# ENVIRONMENTAL PRODUCT DECLARATION

## STYROFOAM™ BRAND PRODUCTS

DuPont™ Styrofoam™ Brand XPS Insulation products offer high, long-term thermal resistance, moisture resistance, and a wide variety of sizes and edge treatments for both residential and commercial applications.

The biggest sustainability problems can't be solved without big contributions from the building and construction industry. Solving these problems calls for sweeping transformation in today's building practices. As DuPont Performance Building Solutions, we're up to the challenge, and have charted a course to help make sustainability a reality in the building industry over the next decade. Inspired by the United Nations' Sustainable Development Goals (UN SDGs), and in support of the DuPont 2030 Sustainability Goals, we are committed to deliver solutions that help solve climate change, drive the circular economy, deliver safer solutions and help communities thrive.

Our Product Stewardship commitment drives us toward a vision that every product we bring to the market is safe for use across its life cycle, compliant, risk-managed, trusted, and contributing to a sustainable society. As part of this vision, we recognize the stakeholder need regarding product transparency beyond the Safety Data Sheet and are committed to providing transparency documents for products in our portfolio.

For additional details on our sustainability journey, please see: https://www.dupont.com/building/sustainability.html

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

# ENVIRONMENTAL PRODUCT DECLARATION

DUPONT™

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

**Styrofoam™ Brand XPS Products**

**According to ISO 14025, EN 15804, and ISO21930:2017**

| | |
|---|---|
| EPD Program and Program Operator Name, Address, Logo, and Website | UL Environment<br>333 Pfingsten Road Northbrook, IL 60611<br>https://www.ul.com/<br>https://spot.ul.com/ |
| General Program Instructions and Version Number | General Program Instructions v2.5 March 2020 |
| Manufacturer Name and Address | DuPont de Nemours, Inc.<br>974 Centre Road<br>Wilmington, DE 19805 |
| Declaration Number | 4789868895.101.2 |
| Declared Product & Functional Unit or Declared Unit | Extruded Polystyrene Foam Insulations<br>1 $m^2$ of insulation with a thickness that gives an average thermal resistance RSI = 1 $m^2K/W$ for a period of 75 years |
| Reference PCR and Version Number | Part A: LCA Calculation Rules and Report Requirements (UL, V3.2, 2018)<br>Part B: Building Envelope Thermal Insulation EPD Requirements (UL V2.0, 2018) |
| Description of Product Application/Use | Insulation is used in a variety of applications including roofs, ceilings, interior and exterior walls, floors, basements, exterior insulation finishing systems, and composite panels. |
| Product RSL Description (if Appl.) | 75 years |
| Markets of Applicability | North America |
| Date of Issue | July 1, 2021 |
| Date of Expiraiton | June 30, 2027 |
| EPD Type | Product Specific |
| Range of Dataset Variability | N/A |
| EPD Scope | Cradle-to-Grave |
| Year(s) of Reported Primary Data | 2019 |
| LCA Software & Version Number | GaBi v9.5.2.49 |
| LCI Database(s) & Version Number | GaBi Service Pack 40 |
| LCIA Methodology & Version Number | TRACI 2.1 and CML 2001-2016 |

| | |
|---|---|
| The PCR review was conducted by: | UL Environment<br>PCR Review Panel<br>epd@ulenvironment.com |
| This declaration was independently verified in accordance with ISO 14025: 2006.<br>☐ INTERNAL ☒ EXTERNAL | Wade Stout |
| This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: | Lindsay Corner<br>WAP Sustainability Consulting, LLC |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the referessnce PCR by: | Thomas P. Gloria, Industrial Ecology Consultants |

Limitations

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

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

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

# 1. Product Definition and Information

## 1.1. Description of Company/Organization

Grounded in science, DuPont™ Performance Building Solutions is working alongside those who also seek a sustainable tomorrow to help people thrive in home and buildings in their communities for years to come. By developing solutions for managing the air, water and thermal performance of buildings and residences, we help our customers build energy-efficient, resilient, and durable shelters in a rapidly changing world. Backed by unmatched industry insight, building knowledge, and technical support, as well as world-class brands such as Styrofoam™ Brand, Thermax™ Brand, Tyvek®, and Great Stuff™, our products and services portfolio enables customers to focus on what they do best, no matter where and how they choose to build.

