

**Made in the U.S.A.**

**Declaration Owner**

FLEXCO Corporation  
1401 East 6<sup>th</sup> Street  
Tuscumbia, AL 35674  
[www.flexcofloors.com](http://www.flexcofloors.com) | (800) 633-3151

**Product**

- Natural Elements Premium Luxury Vinyl Tile Wood (Dryback)
- Natural Elements Premium Luxury Vinyl Tile Stone (Dryback)

**Functional Unit**

The functional unit is one square meter of floor covering provided and maintained for a period of 60 years.

**EPD Number and Period of Validity**

SCS-EPD-05556  
EPD Valid June 4, 2019 through June 3, 2024

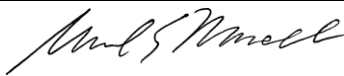

**Product Category Rule**

Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.

**Program Operator**

SCS Global Services  
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|   |  |
|---|--|
| Declaration Owner:  | FLEXCO Corporation   |
| Address:  | 1401 East 6 <sup>th</sup> Street, Tuscumbia, AL 35674  |
| Declaration Validity Period:  | Approved Date: June 4, 2019 – End Date: June 3, 2024   |
| Program Operator:   | SCS Global Services  |
| Declaration URL Link:   | <a href="https://www.scsglobalservices.com/certified-green-products-guide">https://www.scsglobalservices.com/certified-green-products-guide</a>  |
| LCA Practitioner:   | Jeremie Hakian, SCS Global Services  |
| LCA Software:   | openLCA v1.7.4   |
| 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:   | <br>Dr. Gerard Mansell, SCS Global Services  |
| Product Category Rule:  | Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.   |
| PCR Review conducted by:  | Jack Geibig, EcoForm. <a href="mailto:jgeibig@ecoform.com">jgeibig@ecoform.com</a>   |
| 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:   | <br>Tom Gloria, Ph.D., Industrial Ecology Consultants  |
| Declaration Contents:   | PRODUCT SCOPE.....cover<br>ABOUT FLEXCO CORPORATION.....2<br>PRODUCT DESCRIPTION.....2<br>PRODUCT APPLICATION.....2<br>PRODUCT PERFORMANCE.....3<br>MATERIAL CONTENT.....3<br>PRODUCTION OF MAIN MATERIALS.....4<br>PRODUCT CHARACTERISTICS.....5<br>LIFE CYCLE ASSESSMENT.....5<br>FUNCTIONAL UNIT.....5<br>PRODUCT LIFE CYCLE FLOW DIAGRAM.....6<br>LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION.....7<br>LIFE CYCLE INVENTORY.....8<br>LIFE CYCLE IMPACT ASSESSMENT.....9<br>SUPPORTING TECHNICAL INFORMATION.....12<br>ADDITIONAL ENVIRONMENTAL INFORMATION.....15<br>REFERENCES.....16 |
| <p><b>Disclaimers:</b> This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.</p> <p><b>Scope of Results Reported:</b> 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><b>Accuracy of Results:</b> Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.</p> <p><b>Comparability:</b> 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> |  |



## ABOUT FLEXCO CORPORATION

When you work with FLEXCO®, you're working with a resilient flooring partner that has the experience, the determination and the dedication to make your rubber and vinyl flooring visions become realities. For more than 50 years, FLEXCO has advanced as an industry pioneer and innovator by remaining:

- + Performance-driven – taking flooring quality, selection and service to even higher levels.
- + Progress-oriented – developing cutting-edge products with the best and newest features.
- + Partnership-minded – building and strengthening relationships with distributors, architects, contractors, specifiers and installers to ensure we meet their needs and stay ahead of the curve.

## PRODUCT DESCRIPTION

The luxury vinyl flooring in this EPD is manufactured in an ISO 9001 facility in Fostoria, Ohio. A product lifetime of 30 years is asserted by the manufacturer, which is used as the reference service life in this EPD. The representative nominal thickness of 2.8mm for Dryback is based on a weighted average, but is available in 2mm, 2.5mm, and 3mm thicknesses. The Dryback product line in this EPD is sold under the brand names, *Natural Elements Premium Luxury Vinyl Tile Wood* and *Natural Elements Premium Luxury Vinyl Tile Stone*, and is referenced as *Dryback* throughout the EPD.

## PRODUCT APPLICATION

The luxury vinyl flooring in this EPD is used in various commercial and residential applications.



## PRODUCT PERFORMANCE

**Table 1.** Product performance test results for the luxury vinyl product in this EPD.

| Test Item                      | Test Method      | Results  |
|--------------------------------|------------------|--|
| Overall thickness              | ASTM F386        | Nominal $\pm 0.005$ in ( $\pm 0.127$ mm)                                     |
| Wear-layer thickness           | ASTM F410        | 0.020 in (0.5mm) minimum For Commercial use                                  |
| Dimension                      | ASTM F2055       | $\pm 0.016$ in. per linear foot ( $\pm 0.406$ mm per linear meter)           |
| Squareness                     | ASTM F2055       | Maximum 0.010 in. (0.25mm)   |
| Residual indentation           | ASTM F1914       | Average less than 8%   |
| Flexibility                    | ASTM F137        | 1-in (25.4mm) mandrel<br>No crack, No damage                                 |
| Dimensional stability          | ASTM F2199       | 0.020 in /ln-ft maximum  |
| Curling after exposure to heat | EN ISO 23999     | $\pm 2$ mm<br>(+0.5mm / - 1mm)   |
| Chemical resistance            | ASTM F925        | No more than a slight change in surface dulling, surface attack, or staining |
| Resistance to light            | ASTM F1515       | $\Delta E < 8$ ave MAX   |
| Resistance to heat             | ASTM F1514       | $\Delta E < 8$ ave MAX   |
| Fire resistance                | ASTM E648        | Class 1 (0.45 w/Cm <sup>2</sup> or more)                                     |
| Smoke density                  | ASTM E662        | 450 or less  |
| Static load limit              | ASTM F970        | 0.005 in or less (0.127mm or less)   |
| Indoor air quality             | CDPH v1.1 (2017) | Low VOC, Floorscore® Certified   |

