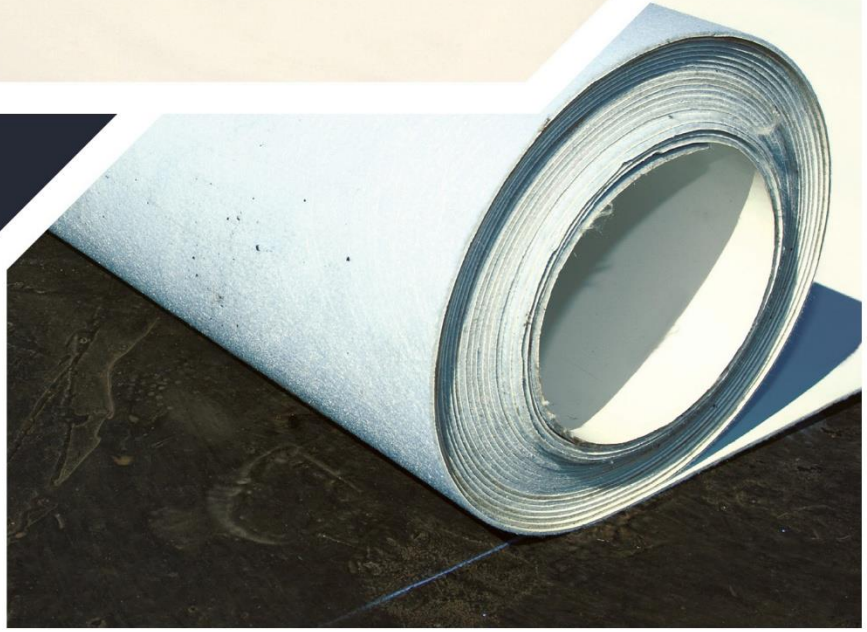
ELEVATE™

ENVIRONMENTAL PRODUCT DECLARATION

FLEECEBACK THERMOPLASTIC POLYOLEFIN [TPO] MEMBRANE



AMRIZE

GENERAL INFORMATION

This cradle-to-gate with options Environmental Product Declaration covers a TPO Single Ply Roofing Membrane product produced at the Muscle Shoals Plant. The Life Cycle Assessment (LCA) was prepared in conformity with ISO 21930, ISO 14025, ISO 14040, and ISO 14044 and Sub-category Product Category Rules: PCR for Single Ply Roofing Membranes (ASTM International, NSF International, 2024). This EPD is intended for business-to-business (B-to-B) audiences.

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ISO 21930; Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services (2017) serves as the core PCR; PCR for Single Ply Roofing Membranes, Version 2.0 extended (ASTM International, NSF International, 2024) serves as the sub-category PCR.

- Sub-category PCR review was conducted by **Thomas P. Gloria**, PhD., Industrial Ecology Consultants (t.gloria@industrial-ecology.com), **Jack Geibig**, Ecoform (jgeibig@ecoform.com), & **Bill Stough**, Sustainable Research Group (bstough@sustainableresearchgroup.com)
- Independent verification of the declaration, according to ISO 21930:2017 and ISO 14025:2006.: ☐ internal ☑ external
- Third party verifier: **Thomas P. Gloria**, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
- For additional explanatory material Manufacture Representative: **Sherrie MacWilliams** (sherrie.macwilliams@amrize.com)
- This LCA EPD was prepared by: **Melissa Díaz**, Senior LCA and EPD Project Manager • Climate Earth (www.climateearth.com)

PRODUCER

Amrize Building Envelope LLC delivers high-performance solutions that make the entire building envelope more sustainable for customers around the world. We are committed to raising the standards of building solutions by delivering superior quality and innovation while addressing industry needs.

Our offerings cover a comprehensive range of residential and commercial roofing, wall and lining systems, insulation, and waterproofing solutions for a variety of industries from construction to marine and aerospace. Our powerful portfolio brands include Elevate, Duro-Last, Malarkey Roofing Products, GenFlex, Gaco, and Enverge. Visit amrize.com to learn more.

