

Vinyl Composition Tile (VCT)

Premium Excelon®, Standard Excelon®
Safety Zone™ Tile, Excelon® SDT™

ACCORDING TO EN 15804, ISO 14025 AND ISO 21930

150+ Years of Excellence

Our founder, Thomas Armstrong, pioneered the principle “Let the buyer have faith,” standing behind his products and giving customers confidence in their purchase. More than a century later, that philosophy is alive and well in Armstrong Flooring.

We are committed to delivering solutions that reduce the environmental impact of the buildings you create. From product design and raw material selection, to production and delivery, we work to demonstrate continuous improvement to remain as strong and vital as our 150-year heritage.

Armstrong Vinyl Composition Tile (VCT) is limestone-based flooring tiles with a PVC binder, featuring a through-pattern construction. VCT with through-color/pattern wear layer retains its color, pattern and appearance longer and has the durability and gouge resistance to withstand heavy foot and rolling load impact.

Lifecycle Impact Categories

Cradle to grave environmental impacts for 1 m² of VCT.



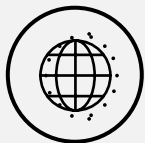
Primary Energy
121.92 MJ



Eutrophication Potential
1.27E-03 kg (PO₄)³⁻-eq.



Global Warming Potential
5.41 kg CO₂-eq.



Ozone Depletion Potential
2.82E-09 kg R11-eq.



Acidification Potential
0.020 kg SO₂-eq.



Photochem Ozone Creation Potential
0.31 kg O₃-eq.

Flooring Components:

Limestone Flour, Polyvinyl chloride (PVC), Dioctyl Terephthalate (DOTP), Blended Dibenzates, Recycled Material, Acrylate, Pigments

Armstrong Flooring



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Walk On. Walk Strong:

Vinyl Composition Tile (VCT)

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ArmstrongFlooring™

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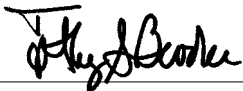
This document is a Type III Environmental Product Declaration by Armstrong Flooring, Inc. that is certified by ASTM as conforming to the requirements of ISO 14025, EN 15804 and ISO 21930. ASTM has assessed that the Life Cycle Assessment (LCA) information fulfills the requirements of ISO 14040 in accordance with the instructions listed in the product category rules cited below. The intent of this document is to further the development of environmentally compatible and sustainable construction methods by providing comprehensive environmental information related to potential impacts in accordance with international standards.

Declaration Number	EPD-0001
Program Operator	ASTM International - 100 Barr Harbor Drive, West Conshohocken, PA, 19428, USA www.astm.org
Manufacturer	Armstrong Flooring, Inc. - 2500 Columbia Avenue, Lancaster, PA 17603
Declared Product & Functional Unit	Vinyl Composition Tile, 1 m ²
Reference PCR	Part A: PCR for building-related products, 2018 Part B: Flooring EPD Requirements [UL Environment], v2.0 September, 2018
Product Application	Floor covering choice in commercial spaces: • Healthcare • Education • Retail • Hospitality • Office
Product Reference Service Life	25 Years
Markets of Applicability	North America
Date of Issue	December 20, 2019
Date of Validity	5 Years
EPD Type	Product Specific
EPD Scope	Cradle to Grave
Year of Primary Data	2017-2018
LCA Software & Version	GaBi v8.7.1.30
LCI Database(s) & Version	GaBi 2017
LCIA Method	TRACI 2.1

Verification and Authorization of the Declaration

This declaration and the rules on which this EPD is based have been examined by an independent external verifier in accordance with ISO 14025 and ISO 21930.

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

X 

X 

Tim Brooke
Vice President, Certification

Date
December 20, 2019

Tom Gloria
External Verifier

Date
December 20, 2019

ASTM certification of this EPD is not to be construed as representing aesthetics or any other attributes not specifically addressed, nor should it be construed as an ASTM endorsement of the subject of the EPD or a recommendation for its use. There is no warranty by ASTM, express or implied, as to any finding or other matter in the EPD, or as to any product covered by the EPD. The EPD holder is liable for the information and evidence on which the EPD is based.

