ENVIRONMENTAL PRODUCT DECLARATION

APP MODIFIED BITUMEN ROOFING MEMBRANE

TORCH APPLIED

HOLCIM

GENERAL INFORMATION

The Life Cycle Assessment (LCA) was prepared in conformity with ISO 14025, ISO 14040, ISO 14044, PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements (UL 10010, Version 4.0) and Sub-category PCR: Part B: Asphalt Shingles, Built-up Asphalt Membrane Roofing and Modified Bituminous Membrane Roofing (UL 100010-11, 2024). This EPD is intended for business-to-business (B-to-B) audiences.

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UL's PCR Part A: LCA Calculation Rules and Report Requirements (UL 10010, Version 4.0): serves as the core PCR. Product Category Rules for Asphalt Shingles, Build-Up Asphalt Membrane, and Modified Bituminous Asphalt Membrane Roofing (UL 100010-11, 2024) serves as the sub-category PCR

- Sub-category PCR review was conducted by
  Thomas P. Gloria, PhD. (t.gloria@industrial-ecology.com) • Industrial Ecology Consultants
- 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 Manufacturer Representative: Sherrie MacWilliams (sherrie.macwilliams@holcim.com)
  This LCA EPD was prepared by: Leila Schein LCA and EPD Project Manager • Climate Earth (www.climateearth.com)
- EPDs are comparable only if they comply with ISO 21930 (2017), 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.

PRODUCER

Holcim Solutions and Products US 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 of brands include Elevate, Duro-Last, Malarkey Roofing Products, GenFlex, Gaco, and Enverge. Holcim Solutions and Products US LLC is a division of the Holcim Group. Visit HolcimBE.com to learn more.

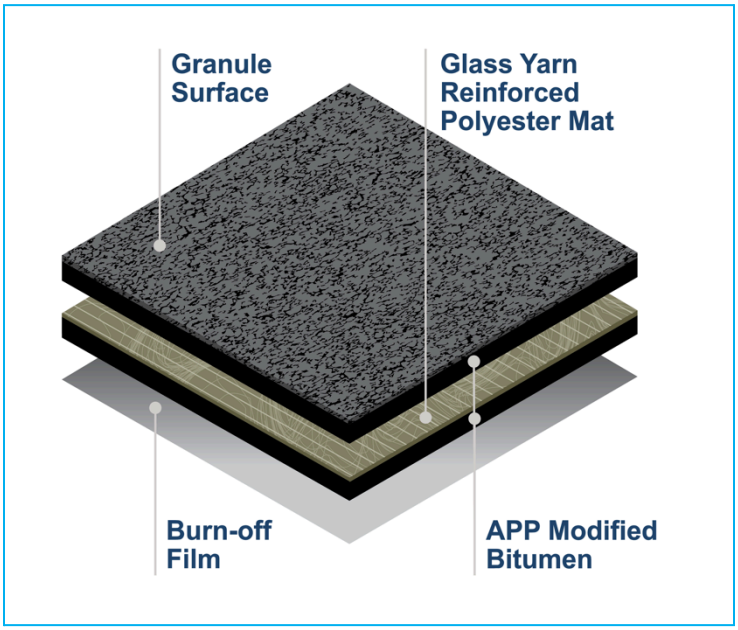
Holcim's Beech Grove, IN facility is ISO 9000 certified and manufactures Elevate APP and SBS modified bitumen roofing membranes for use in commercial roofing systems. The facility is 225,000 square feet and opened in 1990.

PRODUCT: APP MODIFIED BITUMEN ROOFING MEMBRANE – TORCH APPLIED

With superior durability, flexibility and UV resistance, APP modified bitumen roofing membrane is a versatile roofing solution that withstands the test of time. APP modified bitumen roof membrane can have a granulated or smooth surface and is designed to be installed with a torch. It consists of select asphalt, modified with atactic polypropylene, strengthened with fiberglass and fiberglass reinforced polyester nonwoven mat. APP modified bitumen roofing membrane is strong and stable, and resistant to natural forces and other factors on the rooftop. It is ideal for both new construction and re-roofing applications. Additionally, UltraWhite APP modified bitumen roofing membrane can contribute to LEED® certification.