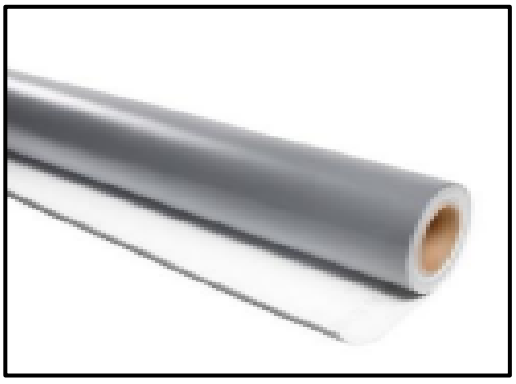
Amrize's Muscle Shoals, AL facility is ISO 9000 certified, and manufactures Elevate thermoplastic polyolefin membrane for use in commercial roofing systems. The facility is 254,000 square feet and opened in 2000.

PRODUCT: Elevate UltraPly™ TPO XR Membrane

Elevate UltraPly™ TPO XR combines the durability of a single-ply membrane with an external backing of eight-ounce, non-woven polyester to offer an additional internal and external reinforcement for puncture resistance. Elevate UltraPly™ TPO XR is available in reflective white, tan or gray, which can help reduce a building's cooling requirements. In addition, the membrane provides weatherability and strong resistance to UV rays and common rooftop chemicals. Elevate UltraPly™ TPO XR can also add LEED points. Elevate UltraPly™ TPO membranes manufactured at the Muscle Shoals facility do not contain hazardous materials.

FIGURE 1

Elevate UltraPly™ TPO XR Membrane



The products covered in this EPD have the following Performance Properties & Related Standards

TABLE 1

Performance Properties & Related Standards

PROPERTIES	TEST METHOD	PERFORMANCE MINIMUM	TYPICAL PERFORMANCE XR 100: 45 mil	TYPICAL PERFORMANCE XR 115: 60 mil	TYPICAL PERFORMANCE XR 115: 80 mil
Overall Thickness (Thickness Above Fleece)	D 751	0.039* (1.0 mm)	0.045" (1.14 mm) ± 10%	0.060" (1.52 mm) ± 10%	0.080" (2.03 mm) ± 10%
Coating Over Scrim	D 7635	0.015* (0.38 mm)	0.017" (0.43 mm)	0.021" (0.53 mm)	0.033" (0.84 mm)
Breaking Strength	D 751, Grab Method	220 lbf (979 N)	340 lbf (1,512 N)	390 lbf (1735 N)	460 lbf (2,046 N)
Elongation of Reinforcement Break	D 751, Grab Method	15%	25%	25%	25%
Tearing Strength	D 751	55lbf (245N)	120 lbf (534 N)	120 lbf (534 N)	120 lbf (534 N)
Brittleness Point	D 2137	-40 °F (-40 °C)	Pass	Pass	Pass
Ozone Resistance, No Cracks	D 1149	Pass (No Cracks)	Pass	Pass	Pass
PROPERTIES AFTER HEAT AGING (RETAINED VALUES) ASTM D 573*5378 h (224 days or 32 weeks at 240 °F (116 °C)					
Breaking Strength	D 751, Grab Method	90% minimum	>90%	>90%	>90%
Elongation at Break	D 751, Grab Method	90% minimum	>90%	>90%	>90%
Tearing Strength	D 751	60% minimum	>60%	>60%	>60%
Weight of Change	--	±1% maximum	<1%	<1%	<1%
Linear Dimension Change	D1204, 6h at 158 °F (70 °C)	±1% maximum	<1%	<1%	<1%
Water Absorption	D 471	± 3% Maximum	<3%	<3%	<3%
Weather Resistance *	G 155	10,800 kJ/m2 Minimum	>60,000 kJ/ m2	>60,000 kJ/ m2	>60,000 kJ/ m2
Puncture Resistance	FTM 101C, Method 2031	--	--	--	450 LBF (2,002 N)
Dynamic Puncture Resistance MD	D 5635	--	Pass (60 J)	Pass (65 J)	Pass (60 J)
Dynamic Puncture Resistance CD	D 5635	--	Pass (55 J)	Pass (65 J)	Pass (60 J)
Static Puncture Resistance	--	--	--	--	Pass (25 kg)
Air Permeance (Material)	--	--	--	--	Pass

**176 °F (80 °C) Black Panel, no cracking crazing when wrapped around a 3" (76.2mm) mandrel and inspected at 7X magnification*
1. The ASTM 2178 values listed above are for the air permeance of the UltraPly™ TPO Membrane component only.
2. When system design includes an air barrier, please consult your Elevate Technical Services Advisor for additional roof system securement enhancements.
3. Consult the Designer / Architect, Code Agency or Authority having Jurisdiction (AHJ) for requirements regarding the selection and use of an appropriate air barrier material, and its installation into the building envelope.