The results presented in this Environmental Product Declaration are for products manufactured and planned to be manufactured at the locations listed below.

| BURLEY PLANT | JOLIET PLANT | DALTON PLANT | RIVERSIDE PLANT |
|---|---|---|---|
| Burley, ID 83318 | Channahon, IL 60410 | Dalton, GA 30721 | Pevely, MO 63070 |

## 1.2. Product Description

**Product Identification**

This EPD is for representative products derived from DuPont's line of Styrofoam™ Brand products produced at the facilities located in in the table above. The line of products under review include: Styrofoam™ Brand Ag Board, Styrofoam™ Brand Cavitymate™, Styrofoam™ Brand Cladmate™, Styrofoam™ Brand Deckmate™, Styrofoam™ Brand Duramate™, Styrofoam™ Brand Freezermate™, Styrofoam™ Brand Highload, Styrofoam™ Brand Panel Core, Styrofoam™ Brand Panelmate™, Styrofoam™ Brand Perimate™, Styrofoam™ Brand Plazamate™, Styrofoam™ Brand Recovermate, Styrofoam™ Brand Residential Sheathing, Styrofoam™ Brand Residing Board, Styrofoam™ Brand Roofmate™, Styrofoam™ Brand Scoreboard, Styrofoam™ Brand SM, Styrofoam™ Brand Square Edge, Styrofoam™ Brand Styrospan™, Styrofoam™ Brand Tongue and Groove, Styrofoam™ Brand Ultra, Styrofoam™ Brand UtilityFit™, Styrofoam™ Brand Wallmate™, and Styrofoam™ Brand Z-mate™.

DuPont's XPS insulation primarily consists of polystyrene foam and a blend of blowing agents. Additionally, some of the products under review are lined with films or facers that help prevent water and water vapor intrusion into the insulation foam, meaning less potential for mold and mildew in the building envelope. All of DuPont's XPS insulation products offer consistently high, long-term thermal resistance to reduce energy costs, are moisture resistant to increase resiliency, and are availablle in a variety of thicknesses and edge treatments to meet today's design demands.

