ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2024-020-0116-01

Theatre Black f

certainteed
SAINT-GOBAIN

SMART EPD
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION

Date of Issue:
May 13, 2024

Expiration:
May 13, 2029

Last updated:
May 13, 2024

General Information

CertainTeed Saint-Gobain

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Product Name:	Theatre Black f
Functional Unit:	0.093 m2 of installed product
Declaration Number:	SmartEPD-2024-020-0116-01
Date of Issue:	May 13, 2024
Expiration:	May 13, 2029
Last updated:	May 13, 2024
EPD Scope:	Cradle to gate with other options A1 - A3, A4, A5, C1 - C4
Market(s) of Applicability:	North America

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017
Core PCR:	UL Part A v4, UL PCR for Building-Related Products and Services Part A v.4, ISO 21930:2017 Date of issue: March 01, 2022
Sub-category PCR:	UL Part B: Non-Metal Ceiling and Interior Wall Panels v.2 Date of issue: April 13, 2021 Valid until: April 13, 2026
Sub-category PCR review panel:	Contact Smart EPD for more information.
General Program Instructions:	Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

LCA Author/Creator:	Saint-Gobain North American ESG Sustainability Group | sustainability@saint-gobain.com
EPD Program Operator:	Smart EPD | info@smartepd.com | www.smartepd.com | 585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA

Verification:

Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071 : External

Tom Etheridge | EarthShift Global | Thomas@earthshiftglobal.com

Independent external verification of EPD, according to ISO 14025 and reference PCR(s) : External

Tom Etheridge | EarthShift Global | Thomas@earthshiftglobal.com

Limitations, Liability, and Ownership

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of 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 whole building life cycle. EPD comparability is only possible 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. The EPD owner has sole ownership, liability, and responsibility for the EPD.

Organization Information

CertainTeed Corporation, a subsidiary of Saint-Gobain, is a leading North American manufacturer of interior building materials including gypsum, ceilings, and insulation as well as exterior building materials which include roofing, vinyl siding, trim, and water protection.

Further information can be found at: https://www.certainteed.com/

Product Description

Theatre Black f is a specialized ceiling panel manufactured by CertainTeed, designed to meet the unique acoustic and aesthetic requirements of theatre applications. The product is produced at the CertainTeed facility in Plymouth, WI, using a proprietary mixture that is sized in various thicknesses, with the density of the product being 43.25 kg/m^3. The reference flow for this product is 1 kg, with 5/8 inches and 1 inch thicknesses available. Notably, the material composition remains consistent across all thicknesses. This EPD represents both sizes of the Theatre Black f.

The modular installation of suspended ceiling panels in commercial buildings is the intended application of this product. The product meets various ASTM standards. The sizes available are 2'x2' and 2'x4', with thickness options of 5/8" and 1". The edges of the panels are square finished, and the surface is laminated matte finished, with the color being black. Optional panel backing is available, which consists of foil. The core composition of the panel is fiberglass, with a recycled content of 33%, which includes 0% pre-consumer and 33% post-consumer materials.

Further information can be found at: https://www.certainteed.com/products/ceiling-wall-systems-products/theatre-black-f

Product Information

Functional Unit:	0.093 m2 of installed product
Mass:	0.083 kg
Reference Service Life:	30 Years
Product Specificity:	✗ Product Average
	✓ Product Specific

Averaging:

An average was not computed for this Environmental Product Declaration (EPD). However, to account for the results of differing thicknesses in this EPD, the mass of the two thicknesses was averaged. The mass of the product family ranges from 0.064 to 0.102 kilograms per functional unit across the two thicknesses.

