www.actionfloors.com/flooring-systems/maple-sports-floors>. The maple sports flooring provides uniform playability, durability, resiliency, and shock absorption for athletes' safety.



2.2 PRODUCT FLOW DIAGRAM

A flow diagram of the product system, illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

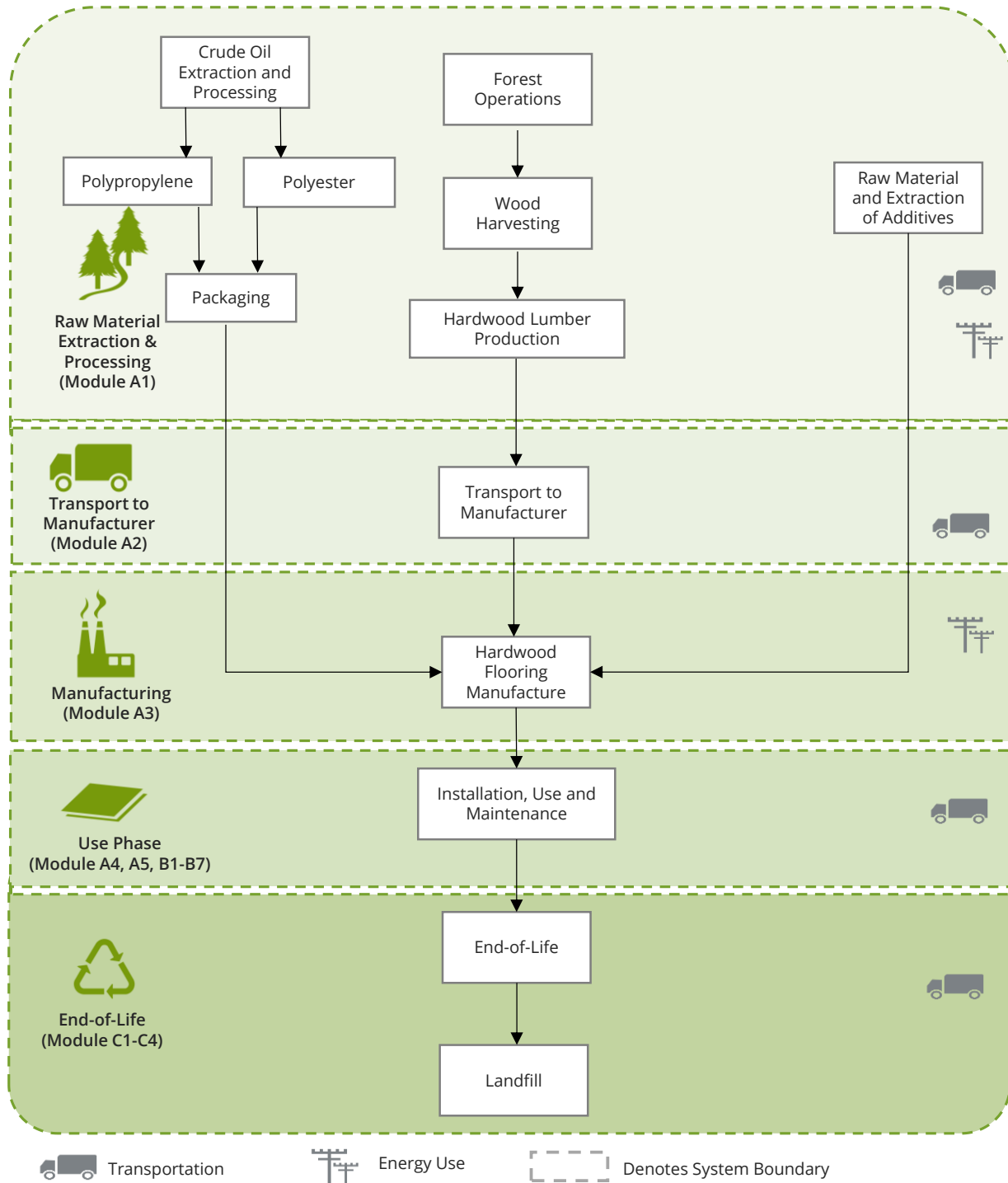


Figure 1. Flow diagram for the life cycle of the hardwood sports flooring product.

2.3 APPLICATION

Action Floor Systems' maple sports flooring provide sports floor options for college and universities, K-12 gyms, field houses, professional arenas, multipurpose community centers, squash and racquetball courts, aerobic and dance rooms, and more.



2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of this EPD is cradle-to-grave, including raw material extraction, processing of raw materials, product manufacture and packaging, distribution, product use and maintenance, and disposal stages. The life cycle phases included in the product system boundary are shown below.

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

Table 1. Life cycle phases included in the product system boundary.

Product			Construction Process		Use							End-of-life				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 extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

X = included | MND = Module Not Declared

2.5 TECHNICAL DATA

Technical specifications for the hardwood flooring product are summarized in Table 2. The hardwood flooring is available in thicknesses of 25/32" (20 mm) or 33/32" (27 mm) and width of 2-1/4" (57 mm). The UNSPSC code for this flooring product is 30161702 and CSI code is 09 64 00.

Table 2. Product technical data for the 25/32" and 33/32" hardwood flooring products.