2.0 Product Introduction

2.1 Company Description

Armstrong Flooring, Inc. (NYSE: AFI) is a global leader in the design and manufacture of innovative flooring solutions that inspire beauty wherever your life happens. Headquartered in Lancaster, Pennsylvania, Armstrong Flooring is a leading manufacturer of resilient products across North America. The company safely and responsibly operates 8 manufacturing facilities globally, working to provide the highest levels of service, quality and innovation to ensure it remains as strong and vital as its 150-year heritage. Learn more armstrongflooring.com.

2.2 Product Description

Armstrong Vinyl Composition Tile (VCT) is limestone-based flooring tiles with a PVC binder, featuring a through-pattern construction. After years of foot and rolling load traffic, the pattern of the flooring is preserved; wear is less visible and can be restored using simple maintenance methods.

2.2.1 Brands

Premium Excelon®, Standard Excelon®, Safety Zone™ Tile, Excelon® SDT™

2.2.2 Specifications

Armstrong Flooring VCT meets or exceeds the performance requirements of ASTM F1066, Standard Specification for Vinyl Composition Tile

2.2.3 Product Specific EPD

This EPD is intended to represent product specific life cycle assessment results for the Armstrong Flooring VCT brands in Section 2.2.1

2.3 Application

VCT is a widely used commercial resilient flooring option and is routinely used with great success in healthcare, education, and retail segments. Properly installed and maintained, VCT provides decades of proven performance across all commercial segments.

2.4 Declaration of Methodological Framework

The Life Cycle Assessment (LCA) was performed according to ISO 14040 and followed the PCR instructions. The cradle-to-grave LCA encompasses all relevant life cycle stages and modules including raw material production; transport of raw materials to the production facility; manufacturing of flooring; packaging; transportation to job site; use phase; and end of life including disposal or recycling. Detailed information regarding cut-off and allocation procedures are in sections 2.5 and 2.9.

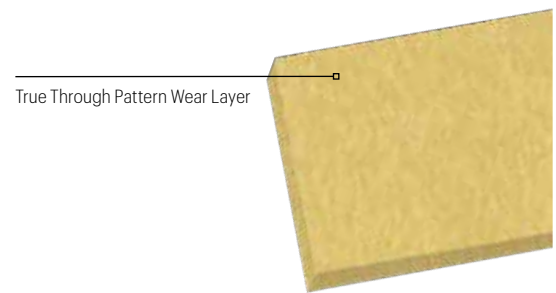
2.5 Technical Data

Table 1: Armstrong Flooring VCT Technical Data

Armstrong Flooring VCT	Average Value	Unit	Min. Value	Max. Value
Product Thickness	3.2 (0.125)	mm (in.)	-	-
Wear Layer Thickness	3.2 (0.125)	mm (in.)	-	-
Product Weight	7030 (1.4)	g/m ² (lbs.)	-	-
Product Form	Tile		305 mm x 305 mm	305 mm x 610 mm

Figure 1. Example product structure for VCT

Product Structure



2.6 Market Placement / Application Rules

All Armstrong VCT meets or exceeds the performance requirements of ASTM F1066, Standard Specification for Vinyl Composition Floor Tile. It meets the below performance requirements for the following test methods:

Table 2: VCT Performance and Test Methods

ASTM F1066			
Performance	Test Method	Requirement	Performance vs. Requirement
Thickness	ASTM F386	Nominal ± 0.005 in.	Meets
Size	ASTM F2055	± 0.016 in. per linear foot	Meets
Squareness	ASTM F2055	0.010 in. maximum	Meets
Indentation – One Minute	ASTM F1914	≥ 0.006 in. to ≤ 0.015 in.	Meets
Indentation @ 115°F	ASTM F1914	< 0.032 in.	Meets
Impact	ASTM F1265	No cracks beyond limit	Meets
Deflection	ASTM F1304	1.0 in. minimum	Meets
Dimensional Stability	ASTM F2199	≤ 0.024 in. per linear foot max.	Meets
Chemical Resistance	ASTM F925	No more than slight change in surface dulling, attack or staining	Meets
Resistance to Heat	ASTM 1514	ΔE not greater than 8.0	Meets
Static Load Resistance @ 125 psi	ASTM F970	≤ 0.005 in.	Meets
Additional Testing			
Static Load Resistance	ASTM F970*	≤ 0.005 in.	2000 psi
Fire Test Data – Flame Spread	ASTM E648	0.45 W/cm ² or more Class I	Meets
Fire Test Data – Smoke Evolution	ASTM E662	450 or less	Meets
Fire Test Data – Canada	CAN/ULC S-102.2	Use dependent	Flame Spread - 0 Smoke Developed - 5
ADA Standards for Accessible Design	ADA Standards for Accessible Design	Floor surfaces shall be stable, firm and slip-resistant	Meets
Static Coefficient of Friction*	ASTM D2047/ UL 410	≥ 0.5	Meets