## MATERIAL CONTENT

The material content of each product, including the material origin and its availability, is provided below. The percent of each material component is presented as a range, which varies depending on its thickness. The range shown is therefore representative of the product line, which is available in several thicknesses. The results in this EPD are based on a representative thickness, described in the product description and product characteristics sections, and is therefore based on a specific material content corresponding to that thickness.



**Table 2.** *Origin and availability of material content for Dryback.*

| Component             | Materials  | Percent of Total (%) | Availability |                                    |                                 | Origin of Raw Materials |
|-----------------------|--|----------------------|--------------|------------------------------------|---------------------------------|-------------------------|
|                       |  |                      | Renewable    | Non-renewable                      | Recycled (% pre-/post-consumer) |                         |
| Filler                | Calcium carbonate, magnesium carbonate, silicon dioxide                      | 50-55%               | -            | Mineral, abundant                  | 0%/0%                           | Global                  |
| Binder                | Polyvinyl chloride   | 30-35%               | -            | Fossil, limited                    | 0%/0%                           | Global                  |
| Plasticizer           | 1,4-Benzenedicarboxylic acid, Bis(2-ethylhexyl) ester                        | 10-12%               | -            | Fossil, limited                    | 0%/0%                           | Global                  |
| Stabilizer            | Confidential   | 2.0-3.0%             | -            | Fossil, limited                    | 0%/0%                           | Global                  |
| Print Layer Film      | Polyvinyl chloride, ink  | 0.50-1.5%            | -            | Fossil, limited; Mineral, abundant | 0%/0%                           | Global                  |
| UV Coating & Additive | Confidential   | 0.50-1.5%            |              | Fossil, limited                    | 0%/0%                           | Global                  |
| Pigment               | Carbon black, polyvinyl chloride, bis(2-ethylhexyl) ester, calcium carbonate | 0.10-0.30%           |              | Fossil, limited; Mineral, abundant | 0%/0%                           | Global                  |
| <b>TOTAL</b>          | <b>-</b>   | <b>100%</b>          | <b>-</b>     | <b>-</b>                           | <b>0%/0%</b>                    | <b>-</b>                |

In conformance with the PCR, product materials were reviewed for the presence of any hazardous chemicals. A review of Material Data Safety Sheets (MSDS) provided by the manufacturer reveals the presence of the following regulated chemicals in the product (this does not indicate that the threshold for reportable quantities is exceeded):

- Calcium carbonate (CAS# 471-34-1)

## PRODUCTION OF MAIN MATERIALS

**Calcium Carbonate:** An abundant mineral found worldwide and a common substance found in rocks. It can be ground into varying particle sizes.

**Plasticizer:** Plasticizers are used to make vinyl soft and flexible. The plasticizers used in the products declared in this EPD include 1,4-Benzenedicarboxylic acid and Bis(2-ethylhexyl) ester.

**Polyvinyl Chloride (PVC):** Derived from fossil fuel and salt. Petroleum or natural gas is processed to make ethylene, and salt is subjected to electrolysis to separate out the natural element chlorine. Ethylene and chlorine are combined to produce ethylene dichloride, which is further processed into vinyl chloride monomer (VCM) gas. Finally, in polymerization the VCM molecule forms chains, converting the gas into fine, white powder—vinyl resin.

**Stabilizers:** Stabilizers are used to prevent the decomposition which occurs as PVC is heated to soften during the extrusion or molding process. Stabilizers also provide enhanced resistance to daylight, weathering and heat aging and have an important influence on the physical properties of PVC.

## PRODUCT CHARACTERISTICS

The representative nominal thickness of 2.8mm for Dryback is based on a weighted average, but is available in 2mm, 2.5mm, and 3mm thicknesses.

**Table 3.** Product characteristics for Dryback (2.8mm).

| Characteristic             |       |        | Nominal Values | Unit                  | Maximum Value | Minimum Value |
|----------------------------|-------|--------|----------------|-----------------------|---------------|---------------|
| Product thickness          |       |        | 2.80           | mm                    | 3.15          | 2.35          |
|                            |       |        | (0.110)        | (in)                  | (0.124)       | (0.0925)      |
| Wear layer thickness       |       |        | 0.20           | mm                    | 0.22          | 0.18          |
|                            |       |        | (0.0079)       | (in)                  | (0.0087)      | (0.0071)      |
| Product Weight             |       |        | 4.68           | kg/m <sup>2</sup>     | 4.68          | 3.70          |
|                            |       |        | (15.3)         | (oz/ft <sup>2</sup> ) | (15.3)        | (12.1)        |
| VOC emissions test method  |       |        | FloorScore®    | -                     |               |               |
| Sustainable Certifications |       |        | FloorScore®    | -                     |               |               |
| Product form               | Tiles | Width  | 152.40         | mm                    | 457.81        | 101.46        |
|                            |       | Length | 1,219.20       | mm                    | 1,506.00      | 1,502.00      |