Name	Value		Unit
	25/32"	33/32"	
Thickness	20	27	mm
Width	57 (2-1/4")	57 (2-1/4")	mm (inch)
Product Weight	13.9	18.8	kg/m ²

2.6 MARKET PLACEMENT/APPLICATION RULES

Technical specifications of the flooring products are summarized in the following sections. Detailed product performance results can be found on the manufacturer's website, <https://www.actionfloors.com>.

2.7 MATERIAL COMPOSITION

The hardwood flooring product is manufactured without chemical treatments or resins/additives and constituted of *Acer saccharum* (sugar maple). *Acer saccharum* (sugar maple) a maple specie and native to hardwood forests of eastern Canada and the northern parts of central and eastern United States. The average material composition of a hardwood flooring products is presented in Table 3.



Table 3. Material composition summary for the hardwood flooring products by mass (per 1 m²) for 25/32" and 33/32" hardwood flooring.

Component	Material	Mass (kg)	
		25/32"	33/32"
Hardwood flooring	Acer saccharum	13.9	18.8
Total		13.9	18.8

No substances required to be reported as hazardous are associated with the production of this product.

2.8 MANUFACTURING

Sugar maple rough green and dry lumber from the forests of Wisconsin and upper Michigan are delivered to the Mercer, WI facility. About 85% of the lumber sourced was rough green lumber. The rough green lumber is fed into AFS' stacking machine prior to kiln drying. Wood boilers are used for drying process. Wood coproducts generated during hardwood floor manufacturing, are used as boiler fuel to generate heat for drying lumber. Once the lumber is dried (typically 7-9% moisture content), it is stored before being sent to the flooring mill where the lumber is processed, and all defects are removed. The dried lumber is planned, ripped, and trimmed so each piece is a uniform thickness, width, and random length. Tongue and grooves are subsequently formed via a molding process along the length of the boards. The unfinished solid hardwood flooring product is sorted by grade, packaged, and then stored prior to the shipment of the final product.

2.9 PACKAGING

The products are packaged for shipment using polyester and polypropylene straps.

Table 4. Material composition summary for the hardwood flooring packaging by mass (per 1 m²) for 25/32" and 33/32" hardwood flooring systems.

Component	Material	Mass (kg)	
		25/32"	33/32"
Packaging	Polyester strap	1.46x10 ⁻²	1.81x10 ⁻²
Packaging	Polypropylene strap	1.54x10 ⁻³	2.07x10 ⁻³

2.10 PRODUCT INSTALLATION

The installation stage includes covering slab with a vapor barrier, sealing with adhesive, placing the subfloor (i.e., plywood), nailing, and installing the rest of the flooring using flooring cleats. Industry standard practices for sanding, sealing, and finishing, specified by Maple Flooring Manufacturers Association (MFMA), are adopted for the analysis. Electricity used for sanding, buffing, and vacuuming is included.

2.11 USE CONDITIONS

No special conditions of use are noted.

2.12 PRODUCT REFERENCE SERVICE LIFE

Reference service life (RSL) for the 25/32" and 33/32" thick flooring products is assumed to be 75 years and will last for the building lifetime.

2.13 RE-USE PHASE

The flooring products are not reused at end-of-life.

2.14 DISPOSAL

At the end of the service life hardwood flooring products can be recycled or used as biomass fuel. For the product end-of-life, it is assumed the products are disposed of in a landfill based on the product disposal assumption provided in UL PCR Part A.

2.15 FURTHER INFORMATION

Further information on the product can be found on the manufacturer's website, <https://www.actionfloors.com>.

3. LCA Calculation Rules

3.1 FUNCTIONAL UNIT

The functional unit used in the study is defined as 1 m² of floor covering installed for use over a 75-year period.

Table 5. Functional unit and reference flow information for hardwood flooring products.

Name	Unit	Value	
		25/32"	33/32"
Functional Unit	m ²	1	
Mass	kg	13.9	18.8

3.2 SYSTEM BOUNDARY

The scope of the EPD is cradle-to-grave, including raw material extraction, processing of raw materials, product manufacture and packaging, distribution, product use and maintenance, and disposal stages. The life cycle stages included in the EPD scope are described in Table 6.

Table 6. *The modules and unit processes included in the scope for the hardwood flooring product system.*

Module	Module description from the PCR	Unit Processes Included in Scope
A1	Extraction and processing of raw materials, any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Extraction and processing of lumber raw material for the flooring manufacturing.
A2	Transport (to the factory)	Transport of component materials to the manufacturing facilities.
A3	Manufacturing, including ancillary material production and packaging	Manufacturing of flooring products and packaging (including upstream unit processes).
A4	Transport (to the building site)	Transport of product (including packaging) to the building site.
A5	Construction, installation process. Includes materials used in installation	Impacts from installation and packaging disposal are included in this phase.
B1	Product use	Use of the flooring in a commercial building setting. There are no associated emissions or impacts from the use of the product.
B2	Product maintenance	Maintenance of products over the 75-year estimated service life (ESL), including periodic cleaning and resurfacing.
B3	Product repair	The flooring is not expected to require repair over its lifetime.
B4	Product replacement	The flooring is not expected to be replaced over its lifetime.
B5	Product refurbishment	The flooring is not expected to be refurbished over its lifetime.
B6	Operational energy use by technical building systems	There is no operational energy use associated with the use of the product.
B7	Operational water use by technical building systems	There is no operational water use associated with the use of the product.
C1	Deconstruction/ demolition	Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts.
C2	Transport (to waste processing)	Transport of flooring product to waste treatment at end-of-life.
C3	Waste processing for reuse, recovery and/or recycling	Product is landfilled at the end-of-life.
C4	Disposal	Disposal of flooring product in municipal landfill.
D	Reuse-recovery-recycling potential	Module Not Declared