* Testing at loads above 125 psi is outside the scope of the test method. Since testing is conducted on uninstalled flooring, results do not consider the performance of the adhesive, underlayment, or subfloor. These test results are not an indicator of the installed flooring system performance

** Using the James Machine as described in D2047 and as directed in UL 410 for floor covering materials (FCM) using a leather foot under dry conditions. The application of site-applied floor sealers, polishes and other types of finishes routinely used to maintain resilient flooring materials will change the walking surface and consequently the SCOF value.

2.7 Material Composition

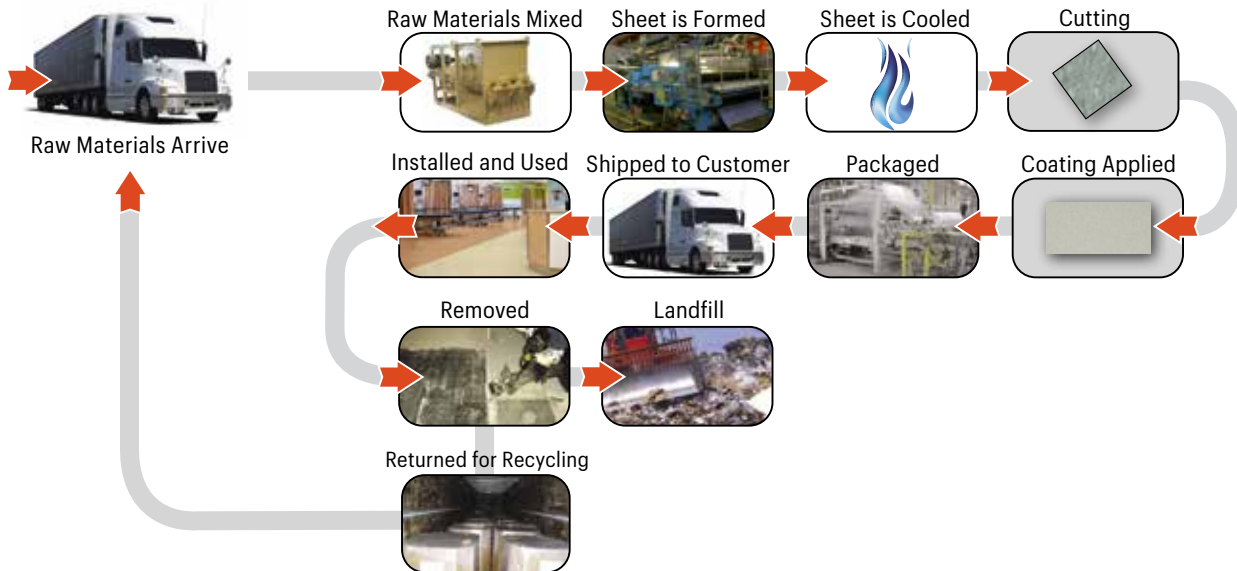
Table 3: Material Composition for VCT

Material Content	Function	Casrn	Quantity (%by weight)	Availability	
Limestone Flour	Filler	1317-65-3	80-85%	Abundant Mineral	Non-Renewable
Polyvinyl Chloride (PVC)	Binder/Film	9002-86-2	5-10%	Fossil Limited	Non-Renewable
		9003-22-9			
Diocetyl Terephthalate (DOTP)	Plasticizer	6422-86-2	1-5%	Fossil Limited	Non-Renewable
Blended Dibenzates	Plasticizer	120-55-8	1-5%	Fossil Limited	Non-Renewable
		19224-26-1			
		21738-31-4			
Recycled Material	Binder	N/A	5%	Fossil Limited	Non-Renewable
Acrylate	Coating	52408-84-1	0.0%	Fossil Limited	Non-Renewable
Pigments	Titanium Dioxide	13463-67-7	0.5-1%	Abundant Mineral	Non-Renewable
	Colored Pigment	Various	0.01-0.1%		

2.8 Manufacturing

Vinyl Composition Tile is floor tile primarily used in commercial flooring applications and is comprised mostly of limestone in a vinyl binder matrix. The manufacturing process involves the hot mixing of the raw materials milled and calendered into a hot sheet that is then cooled before punching into floor tiles. VCT will have a factory applied finish to protect the tile face during packaging and installation.