## LIFE CYCLE ASSESSMENT

A cradle to grave life cycle assessment (LCA) was completed for this product group in accordance with ISO 14040, ISO 14044, ISO 21930, and Product Category Rule for Environmental Product Declarations for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood (Version 2)



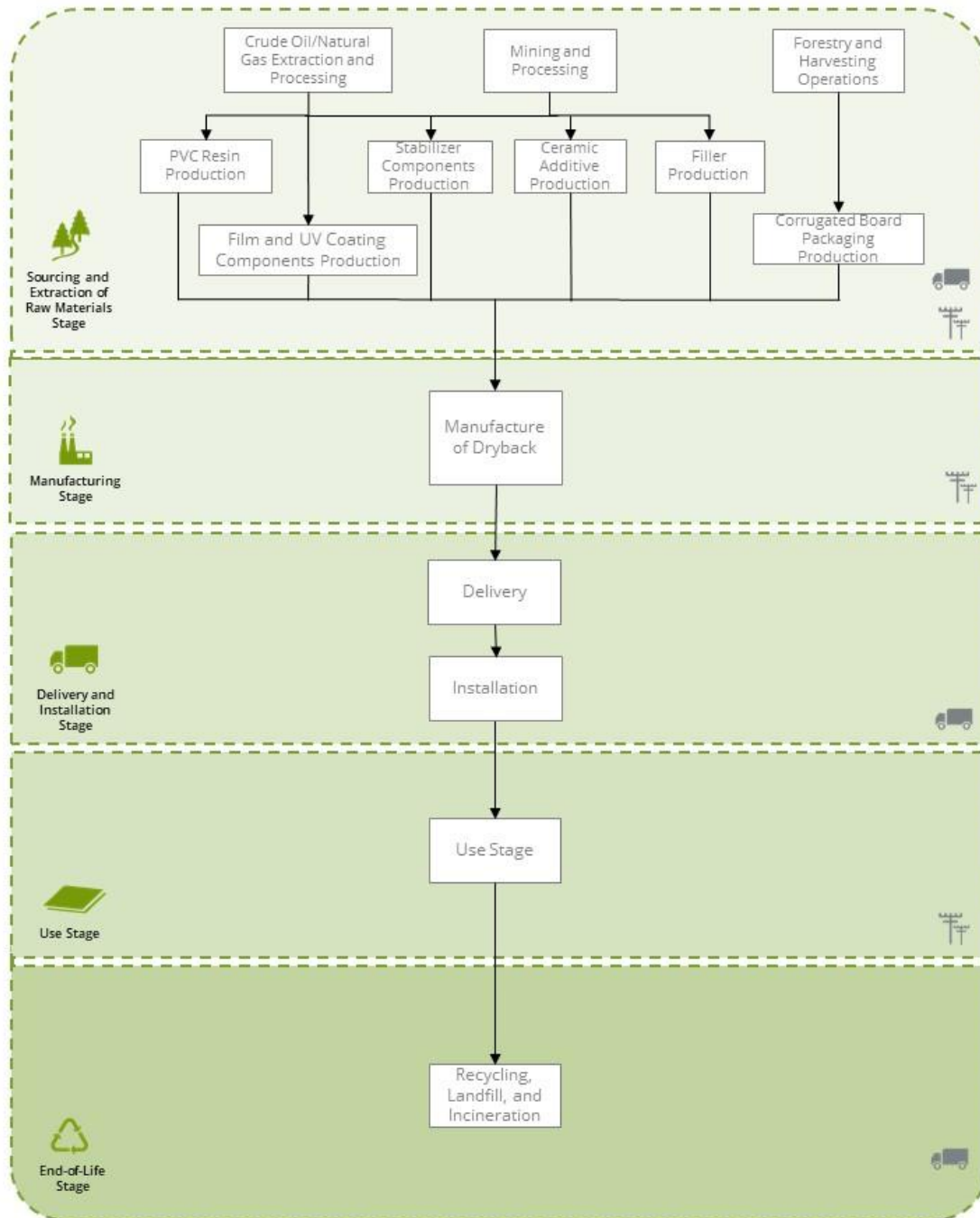
## FUNCTIONAL UNIT

The functional unit is, according to the PCR, the total impact for the expected life of the building (60 years). But the service life is dependent on the product lifetime, which is 30 years in this case. The PCR consequently requires separate reporting of LCA results A) for 1 m<sup>2</sup> of floor covering - extraction/processing, manufacturing, delivery and installation and end of life, B) the average 1- year use stage, and C) for the 60-year life of the building as combined using A) and B), calculated from the reference service life (RSL) of the product.

## PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of the luxury vinyl flooring. This includes resource extraction and processing, product manufacture, use and maintenance, and end-of-life.

### Process Life Cycle Flow Diagram for Dryback





## LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

### Sourcing/Extraction Stage (raw material acquisition)

This stage includes extraction and processing of raw materials used for packaging and the manufacturing of luxury vinyl flooring, including delivery of these material components to the production site.