3.3 PRODUCT SPECIFIC CALCULATION FOR USE PHASE (MODULES B1-B7)

The use stage includes the cleaning and resurfacing (i.e., sanding, vacuuming, sealing, buffing, and finishing) of the hardwood flooring. Guidelines for maintenance by Maple Flooring Manufacturers Association (MFMA) were used for the analysis, where typically floors are sanded every 8 to 12 years, up to 6 sanding events over the lifetime of the flooring. According to MFMA, average life cycle is above 75 years if proper maintenance and sanding is performed as suggested. The product system's maintenance life cycle phase was modeled over the 75-yr estimated service lifetime (ESL) of the building for 6 sanding events.

The floor is recommended to be cleaned using a dust mop or sweep. Regular sweeping is the only routine cleaning required for the product and there are no impacts associated with the use (B1) of the products.

3.4 UNITS

All data and results are presented using SI units.

3.5 ESTIMATES AND ASSUMPTIONS

- The hardwood flooring products manufactured at the Mercer, WI facility are analyzed in this study. Representative subregional electricity supply mix data, MROW eGRID 2020, were used to reflect the electricity used at the facility. The supply mix was modeled using Ecoinvent 3.8 database.
- Representative inventory data for the extraction and production of raw materials, rough green and dry hardwood input, are modeled with unit process data taken from the 2020 CORRIM hardwood lumber production LCA report and modeled using Ecoinvent 3.8 database.
- Several assumptions were made to represent the installation and refinishing (maintenance during the use stage) of the hardwood flooring. Sensitivity analysis was conducted to understand the contribution of potential environmental impacts associated with use of finish and sealer.
- The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted taking into account this limitation.

3.6 CUT-OFF RULES

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

3.7 DATA SOURCES

Primary data were provided for the manufacturing facility and select suppliers. The sources of secondary LCI data are the Ecoinvent database and literature.



Table 7. Data sources for the 25/32" and 33/32" hardwood flooring products.

Flow	Dataset	Data Source	Publication Date
Raw materials			
Sugar maple (Acer saccharum)	Sawn lumber, hardwood, rough, green, at sawmill, NE-NC/kg/RNA	CORRIM/Ecoinvent v3.8	2020/2021
Sugar maple (Acer saccharum)	Sawn lumber, hardwood, rough, dry, at sawmill, NE-NC/kg/RNA	CORRIM/Ecoinvent v3.8	2020/2021
Energy and Water			
Electricity	Electricity, medium voltage, at grid/MROW 2020 U	eGRID/Ecoinvent v3.8	2020/2021
Heavy Fuel Oil	market for heavy fuel oil, burned in refinery furnace Cutoff, U - GLO	Ecoinvent v3.8	2021
Biomass boiler- Wood coproduct	Wood combusted; at boiler; at lumber mill	CORRIM/Ecoinvent v3.8	2017/2021
Diesel Fuel	diesel, burned in building machine Cutoff, U - GLO	Ecoinvent v3.8	2021
Packaging			
Polyester strap	polyethylene terephthalate production, granulate, amorphous Cutoff, U - RoW	Ecoinvent v3.8	2021
Polypropylene strap	polyethylene terephthalate production, granulate, amorphous Cutoff, U - RoW	Ecoinvent v3.8	2021
Transportation			
Road transport	transport, freight, lorry 16-32 metric ton, EURO4	Ecoinvent v3.8	2021
Installation/Maintenance			
Sealer	White spirit {GLO} market for Alloc Rec, U; Toluene diisocyanate {GLO} market for Alloc Rec, U; Polyol {GLO} market for Alloc Rec, U	Ecoinvent v3.8	2021
Finish	White spirit {GLO} market for Alloc Rec, U; Toluene diisocyanate {GLO} market for Alloc Rec, U; Polyol {GLO} market for Alloc Rec, U	Ecoinvent v3.8	2021
Poly shield	market for polyethylene, low density, granulate Cutoff, U - GLO	Ecoinvent v3.8	2021
Adhesive	market for vinyl acetate vinyl acetate Cutoff, U - GLO	Ecoinvent v3.8	2021
Staples	market for steel, low-alloyed steel, low-alloyed Cutoff, U - GLO	Ecoinvent v3.8	2021
Plywood	North American Softwood Plywood	AWC/CWC EPD	2020
Nails	market for steel, low-alloyed steel, low-alloyed Cutoff, U - GLO	Ecoinvent v3.8	2021
Natural rubber pads	market for chemical, organic chemical, organic Cutoff, U - GLO	Ecoinvent v3.8	2021

3.8 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 8. Data quality assessment for the 25/32" and 33/32" hardwood flooring product system.