Figure 2: Process for Manufacturing Vinyl Composition Tile



2.9 Packaging

Armstrong VCT is packaged in a recyclable corrugated box and placed on a wooden pallet for shipping.

2.10 Installation

Armstrong Flooring VCT must be installed in strict accordance with the Armstrong Flooring Guaranteed Installation Systems manual, F-5061. This comprehensive guide to Armstrong flooring installation provides all the information needed to properly install Armstrong Flooring VCT to ensure it will look great and perform exactly as it should. Visit armstrongflooring.com/commercial for more information.

2.11 Use Conditions

Recommended maintenance practices are provided in the installation guide and are required as part of the warranty. Warranty details can be found at armstrongflooring.com/commercial. For Armstrong Flooring VCT, the recommended maintenance is representative of medium intensity maintenance, as shown in Table 6. Because maintenance procedures often vary depending on the building owner's maintenance practices, level of use, and traffic conditions, Table 6 provides low, medium and high maintenance scenarios. The low intensity maintenance scenario results in lower environmental impacts. For example, less scrubbing means less water consumption and a lower eutrophication potential.

2.12 Reference Service Life & Estimated Building Service Life

Per the PCR, this product has a 25 year reference service life and is intended for a building with a 75-year estimated service life.

2.13 Reuse, Recycling & Energy Recovery

Armstrong Flooring VCT can be recycled through the On&On® Recycling Program provided it meets program requirements. See www.armstrongflooring.com/reclaim

3.3 Product for Use Phase (Module B1-B7)

For this study, it was assumed that VCT would last 25 years and therefore would need to be replaced 2 times over the building’s useful life if properly installed and maintained. The useful life indicated in the PCR for flooring is 75 years. Recommended maintenance practices are provided in the Armstrong® Installation Guide and required as part of the warranty. For VCT, the recommended maintenance is representative of medium intensity maintenance, as shown in Table 6. Because maintenance procedures often vary depending on the building owner’s maintenance practices, level of use, and traffic conditions, Table 6 provides low, medium and high maintenance scenarios..

Table 6: Estimated Maintenance Intensity & Assumptions

Maintenance Schedule	Number Of Times Performed In 1 Year (365 Days)			Additional Resource Consumption
	Low	Medium	High	
Sweep/Dry Mop	260	260	260	None
Damp Mop	26	52	104	Water, pre-diluted cleaner
Scrubbing/Spray Buff	6	12	24	Floor finish, electricity
Stripping/Floor Finish	1	2	4	

3.4 Units

The PCR require SI units for all LCA results.

3.5 Estimations and Assumptions Transportation

Per the PCR (UL, 2018) a distance of 800 km (497 miles) by diesel-powered truck is used to represent the distribution of product to the installation site. For products manufactured outside of the United States, inbound transportation by cargo ship is also included. Additionally, transportation is assumed to be 161 km (100 miles) by diesel-powered truck for the following:

- Product to building site
- Installation waste to disposal
- Deconstructed product to end of life destination

3.6 Cut-off Rules

Cut-off rules are consistent with PCR (UL, 2018). No known flows were deliberately excluded.

3.7 Data Sources

All gate-to-gate, primary foreground data was collected for the flooring manufacturing process. This foreground data was from annual production for the year of 2017. Relevant background data was taken from the database provided in the GaBi 8.7.1.30 software system for life cycle engineering. The GaBi database provides the life cycle inventory data for the raw and process materials obtained from the background system.

3.8 Data Quality

A variety of tests and checks were performed throughout the project to ensure high quality of the completed LCA. Checks included data verification and triangulation against several sources including published LCA studies. Overall, the data quality is considered to be good to high quality.

Temporal: All of the primary data is taken from 12 months of continuous operation in the 2017 calendar year. All secondary data were obtained from the GaBi 2018 databases.