### Manufacturing Stage

This stage includes all the relevant manufacturing processes and flows, including the impacts from energy use, emissions, and wastes at the facility. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are excluded.

### Delivery and Installation Stage

#### Delivery

This stage includes the delivery of the flooring product to the point of installation. Modeling used in the life cycle assessment assumed an estimated distribution distance to point of sale of 1,600 kilometers (994 miles) via diesel truck, representing transport from the manufacturing facility in Fostoria, Ohio to various locations across the United States.

#### Installation

The manufacturer provides recommended installation guidance on the web: <https://flexcofloors.com>

#### Waste

Waste generated during product installation can be disposed of in a landfill, incinerated, or recycled.

#### Packaging

**Table 4.** *Origin and availability of material content for packaging of Dryback.*

| Packaging Materials |                  |                             |                      |              |                 |                                 |                         |
|---------------------|------------------|-----------------------------|----------------------|--------------|-----------------|---------------------------------|-------------------------|
| Component           | Materials        | Amount (kg/m <sup>2</sup> ) | Percent of Total (%) | Availability |                 |                                 | Origin of Raw Materials |
|                     |                  |                             |                      | Renewable    | Non-renewable   | Recycled (% pre-/post-consumer) |                         |
| Box                 | Corrugated board | 0.154                       | 100%                 | Biogenic     | Fossil, limited | 0%/0%                           | Global                  |
| <b>TOTAL</b>        | -                | <b>0.154</b>                | <b>100%</b>          | -            | -               | <b>0%/0%</b>                    | -                       |

### Use Stage

#### Cleaning and maintenance

**Table 5.** *Cleaning and maintenance for the luxury vinyl flooring product in this EPD.*

| Cleaning Process   | Cleaning Frequency / Traffic Level |               |               | Method   |
|--------------------|------------------------------------|---------------|---------------|--|
|                    | Light                              | Moderate      | Heavy         |  |
| Daily Maintenance* | 208 days/year                      | 156 days/year | 0 days/year   | Sweep and mopping<br>(3 oz neutral cleaner/gal water or 23 mL neutral cleaner/ L water)                  |
| Routine Cleaning   | 52 days/year                       | 104 days/year | 260 days/year | Sweep and clean with auto scrubber<br>(3 oz neutral cleaner/gal water or 23 mL neutral cleaner/ L water) |

\*Based on working days per year minus the days for routine cleaning.



## End-of-Life Stage

### Recycling, reuse, or repurpose

Data for the estimation of recycling rates for the product and packaging are based on data prepared by the US Environmental Protection Agency's Municipal Solid Waste Report. These data provide 2014 statistics on US disposal, including recycling rates.

**Table 6.** Recycling rates based on 2014 US EPA Municipal Solid Waste statistics.

| Material             | Durable Goods | Packaging |
|----------------------|---------------|-----------|
| Paper and paperboard | N/A           | 75.4%     |

### Disposal

For disposal of product materials, it is assumed that 20% are incinerated and 80% go to a landfill, based on the US EPA data. Transportation of waste materials at end of life assumes a 32 kilometer (20 mile) average distance to disposal, consistent with assumptions used in the US EPA WARM model.

## LIFE CYCLE INVENTORY

In accordance with ISO 21930:2007, the following aggregated inventory flows are included in the LCA, in addition to the LCIA and inventory flow requirements specified by the PCR:

- Use of renewable material resources
- Use of non-renewable material resources
- Consumption of freshwater
- Hazardous Waste
- Non-hazardous Waste

All results are calculated using the openLCA v1.7.4 model using primary and secondary inventory data. Classification for the use of material resources is based on a review of materials in the foreground system.

**Table 7.** Aggregated inventory flows, shown in kg per 1 m<sup>2</sup> of Dryback (2.8mm) maintained for 60 years.

| Parameter                               | Units          | Sourcing and Extraction | Manufacturing        | Delivery and Installation | Use                  | End of Life          | Total                |
|---|----------------|-------------------------|----------------------|---------------------------|----------------------|----------------------|----------------------|
| <b>Total Primary Energy Consumption</b> |                |                         |                      |                           |                      |                      |                      |
| Non-renewable energy resources          | MJ             | 280                     | 62                   | 53                        | 280                  | 3.5                  | 680                  |
| Renewable primary energy                | MJ             | 6.3                     | 1.4                  | 1.3                       | 74                   | 0.16                 | 83                   |
| <b>Material Resources Consumption</b>   |                |                         |                      |                           |                      |                      |                      |
| Non-renewable material resources        | kg             | 9.1                     | 0.0                  | Neg                       | 1.0                  | Neg                  | 10                   |
| Renewable material resources            | kg             | 0.31                    | 0.0                  | Neg                       | Neg                  | Neg                  | 0.31                 |
| Freshwater                              | m <sup>3</sup> | 2.1                     | 0.32                 | 9.6x10 <sup>-2</sup>      | 4.5                  | 1.1x10 <sup>-2</sup> | 7.0                  |
| <b>Waste Generated</b>                  |                |                         |                      |                           |                      |                      |                      |
| Hazardous waste                         | kg             | 7.4x10 <sup>-5</sup>    | 1.0x10 <sup>-4</sup> | 4.1x10 <sup>-5</sup>      | 4.9x10 <sup>-4</sup> | 1.0x10 <sup>-5</sup> | 7.2x10 <sup>-4</sup> |
| Non-hazardous waste                     | kg             | 2.3                     | 1.1                  | 2.0                       | 2.4                  | 17                   | 25                   |