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage Age of data and the minimum length of time over which data should be collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old (typically 2016). All of the data used represented an average of at least one year's worth of data collection. Manufacturer-supplied data (primary data) are based on annualized production for 2021.
Geographical Coverage Geographical area from which data for unit processes should be collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative USEPA eGRID electricity mix data for MROW region. Surrogate data used in the assessment are representative of global or European operations. Data representative of global or European operations are considered sufficiently similar to actual processes. Data representing product disposal based on regional statistics.
Technology Coverage Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations.
Precision Measure of the variability of the data values for each data expressed (e.g., variance)	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the flooring products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness Qualitative assessment of the degree to which the data set reflects the true population of interest (i.e., geographical coverage, time period, and technology coverage)	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.8 data where available. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in the Asia.
Reproducibility Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented in the LCA report.
Sources of the Data Description of all primary and secondary data sources	Data representing energy use at AFS's manufacturing facility represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI datasets ecoinvent v3.8 LCI datasets are used.
Uncertainty of the Information Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the hardwood flooring products is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. Hardwood lumber model was based on representative, recent data (<5 years) and was geographically representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.9 PERIOD UNDER REVIEW

The period of review is calendar year 2021.

3.10 ALLOCATION

The total facility production volume of hardwood flooring was provided and used to allocate resource use (e.g., electricity, natural gas, water), waste, and emissions released at the manufacturing facility to the products based on total annual production in square meters.

At the manufacturing stage wood shavings are generated that are sold to be used in production of MDF/press board type wood products, converted to wood pellets (fuel), or used as animal bedding. In accordance with UL PCR, the environmental burden of these products was allocated on a mass-basis, with ~55% allocated to the hardwood flooring product. Impacts from transportation were allocated based on the mass of material and distance transported.

3.11 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: Scenarios and Additional Technical Information

Delivery and Installation stage (A4 - A5)

Distribution of the hardwood flooring products to the point of installation is included in the assessment. An estimated distribution distance to point of sale of 800 km via diesel truck was assumed in line with UL Part A PCR requirements. Parameters used for modeling the distribution of the hardwood flooring products to the point of installation are presented in Table 9. Weighted average transportation distances are calculated based on sales, to represent regional transportation distances.

Table 9. Product distribution parameters (A4).

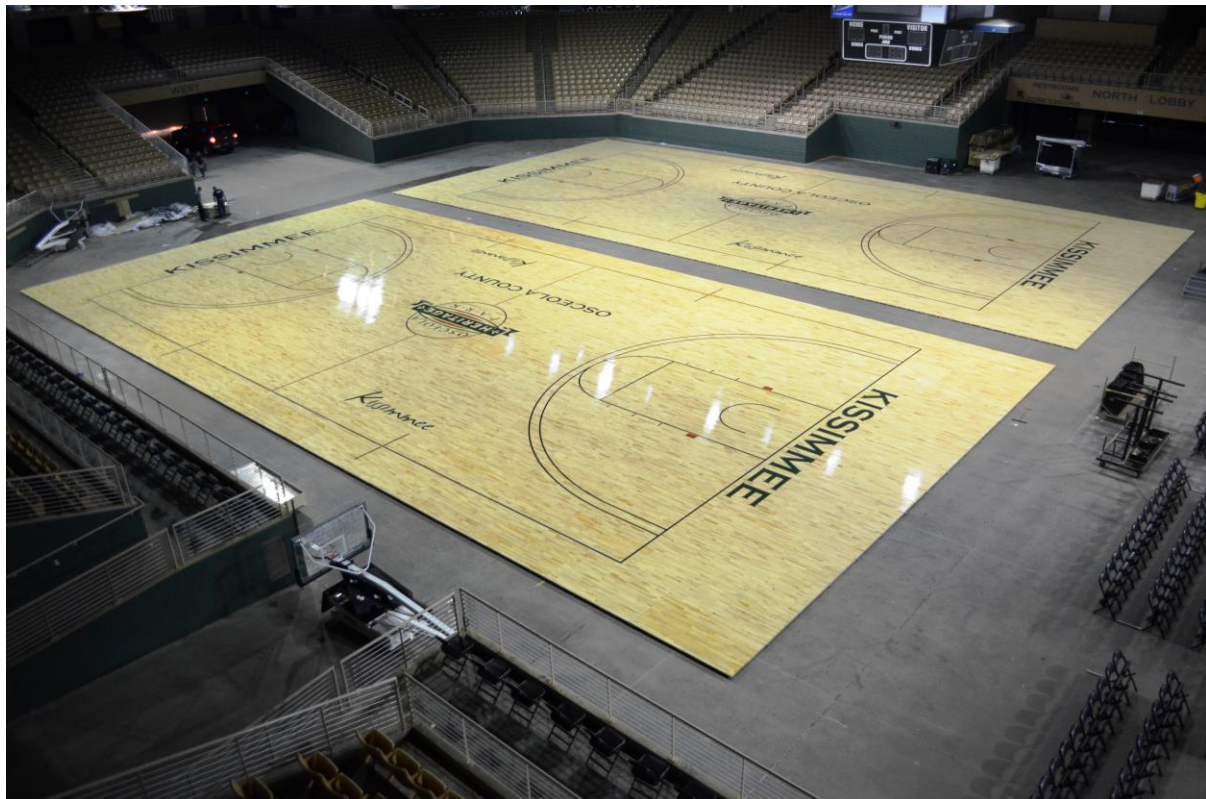
Name	Value		Unit
	25/32"	33/32"	
Fuel type	Diesel	Diesel	
Liters of fuel	18.7	18.7	l/100km
Vehicle type	Diesel truck	Diesel truck	
Transport distance	800	800	km
Capacity utilization (including empty runs, mass based)	76	76	%
Weight of products transported (if gross density not reported)	13.91	18.80	kg/m ²
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	1	-

Installation of the product is accomplished using hand tools with no associated emissions and negligible impacts. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements. Installation parameters used are presented in Table 10.