Geographical: All primary and secondary data were collected specific to the countries or regions under study. Where country-specific or region-specific data were unavailable, proxy data were used. Geographical representativeness is considered to be high.

Technological: All primary and secondary data were modeled to be specific to the technologies or technology mixes under study. Where technology-specific data were unavailable, proxy data were used. Technological representativeness is considered to be high.

3.9 Period under review

Primary data was collected during 2018. This analysis is intended to represent production in 2017.

3.10 Allocation

No co-product or multi-input process allocation occurs in the product system. For reuse, recycling, and recovery allocation, the cut-off allocation approach is adopted in the case of any recycled content, which is assumed to enter the system burden-free. Only environmental impacts from the point of recovery and forward (e.g., collection, sorting, processing, etc.) are considered. With the exception of biobased packaging waste, product and packaging waste is modeled as being disposed in a landfill rather than incinerated or recycled. Plastic and other construction waste is assumed to be inert in landfills so no system expansion or allocation is necessary as landfill gas is not produced. In the case of biobased packaging waste disposed during installation, landfill gas from the decomposition of this waste is assumed to be collected and used to produce electricity. It is assumed that this recovered energy offsets energy produced by the U.S. average grid.

3.11 Comparability and Benchmarking

EPD from different Program Operators may not be comparable. EPD comparability may only be achieved when product category definition and description are identical, all life cycle stages are considered, the scope and goals of the LCA are identical and other requirements identified in ISO 14025 are met. Armstrong Flooring EPDs are comparable.

Life Cycle Assessment Scenarios

The following information is required by the PCR to be documented.

Table 7: Transportation to the Building Site (A4)

Name	Value	Unit
Fuel Type	Diesel	-
Liters of Fuel	35	L/100km
Vehicle Type	Truck (trailer)	-
Transportation Distance	800	km
Capacity Utilization (including Empty Runs, Mass Based)	78	%
Gross Density of Products Transported	2.1	kg/m ²
Capacity Utilization Volume Factor	1	-

Table 8: Installation into the Building (A5)

Name	Value	Unit
Ancillary Materials	0.37	kg
Electricity Consumption	0.02	MJ
Waste Materials at the Construction Site	0.26	kg

Table 9: Reference Service Life

Name	Value	Unit
Reference Service Life	25	years

Table 10: Maintenance (B2)

Name	Value	Unit
Maintenance Process Information (Cite Source)	AFI Maintenance Guide	
Maintenance Cycle (Reference Service Life)	1,560 (weekly)	Cycles/RSL
Maintenance Cycle (Estimated Service Life)	3,900 (weekly)	Cycles/ESL
Net Freshwater Consumption: Municipal Water to POTW	0.11	kg/ESL
Ancillary Materials (Pre-diluted Cleaner)	306.7	L/ESL
Energy Input for Spray Buffing	5.67	kWh/ESL

Table 11: Replacement (B4)

Name	Value	Unit
Reference Service Life	30	Years
Replacement Cycle	1.5	-
Ancillary Materials (Adhesive)	0.56	kg
Electricity Consumption	0.03	MJ
Waste Materials at the Construction Site	0.39	kg

Table 12: End of Life (C1-C4)

Name	Description	Value	Unit
Collection Process	Collect Separately	3.3	kg
Disposal	Product or Materials for Final Disposition	3.3	kg

4.0 Life Cycle Assessment Results

The results in this EPD represent product specific results for one square meter of Armstrong Flooring products. Caution should be used when trying to compare the results presented in this EPD to other products.

4.1 Life Cycle Assessment Impact Results

Results for the life cycle assessment are presented in the tables below. The Product Category Rules for Flooring require impacts be calculated for a building life of 75 years. This means that during a 75 year time frame, the floor is manufactured, installed, maintained, and replaced multiple times depending upon the floor’s reference service life. The estimated reference service life for the BBT product is provided in Table 9. The total 75-year impacts are calculated by adding the values from all of the modules plus 74 times the impact value shown in B2 module. Additionally, impacts for a 1-year service life including disposal are shown in the tables below.