Plants

CertainTeed Architectural Solutions
1415 Pilgrim Rd, Plymouth, WI, USA

Product Specifications

Product Classification Codes:	EC3 - Finishes -> CeilingPanel -> AcousticalCeilings
Sound absorption coefficient (NRC) (ASTM C423):	0.90 %
Light reflectance (ASTM E1477):	0.03 %
Interzone Attenuation of Open Office Components (AC):	190
Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum (CAC)(ASTM E1414 and Classification E413):	25 dB
Declared thickness:	2.06 cm
Surface weight per declared unit:	0.89 kg/m2
Density per declared unit:	43.25 kg/m3

Material Composition

Material/Component Category	Origin	% Mass
Theatre Black f Laminate	None	10-13
Adhesive	None	7-9
Fiberglass	None	77-80

Packaging Material	Origin	kg Mass
Shrink Wrap	None	1.10E-03
Cardboard Sleeve	None	3.34E-03
Label	None	3.87E-05
Wood Pallets	None	3.15E-04

Hazardous Materials
No regulated hazardous or dangerous substances are included in this product

EPD Data Specificity

Primary Data Year: 2022

Manufacturing Specificity:

- ✗ Industry Average
- ✗ Manufacturer Average
- ✓ Facility Specific

Software and LCI Data Sources

LCA Software: GaBi v. 10.0

LCI Foreground Database(s): GaBi Professional Database v. 2022

LCI Background Database(s): Ecoinvent v. 3.9.1 | GaBi Extension database XVIII: NREL USLCI Integrated v. 2022 | GaBi Extension database VII: Plastics v. 2022