TABLE 2

Product Components

MATERIAL	% WEIGHTED AVERAGE COMPOSITION
Resin (TPO)	50.0 – 80.0
Flame Retardant	10.0 - 40.0
Fleece	7.0 – 22.0
Polyester Scrim	3.0 - 9.0
Stabilizer and Other Additives	1.0 - 5.0
TPO Scrap (Internally)	0.0 - 3.0

LIFE CYCLE ASSESSMENT

DELCARED UNIT

The declared unit is one square meter (1 m^2) of single-ply roofing membrane for a stated product thickness.

SYSTEM BOUNDARY

This EPD is a cradle-to-gate with options EPD, covering the life cycle stages indicated in Table 3. Modules C1 and C3 do not contribute to the end of life scenarios considered, so they are declared as zero.

TABLE 3
Life Cycle Product Stages

PRODUCTION STAGE (MANDATORY)			CONSTRUCTION STAGE		USE STAGE							END-OF-LIFE STAGE			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X

NOTE: MND = module not declared; X = module included.

CUT-OFF

Items excluded from system boundary include:

- production, manufacture and construction of manufacturing capital goods and infrastructure;
- production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
- personnel-related activities (travel, furniture, and office supplies); and
- energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

COMPARISON

Only EPDs prepared from cradle-to-grave life-cycle results, and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products. As this EPD is prepared from cradle-to-gate with options, this document shall not be used for comparison between products per Section 5.5 of the PCR (ASTM International, NSF International, 2024).

ALLOCATION PROCEDURE

Allocation follows the requirements and guidance of ISO 14044:2006, Clause 4.3.4; and ISO 21930:2017 section 7.2. Recycling and recycled content is modeled using the cut-off rule.