Table 13: Impact Assessment Results for 1 m² of VCT

VCT	TRACI 2.1 IMPACT CATEGORY	Global Warming Air, incl. Biogenic Carbon	Ozone Depletion Air	Acidification	Eutrophication	Smog Air	Resources, Fossil Fuels
	Units	kg CO2 eq.	kg CFC 11 eq.	kg SO2 eq.	kg N eq.	kg O3 eq.	MJ
Production	A1-A3	3.52	0.00	0.01	0.00	0.16	7.58
Transport	A4	0.71	0.00	0.00	0.00	0.08	1.35
Install	A5	0.43	0.00	0.00	0.00	0.02	2.03
Maintain	B2	0.31	0.00	0.00	0.00	0.01	0.78
Replace	B4	9.905	5.64E-09	3.72E-02	2.18E-03	0.570	23.078
Transport	C2	0.148	0.000	0.001	0.000	0.016	0.278
Disposal	C4	0.293	0.000	0.001	0.000	0.026	0.577
Recycling	D	0	0	0	0	0	0
Total	1 Year	25.478	8.64E-09	0.104	0.012	1.74	93.47
Total	75 Years	5.41	2.82E-09	0.020	1.27E-03	0.31	12.60

4.2. Life Cycle Inventory Results

Tables 14 and 15 provide life cycle inventory results for products included in this EPD. Inventory data are not included for non-renewable primary energy resources used as raw materials, use of secondary materials (SM), use of renewable secondary fuels (RSF), or use of non-renewable secondary fuels (NRSF) as values for these inventory categories are zero.

Table 14: Resources Use for 1 m² of VCT

VCT	Resource Use Parameters	Total Use of Renewable Primary Energy Resources	Renewable Primary Energy Used as Energy Carrier	Total Use of Non-Renewable Primary Energy Resources	Non-Renewable Primary Energy Used as Energy Carrier	Use of Net Fresh Water Resources (FW)
	Units	[MJ, LHV]	[MJ, LHV]	[MJ, LHV]	[MJ, LHV]	[m ³]
Production	A1-A3	7.59	7.59	76.77	76.77	0.02
Transport	A4	0.31	0.31	10.90	10.90	0.00
Install	A5	0.11	0.11	16.10	16.10	0.00
Maintain	B2	0.32	0.32	7.12	7.12	0.00
Replace	B4	17.48	17.48	236.22	236.22	0.03
Transport	C2	0.06	0.06	2.25	2.25	0.00
Disposal	C4	0.35	0.35	4.97	4.97	0.00
Recycling	D	0.00	0.00	0.00	0.00	0.00
Total	1 Year	8.74	8.74	118.11	118.11	0.02
Total	75 Years	49.75	49.75	881.21	881.21	-0.23

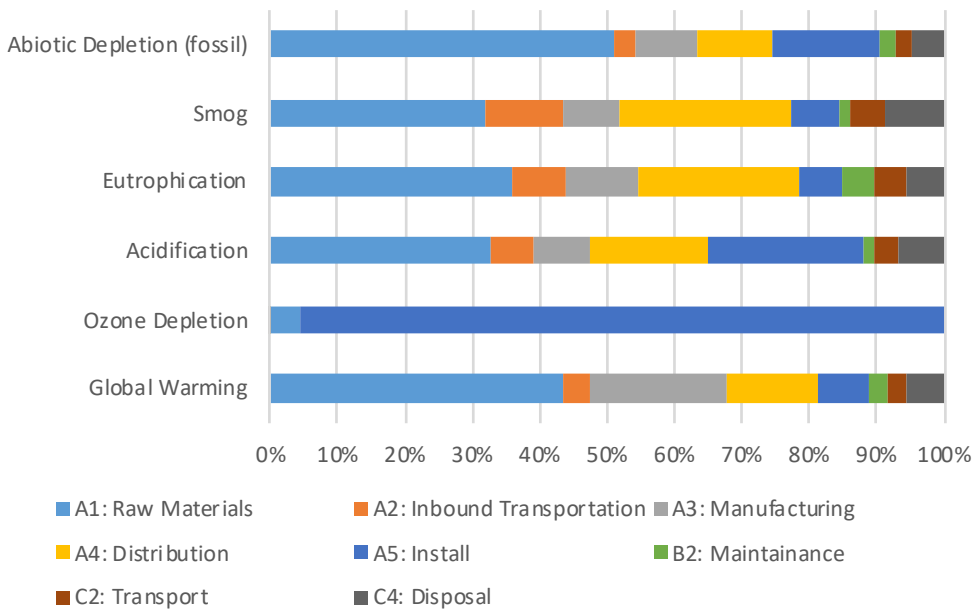
Table 15: Outflows and Waste Categories for 1 m² of VCT