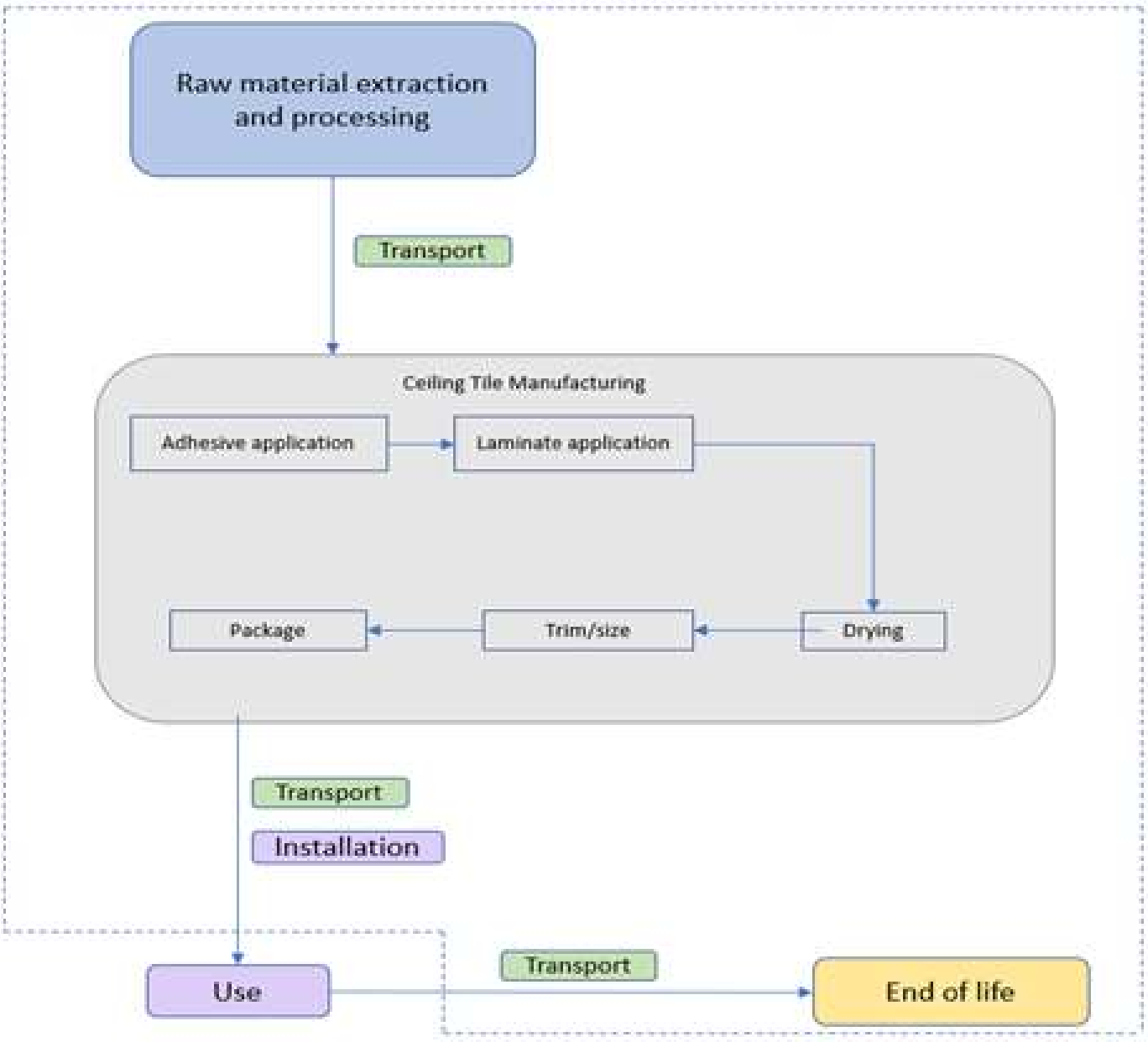
Renewable Electricity

Renewable electricity is used: No

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	✓
	A5	Assembly / Install	✓
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	✓
	C2	Transport	✓
	C3	Waste Processing	✓
	C4	Disposal	✓
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Product Flow Diagram



Life Cycle Module Descriptions

This EPD study is characterized as a “cradle-to-gate with options” study, examining the Theatre Black f ceiling panels product line. The production stage encompasses a range of processes, including the extraction and processing of raw materials, the processing of secondary materials, the transportation of raw materials to the manufacturing site, manufacturing and processing, the consumption of materials, energy, and water, the waste and loss rate during the installation of the product in the building, and the disposal of the product at the end of its life. The final stage of the product's life cycle involves deconstruction, transportation to waste processing, waste processing, and disposal. Each of these stages is closely monitored and optimized to ensure maximum efficiency and sustainability.

Raw Material Transportation (Module A2)
Raw materials are transported to the manufacturing sites by standard freight truck, train, or ocean freighters. Unless otherwise noted, transport vehicles are fueled with diesel fuel.

Manufacturing Process Overview (Module A3)
A detailed analysis of the ceiling tile manufacturing process was completed by the Saint-Gobain North American Environmental, Social and Governance (ESG) department to observe and understand the manufacturing processes for theatre black f. A process flow diagram is attached above and illustrates all process steps, inputs, and outputs including material, energy, emissions, and wastes. At the Plymouth facility, the fiberglass is received, glue is applied for the laminate to adhere to the board. The panels are then cut to size, packaged and shipped.

Packaging (Module A3)
Packaging of the final product after production is included in the life cycle assessment. The product is stacked in cardboard sleeves, wrapped in shrink wrap, and paper labels affixed. The packages of product in cardboard sleeves are then stacked on a pallet with other finished product and wrapped in shrink wrap again before final shipping. The purchased amount of packaging material was provided by the Plymouth facility personnel and the weight of each material per square foot of finished product was calculated.

Product Distribution (Module A4)
Final products are transported on trucks throughout the United States and Canada. This study assumed an average of 800 km for the final shipment of product based on the assumption within the Product Category Rule (PCR).
Use (Modules B1-B7)
The use phase is excluded from the study. The associated results tables will be excluded from the Scenarios Section. Installation (Module A5) Installation of CertainTeed products is accomplished by manual labor and typically does not require any additional materials. If necessary, cutting is done by hand using hand held cutting tools.

End of Life (Module C1-C4)
The end-of-life phase for the ceiling and wall panels was included in the study. End-of-life impacts include landfill disposal of ceiling/ wall panels, scrap, and packaging at the end of installation.

LCA Discussion

Allocation Procedure

Allocation was conducted based on the production mass data provided by the facility as a percentage of the overall production mass at the Plymouth facility.