This study consists of APP modified bitumen cap sheet and base sheet.

FIGURE 1
APP Modified Bitumen Roofing Membrane



The products covered in this EPD meet the following physical properties:

TABLE 1

Typical Properties (Meets or exceeds ASTM D 4637, Type I)

Properties	Test Method	Performance Minimum	Typical Performance
Product Thickness	D 5147	160 mil (4 mm)	165 mil (4.2 mm)
Net Mass	D 146	85 lb/100 ft² (4,150 g/m²)	97 lb/100 ft² (4,736 g/m²)
Bottom Side Coating	D 5147	30 mil (0.76 mm)	43 mil (1.10 mm)
Peak Load at 73 °F (23 °C)	D 5147	50 lbf/in, MD (8.8 kN/m, MD) 50 lbf/in, XMD (8.8 kN/m, XMD)	55 lbf/in, MD (9.6 kN/m, MD) 55 lbf/in, XMD (9.6 kN/m, XMD
Elongation at Peak Load at 73 °F (23°C)	D 5147	23 %, MD 23 %, XMD	30 %, MD 30 %, XMD
Peak Load at 0 °F (-18 °C)	D 5147	60 lbf/in, MD (10.5 kN/m, MD) 60 lbf/in, XMD (10.5 kN/m, XMD)	65 lbf/in, MD (11.4 kN/m, MD) 65 lbf/in, XMD (11.4 kN/m, XMD)
Elongation at Peak Load at 0 °F (-18 °C)	D 5147	10 %, MD 10 %, XMD	15 %, MD 15 %, XMD
Ultimate Elongation at 5 % of Peak Load 73 °F (23 °C)	D 5147	30 %, MD 30 %, XMD	40 %, MD 40 %, XMD
Tear Strength at 73 °F (23 °C)	D 5147, D 4073	70 lbf, MD (311 N, MD) 70 lbf, XMD (311 N, XMD)	75 lbf, MD (334 N, MD) 75 lbf, XMD (334 N, XMD)
Low Temperature Flexibility	D 5147	32 °F (0 °C)	32 °F (0 °C)
Dimensional Stability	D 5147, D 1204	1 % Change, MD 1 % Change, XMD	0.2 % Change, MD 0.2 % Change, XMD
Compound Stability	D 5147	230 °F (110 °C)	270 °F (132 °C)
Granule Embedment, max loss	D 4977	2 g	0.5 g
Water Absorption	D 5147, D 95	3.2 %	0 %
Moisture Content	D 5147, D 95	1 %	0 %
Low Temperature Unrolling	D 5636	41 °F (5 °C)	0 °F (-18 °C)

TABLE 2

Product Components

MATERIAL	% WEIGHTED AVERAGE COMPOSITION
Asphalt	30-35%
Surfacing	20-50%
Mineral Filler/Fire Retardant	15-20%
Polymer	6-10%
Fiberglass Mat	1-5%

LIFE CYCLE ASSESSMENT

DECLARED UNIT

The declared unit is 1 m^2 of roofing membrane for a stated product thickness.

SYSTEM BOUNDARY

This EPD is a cradle-to-grave covering A1-C4 stages of the life cycle.

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	De-construction / Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
X	X	X	X	X	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.