*Neg = Negligible*

## LIFE CYCLE IMPACT ASSESSMENT

The impact assessment for the EPD is conducted in accordance with requirements of the PCR. Impact category indicators are estimated using the CML-IA (Table 8 through Table 10) and TRACI 2.1 (Table 11 through Table 13) characterization methods. Aggregated inventory flows for energy use are also calculated. The LCIA and inventory flow results are calculated using openLCA v1.7.4 software and declared in this EPD in the following ways:

- **Table A:** The potential impacts for 1 m<sup>2</sup> of floor covering for each of the following life cycle stages: sourcing/extraction, manufacturing, delivery and installation, and end of life. The impacts are not normalized to the 60-year reference service life of the building.
- **Table B:** The impacts for the use stage for 1 m<sup>2</sup> of floor covering for an average one-year use.
- **Table C:** The total impacts of all life cycle stages based on the estimated replacement schedule for 1 m<sup>2</sup> of floor covering over a 60-year reference service life of a building.



**Table 8.** Table A: Cradle to install and end of life LCIA results for 1 m<sup>2</sup> of Dryback (2.8mm). Results are calculated using CML-IA.

| Impact Category                            | Units                               | Sourcing and Extraction     | Manufacturing                | Delivery and Installation    | End of Life                  | Total                        |
|--|-------------------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Abiotic Depletion Potential (Elements)     | kg Sb eq                            | 6.8x10 <sup>-6</sup><br>49% | 3.7x10 <sup>-7</sup><br>2.7% | 6.6x10 <sup>-6</sup><br>47%  | 1.9x10 <sup>-7</sup><br>1.4% | 1.4x10 <sup>-5</sup><br>100% |
| Abiotic Depletion Potential (Fossil Fuels) | MJ                                  | 160<br>75%                  | 22<br>10%                    | 30<br>14%                    | 1.9<br>0.88%                 | 220<br>100%                  |
| Global Warming Potential                   | kg CO <sub>2</sub> eq               | 7.7<br>52%                  | 2.5<br>17%                   | 1.8<br>12%                   | 2.9<br>19%                   | 15<br>100%                   |
| Ozone Depletion Potential                  | kg CFC-11 eq                        | 4.4x10 <sup>-7</sup><br>50% | 1.5x10 <sup>-7</sup><br>17%  | 2.8x10 <sup>-7</sup><br>31%  | 1.9x10 <sup>-8</sup><br>2.1% | 8.9x10 <sup>-7</sup><br>100% |
| Photochemical Oxidant Formation Potential  | kg C <sub>2</sub> H <sub>4</sub> eq | 1.3x10 <sup>-3</sup><br>49% | 4.0x10 <sup>-4</sup><br>14%  | 4.8x10 <sup>-4</sup><br>17%  | 5.2x10 <sup>-4</sup><br>19%  | 2.7x10 <sup>-3</sup><br>100% |
| Acidification Potential                    | kg SO <sub>2</sub> eq               | 2.6x10 <sup>-2</sup><br>60% | 8.8x10 <sup>-3</sup><br>20%  | 7.3x10 <sup>-3</sup><br>17%  | 8.8x10 <sup>-4</sup><br>2.1% | 4.3x10 <sup>-2</sup><br>100% |
| Eutrophication Potential                   | kg PO <sub>4</sub> <sup>3-</sup> eq | 5.9x10 <sup>-3</sup><br>27% | 4.3x10 <sup>-3</sup><br>19%  | 2.0x10 <sup>-3</sup><br>8.9% | 1.0x10 <sup>-2</sup><br>45%  | 2.2x10 <sup>-2</sup><br>100% |
| Primary Energy, Non-Renewable              | MJ                                  | 140<br>70%                  | 31<br>16%                    | 27<br>13%                    | 1.7<br>0.88%                 | 200<br>100%                  |
| Primary Energy, Renewable                  | MJ                                  | 3.2<br>69%                  | 0.68<br>15%                  | 0.64<br>14%                  | 8.0x10 <sup>-2</sup><br>1.8% | 4.6<br>100%                  |

**Table 9.** Table C: Cradle to grave impacts over 60-year building service life for 1 m<sup>2</sup> of Dryback (2.8mm). Results are calculated using CML-IA.