BBT™	Outflows and Waste Categories	Harardous Waste Disposed (HWD)	Non-Harardous Waste Disposed (NHWD)	High Level Radioactive Waste Disposed (HLRW)	Intermediate Low Level Radioactive Waste (ILLRW)	Exported Energy, Electrical	Exported Energy, Thermal
	Units	kg	kg	kg	kg	[MJ, LHV]	[MJ, LHV]
Production	A1-A3	1.35E-04	3.67E-01	-3.31E-06	-2.69E-03	0	0
Transport	A4	8.20E-08	3.81E-04	-2.70E-08	-2.19E-05	0	0
Install	A5	7.27E-09	4.27E-01	-4.22E-08	-3.43E-05	1.08E-04	5.07E-05
Maintain	B2	5.85E-09	1.03E-02	-2.03E-07	-1.66E-04	0	0
Replace	B4	2.70E-03	1.47E+01	-7.28E-06	-5.92E-03	2.16E-04	1.01E-04
Transport	C2	1.69E-08	7.88E-05	-5.59E-09	-4.53E-06	0	0
Disposal	C4	1.61E-08	6.75E+00	-5.59E-08	-4.36E-05	0	0
Recycling	D	0	0	0	0	0	0
Total	1 Year	1.35E-04	7.37E+00	-3.64E-06	-2.69E-03	1.08E-04	5.07E-05
Total	75 Years	4.05E-04	2.29E+01	-2.60E-05	-2.11E-02	3.42E-04	1.52E-04

5.0 LCA Interpretation

Under the 75-year building service life assumption, product manufacturing (A1-A3) and recommended maintenance (B2) are the largest contributors to most impacts categories considered. The production of raw materials as shown in Figure 4, represents a substantial fraction of potential impact, even over the life of a building. The potential impact of floor maintenance adds up over time and are relevant contributors to the life cycle. Transportation of the flooring product from the manufacturing facility to the installation site (A4) is a relatively minor contributor to all impact categories. Replacement (B4) is a key contributor, because it represents the production (A1-A3), installation (A5) and disposal of replacement products (B4) needed to satisfy the 75-year building service. The PCR assumes that all flooring product have the same durability, however more durable products will have lower impact.

Figure 3. One-Year Life Cycle Impacts for VCT



6.0 Additional Environmental Information

The PCR assumes that all flooring product have the same durability, however more durable products will have lower impact.

6.1 Environment and Health During Manufacturing

All Armstrong Flooring manufacturing plants maintain an Environmental Management System (EMS) in accordance with ISO 14001 which includes continuous environmental performance targets. Manufacturing plants located outside of the United States including plants in China and Australia are third party certified to ISO 14001 and ISO 9001.

Additionally, Armstrong has a robust internal Quality Assurance process that is based on industry-accepted best practices and is led by a team of quality professionals who have been certified by the American Society for Quality. The process involves several hundred different measures made throughout the manufacturing processes.

6.2 Environment and Health During Installation and Use.

All Armstrong flooring products are tested and certified by FloorScore® to comply with the requirements of the California Department of Public Health Standard for the Testing and Evaluation of VOC emissions (CDPH v1.2).

7.0 References

Armstrong Flooring (2018), Guaranteed Installation Systems (F-5061) manual.

CDPH. (2017) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – v1.2.

ISO. (2006) 14025: Environmental labels and declarations – Type III – environmental declarations – Principles and procedures.

ISO. (2006) 14040: Environmental management – Life cycle assessment – Principles and framework.

ISO. (2006) 14044: 2006 Environmental management – Life cycle a assessment – Requirements and guidelines.

European Standards. (2013) EN 15804+A1 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

ISO. 9001 (2015): Quality Management Systems - Requirements.

ISO. (2017) 21930: Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.

UL (2018) Product Category Rules for Building-Related products and Services in North America – Part A life Cycle.

UL (2018) Product Category Rules for Building-Related Products and Service, Part B: Flooring EPD Requirements.

US EPA. (2012). Tool for the reduction and assessment of Chemical and other Environmental Impacts (TRACI) v 2.1.