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

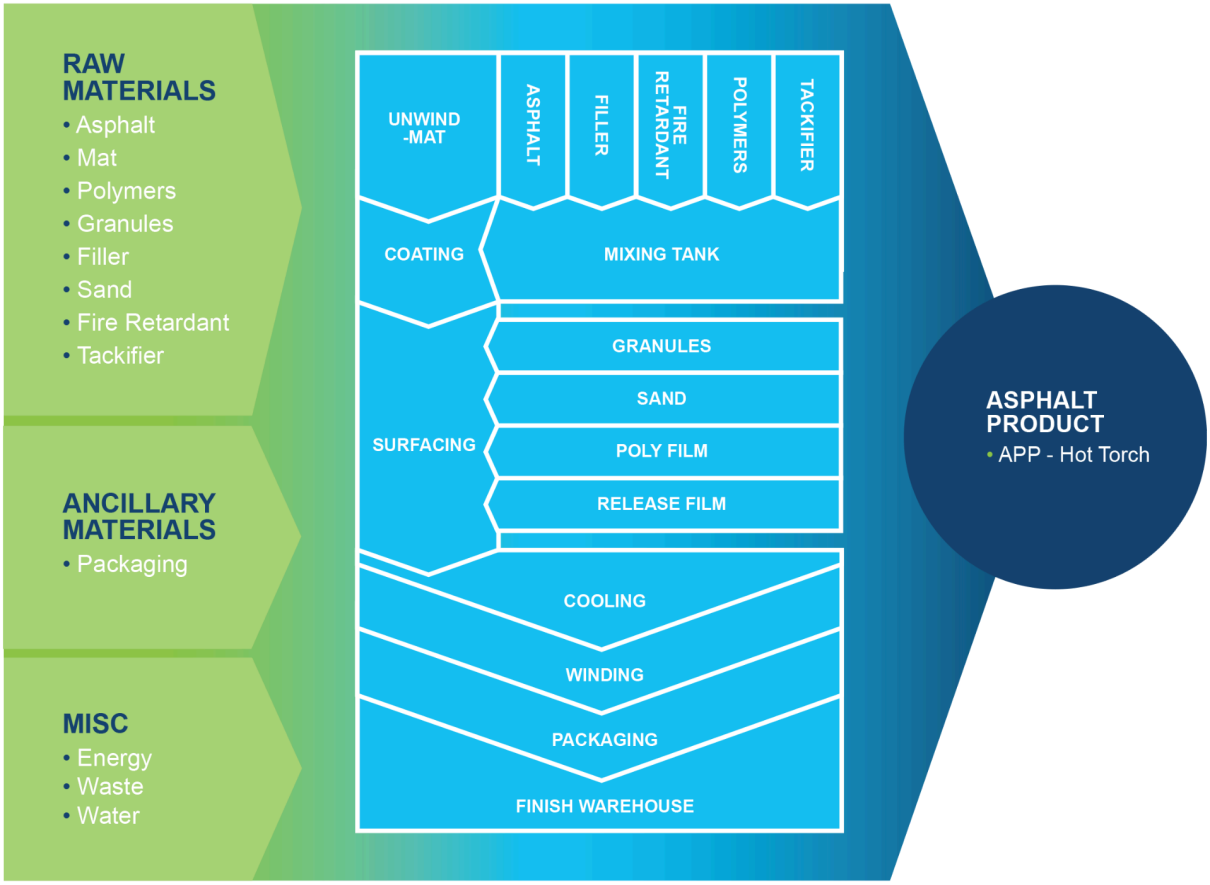
APP Modified Bitumen Roof Membrane Manufacturing

The main material input into the manufacturing process is asphalt, polymer, filler, sand, granules and fiberglass mat. Asphalt and sand are delivered by truck and pumped into storage tanks. Raw materials are blended together in a mixing tank. Fiberglass mat rolls are placed on a let-off stand at the front end of the coater process. The fiberglass mat sheets are fed through several loops into the coater section. During this process, the asphalt is pumped from the mixing tank and is applied to the fiberglass mat.

Once the fiberglass is coated with asphalt, granules and sand are applied. The coated fiberglass mat sheet is cooled by a water spray. The final product goes into a winder where it is cut into approximately 100-pound rolls, placed on a pallet, and wrapped with plastic stretch wrap.

FIGURE 2

Process Flow Diagram of APP Modified Bitumen Roofing Membrane



A4, TRANSPORTATION

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

A5, INSTALLATION

The installation scenario includes the energy and ancillary materials typically consumed to install APP modified bitumen membrane using a hot torch on a standard-shaped roof of 20,000 square feet, with a total membrane weight of 31,939 pounds.

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 APP modified bitumen roofing membranes may be reused, recovered and repurposed, or disposed of. 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.