| Impact Category                            | Units                               | Sourcing and Extraction     | Manufacturing                 | Delivery and Installation    | Use                         | End of Life                   | Total                        |
|--|-------------------------------------|-----------------------------|-------------------------------|------------------------------|-----------------------------|-------------------------------|------------------------------|
| Abiotic Depletion Potential (Elements)     | kg Sb eq                            | 1.4x10 <sup>-5</sup><br>10% | 7.5x10 <sup>-7</sup><br>0.53% | 1.3x10 <sup>-5</sup><br>9.4% | 1.1x10 <sup>-4</sup><br>80% | 3.9x10 <sup>-7</sup><br>0.28% | 1.4x10 <sup>-4</sup><br>100% |
| Abiotic Depletion Potential (Fossil Fuels) | MJ                                  | 320<br>42%                  | 44<br>5.9%                    | 59<br>7.8%                   | 330<br>43%                  | 3.8<br>0.50%                  | 760<br>100%                  |
| Global Warming Potential                   | kg CO <sub>2</sub> eq               | 15<br>28%                   | 5.0<br>9.2%                   | 3.6<br>6.7%                  | 25<br>45%                   | 5.8<br>11%                    | 54<br>100%                   |
| Ozone Depletion Potential                  | kg CFC-11 eq                        | 8.9x10 <sup>-7</sup><br>16% | 3.0x10 <sup>-7</sup><br>5.4%  | 5.6x10 <sup>-7</sup><br>10%  | 3.8x10 <sup>-6</sup><br>68% | 3.8x10 <sup>-8</sup><br>0.69% | 5.5x10 <sup>-6</sup><br>100% |
| Photochemical Oxidant Formation Potential  | kg C <sub>2</sub> H <sub>4</sub> eq | 2.7x10 <sup>-3</sup><br>22% | 7.9x10 <sup>-4</sup><br>6.4%  | 9.5x10 <sup>-4</sup><br>7.8% | 6.8x10 <sup>-3</sup><br>55% | 1.0x10 <sup>-3</sup><br>8.5%  | 1.2x10 <sup>-2</sup><br>100% |
| Acidification Potential                    | kg SO <sub>2</sub> eq               | 5.2x10 <sup>-2</sup><br>24% | 1.8x10 <sup>-2</sup><br>8.0%  | 1.5x10 <sup>-2</sup><br>6.7% | 0.13<br>61%                 | 1.8x10 <sup>-3</sup><br>0.81% | 0.22<br>100%                 |
| Eutrophication Potential                   | kg PO <sub>4</sub> <sup>3-</sup> eq | 1.2x10 <sup>-2</sup><br>13% | 8.6x10 <sup>-3</sup><br>9.1%  | 3.9x10 <sup>-3</sup><br>4.2% | 5.0x10 <sup>-2</sup><br>53% | 2.0x10 <sup>-2</sup><br>21%   | 9.4x10 <sup>-2</sup><br>100% |
| Primary Energy, Non-Renewable              | MJ                                  | 280<br>41%                  | 62<br>9.1%                    | 53<br>7.8%                   | 280<br>41%                  | 3.5<br>0.51%                  | 680<br>100%                  |
| Primary Energy, Renewable                  | MJ                                  | 6.3<br>7.6%                 | 1.4<br>1.6%                   | 1.3<br>1.5%                  | 74<br>89%                   | 0.16<br>0.19%                 | 83<br>100%                   |

**Table 10.** Table B: Average 1-year use stage impacts for 1 m<sup>2</sup> for the luxury vinyl flooring product in this EPD. Results are calculated using CML-IA.

| Impact Category                            | Units                               | Average 1-year Use and Maintenance Impacts |
|--|-------------------------------------|--|
| Abiotic Depletion Potential (Elements)     | kg Sb eq                            | 2.6x10 <sup>-6</sup>                       |
| Abiotic Depletion Potential (Fossil Fuels) | MJ                                  | 5.6  |
| Global Warming Potential                   | kg CO <sub>2</sub> eq               | 0.32                                       |
| Ozone Depletion Potential                  | kg CFC-11 eq                        | 6.3x10 <sup>-8</sup>                       |
| Photochemical Oxidant Formation Potential  | kg C <sub>2</sub> H <sub>4</sub> eq | 1.2x10 <sup>-4</sup>                       |
| Acidification Potential                    | kg SO <sub>2</sub> eq               | 2.2x10 <sup>-3</sup>                       |
| Eutrophication Potential                   | kg PO <sub>4</sub> <sup>3-</sup> eq | 1.1x10 <sup>-3</sup>                       |
| Primary Energy, Non-Renewable              | MJ                                  | 4.7  |
| Primary Energy, Renewable                  | MJ                                  | 1.2  |

**Table 11.** Cradle to install and end of life LCIA results for 1 m<sup>2</sup> of Dryback (2.8mm). Results are calculated using TRACI 2.1.

| Impact Category       | Units                 | Dryback (2.8 mm)     |
|-----------------------|-----------------------|----------------------|
| Ozone depletion       | kg CFC-11 eq          | 1.2x10 <sup>-6</sup> |
| Global warming        | kg CO <sub>2</sub> eq | 14                   |
| Smog                  | kg O <sub>3</sub> eq  | 0.68                 |
| Acidification         | kg SO <sub>2</sub> eq | 4.5x10 <sup>-2</sup> |
| Eutrophication        | kg N eq               | 4.8x10 <sup>-2</sup> |
| Fossil fuel depletion | MJ surplus            | 28                   |

**Table 12.** Cradle to grave impacts over 60-year building service life for 1 m<sup>2</sup> Dryback (2.8mm). Results are calculated using TRACI 2.1.

| Impact Category       | Units                 | Dryback (2.8 mm)     |
|-----------------------|-----------------------|----------------------|
| Ozone depletion       | kg CFC-11 eq          | 6.5x10 <sup>-6</sup> |
| Global warming        | kg CO <sub>2</sub> eq | 53                   |
| Smog                  | kg O <sub>3</sub> eq  | 2.6                  |
| Acidification         | kg SO <sub>2</sub> eq | 0.22                 |
| Eutrophication        | kg N eq               | 0.20                 |
| Fossil fuel depletion | MJ surplus            | 89                   |