Table 10. Installation parameters for the 25/32" and 33/32" hardwood flooring products, per 1 m² of flooring (A5).

Name	Value		Unit
	25/32"	33/32"	
Ancillary materials- Seal	0.12	0.12	kg
Ancillary materials- Finish	0.11	0.11	kg
Ancillary materials-Adhesive	0.07	0.07	kg
Net freshwater consumption specified by water source and fate	0	0	m ³
Staples	0.116	0.116	kg
Plywood	0.019	0.019	m ³
Nails	0.001	0.001	kg
Rubber pads	0.660	0.660	kg
Electricity consumption	0.22	0.22	kWh
Product loss per functional unit	0	0	kg
Waste materials at the construction site before waste processing, generated by product installation	0.57	0.59	kg
Mass of packaging waste, plastic	0.01	0.02	kg
Biogenic carbon contained in packaging	0	0	kg CO ₂
VOC emissions	FloorScore	FloorScore	µg/m ³

The VOC emissions shall be determined in accordance to "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers-Version 1.2" CA Specification 01350.



Use stage (B1)

No impacts are associated with the use of the product over the Reference Service Lifetime.

Table 11. *Reference service life for the 25/32" and 33/32" hardwood flooring products*

Name	Value	Unit
RSL	75	Years
Declared product properties (at the gate) and finishes, etc.	Provided in Table 3	-
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes)	Installation requirements per manufacturer	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Industry standard	-
Indoor environment, (if relevant for indoor applications), e.g., temperature, moisture, chemical exposure)	Typical building operating conditions	-
Use conditions, e.g. frequency of use, mechanical exposure.	Typical building operating conditions	-
Maintenance, e.g. required frequency, type and quality of replacement components	Resurfacing (i.e., sanding, vacuuming, sealing, buffing, and finishing) of the hardwood flooring. Six sanding (resurfacing) over the 75-year RSL	-

Maintenance stage (B2)

The maintenance stage was modeled based on guidelines recommended by the manufacturer and MFMA.

Table 12. *Maintenance parameters for the 25/32" and 33/32" hardwood flooring products, per 1 m² of flooring over 75-year RSL (B2).*

Name	Value	Unit
Maintenance process information	Maple Flooring Manufacturers Association (MFMA)	-
Maintenance cycle	6	Cycles/ RSL
Maintenance cycle	6	Cycles/ ESL
Net freshwater consumption specified by water source and fate (e.g., X m3 river water evaporated, X m3 city water disposed to sewer)	-	m ³
Ancillary materials, Seal	0.74	kg
Ancillary materials, Finish	0.65	kg
Energy input, electricity	1.32	kWh
Waste materials from maintenance, wood dust	3.38	kg
Direct emissions to ambient air, soil and water	-	kg

Repair/Refurbishment stage (B3; B5)

Product repair and refurbishment are not relevant during the lifetime of the product.

Replacement stage (B4)

The material is not replaced over the 75-year ESL of the assessment.

Building operation stage (B6 – B7)

There is no operational energy or water use associated with the use of the product.

Disposal stage (C1 - C4)

The disposal stage includes the demolition of the products (C1); transport of the flooring products to waste treatment facilities (C2); waste processing (C3); and associated emissions as the product degrades in a landfill (C4). For the product, no emissions are generated during demolition while no waste processing is required for landfill disposal. Results for these stages (C1 & C3) are reported as zero for the product system.

Transportation of waste materials at end-of-life (C2) assumes a 161 km average distance to disposal, consistent with UL Part A PCR requirement .

Disposal of the product packaging is modeled based on regional statistics regarding municipal solid waste generation and disposal data provided in UL PCR Part A (presented in Table 13). Paper packaging waste disposal data were retrieved from UL PCR. The data include end-of-life recycling rates of packaging. No components of the product are assumed to be recycled.

Table 13. End-of-life (C1-C4) parameters for the 25/32" and 33/32" hardwood flooring products, per 1 m² of flooring.

Name	Value		Unit
	25/32"	33/32"	
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)	100% landfill	100% landfill	-
Collection process-	Collected with mixed construction waste	Collected with mixed construction waste	kg
Recovery (specified by type)	N/A	N/A	kg
Landfill Disposal	24.2	29.1	kg
Removals of biogenic carbon (excluding packaging)	15.9	16.3	kg CO ₂

Table 14. Recycling rates for product and packaging material at end-of-life.