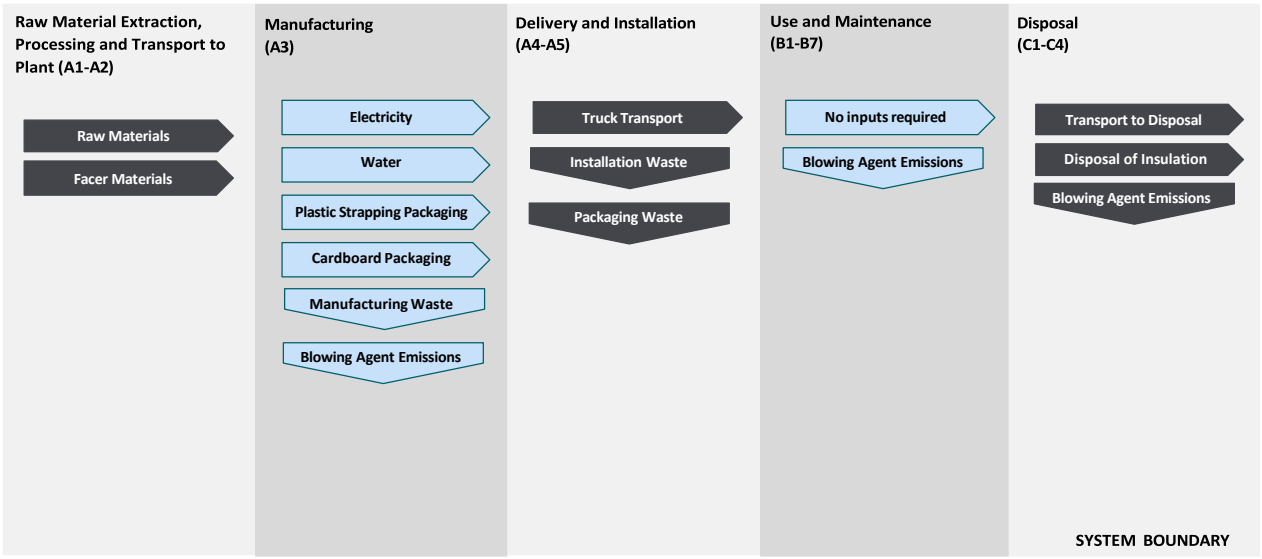
**Product Specification**

The UNSPSC code for this insulation product is 30141503 and the CSI code is 07 21 00.

**Product Average**

Results in this LCA are presented based on a representative product that is calculated based on the total materials purchased during 2019 and annual production data. The results in this study represent a weighted-average of the impacts from each product. The weighting is based on 2019 production volume of each product under review.

### Flow Diagram




## 1.3. Application

DuPont Styrofoam™ Brand insulation products are commonly used on all six sides of the building envelope, including roofs, exterior walls, below grade, basements, exterior insulation finishing systems (EIFS), and composite panels.

## 1.4. Declaration of Methodological Framework

This EPD is considered a Cradle-to-Grave study. The LCA for this study follows an attributional approach. Infrastructure flows have been excluded.

A summary of the life cycle stages included in this EPD is presented in Table 5. The reference service life is outlined in Table 8 and is only applicable if all manufacturing guidelines are followed regarding site-selection and installation, found online. No known flows are deliberately excldued from this EPD. Third party verified ISO 14040/44 secondary LCI datasetes contribute more than 67% of total impacts in all impacts categories required by the PCR.

## 1.5. Technical Requirements

Table 1 shows the technical specifications of various products under review, including any testing data as appropriate.

**Table 1: Technical Details**

| PARAMETER | TEST METHOD | VALUE | UNIT |
|---|---|---|---|
| Thermal Conductivity | ASTM C518 | 5.0-5.6 at 1 inch | R-value |
| Compressive Strength | ASTM D1621 | 15-25 | Psi, min |
| Water Absorption | ASTM C272 | 0.1 | % by volume, max. |
| Water Vapor Permeance | ASTM E96 | 1.5 | perm, max |
| Maximum Use Temperature | N/A | 165 | °F |
| Coefficient of Linear Thermal Expansion | ASTM D696 | 3.5 x 10-5 | in/in•°F |
| Flexural Strength | ASTM C203 | 50 | Psi, min. |
| Flame Spread | ASTM E84 | <25 | - |
| Smoke Development | ASTM E84 | <450 | - |

## 1.6. Properties of Declared Product as Delivered

DuPont Styrofoam™ Brand insulation products are delivered as stacked foam boards with cardboard belly banding and plastic shrink wrap protection. Styrofoam™ Brand insulation products typically measure 8 feet in length and 4 feet in width upon delivery with varying thicknesses as required, though other sizes are available.

## 1.7. Material Composition

Products included in the study consist of two major components, thermoplastic resin and a blowing agent. A flame retardant, colorant, and additives make up the remainder of the formula. Additionally, some products are faced with films or facers to help prevent water and water vapor intrusion into the insulation foam.

**Table 2: Material Composition**

| COMPONENT | COMPOSITION (%) |
|---|---|
| Polystyrene (Virgin) | 40%-60% |
| Polystyrene (Recycled) | 15%-25% |
| Blowing Agent | 9%-12% |
| Colorant | 0-3% |
| Flame Retardant and Other Additives | 0-3% |
| Film/Facer | 0-8% |

## 1.8. Manufacturing

The products under review are manufactured at the facilities described in section 1.1.