Cut-off Procedure

Processes whose total contribution to the final result, with respect to their mass and in relation to all considered impact categories, is less than 1% can be neglected. The sum of the neglected processes may not exceed 5% by mass of the considered impact categories. For that a documented assumption is admissible. For Hazardous Substances – as defined by the U.S. Occupational Health and Safety Act the following requirements apply:

- The Life Cycle Inventory (LCI) of hazardous substances will be included, if the inventory is available.
- If the LCI for a hazardous substance is not available, the substance will appear as an input in the LCI of the product, if its mass represents more than 0.1% of the product composition.
- If the LCI of a hazardous substance is approximated by modeling another substance, documentation will be provided. This EPD is in compliance with the cut-off criteria. No known flows were deliberately excluded. Capital items for the production processes (machines, buildings, etc.) were not taken into consideration.

Data Quality Discussion

Wherever secondary data is used, the study adopts critically reviewed data for consistency, precision, and reproducibility to limit uncertainty. Since the inventory flows for the utilized databases are very often accompanied by a series of data quality ratings, a general indication of precision can be inferred. Using these ratings, the data sets used generally have medium-to-high precision. The Saint-Gobain North American ESG Department collected specific data on energy and material inputs, wastes, water use, emissions, and transportation impacts for the Plymouth, WI manufacturing plant.

Results

Environmental Impact Assessment Results

IPCC AR5 GWP 100, TRACI 2.1
per 0.093 m2 of installed product.
LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Theatre Black f - 1" Thickness

Impact Category	Method	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
GWP-total	IPCC AR5 GWP 100	kg CO2 eq	0.367	0.00746	0.011	ND	0.000326	ND	0.0204
ODP	TRACI 2.1	kg CFC 11 eq	2.11e-8	2.86e-13	3.58e-13	ND	1.25e-14	ND	1.26e-14
AP	TRACI 2.1	kg SO2 eq	0.00206	0.0000455	0.0000755	ND	0.00000199	ND	0.000225
EP	TRACI 2.1	kg N eq	0.000116	0.00000252	0.00000978	ND	1.1e-7	ND	0.0000796
POCP	TRACI 2.1	kg O3 eq	0.000278	0.00000116	0.00000172	ND	5.06e-8	ND	0.00000326
ADP-fossil	TRACI 2.1	MJ	0.543	0.0134	0.0171	ND	0.000586	ND	0.00489
GWP-total	TRACI 2.1	kg CO2 eq	0.376	0.00757	0.0123	ND	0.000331	ND	0.0342
ND	IPCC AR5 GWP 100	ND	ND	ND	ND	ND	ND	ND	ND

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

This section presents an exposition of the environmental impact potentials for the Theatre Black Ceiling Panel Product families that have a thickness of 1 inch and are manufactured at the Plymouth facility. The results are delineated for different stages of the product's lifecycle, including raw material sourcing (A1), transportation of raw materials (A2), manufacturing (including packaging) (A3), shipping of the final product (A4), installation (A5), and end-of-life (C2 and C4). It is important to highlight that stages C1 and C3 of the end-of-life process are presumed to carry no burden, resulting in a presentation of 0 for these stages.

The data in the table represents the environmental impact per 0.093m2 (1ft2) of installed ceiling panel, with an estimated service life of 30 years. The results are indicative of the overall impact potentials of the Theatre Black Ceiling Panel Product families at the Plymouth facility

per 0.093 m2 of installed product.

Theatre Black f - 5/8" Thickness

Impact Category	Method	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
GWP-total	IPCC AR5 GWP 100	kg CO2 eq	0.229	0.00466	0.0069	ND	0.0128	ND	0.000204
ODP	TRACI 2.1	kg CFC 11 eq	1.32e-8	1.79e-13	2.24e-13	ND	7.83e-15	ND	7.9e-15
AP	TRACI 2.1	kg SO2 eq	0.00129	0.00000157	0.00000611	ND	6.89e-8	ND	0.0000497
EP	TRACI 2.1	kg N eq	0.0000727	0.00000157	0.00000611	ND	6.89e-8	ND	0.0000497
POCP	TRACI 2.1	kg O3 eq	0.000173	7.23e-7	0.00000107	ND	3.16e-8	ND	0.00000204
ADP-fossil	TRACI 2.1	MJ	0.339	0.00837	0.0107	ND	0.000366	ND	0.00305
GWP-fossil	TRACI 2.1	kg CO2 eq	0.235	0.00473	0.00768	ND	0.000207	ND	0.0214