Material	Recycling rate (%)
Product	
Recycling Rates	
All materials	N/A
Disposal Rates	
Landfill	100%
Packaging	
Recycling Rates	
Plastic	15%
Disposal Rates	
Landfill	68%
Incineration	17%

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All LCA results are stated to three significant figures in agreement with the PCR for this flooring product and therefore the sum of the total values may not exactly equal 100%.

The following environmental impact category indicators are reported using characterization factors based on the CML-IA and U.S. EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts – TRACI 2.1.

Table 15. *Environmental Indicators.*

Impact Category	Unit	Impact Method
Global Warming Potential (GWP)	kg CO ₂ eq	TRACI 2.1
Ozone Depletion Potential (ODP)	kg CFC 11 eq	TRACI 2.1
Acidification Potential (AP)	kg SO ₂ eq	TRACI 2.1
Eutrophication Potential (EP)	kg N eq	TRACI 2.1
Smog Formation Potential (SFP)	kg O ₃ eq	TRACI 2.1
Fossil Fuel Depletion Potential (FFD)	MJ Surplus	TRACI 2.1
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources- (ADP_{fossil})	MJ, LHV	CML-baseline

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported.

Table 16. *Life Cycle Inventory Parameters.*

Resources	Unit	Waste and Outflows	Unit
RPR_E : Renewable primary resources used as energy carrier (fuel)	MJ, LHV	HWD : Hazardous waste disposed	kg
RPR_M : Renewable primary resources with energy content used as material	MJ, LHV	NHWD : Non-hazardous waste disposed	kg
NRPR_E : Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	HLRW : High-level radioactive waste, conditioned, to final repository	kg
NRPR_M : Non-renewable primary resources with energy content used as material	MJ, LHV	ILLRW : Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM : Secondary materials	MJ, LHV	CRU : Components for re-use	kg
RSF : Renewable secondary fuels	MJ, LHV	MR : Materials for recycling	kg
NRSF : Non-renewable secondary fuels	MJ, LHV	MER : Materials for energy recovery	kg
RE : Recovered energy	MJ, LHV	EE : Recovered energy exported from the product system	MJ, LHV
FW : Use of net freshwater resources	m ³	-	-

Table 17. Indicators describing biogenic carbon emissions and removals.

Parameter	Parameter	Unit
Biogenic Carbon Removal from Product	BCRP	kg CO ₂
Biogenic Carbon Emission from Product	BCEP	kg CO ₂
Biogenic Carbon Removal from Packaging	BCRK	kg CO ₂
Biogenic Carbon Emission from Packaging	BCEK	kg CO ₂
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production	BCEW	kg CO ₂

Modules B1, B3, B4, B5, B6, and B7 are not associated with any impact and are therefore declared as zero. In addition, modules C1 and C3 are likewise not associated with any impact as the products are expected to be manually deconstructed. Module D is not declared. In the interest of space and table readability, these modules are not included in the results presented below.

Table 18. Life Cycle Impact Assessment (LCIA) results for the 25/32" hardwood flooring product over a 75-yr time horizon. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating values.

Impact category	A1	A2	A3	A4	A5	B2	C2	C4	D
GWP (kg CO ₂ eq)	4.54	1.25	1.39	1.89	6.97	4.83	0.629	1.43	MND
	19.8%	5.5%	6.0%	8.3%	30.4%	21.1%	2.7%	6.2%	MND
ODP (kg CFC-11 eq)	8.65x10 ⁻⁷	2.90x10 ⁻⁷	2.55x10 ⁻⁷	4.39x10 ⁻⁷	4.35x10 ⁻⁷	5.87x10 ⁻⁷	1.46x10 ⁻⁷	7.87x10 ⁻⁸	MND
	27.9%	9.4%	8.2%	14.2%	14.0%	19.0%	4.7%	2.5%	MND
AP (kg SO ₂ eq)	3.14x10 ⁻²	5.71x10 ⁻³	7.76x10 ⁻³	8.63x10 ⁻³	3.18x10 ⁻²	2.09x10 ⁻²	2.87x10 ⁻³	1.89x10 ⁻³	MND
	28.3%	5.1%	7.0%	7.8%	28.6%	18.8%	2.6%	1.7%	MND
EP (kg N eq)	1.01x10 ⁻²	1.37x10 ⁻³	8.26x10 ⁻³	2.07x10 ⁻³	2.80x10 ⁻²	4.09x10 ⁻²	6.88x10 ⁻⁴	0.167	MND
	3.9%	0.5%	3.2%	0.8%	10.8%	15.9%	0.3%	64.6%	MND
SFP (kg O ₃ eq)	0.869	0.137	0.155	0.207	0.574	0.254	6.89x10 ⁻²	4.56x10 ⁻²	MND
	37.6%	5.9%	6.7%	9.0%	24.8%	11.0%	3.0%	2.0%	MND
FFD (MJ, Surplus)	8.35	2.65	1.93	4.01	17.8	14.1	1.33	0.798	MND
	16.4%	5.2%	3.8%	7.9%	35.0%	27.6%	2.6%	1.6%	MND
ADP _{Fossil} (MJ, LHV)	61.5	18.6	17.5	28.1	135	99.9	9.34	5.66	MND
	16.4%	4.9%	4.7%	7.5%	35.9%	26.6%	2.5%	1.5%	MND

MND = Module not declared

Table 19. Life Cycle Impact Assessment (LCIA) results for the 33/32" hardwood flooring product over a 75-yr time horizon. All values are rounded to three significant digits. Results reported in MJ are calculated using lower heating values.