Styrofoam™ Brand products are manufactured in a continuous extrusion process with electricity as the main energy source. Polystyrene-acrylonitrile pellets are melted together with the additives in the extruder under high pressure. A blowing agent, which serves to expand the foam during the foaming process, is injected into the melted mass and dissolved into it. The melted mass is extruded through a flat die. The drop in pressure causes the polystyrene to foam, cool down and solidify. An endless board of homogenous closed-cell polystyrene foam is produced. This is cooled further and then cut to dimensions and trimmed, if necessary. A portion of the foam production trimmings and production waste is recycled directly back into the production facilities to manufacture extruded polystyrene foam. Thermoplastic resin can be recycled easily and economically by melting it.

Raw materials for the product were obtained from various parts of the United States.

## 1.9. Environment and Health During Manufacturing

During the manufacturing of the products covered in the EPD, all legal regulations regarding emissions to air, wastewater discharge, solid waste disposal and noise emissions are followed.

## 1.10. Packaging

Once the insulation is manufactured, it is packaged in plastic strapping and/or cardboard. The amount of packaging is detailed in Table 3.

**Table 3: Packaging Inputs, per kg of Product**

| INPUT | VALUES | UNIT |
|---|---|---|
| Cardboard Belly Band | 0.000846 | kg |
| Plastic Spiral Wrapping | 0.0127 | kg |
| Plastic Hooding Film | 0.000104 | kg |

## 1.11. Transportation

DuPont insulations are delivered to the customer via truck. The average distance from the manufacturing facilities to the construction site is 805 km.

## 1.12. Product Installation

Installation equipment is not required. Packaging and installation waste disposal have been modeled as per guidelines in section 2.8.5 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements.

## 1.13. Environment and Health During Installation

All recommended personal protective equipment (PPE) should be utilized during installation.

## 1.14. Use

As required in the PCR, the results are based on the estimated service life (ESL) of the building of 75 years. Since insulation typically lasts as long as the building itself, the RSL of the building is assumed to be 75 years. Hence, no replacements are necessary during the service life of the building.

## 1.15. Reference Service Life and Estimated Building Service Life

According to Part A of the PCR, the Estimated Service Life (ESL) of the building is assumed to be 75 years. Since insulation is expected to last as long as the building itself, the Reference Service Life (RSL) of insulation is taken to be 75 years.

## 1.16. Reuse, Recycling, and Energy Recovery

Styrofoam™ Brand insulation can be reused if the product is not damaged during disassembly. The insulation can also be recycled or incinerated for energy recovery if local facilities are available.

## 1.17. Disposal

All end-of-life product waste has been modeled according to the requirements laid out in Section 2.8.6 in Part A: Life Cycle Assessment Calculation rules and Report Requirements from UL Environment. Specifically, the product is modeled to be 100% landfilled at end-of-life.

# 2. Life Cycle Assessment Background Information

## 2.1. Functional or Declared Unit

The functional unit is 1 $m^2$ of insulation material with a thickness that gives an average thermal resistance $R_{SI}$ = 1 $m^2K/W$ for a period of 75 years. Table 4 shows additional details related to the functional unit.

**Table 4: Functional Unit – Average of Products Under Review**

| NAME | VALUE | UNIT |
|---|---|---|
| Functional Unit | 1 m2 of insulation material with a thickness that gives an average thermal resistance $R_{SI}$ = 1 $m^2K/W$ for a period of 75 years | |
| Mass | 0.744 | kg |
| Thickness to achieve Functional Unit | 0.0276 | m |

## 2.2. System Boundary

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle modules included in this EPD is presented in Table 5. Infrastructure flows have been excluded.