MANUFACTURING

A1-A3, PRODUCTION STAGE

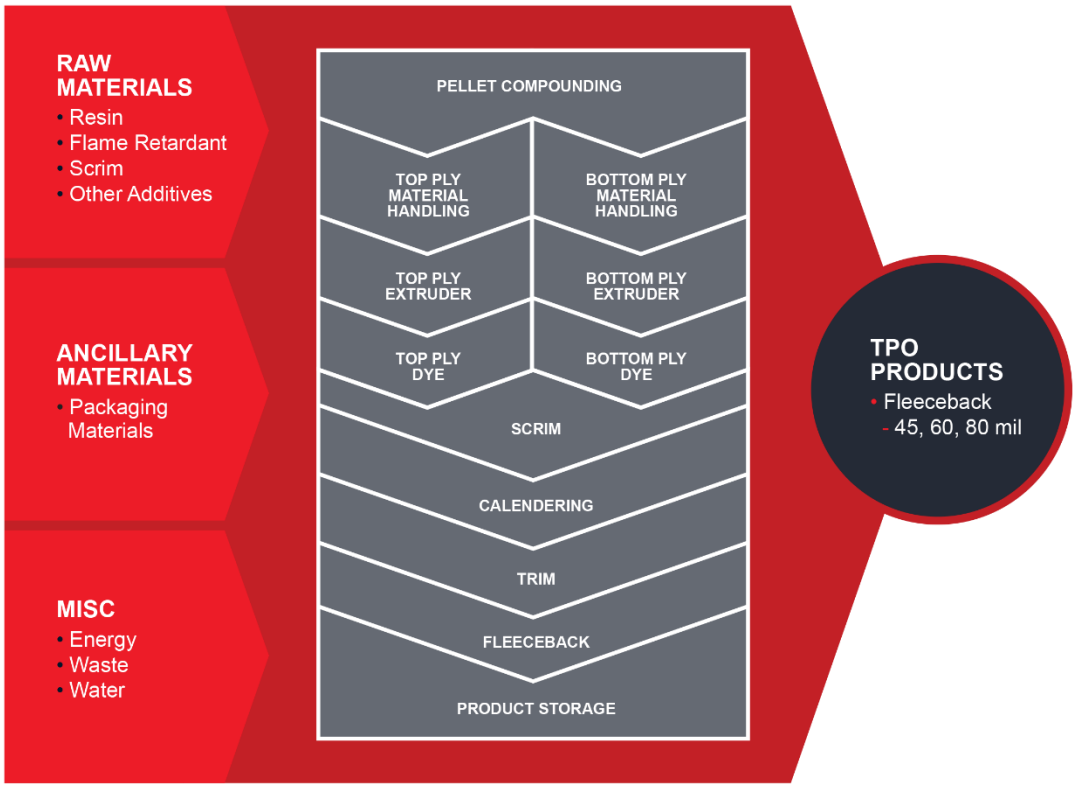
Compounding Process Description

TPO compounding is a process that mixes polymer and filler materials, along with additives, to create a homogeneous compound. The materials are transferred to an extruder, which softens and compresses the material and presses it toward a die outlet that makes the pellet. The finished pellets are collected and used as the raw material in the thermoplastic olefin roofing manufacturing line. Raw materials are received by truck or rail.

TPO Roofing Manufacturing

The raw material pellets are stored in silos. The manufacturing process consists of two sets of two extruders each, one set of extruders processes the top layer of the membrane, and the other set of extruders processes the bottom layer. Each set of extruders melts polyethylene/polypropylene pellets and extrudes them into a continuous sheet of polymer that encases a layer of fabric. The sheet of polymer passes through a calendering process that compresses and flattens the membrane. After the calendering process, the sheet is cooled, and the fleeceback fabric is applied. The edges are trimmed to a specific membrane width and the trimmed edges are ground and reused in the manufacturing process. The membrane is wound into rolls and packaged as a finished product.

FIGURE 2
Process Flow Diagram of TPO Manufacturing



A4, TRANSPORTATION

An average truck and transport distance of 725 miles from the plant to the construction site is assumed.

A5, INSTALLATION

The installation scenario includes the energy and ancillary materials typically consumed to apply TPO fleeceback membrane on a standard-shaped roof of 25,000 square feet, with a total TPO membrane weight of 7,275 pounds. Waste from packaging includes cardboard, paper, and wood pallets.

B1 – B5 USE STAGE

As defined in the PCR, the Building Estimated Service Life (ESL) is 75 years. Use stage information modules have been omitted from this LCA study.

C1 – C4 END-OF-LIFE STAGE

At the end of building service life and during roof replacement, the TPO roofing membranes may be reused, recovered and repurposed, or disposed. This study does not take reuse and recovery into account, and it is assumed that insulation is removed when the building is decommissioned and disposed of in a landfill, for which an average distance and specific end of life LCI is applied. Therefore, it is assumed zero impacts come from demolition and waste processing.

LIFE CYCLE ASSESSMENT RESULTS

This declaration is cradle-to-gate with options. As discussed in the Life Cycle Assessment System Boundaries section, Modules C1 and C3 do not contribute to impacts and are declared as zero. Modules B1-B7 and Optional Module D – Benefits and Loads Beyond the System Boundary – are not included in this LCA study. Only relevant stages are presented with results, to make it easier to follow. Table 4 presents results for the declared unit, 1 m^2 of single-ply roofing membrane, of the stated product thicknesses.

TABLE 4: **UltraPly™ TPO XR Single Ply Roofing Membrane**, Fleeceback Products, per 1 m^2