Impact category	A1	A2	A3	A4	A5	B2	C2	C4	D
GWP (kg CO ₂ eq)	4.84	1.29	1.45	2.56	6.97	4.83	0.602	1.43	MND
	20.2%	5.4%	6.0%	10.7%	29.1%	20.2%	2.5%	6.0%	MND
ODP (kg CFC-11 eq)	9.21x10 ⁻⁷	2.99x10 ⁻⁷	2.82x10 ⁻⁷	5.93x10 ⁻⁷	4.35x10 ⁻⁷	5.87x10 ⁻⁷	1.40x10 ⁻⁷	7.87x10 ⁻⁸	MND
	27.6%	9.0%	8.4%	17.8%	13.0%	17.6%	4.2%	2.4%	MND
AP (kg SO ₂ eq)	3.35x10 ⁻²	5.89x10 ⁻³	8.61x10 ⁻³	1.17x10 ⁻²	3.18x10 ⁻²	2.09x10 ⁻²	2.75x10 ⁻³	1.89x10 ⁻³	MND
	28.7%	5.0%	7.4%	10.0%	27.1%	17.8%	2.3%	1.6%	MND
EP (kg N eq)	1.08x10 ⁻²	1.41x10 ⁻³	8.52x10 ⁻³	2.79x10 ⁻³	2.81x10 ⁻²	4.09x10 ⁻²	6.58x10 ⁻⁴	0.167	MND
	4.2%	0.5%	3.3%	1.1%	10.8%	15.8%	0.3%	64.1%	MND
SFP (kg O ₃ eq)	0.928	0.141	0.179	0.280	0.574	0.254	6.59x10 ⁻²	4.56x10 ⁻²	MND
	37.6%	5.7%	7.3%	11.3%	23.3%	10.3%	2.7%	1.8%	MND
FFD (MJ, Surplus)	8.89	2.74	2.03	5.42	17.8	14.1	1.28	0.798	MND
	16.8%	5.2%	3.8%	10.2%	33.6%	26.6%	2.4%	1.5%	MND
ADP _{Fossil} (MJ, LHV)	65.6	19.2	18.3	38.0	135	99.9	8.93	5.66	MND
	16.8%	4.9%	4.7%	9.7%	34.5%	25.6%	2.3%	1.5%	MND

MND = Module not declared

Table 20. Resource use, waste, and outflows for the 25/32" hardwood flooring product. Results are shown per square meter of flooring product for a 75-yr time horizon. Results reported in MJ are calculated using lower heating values.

Resources	A1	A2	A3	A4	A5	B2	C2	C4	D
RPR _E (MJ)	2.20	0.217	71.4	0.328	71.7	5.16	0.109	0.105	MND
	1.5%	0.1%	47.2%	0.2%	47.4%	3.4%	0.1%	0.1%	
RPR _M (MJ)	471	0.00	0.00	0.00	251	0.00	0.00	0.00	MND
	65.2%	0.0%	0.0%	0.0%	34.8%	0.0%	0.0%	0.0%	
NRPR _E (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	MND
NRPR _M (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	MND
SM (kg)	0.0	0.0	0.0	0.0	11	0.0	0.0	0.0	MND
RSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
NRSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
FW (m ³)	0.115	1.19x10 ⁻²	6.81x10 ⁻²	1.81x10 ⁻²	0.177	0.276	6.00x10 ⁻³	5.42x10 ⁻³	MND
	17.0%	1.8%	10.1%	2.7%	26.1%	40.8%	0.9%	0.8%	
Wastes and outflows	A1	A2	A3	A4	A5	B2	C2	C4	D
HWD (kg)	1.40x10 ⁻⁴	4.97x10 ⁻⁵	2.01x10 ⁻⁵	7.52x10 ⁻⁵	4.20x10 ⁻⁵	6.71x10 ⁻⁵	2.50x10 ⁻⁵	9.06x10 ⁻⁶	MND
	32.7%	11.6%	4.7%	17.6%	9.8%	15.7%	5.8%	2.1%	
NHWD (kg)	0.916	0.956	0.227	1.45	1.61	3.63	0.481	24.3	MND
	2.7%	2.8%	0.7%	4.3%	4.8%	10.8%	1.4%	72.4%	
HLRW (kg)	2.15x10 ⁻⁵	9.52x10 ⁻⁷	6.53x10 ⁻⁶	1.44x10 ⁻⁶	5.98x10 ⁻⁶	6.30x10 ⁻⁶	4.79x10 ⁻⁷	5.14x10 ⁻⁷	MND
	49.3%	2.2%	14.9%	3.3%	13.7%	14.4%	1.1%	1.2%	
ILLRW (kg)	4.10x10 ⁻⁴	1.22x10 ⁻⁴	6.69x10 ⁻⁵	1.84x10 ⁻⁴	8.34x10 ⁻⁵	2.58x10 ⁻⁴	6.13x10 ⁻⁵	3.39x10 ⁻⁵	MND
	33.6%	10.0%	5.5%	15.1%	6.8%	21.1%	5.0%	2.8%	
CRU (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
MR (kg)	0.0	0.0	0.0	0.0	4.7x10 ⁻²	0.0	0.0	0.0	MND
	0%	0%	0%	0%	100%	0%	0%	0%	
MER (kg)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	MND
EE (MJ)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	MND

Neg. = Negligible | MND = Module not declared

Table 21. Resource use, waste, and outflows for the 33/32" hardwood flooring product. Results are shown per square meter of flooring product for a 75-yr time horizon. Results reported in MJ are calculated using lower heating values.