LIFE CYCLE ASSESSMENT RESULTS

TABLE 4: **Asphalt APP Modified Bitumen Roofing Membrane,** Torch Applied Products, per 1 m^2 of average thickness*

IMPACT ASSESSMENT UNIT	PRODUCTION (A1-A3)	TRANSPORT (A4)	INSTALLATION (A5)	EOL (C1)	EOL (C2)	EOL (C3)	EOL (C4)	TOTAL
Global warming potential (GWP)[1] (kg CO2 eq)								
APP Hot Torch	4.73	0.98	0.35	0.00	.04	0.00	0.16	6.25
Depletion potential of the stratospheric ozone layer (ODP) (kg CFC-11 eq)								
APP Hot Torch	4.46E-07	4.09E-11	-7.56E-10	0.00	1.80E-12	0.00	3.28E-08	4.78E-07
Eutrophication potential (EP) (kg N eq)								
APP Hot Torch	7.73E-03	7.77E-04	-6.05E-06	0.00	2.86E-05	0.00	6.90E-03	2.00E-02
Acidification potential of soil and water sources (AP) (kg SO2 eq)								
APP Hot Torch	2.11E-02	1.29E-02	2.29E-04	0.00	4.79E-04	0.00	7.60E-04	4.00E-02
Formation potential of tropospheric ozone (POCP) (kg O_3 eq)								
APP Hot Torch	0.31	0.33	1.00E-02	0.00	1.21E-02	0.00	2.03E-02	0.69
Resource Use								
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*								
APP Hot Torch	2.97E-06	0.00	-1.95E-08	0.00	0.00	0.00	1.24E-07	3.07E-06
Abiotic depletion potential for fossil resources (ADPfossil) (MJ, NCV)								
APP Hot Torch	121.00	13.90	-7.74E-02	0.00	0.61	0.00	2.35	138.00
Renewable primary energy resources as energy (fuel), (RPRE[2])* (MJ, NCV)								
APP Hot Torch	3.35	0.00	-2.43E-03	0.00	0.00	0.00	2.96E-02	3.38
Renewable primary resources as material, (RPRM2)* (MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE2)* (MJ, NCV)								
APP Hot Torch	129.00	13.90	-8.03E-02	0.00	0.61	0.00	2.46	146.00
Non-renewable primary resources as material, (NRPRM2)* (MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption of fresh water, (FW2) (m3)								
APP Hot Torch	7.74E-02	0.00	-2.60E-05	0.00	0.00	0.00	2.83E-03	8.00-E02
Secondary Material, Fuel and Recovered Energy								
Secondary Materials, (SM2) * (kg)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels, (RSF2)* (MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF2)* (MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy, (RE2) *(MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waste & Output Flows								
Hazardous waste disposed, (HW2) * (kg)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed, (NHWD2) * (kg)								
APP Hot Torch	0.419	0.00	0.00	0.00	0.00	0.00	0.00	0.42

[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.

High-level radioactive waste, (HLRW2) * (kg)								
APP Hot Torch	1.91E-09	0.00	-1.66E-12	0.00	0.00	0.00	4.90E-11	1.96E-09
Intermediate and low-level radioactive waste, (ILLRW2)* (kg)								
APP Hot Torch	1.11E-08	0.00	0.00	0.00	0.00	0.00	-1.34E-10	1.12E-08
Components for reuse, (CRU2) * (kg)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling, (MR2) * (kg)								
APP Hot Torch	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.19
Materials for energy recovery, (MER2) * (kg)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported from the product system, (EE2) * (MJ, NCV)								
APP Hot Torch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 5: **Asphalt APP Modified Bitumen Roofing Membrane with Fire Retardant,** Torch Applied Products, per 1 m^2 of averaged thickness*