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

This section presents an exposition of the environmental impact potentials for the Theatre Black Ceiling Panel Product families that have a thickness of 5/8 inches and are manufactured at the Plymouth facility. The results are delineated for different stages of the product's lifecycle, including raw material sourcing (A1), transportation of raw materials (A2), manufacturing (including packaging) (A3), shipping of the final product (A4), installation (A5), and end-of-life (C2 and C4). It is noteworthy that the end-of-life stages C1 and C3 are assumed to be burden-free, and hence the results will be presented as 0.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicators

per 0.093 m2 of installed product.

Theatre Black f - 1" Thickness

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
RPRE	MJ, net calorific value	0.508	ND	0.000347	ND	ND	ND	0.004
RPRM	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
RPRT	MJ, net calorific value	0.508	ND	0.000347	ND	ND	ND	0.004
NRPRE	MJ, net calorific value	6.11	0.0974	0.125	ND	0.00426	ND	0.0342
NRPRM	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
NRPRT	MJ, net calorific value	6.11	0.0974	0.125	ND	0.00426	ND	0.0342
SM	kg	ND	ND	ND	ND	ND	ND	ND
RSF	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
NRSF	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
RE	MJ	ND	ND	ND	ND	ND	ND	ND
FW	m3	0.000766	ND	0.00000156	ND	ND	ND	0.00000923

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

per 0.093 m2 of installed product.

Theatre Black f - 5/8" Thickness

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
RPRE	MJ, net calorific value	0.318	ND	0.000217	ND	ND	ND	0.0025
RPRM	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
RPRT	MJ, net calorific value	0.318	ND	0.000217	ND	ND	ND	0.0025
NRPRE	MJ, net calorific value	3.82	0.0609	0.078	ND	0.00266	ND	0.0214
NRPRM	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
NRPRT	MJ, net calorific value	3.82	0.0609	0.078	ND	0.00266	ND	0.0214
SM	kg	ND	ND	ND	ND	ND	ND	ND
RSF	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
NRSF	MJ, net calorific value	ND	ND	ND	ND	ND	ND	ND
RE	MJ	ND	ND	ND	ND	ND	ND	ND
FW	m3	0.000766	ND	0.00000156	ND	ND	ND	0.00000923

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

per 0.093 m2 of installed product.

Theatre Black f - 1" Thickness

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
HWD	kg	5.39e-8	ND	7.57e-14	ND	ND	ND	8.52e-13
NHWD	kg	0.00913	ND	0.0074	ND	ND	ND	0.0887
RWD	kg	0.000269	ND	3.62e-8	ND	ND	ND	3.78e-7
HLRW	kg	4.39e-7	ND	4.08e-11	ND	ND	ND	4.23e-10
ILLRW	kg	0.000268	ND	3.62e-8	ND	ND	ND	3.78e-7
MER	kg	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	ND	ND	ND	ND	ND	ND	ND
EET	MJ	ND	ND	ND	ND	ND	ND	ND

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

per 0.093 m2 of installed product.

Theatre Black f -5/8'' Thickness

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
HWD	kg	3.37e-8	ND	4.73e-14	ND	ND	ND	5.32e-13
NHWD	kg	0.00571	ND	0.00463	ND	ND	ND	0.0554
RWD	kg	0.000168	ND	2.26e-8	ND	ND	ND	2.36e-7
HLRW	kg	2.74e-7	ND	2.55e-11	ND	ND	ND	2.64e-10
HLRW	kg	0.000168	ND	2.26e-8	ND	ND	ND	2.36e-7
MER	kg	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	ND	ND	ND	ND	ND	ND	ND
EET	MJ	ND	ND	ND	ND	ND	ND	ND

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Carbon Emissions and Removals

per 0.093 m2 of installed product.

Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
BCRP	kg CO2	ND	ND	ND	ND	ND	ND	ND
BCEP	kg CO2	ND	ND	ND	ND	ND	ND	ND
BCRK	kg CO2	ND	ND	ND	ND	ND	ND	ND
BCEK	kg CO2	ND	ND	ND	ND	ND	ND	ND
BCEW	kg CO2	ND	ND	ND	ND	ND	ND	ND
CCE	kg CO2	ND	ND	ND	ND	ND	ND	ND
CCR	kg CO2	ND	ND	ND	ND	ND	ND	ND
CWNR	kg CO2	ND	ND	ND	ND	ND	ND	ND

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

Impact Scaling Factors

Product Name and/or Product Attribute	Product Specific Functional/Declared Unit Multiplier

Scenarios

Transport to the building/construction site (A4)

A4 Module

Fuel Type:	Diesel
Liters of Fuel:	30 l/100km
Vehicle Type:	Standard Freight Trailer
Transport Distance:	800 km
Capacity Utilization:	85 %
Packaging Mass:	0.00389 kg
Gross density of products transported:	43.25 kg/m3
Weight of products transported:	0.083 kg
Assumptions for scenario development:	Final products are transported on trucks throughout the United States. This study assumed an average of 800 km for the final shipment of product based on the assumption within the PCR.

Installation in to the building/construction site (A5)

A5 Module

Installation Scrap Rate Assumed:	7 %
Product Lost per Functional Unit:	0.00749 kg
Waste Materials at the Construction Site Before Waste Processing:	0.00967 kg
Mass of Packaging Waste Specified by Type:	0.00389 kg
Assumptions for scenario development:	The installation of ceiling panels involves the utilization of a suspended grid system that secures them in place. It is important to note that this study exclusively covers the ceiling panels themselves and not the grid system. The process of installing the ceiling panels requires a manual approach that entails maneuvering and tilting the panels above the ceiling grid and carefully resting them on it. To prepare the panels for border installation, they are cut to size beforehand using a handheld cutting tool. This study has taken into account a 7% scrap rate from the installation of the product, as mandated by the PCR. Additionally, the disposal of packaging materials is factored into the installation phase.

End of Life

C1 - C4 Modules

Recovery

Landfill:	0.0055 kg

Disposal

Product or Material for Final Disposal:	0.083 kg

Assumptions for scenario development:

This study is based on the assumption that the product service life of Versatone ceiling panels is 30 years. The selected service life used in this project is based on the expert opinion of the product manufacturer and the building service life indicated in the PCR. Additionally, the deconstruction module, module C1, is also assumed to be manually completed. As such, this study assumes that the deconstruction module is burden-free. The end-of-life of the product is considered inert in a landfill. At present, there are no recycling scenarios for Versatone ceiling panels at the end of their service life. Therefore, the waste processing module (C3) of the end-of-life stage is also assumed to be burden-free. It is worth noting that there is currently no industry consensus for end-of-life scenarios, as per the PCR guidance. Given the lack of such consensus, this study assumes that the most likely scenario involves landfill disposal at the end of the product's life.

Interpretation

The data pertaining to the operation of the Plymouth, WI facility, along with the transportation distances and modes, were directly obtained from CertainTeed Corporation. The data were meticulously scrutinized for internal consistency, and cross-verified with plant personnel. The researchers recommend sub-metering of energy use for each critical stage in the manufacturing process to allow for a more detailed analysis. It is important to note that the findings of this research are limited by the inherent uncertainty of creating a representative model through Life Cycle Assessment (LCA). The modeling of the product system involved numerous assumptions, including representative processes and datasets. While quality control measures were implemented at each step of building the Life Cycle Inventory (LCI) and conducting the Life Cycle Impact Assessment (LCIA), the results are inevitably subject to uncertainty since the data represents only one year of manufacturing information from Plymouth, WI. A detailed evaluation of more time periods would serve to reduce this uncertainty. The outcomes of the life cycle assessment reveal that the life cycle impacts are predominantly influenced by the raw materials and the manufacturing processes. Enhancing energy efficiency is a viable approach to curtail the overall environmental impacts associated with the two categories of products. In addition, the incorporation of more recycled content in the product is recommended to mitigate the environmental impacts of the raw materials phase in the life cycle of the ceiling panels. As the recycled content increases, the raw materials driving the impacts will decrease, thereby improving the overall environmental impacts. Fiberglass, being the largest contributor to the raw material impacts for the ceiling product lines, was found to be responsible for over 80% of the environmental impact potentials in several categories. The substitution of virgin fiberglass with recycled content will significantly reduce the usage of these materials and their impacts on the environment.