IMPACT ASSESSMENT UNIT	PRODUCTION (A1-A3)	TRANSPORT (A4)	INSTALLATION (A5)	TRANSPORT TO DISPOSAL OF WASTE (C2)	DISPOSAL OF WASTE (C4)
Global warming potential (GWP)[1]; kg CO_2 eq					
45 mils	4.59	0.15	0.11	7.01E-03	9.80E-03
60 mils	6.15	0.20	0.11	9.40E-03	1.31E-02
80 mils	7.96	0.26	0.11	1.22E-02	1.70E-02
Depletion potential of the stratospheric ozone layer (ODP); kg CFC-11 eq					
45 mils	1.58E-07	6.16E-12	1.36E-08	2.93E-13	3.67E-09
60 mils	2.12E-07	8.26E-12	1.36E-08	3.93E-13	4.92E-09
80 mils	2.74E-07	1.07E-11	1.36E-08	5.08E-13	6.37E-09
Eutrophication potential (EP); kg N eq					
45 mils	4.61E-03	1.10E-04	1.04E-03	4.66E-06	1.01E-05
60 mils	6.18E-03	1.40E-04	1.04E-03	6.25E-06	1.35E-05
80 mils	8.00E-03	1.90E-04	1.04E-03	8.08E-06	1.75E-05
Acidification potential of soil and water sources (AP); kg SO_2 eq					
45 mils	1.48E-02	1.80E-03	1.50E-04	7.81E-05	7.00E-05
60 mils	1.98E-02	2.41E-03	1.50E-04	1.00E-04	9.38E-05
80 mils	2.56E-02	3.12E-03	1.50E-04	1.40E-04	1.20E-04
Formation potential of tropospheric ozone (POCP); kg O_3 eq					
45 mils	0.21	4.59E-02	1.43E-03	1.97E-03	2.00E-03
60 mils	0.28	6.16E-02	1.43E-03	2.64E-03	2.68E-03
80 mils	0.36	7.96E-02	1.43E-03	3.41E-03	3.46E-03
Resource Use					
Abiotic depletion potential for non-fossil mineral resources ($ADP_{elements}$); kg Sb eq					
45 mils	3.36E-06	0.00	8.02E-09	0.00	1.01E-08
60 mils	4.51E-06	0.00	8.02E-09	0.00	1.36E-08
80 mils	5.83E-06	0.00	8.02E-09	0.00	1.76E-08
Abiotic depletion potential for fossil resources (ADP_{fossil}); MJ, NCV					
45 mils	119	2.09	1.15	9.94E-02	0.24
60 mils	159	2.80	1.15	0.13	0.32
80 mils	206	3.62	1.15	0.17	0.41
Renewable primary energy resources as energy (fuel) (RPRE)[2]; MJ, NCV					
45 mils	2.04	0.00	6.80E-03	0.00	1.61E-03
60 mils	2.74	0.00	6.80E-03	0.00	2.16E-03
80 mils	3.54	0.00	6.80E-03	0.00	2.79E-03
Renewable primary resources as material (RPRM); MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel) (NRPRE)[2]; MJ, NCV					
45 mils	129	2.09	1.19	9.94E-02	0.24
60 mils	173	2.80	1.19	0.13	0.33
80 mils	224	3.62	1.19	0.17	0.42
Non-renewable primary resources as material (NRPRM)[2]; MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Consumption of fresh water (FW)[2]; m^3					
45 mils	8.38E-02	0.00	3.20E-04	0.00	2.60E-04
60 mils	0.11	0.00	3.20E-04	0.00	3.50E-04
80 mils	0.15	0.00	3.20E-04	0.00	4.50E-04
Secondary Material, Fuel and Recovered Energy					
Secondary Materials (SM)[2]; kg					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels (RSF)[2]; MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00

[1] GWP 100; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
CO2 from biogenic secondary fuels used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.
[2] Calculated per ACLCA ISO 21930 Guidance.