**Table 5: System Boundary**

| MODULE NAME | DESCRIPTION | ANALYSIS PERIOD | SUMMARY OF INCLUDED ELEMENTS |
|---|---|---|---|
| A1 | Product Stage: Raw Material Supply | 2019 | Raw Material sourcing and processing as defined by secondary data. |
| A2 | Product Stage: Transport | 2019 | Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and measured and calculated distance. |
| A3 | Product Stage: Manufacturing | 2019 | Energy and material inputs required for manufacturing products from raw materials. Packaging materials, blowing agent emissions, and manufacturing waste are included as well. |
| A4 | Construction Process Stage: Transport | 2019 | Shipping from manufacturing site to project site. Fuel use requirements estimated based on measured and calculated distance. |
| A5 | Construction Process Stage: Installation | 2019 | Installation waste and packaging material waste. |
| B1 | Use Stage: Use | 2019 | No inputs are required for the use of the product however, this stage includes additional blowing agent emissions. |
| B2 | Use Stage: Maintenance | 2019 | No inputs required for maintenance as minimal resources are used in the rare occasion that maintenance is necessary. |
| B3 | Use Stage: Repair | 2019 | No inputs required for repairs as minimal resources are used in the rare occasion that a repair is necessary. |
| B4 | Use Stage: Replacement | 2019 | No inputs required for replacement manufacturing as minimal resources are used in the rare occasion that a replacement is necessary. |
| B5 | Use Stage: Refurbishment | 2019 | DuPont insulation lasts as long as the building and generally, does not need refurbishment. |
| B6 | Operational Energy Use | 2019 | No Operational Energy Use of Building Integrated System During Product Use |
| B7 | Operational Water Use | 2019 | No Operational Water Use of Building Integrated System During Product Use |
| C1 | EOL: Deconstruction | 2019 | No inputs required for deconstruction. |
| C2 | EOL: Transport | 2019 | Shipping from project site to landfill, incineration, and recycling. Fuel use requirements estimated based on product weight and assumed distance recommended by the PCR (Part B). |
| C3 | EOL: Waste Processing | 2019 | Waste processing included for landfill. |
| C4 | EOL: Disposal | 2019 | Assumes all products are sent to landfill, per PCR Part A. This stage includes additional blowing agent emissions. |
| D | Benefits beyond system | MND | Module Not Declared |

## 2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. Some assumptions made in the study that may have affected the results are:

- The primary data was collected as annual totals including all utility usage and production information. For the LCA, the usage information was divided by the production mass to create energy, water, and waste consumption/generation per kg of product. Energy, water and waste inputs were weighted based on annual production at each facility.
- The disposal pathways and the corresponding transportation distances of unused product waste, packaging waste, and post-consumer product waste are assumed in accordance with the PCR.
- The use and selection of secondary datasets from GaBi – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between LCA practitioner, DuPont associates and GaBi data experts was valuable in determining best-case scenarios in the selection of data. However, no generic data can be a perfect fit. Improved supply chain specific data would improve the accuracy of results, however budgetary and time constraints have to be taken into account.

Although the PCR for these products does not specify assumptions that need to be made related to blowing agent emissions, which make a significant contribution to the GWP results, a worst-case scenario has been assumed such that all blowing agents incorporated into the products during the foaming process are released into the atmosphere across the product life cycle.

## 2.4. Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. No known flows are deliberately excluded from this EPD.

## 2.5. Data Sources

Primary data was collected by DuPont associates for onsite energy, water and waste during the course of manufacturing. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was used from GaBi Software Version 9.5 and database Service Pack 40. All calculation procedures adhere to ISO14044.

## 2.6. Data Quality

The geographical scope of the manufacturing portion of the life cycle is North America. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2019. Primary data provided by the manufacturer is specific to the technology that the company uses in manufacturing their product. It is site-specific and considered of good quality. Data used to allocate energy, water, and waste on a per unit of product produced includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality.

## 2.7. Period under Review

The period under review is calendar year 2019.

## 2.8. Allocation

General principles of allocation were based on ISO 14040/44.