IMPACT ASSESSMENT UNIT	PRODUCTION (A1-A3)	TRANSPORT (A4)	INSTALLATION (A5)	EOL (C1)	EOL (C2)	EOL (C3)	EOL (C4)	TOTAL
Global warming potential (GWP)[3] (kg CO2 eq)								
APP Hot Torch with Fire Retardant	3.61	0.97	0.34	0.00	0.04	0.00	0.01	5.13
Depletion potential of the stratospheric ozone layer (ODP) (kg CFC-11 eq)								
APP Hot Torch with Fire Retardant	4.04E-07	4.07E-11	-7.52E-10	0.00	1.79E-12	0.00	3.26E-08	4.36E-07
Eutrophication potential (EP) (kg N eq)								
APP Hot Torch with Fire Retardant	1.00E-02	7.73E-04	-6.02E-06	0.00	2.84E-05	0.00	1.00E-02	2.00E-02
Acidification potential of soil and water sources (AP) (kg SO2 eq)								
APP Hot Torch with Fire Retardant	2.00E-02	1.00E-02	2.28E-04	0.00	4.76E-04	0.00	7.56E-04	3.00E-02
Formation potential of tropospheric ozone (POCP) (kg O_3 eq)								
APP Hot Torch with Fire Retardant	0.31	0.33	1.00E-02	0.00	1.00E-02	0.00	2.00E-02	0.68
Resource Use								
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*								
APP Hot Torch with Fire Retardant	3.10E-06	0.00	-1.94E-08	0.00	0.00	0.00	1.24E-07	3.21E-06
Abiotic depletion potential for fossil resources (ADPfossil) (MJ, NCV)								
APP Hot Torch with Fire Retardant	78.80	13.80	-8.00E-02	0.00	0.61	0.00	2.34	95.50
Renewable primary energy resources as energy (fuel), (RPRE[4])* (MJ, NCV)								
APP Hot Torch with Fire Retardant	3.10	0.00	-2.42E-03	0.00	0.00	0.00	3.00E-02	3.13
Renewable primary resources as material, (RPRM2)* (MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE2)* (MJ, NCV)								
APP Hot Torch with Fire Retardant	83.80	13.80	-8.00E-02	0.00	0.61	0.00	2.44	101.00
Non-renewable primary resources as material, (NRPRM2)* (MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumption of fresh water, (FW2) (m3)								
APP Hot Torch with Fire Retardant	5.00E-02	0.00	-2.59E-05	0.00	0.00	0.00	2.81E-03	5.00E-02
Secondary Material, Fuel and Recovered Energy								
Secondary Materials, (SM2) * (kg)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[3] 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.
[4] Calculated per ACLCA ISO 21930 Guidance.

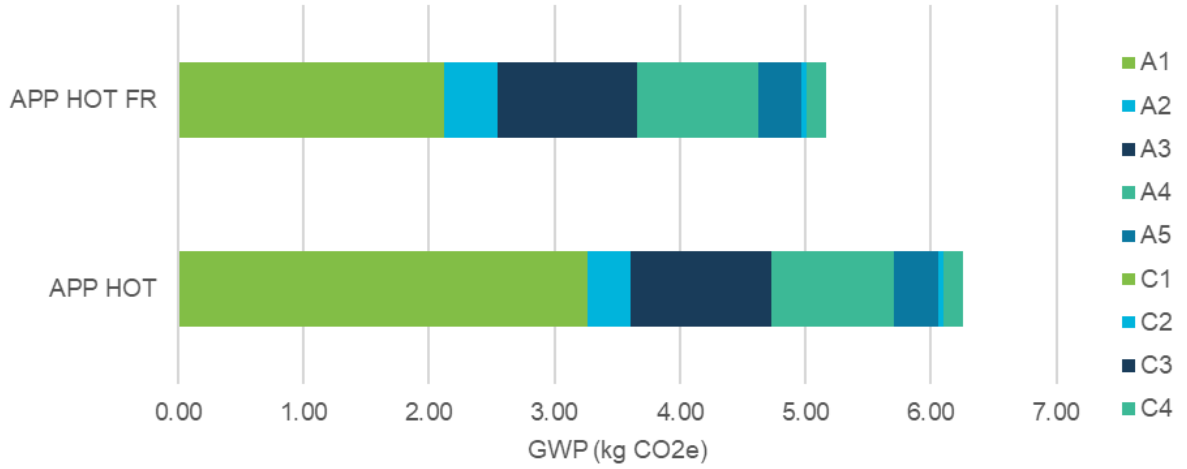
Renewable secondary fuels, (RSF2)* (MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF2)* (MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy, (RE2) *(MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waste & Output Flows								
Hazardous waste disposed, (HW2) * (kg)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-hazardous waste disposed, (NHWD2) * (kg)								
APP Hot Torch with Fire Retardant	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.42
High-level radioactive waste, (HLRW2) * (kg)								
APP Hot Torch with Fire Retardant	1.90E-09	0.00	-1.65E-12	0.00	0.00	0.00	4.88E-11	1.95E-09
Intermediate and low-level radioactive waste, (ILLRW2)* (kg)								
APP Hot Torch with Fire Retardant	1.44E-08	0.00	-1.33E-10	0.00	0.00	0.00	8.02E-11	1.45E-08
Components for reuse, (CRU2) * (kg)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling, (MR2) * (kg)								
APP Hot Torch with Fire Retardant	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Materials for energy recovery, (MER2) * (kg)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recovered energy exported from the product system, (EE2) * (MJ, NCV)								
APP Hot Torch with Fire Retardant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