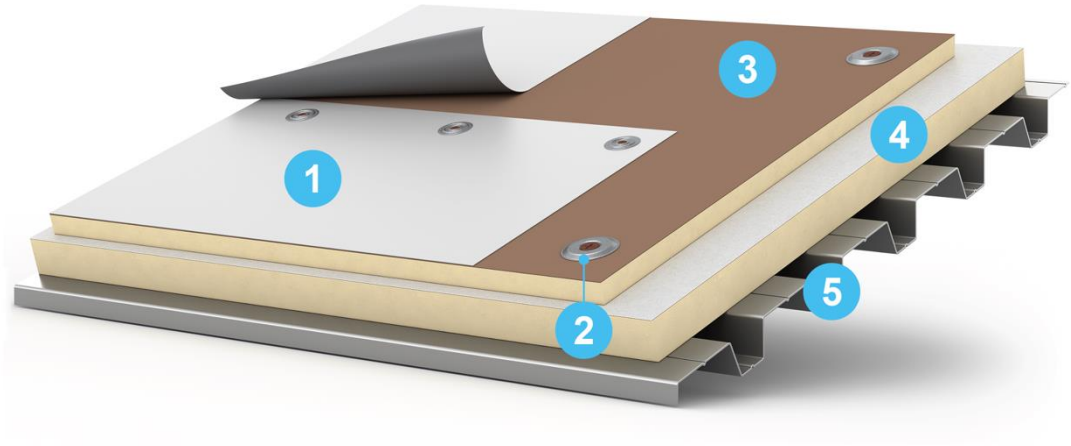
IMPACT ASSESSMENT UNIT	PRODUCTION (A1-A3)	TRANSPORT (A4)	INSTALLATION (A5)	TRANSPORT TO DISPOSAL OF WASTE (C2)	DISPOSAL OF WASTE (C4)
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)[3]; MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Recovered energy (RE)[3]; MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Waste & Output Flows					
Hazardous waste disposed (HW)[3]; kg					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed (NHWD)[3]; kg					
45 mils	0.12	0.00	0.11	0.00	1.30
60 mils	0.16	0.00	0.11	0.00	1.75
80 mils	0.21	0.00	0.11	0.00	2.26
High-level radioactive waste (HLRW)[3]; kg					
45 mils	3.29E-09	0.00	1.88E-11	0.00	2.73E-12
60 mils	4.41E-09	0.00	1.88E-11	0.00	3.66E-12
80 mils	5.71E-09	0.00	1.88E-11	0.00	4.73E-12
Intermediate and low-level radioactive waste (ILLRW)[3]; kg					
45 mils	1.59E-08	0.00	9.06E-11	0.00	1.31E-11
60 mils	2.13E-08	0.00	9.06E-11	0.00	1.75E-11
80 mils	2.76E-08	0.00	9.06E-11	0.00	2.27E-11
Components for reuse (CRU)[3]; kg					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Materials for recycling (MR)[3]; kg					
45 mils	3.33E-03	0.00	0.00	0.00	0.00
60 mils	4.46E-03	0.00	0.00	0.00	0.00
80 mils	5.77E-03	0.00	0.00	0.00	0.00
Materials for energy recovery (MER)[3]; kg					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00
Recovered energy exported from the product system (EE)[3]; MJ, NCV					
45 mils	0.00	0.00	0.00	0.00	0.00
60 mils	0.00	0.00	0.00	0.00	0.00
80 mils	0.00	0.00	0.00	0.00	0.00

** Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories. The following optional indicators are not reported and also have high levels of uncertainty: Land use related impacts, toxicological aspects, and emissions from land use change*

***Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products.*

[3] Calculated per ACLCA ISO 21930 Guidance.

ADDITIONAL ENVIRONMENTAL INFORMATION



TPO Fleeceback Roof System

1. **Elevate UltraPly™ XR TPO Membrane**
    - White Elevate UltraPly™ TPO membrane achieves an initial Solar Reflectance Index (SRI) rating of 98 and a three-year aged value of 83, as determined by the Cool Roof Ratings Council (CRRC) through testing.
2. **Elevate Metal Plates and Fasteners**
3. **ISOGARD HD Cover Board** (optional) – **Mechanically Attached or Adhered**
4. **ISOGARD GL or ISOGARD CG Insulation – Mechanically Attached or Adhered**
    - All Elevate polyisocyanurate insulations use EPA accepted blowing agents. Elevate ISOGARD HD Cover Board with ISOGARD foam technology and ISOGARD GL and ISOGARD CG insulation incorporates a HCFC-free blowing agent that does not contribute to the depletion of the ozone layer (ODP-free).
    - The thermal performance of ISOGARD polyiso insulation is up to 40% better than major competitors when tested by an independent third party in cold temperature 40°F (4°C) applications according to ASTM C1289 standards. The increased R-value per inch means better thermal performance from the same roofing systems using the same amount of insulation compared to leading competitive products on the market today.
5. **Steel Deck**

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