Additional Environmental Information

- Environment and Health During Manufacturing

CertainTeed has well-established Environmental, Health, and Safety (EHS) and product stewardship programs which help to enforce proper evaluation and monitoring of chemicals that are chosen to manufacture products. These programs ensure that all environmental and OSHA requirements are met or exceeded to ensure the health and safety of all employees and contractors.

- Environment and Health During Installation

All recommendations should be utilized as indicated by Safety Data Sheets and installation guidelines. This information can be downloaded at: https://www.certain-teed.com/

- Fire: ASTM E1264 Class A ASTM E84:

- Flame Spread of 25 or less / smoke developed of 50 or less

- Water: This product is subject to water damage. No water or water vapor from sources including, but not limited to, condensation, leaking pipes and/or ducts, or live steam should come in contact with the ceiling panels.

- Mechanical Destruction: This product is intended for commercial applications. Use and practice information can be found in “Acoustical Ceilings: Use and Practice” published by Ceilings & Interior Systems Construction Association (CISCA). This product should be installed in accordance with Certainteed installation instruction.

- Delayed Emissions: No delayed emissions are expected from this product.

Modified Impact Results: Renewable Electricity

per 0.093 m2 of installed product.

Impact Category	Indicator	Unit	A1A2A3	A4	A5	C1	C2	C3	C4
GWP-total	ND	kg CO2 eq	0.366	0.00746	0.011	ND	0.0204	ND	0.000326
ODP	ND	kg CFC 11 eq	2.11e-8	2.86e-13	3.58e-13	ND	1.25e-14	ND	0.0342
AP	ND	kg SO2 eq	0.00203	0.0000455	0.0000755	ND	0.00000199	ND	0.000225
EP	ND	kg N eq	0.00011	0.00000252	0.00000978	ND	1.1e-7	ND	0.0000796
POCP	ND	kg O3 eq	0.000277	0.00000116	0.00000172	ND	5.06e-8	ND	0.00000326
ADP-fossil	ND	MJ	0.485	0.0134	0.0171	ND	0.000586	ND	0.00489
GWP-total	ND	kg CO2 eq	0.348	0.00757	0.0123	ND	0.000331	ND	0.0342

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Saint-Gobain is committed to achieving Carbon Neutrality by 2050. In January 2021, Saint-Gobain North America started receiving renewable energy certificates (RECs) from a 12-year virtual power purchase agreement (vPPA) with the Blooming Grove Wind Farm in McLean County, Illinois. Each year within the agreement, the company receives and retires these RECs, effectively reduced approximately 35.2% of CO2 emissions from electricity usage in 2022 and 2023 in the United States and Canada. Updated results reflecting the RECs in the electricity input in manufacturing (A3) are shown below.

References

• Product Category Rules for Building-Related Product and Services: Part A – Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. 2018. UL Environment.
• Product Category Rule Guidance for Building-Related Products and Services Part B: Non-Metal Ceiling and Interior Wall Panel EPD Requirements, Version 2.0 2021. UL Environment.
•ISO 1400/14044. (2006). ISO 14044:2006/Amd 1:2017/Amd 2:2020 – Environmental Management - Life cycle assessment – Requirement and guidelines.
•ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
•Sphera LCA FE Databases. https://gabi..com/america/
•US LCI Database. https://www.nrel.gov/lci/
•Ecoinvent v3.9 Database. http://ecoinvent.org/
•CertainTeed Ceiling and Walls Website. https://www.certainteed.com/products/ceiling-wall-systems