To derive a per-unit value for the manufacturing inputs/outputs, mass allocation based on total production at each Styrofoam™ facility was adopted. For all Styrofoam™ plants, the total consumption during 2019 was divided by the total production mass during 2019 to derive a weighted-average use-per-production unit value. DuPont associates determined the best way to allocate inputs. This allocation methodology was used for the following inputs:

- Electricity
- Thermal Energy from Natural Gas
- Gasoline
- Propane
- Diesel Fuel
- DPO (Heat Transfer Fluid)
- Steam from Natural Gas
- Liquified Petroleum Gas
- Water
- Recycled Waste
- Waste for Energy Recovery
- Incinerated Hazardous Waste
- Incinerated Non-Hazardous Waste
- Landfilled Hazardous Waste
- Landfilled Non-Hazardous Waste

Discussions with DuPont staff divulged this was a more representative way to allocate the manufacturing inputs/outputs due to the fact that all products created at the facilities are similar in nature. As a default, secondary GaBi datasets use a physical mass basis for allocation.

## 2.9. Comparability and Benchmarking

The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the variability of the final results and make comparisons misleading. Without understanding the specific variability, the user is therefore, not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results. Comparison of the environmental performance of thermal insulation products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for thermal insulation products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

Any code approved XPS insulation sheathing will have comparable thermal insulating properties, which when installed in a building will result in significant energy and carbon savings [Mazor, 2011]. However, different XPS insulation sheathing products will have different embodied carbon (EC) values, as indicated by the GWP values provided in the product-specific EPD. If comparing different product-specific EPDs, care must be taken to look for inconsistencies in data sources and assumptions as noted above. Even EPDs that are based off of the same PCR can contain inconsistencies and differing assumptions based on the LCA practicioner's methodology choices.

Note for designers: To determine the net carbon benefit of using Styrofoam in your specific building project, first model the operational carbon (OC) savings with insulation relative to the uninsulated baseline over a 75 year lifetime. Then, multiply the total GWP (A1-C4) of Styrofoam provided in Table 11 in this EPD by the total volume of product used to insulate the building and subtract this number from the operational carbon savings. The carbon payback time of Styrofoam will be significantly less than the lifetime of the building.

## 3. Life Cycle Assessment Scenarios

**Table 6: Transport to the building site (A4)**

| NAME | VALUE | UNIT |
|---|---|---|
| Fuel type | Diesel | |
| Liters of fuel | 39.06 | l/100km |
| Vehicle type | Truck-trailer, Euro 0 - 6 mix, 34 - 40t gross weight / 27t payload capacity | |
| Transport distance | 805 | km |
| Capacity utilization (including empty runs, mass based) | 65 | % |
| Average weight of products transported (if gross density not reported) | 0.744 | kg |
| Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products) | 1 | - |

**Table 7: Installation into the building (A5)**

| NAME | VALUE | UNIT |
|---|---|---|
| Waste materials at the construction site before waste processing, generated by product installation | 0.02113 | kg |

**Table 8: Reference Service Life**

| NAME | VALUE |
|---|---|
| RSL | 75 years |
| Declared product properties (at the gate) and finishes, etc. | Not applicable (Insulation properties require installation into a building.) |
| Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes) | Install per instructions |
| An assumed quality of work, when installed in accordance with the manufacturer's instructions | Will meet R-value (Installer should install per manufacturer instructions) |
| Outdoor environment, (if relevant for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature | DuPont insulations can be exposed to the exterior during normal construction cycles. If exposed for extended periods of time, some mold and mildew may begin to grow. It is best if the product is covered within 180 days to minimize degradation. |
| Indoor environment, (if relevant for indoor applications), e.g. temperature, moisture, chemical exposure) | Typically, to comply with building codes, all foam plastics must be covered with a 15- minute thermal barrier unless specific industry recognized testing is completed for approved exception by building application per local building code. ½" thick gypsum board is a common covering. |
| Use conditions, e.g. frequency of use, mechanical exposure. | Not applicable (Insulation is a passive product which is not used directly during life) |
| Maintenance, e.g. required frequency, type and quality of replacement components | None needed (Insulation does not need maintenance during its use) |

**Table 9: End of life (C1-C4)**

| NAME | | VALUE | UNIT |
|---|---|---|---|
| Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation) | Although reuse and recycling of extruded polystyrene insulation at its end of life is possible, there are no formal programs for collection and transport. It is assumed that all product is sent to landfill at end of life. | | |
| Collection process | Collected with mixed construction waste | 0.681 | kg |
| Disposal to Landfill | Product or material for final deposition | 0.681 | kg |
| Removals of biogenic carbon (excluding packaging) | | 0 | kg $CO_2$ |

Tables for modules B2-B7 are not provided as they are not applicable to this product, as shown in Table 5.