**Table 13.** Average 1-year use stage impacts for 1 m<sup>2</sup> for the luxury vinyl flooring product in this EPD. Results are calculated using TRACI 2.1.

| Impact Category       | Units                 | Average 1-year Use and Maintenance Impacts |
|-----------------------|-----------------------|--|
| Ozone depletion       | kg CFC-11 eq          | 6.9x10 <sup>-8</sup>                       |
| Global warming        | kg CO <sub>2</sub> eq | 0.40                                       |
| Smog                  | kg O <sub>3</sub> eq  | 2.1x10 <sup>-2</sup>                       |
| Acidification         | kg SO <sub>2</sub> eq | 2.2x10 <sup>-3</sup>                       |
| Eutrophication        | kg N eq               | 1.7x10 <sup>-3</sup>                       |
| Fossil fuel depletion | MJ surplus            | 0.56                                       |



## SUPPORTING TECHNICAL INFORMATION

Unit processes are developed with openLCA v1.7.4 software, drawing upon data from multiple sources. Primary data were provided by NOX US, LLC for their manufacturing processes. The primary sources of secondary LCI data are from Ecoinvent, Overcash, and PlasticsEurope Eco-profiles.

**Table 14.** *Data sources used for the LCA study.*

| Flow                     | Dataset   | Data Source(s)      | Publication Date |
|--------------------------|---|---------------------|------------------|
| <b>Product Materials</b> |   |                     |                  |
| PVC resin                | Polyvinylchloride, emulsion polymerised {RoW}   polyvinylchloride production, emulsion polymerisation   Alloc Rec, U  | Ecoinvent           | 2017             |
| Plasticizer              | 2-ethylhexyl phthalate (DEHP) {GLO}   market for   Alloc Rec U  | Ecoinvent; Overcash | 2017; 2004       |
| Stabilizer               | chemical production, organic   chemical, organic   Cutoff, U - GLO  | Ecoinvent           | 2017             |
| Pigment                  | Carbon black {GLO}   production   Alloc Rec, U  | Ecoinvent           | 2017             |
| Filler                   | Limestone, crushed, for mill {GLO}   market for   Alloc Rec, U  | Ecoinvent           | 2017             |
| Print Layer Film         | polyvinylchloride production, emulsion polymerisation   polyvinylchloride, emulsion polymerised   Cutoff, U - RoW   | Ecoinvent           | 2017             |
| Binder                   | polyvinylchloride production, emulsion polymerisation   polyvinylchloride, emulsion polymerised   Cutoff, U - RoW   | MSDS; Ecoinvent     | 2017             |
| UV Coating               | Polyurethane {RoW}   production   Alloc Rec U   | SCS; Ecoinvent      | 2017             |
| Additive                 | silica sand production   silica sand   Cutoff, U - RoW  | Ecoinvent           | 2017             |
| Fiberglass               | market for glass fibre reinforced plastic, polyester resin, hand lay-up   glass fibre reinforced plastic, polyester resin, hand lay-up   Cutoff, U - GLO; market for kraft paper, unbleached   kraft paper, unbleached   Cutoff, U - GLO  | Ecoinvent           | 2017             |
| <b>Installation</b>      |   |                     |                  |
| Adhesive                 | Acrylic binder, without water, in 34% solution state {GLO}   market for   Alloc Rec, U  | Ecoinvent           | 2017             |
| <b>Maintenance</b>       |   |                     |                  |
| Cleaner                  | Chemical, organic {GLO}   market for   Alloc Rec, U; Citric acid {GLO}   market for   Alloc Rec, U; Sodium hydroxide, without water, in 50% solution state {GLO}   market for   Alloc Rec, U; Sodium sulfite {GLO}   market for   Alloc Rec, U; Water, deionised, from tap water, at user {GLO}   market for   Alloc Rec, U | MSDS; Ecoinvent     | 2017             |
| Electricity              | market group for electricity, low voltage   electricity, low voltage   Cutoff, U - US   | Ecoinvent           | 2017             |
| Water                    | Tap water {RoW}   market for   Alloc Rec, U   | Ecoinvent           | 2017             |
| <b>Manufacturing</b>     |   |                     |                  |
| Electricity              | Electricity, medium voltage, at grid/RFCW 2016 U  | eGRID; Ecoinvent    | 2018; 2017       |
| Propane                  | market for propane, burned in building machine   propane, burned in building machine   Cutoff, U - GLO  | Ecoinvent           | 2017             |
| <b>Packaging</b>         |   |                     |                  |
| Cardboard box            | Corrugated board box {RoW}   production   Alloc Rec, U  | Ecoinvent           | 2017             |
| <b>Transportation</b>    |   |                     |                  |
| Truck                    | Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}   market for   Alloc Rec, U   | Ecoinvent           | 2017             |
| Truck (disposal)         | Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}   market for   Alloc Rec, U   | Ecoinvent           | 2017             |
| Ship                     | Transport, freight, sea, transoceanic ship {GLO}   market for   Alloc Rec, U  | Ecoinvent           | 2017             |