INTERPRETATION

The GWP impacts for each information module are shown below in Figure 3.

FIGURE 3

Comparison of APP Hot and APP Hot with Fire Retardant GWP impacts across information modules



As evidenced by Figure 3, module A1 dominates the GWP impacts for APP Hot and Hot FR Asphalt membranes, followed by A3 and A4. Together they account for over 90% of the impacts from all other modules. Module A1 accounts for 41 and 52 % of the total GWP impact of the product due to the upstream production of the materials used in the manufacturing of the Asphalt membranes, in both presentations, with and without FR.

While GWP is specifically assessed in Figure 3, several other impact categories are distributed in a similar fashion.

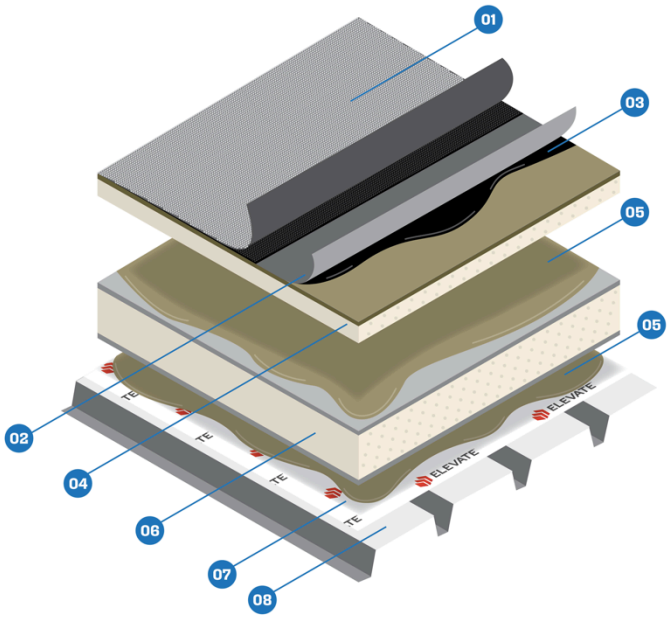
LIMITATIONS

Life cycle impact assessment (LCIA) results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks.

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 from the following categories:

- renewable primary energy resources as energy (fuel), (RPRE)
- renewable primary resources as material, (RPRM)
- nonrenewable primary resources as energy (fuel), (NRPRE)
- nonrenewable primary resources as material (NRPRM)
- secondary materials (SM)
- renewable secondary fuels (RSF)
- nonrenewable secondary fuels (NRSF)
- recovered energy (RE)
- abiotic depletion potential for non-fossil mineral resources (ADPelements)
- hazardous waste disposed
- nonhazardous waste disposed
- high-level radioactive waste
- intermediate and low-level radioactive waste
- components for reuse
- materials for recycling
- materials for energy recovery; and
- recovered energy exported from the product system.

ADDITIONAL ENVIRONMENTAL INFORMATION



APP Modified Bitumen Roof System

1. **Elevate APP Modified Bitumen Roofing Membrane**
2. **Elevate Base Sheet**
3. **Elevate Cold Adhesive**
4. **ISOGARD HD Cover Board**
5. **Elevate Insulation Adhesive**
6. **ISOGARD GL or ISOGARD CG Insulation – 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.
7. **Elevate V-Force Vapor Barrier**
8. **Steel Deck**

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