## 4. Life Cycle Assessment Results

**Table 10: Description of the system boundary modules**

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

### 4.1. Life Cycle Impact Assessment Results

All results are given per functional unit, which is 1 $m^2$ of insulation material with a thickness that gives an average thermal resistance RSI = 1 $m^2K/W$ over 75 years.

**Table 11: North American Impact Assessment Results**

| TRACI v2.1 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP 100 [kg $CO_2$ eq] | 3.51E+00 | 6.95E-02 | 5.50E-02 | 1.16E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.58E-03 | 0.00E+00 | 1.44E+00 |
| ODP [kg CFC-11 eq] | 4.05E-09 | 8.88E-18 | 4.05E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.69E-19 | 0.00E+00 | 1.08E-16 |
| AP [kg $SO_2$ eq] | 5.27E-03 | 1.15E-04 | 6.19E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.26E-05 | 0.00E+00 | 1.47E-04 |
| EP [kg N eq] | 4.85E-04 | 1.81E-05 | 7.06E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.98E-06 | 0.00E+00 | 8.26E-06 |
| POCP [kg $O_3$ eq] | 1.07E-01 | 2.53E-03 | 1.17E-03 | 1.61E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.76E-04 | 0.00E+00 | 2.78E-03 |
| Resources [MJ] | 8.26E+00 | 1.31E-01 | 8.57E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.43E-02 | 0.00E+00 | 6.56E-02 |

**Table 12: EU Impact Assessment Results**

| CML v4.2 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP 100 [kg $CO_2$ eq] | 3.51E+00 | 6.94E-02 | 5.50E-02 | 1.16E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.58E-03 | 0.00E+00 | 1.44E+00 |
| ODP [kg CFC-11 eq] | 7.00E-09 | 8.88E-18 | 7.00E-11 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.69E-19 | 0.00E+00 | 1.08E-16 |
| AP [kg $SO_2$ eq] | 4.49E-03 | 8.81E-05 | 4.91E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 9.61E-06 | 0.00E+00 | 1.34E-04 |
| EP [kg $PO_4^{-3}$ eq] | 6.99E-04 | 2.40E-05 | 9.46E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.61E-06 | 0.00E+00 | 1.67E-05 |
| POCP [kg ethene eq] | 5.17E-04 | -2.15E-05 | 6.78E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | -2.35E-06 | 0.00E+00 | 1.18E-06 |
| $ADP_{element}$ [kg Sb-eq] | 3.04E-05 | 1.18E-08 | 3.05E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.29E-09 | 0.00E+00 | 6.75E-09 |
| $ADP_{fossil}$ [MJ, LHV] | 6.12E+01 | 9.79E-01 | 6.36E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.07E-01 | 0.00E+00 | 5.06E-01 |

## 4.2. Life Cycle Inventory Results

All results are given per functional unit, which is 1 $m^2$ of insulation material with a thickness that gives an average thermal resistance RSI = 1 $m^2K/W$ over 75 years.

**Table 13: Resource Use**

| Parameter | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $RPR_E$ [MJ, LHV] | 1.81E+00 | 4.15E-02 | 1.95E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.53E-03 | 0.00E+00 | 4.18E-02 |
| $RPR_M$ [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| $RPR_T$ [MJ, LHV] | 1.81E+00 | 4.15E-02 | 1.95E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.53E-03 | 0.00E+00 | 4.18E-02 |
| $NRPR_E$ [MJ, LHV] | 3.17E+01 | 9.84E-01 | 3.42E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.07E-01 | 0.00E+00 | 5.17E-01 |
| $NRPR_M$ [MJ, LHV] | 3.14E+01 | 0.00E+00 | 3.14E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| $NRPR_T$ [MJ, LHV] | 6.32E+01 | 9.84E-01 | 6.56E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.07E-01 | 0.00E+00 | 5.17E-01 |
| SM [kg] | 3.21E-01 | 0.00E+00 | 3.21E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ, LHV] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [$m^3$] | 1.21E-02 | 1.85E-04 | 1.33E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.02E-05 | 0.00E+00 | 7.34E-05 |