**Data Quality**

| Data Quality Parameter   | Data Quality Discussion  |
|--|--|
| <b>Time-Related Coverage</b><br>Age of data and the minimum length of time over which data is 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 10 years old. All the primary data used represented an average of one year's worth of data collection. Manufacturer-supplied data are based on calendar year 2017.  |
| <b>Geographical Coverage</b><br>Geographical area from which data for unit processes is collected to satisfy the goal of the study   | The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily in the Republic of Korea and the United States, while downstream processes are primarily in the United States. Representative data used in the assessment are representative of US, Global, or "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes.   |
| <b>Technology Coverage</b><br>Specific technology or technology mix  | For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative datasets, specific to the type of material or as a proxy, are used to represent the actual processes where primary data were not available.  |
| <b>Precision</b><br>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. Manufacturer data, and representative data used for upstream processes were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.  |
| <b>Completeness</b><br>Percentage of flow that is measured or estimated  | The LCA model included all known mass and energy flows for production of luxury vinyl flooring. In some instances, surrogate datasets used to represent upstream processes may be missing some data which is propagated in the model. Missing data represent less than 5% of the mass or energy flows.   |
| <b>Representativeness</b><br>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.  |
| <b>Consistency</b><br>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 data where available. Different portions of the product life cycle are equally considered.   |
| <b>Reproducibility</b><br>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.   |
| <b>Sources of the Data</b><br>Description of all primary and secondary data sources  | Data representing energy use at the manufacturing facility represent an annual average and are considered of good 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. A mass and energy balance check were completed during the data collection period. For secondary LCI datasets, Ecoinvent, Overcash, and PlasticsEurope Eco-profiles databases are used, with a bias towards Ecoinvent data.  |
| <b>Uncertainty of the Information</b><br>Uncertainty related to data, models, and assumptions  | Uncertainty related to materials in the luxury vinyl flooring is low, while uncertainty related to the type of packaging materials used is relatively high. Primary data for upstream processes were not available; as such, the study relied upon use of existing representative datasets for these cases. These representative datasets contained relatively recent data (~10 years, or more recent), but in some instances lacked perfect geographical and technological representativeness. Uncertainty related to the impact assessment methods used in the study are relatively high since they lack characterization of thresholds or tipping points. |

### Allocation

For the raw material supply and all secondary datasets used for this LCA study, processes were modelled using the cut-off system model of Ecoinvent v3.4 database.

For the transport stage, impacts were allocated based on the mass of the material and distance transported to each facility.

This study follows the allocation guidelines of ISO-14044 and allocation rules specified in the PCR and sought to minimize the use of allocation wherever possible. For the manufacturing stage, mass allocation was deemed the most accurate and reproducible way of calculating resource use, emissions, and wastes. Primary data for resource use (e.g., electricity, natural gas, water, etc.), waste, and emissions released at the facility were allocated to the product on a mass-basis as a fraction of total annual production.

### Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact must be included in the inventory. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.



## ADDITIONAL ENVIRONMENTAL INFORMATION

**Additional Information About Raw Materials:** In 2015, RHC Family Companies (of which Flexco Corporation is a part) joined the Sustainable Purchasing Leadership Council (SPLC) and uses SPLC guidance in purchasing decisions. Flexco vinyl products are made using virgin raw materials. In solid homogeneous vinyl products, such as Delane Vinyl Tile and Vinyl Wall Base, Flexco uses bio-based plasticizers, made from soybean oil. Layered vinyl products, such as the luxury vinyl tiles described in this EPD, are made with non-phthalate plasticizers.



Recycled materials are not used in formulations for Flexco products, so that plasticizers, heavy metals from pigments, and other contaminants are not introduced to the Flexco products.



**Additional Information About Chemicals of Concern:** Flexco follows the Lowell Center Framework to remove chemicals of concern from all products. For 30 years, Flexco has been a leader in removing hazardous components from building materials including switching to a green pigment without heavy metals (traces of Lead, Hexavalent Chromium, Mercury, and Cadmium) in 2011. In 2015, Flexco joined the Health Product Declaration Collaborative, and is using HPD 2.1 to prioritize work on chemicals of concern and actively participating in HPDC work groups.

A balance between product quality, chemical risk, and cost is pursued in evaluating raw materials and the production process. Product quality includes durability, aesthetics, ease of maintenance and cleaning—all the aspects of the product that customers rely upon. Chemical risk includes hazard, exposure, and concentration of chemicals of concern. Members of the engineering, chemistry, technical & installation services, and sustainability groups are continuously searching out and evaluating new possible materials and processes.

**Corporate Environmental Sustainability Goals:** Corporate environmental sustainability goals for four key metrics have been set for the period 2016-2025. These metrics and their goals are provided below.

| Metric              | Goal          | Measured as:                                     |
|---------------------|---------------|--|
| Energy Intensity    | 20% reduction | kWh/pound of product                             |
| Greenhouse Gases    | 20% reduction | kg CO <sub>2</sub> -equivalents/pound of product |
| Waste to Landfill   | 25% reduction | Pounds waste/pound of product                    |
| Water Used/Consumed | 20% reduction | Gallons water/pound of product                   |

**Multi-Attribute Sustainability Assessment:** Flexco products are rated according to the NSF/ANSI 332 multi-attribute sustainability assessment. This standard reviews product characteristics including product design, product manufacturing, use of product, end of life, governance, and innovation. Flexco solid homogeneous vinyl products – tile and wall base - are rated at the Platinum level.





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