Resources	A1	A2	A3	A4	A5	B2	C2	C4	D
RPR _E (MJ)	2.36	0.223	95.8	0.443	71.7	5.16	0.104	0.105	MND
	1.3%	0.1%	54.4%	0.3%	40.8%	2.9%	0.1%	0.1%	
RPR _M (MJ)	486	0.00	0.00	0.00	251	0.00	0.00	0.00	MND
	65.9%	0.0%	0.0%	0.0%	34.1%	0.0%	0.0%	0.0%	
NRPR _E (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	MND
NRPR _M (MJ)	INA	INA	INA	INA	INA	INA	INA	INA	MND
SM (kg)	0.0	0.0	0.0	0.0	11	0.0	0.0	0.0	MND
RSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
NRSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
FW (m ³)	0.123	1.23x10 ⁻²	7.16x10 ⁻²	2.44x10 ⁻²	0.177	0.276	5.74x10 ⁻³	5.42x10 ⁻³	MND
	17.7%	1.8%	10.3%	3.5%	25.4%	39.7%	0.8%	0.8%	
Wastes and outflows	A1	A2	A3	A4	A5	B2	C2	C4	D
HWD (kg)	1.50x10 ⁻⁴	5.13x10 ⁻⁵	2.07x10 ⁻⁵	1.02x10 ⁻⁴	4.20x10 ⁻⁵	6.71x10 ⁻⁵	2.39x10 ⁻⁵	9.06x10 ⁻⁶	MND
	32.2%	11.0%	4.4%	21.8%	9.0%	14.4%	5.1%	1.9%	
NHWD (kg)	0.974	0.986	0.229	1.95	1.62	3.63	0.460	24.3	MND
	2.9%	2.9%	0.7%	5.7%	4.8%	10.6%	1.3%	71.1%	
HLRW (kg)	2.31x10 ⁻⁵	9.82x10 ⁻⁷	7.14x10 ⁻⁶	1.95x10 ⁻⁶	5.98x10 ⁻⁶	6.30x10 ⁻⁶	4.58x10 ⁻⁷	5.14x10 ⁻⁷	MND
	49.8%	2.1%	15.4%	4.2%	12.9%	13.6%	1.0%	1.1%	
ILLRW (kg)	4.30x10 ⁻⁴	1.26x10 ⁻⁴	6.95x10 ⁻⁵	2.49x10 ⁻⁴	8.34x10 ⁻⁵	2.58x10 ⁻⁴	5.87x10 ⁻⁵	3.39x10 ⁻⁵	MND
	32.9%	9.6%	5.3%	19.0%	6.4%	19.7%	4.5%	2.6%	
CRU (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	MND
MR (kg)	0.0	0.0	0.0	0.0	4.7x10 ⁻²	0.0	0.0	0.0	MND
	0%	0%	0%	0%	100%	0%	0%	0%	
MER (kg)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	MND
EE (MJ)	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	MND

Neg. = Negligible | MND = Module not declared

Table 22. *Biogenic carbon emissions and removals 25/32" hardwood flooring product.*

Parameter	Unit	TOTAL	A1	A2	A3	A5	C4
BCRP	kg CO ₂	(65.0)	(49.8)	0.0	0.0	(15.3)	0.0
BCEP	kg CO ₂	57.9	0.0	0.0	19.3	0.0	38.6
BCRK	kg CO ₂	0.0	0.0	0.0	0.0	0.0	0.0
BCEK	kg CO ₂	0.0	0.0	0.0	0.0	0.0	0.0
BCEW	kg CO ₂	7.2	0.0	0.0	7.2	0.0	0.0

Table 23. *Biogenic carbon emissions and removals 33/32" hardwood flooring product.*

Parameter	Unit	TOTAL	A1	A2	A3	A5	C4
BCRP	kg CO ₂	(66.6)	(51.3)	0.0	0.0	(15.3)	0.0
BCEP	kg CO ₂	56.9	0.0	0.0	10.2	0.0	46.7
BCRK	kg CO ₂	0.0	0.0	0.0	0.0	0.0	0.0
BCEK	kg CO ₂	0.0	0.0	0.0	0.0	0.0	0.0
BCEW	kg CO ₂	9.7	0.0	0.0	9.7	0.0	0.0

6. LCA: Interpretation

The results of the contribution analysis suggest that the installation phase (A5) is the largest contributing stage to the majority of the impact categories including global warming potential impact category. This is due to plywood input. Raw material and extraction phase (A1) also has notable contribution to global warming potential impact. Electricity use was the major contributor to climate change impact at the manufacturing phase.

7. Additional Environmental Information

Action Floor Systems' unfinished sports flooring is FloorScore® certified for indoor air quality emissions.

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