**Table 14: Output Flows and Waste Categories**

| Parameter | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD [kg] | 2.03E-05 | 1.68E-08 | 2.03E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.84E-09 | 0.00E+00 | 3.46E-09 |
| NHWD [kg] | 1.74E-02 | 7.05E-05 | 1.51E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 7.70E-06 | 0.00E+00 | 7.74E-01 |
| HLRW [kg] | 8.56E-07 | 2.68E-09 | 8.73E-09 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.92E-10 | 0.00E+00 | 5.10E-09 |
| ILLRW [kg] | 7.15E-04 | 2.22E-06 | 7.30E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.42E-07 | 0.00E+00 | 4.37E-06 |
| CRU [kg] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR [kg] | 3.01E-02 | 0.00E+00 | 2.28E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER [kg] | 2.40E-05 | 0.00E+00 | 1.72E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EEE [MJ] | 9.52E-05 | 0.00E+00 | 9.05E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EET [MJ] | 2.07E-05 | 0.00E+00 | 3.62E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Table 15: Carbon Emissions and Removals**

| Parameter | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCRP [kg CO2] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEP [kg CO2] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCRK [kg CO2] | 1.07E-03 | 0.00E+00 | -7.88E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEK [kg CO2] | 0.00E+00 | 0.00E+00 | 2.66E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEW [kg CO2] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCE [kg CO2] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCR [kg CO2] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CWNR [kg CO2] | 2.23E-04 | 0.00E+00 | 2.23E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

## 5. LCA Interpretation

Overall for DuPont's Styrofoam™ Brand products, Global Warming (GWP) and Abiotic Depletion of fossil fuels are the impact categories of most significance. The largest contributor to the Abiotic Depletion of fossil fuels impacts in A1-A3 is the extraction and use of polymer resin material (96%) during manufacturing. Transport to customer (A4) has the second largest ADP – Fossils impact, mainly due to the transportation via truck to customer. Installation (A5) and end-of-life module (C4) have lesser overall ADP-fossil impacts, which is a result of the materials used for installation and resources used to landfill the product at end-of-life, respectively.

For GWP, the impacts are almost equally distributed across the raw material sourcing and manufacturing process (A1-A3), use phase (B1), and end of life disposal (C4), with the largest contributions resulting from the blowing agent emissions in these stages.

The exact product SKU purchased can affect the final results of the LCA due to the functional unit being highly dependent on the R-value of the product sold. If product-specific results are required beyond what is available in this EPD, please contact a DuPont representative.

## 6. Additional Environmental Information

### 6.1. Extraordinary Effects

No extraordinary effects are expected during fire, water, or mechanical destruction events. More information on test results can be found in Section 1.5.

## 7. References

1. BS EN 15804:2012, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
2. ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
3. ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
4. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
5. ISO 14044: 2006/ Amd 1:2017 Environmental Management – Life cycle assessment – Requirements and Guidelines – Amendment 1.
6. Life Cycle Assessment, LCA Report for DuPont Styrofoam™. WAP Sustainability Consulting. May 2021.
7. Mazor et al.; Life Cycle Greenhouse Gas Emissions Reduction From Rigid Thermal Insulation Use in Buildings. J Ind Eco 2011, 15(2), 284-299.
8. Part B: Building Envelope Thermal Insulation EPD Requirements (UL Environment V2.0, 2018
9. Product Category Rule (PCR) for Building-Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL 10010. Version 3.2, December 12, 2018.
10. UL General Program Rules v.2.5 March 2020

Upon written request to DuPont, additional explanatory material can be provided to facilitate understanding of the data contained in this declaration.