SURFACE TECH™

VERIFIED by SCS GLOBAL SERVICES™ ENVIRONMENTAL PRODUCT DECLARATION BASED ON LCA

Declaration Owner
Surface Tech LLC
888 Prospect Street, #200
La Jolla, California 92037
Phone: +1 619 880 0265 | https://surface-tech.com/

Product:
Ace XP™

Declared Unit
The declared unit is one metric ton of Ace XP™ manufactured in Rockford, Illinois

EPD Number and Period of Validity
SCS-EPD-07560
EPD Valid January 5, 2022 through January 4, 2027
Version: October 4, 2023

Product Category Rule
ISO 21930:2017. Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.

Program Operator
SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

SCSglobal SERVICES

Declaration owner:	Surface Tech LLC
Address:	888 Prospect Street, #200, La Jolla, CA 92037
Declaration Number:	SCS-EPD-07560
Declaration Validity Period:	EPD Valid January 5, 2022 through January 4, 2027
Version Date:	October 4, 2023
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Ilan MacAdam-Somer, SCS Global Services
LCA Software and LCI database:	OpenLCA 1.10.3 software and the Ecoinvent v3.7.1 database
Product's Intended Application:	As a reliably balanced mix aramid polymer fiber additive for asphalt
Product RSL:	N/A
Markets of Applicability:	North America, including Mexico
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Gate
LCIA Method and Version:	TRACI 2.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☒ internal ☐ external
LCA Reviewer:	Gerard Mansell, Ph.D., SCS Global Services
Product Category Rule:	ISO 21930:2017. Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.
PCR Review conducted by:	ISO Technical Committee
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. Summary of Results

This section contains a summary of the cradle-to-gate LCIA results (**Table 2**) reported for the impact categories required by the PCR [1]—global warming potential (GWP), acidification potential (AP), eutrophication potential (EP), ozone depletion potential (ODP), smog potential (POCP) and fossil fuel depletion (FF) —using the impact method required by the PCR for North America, TRACI 2.1. The LCIA contribution results can be found in **Section 5** and the LCI results can be found in **Section 6.**

Table 1. *The life cycle modules included within the system boundary.*

Product			Construction Process		Use							End-of-life				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 extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = Module Included | MND = Module Not Declared

Table 2. *The cradle-to-gate impact of the Ace XP™ product, reported by life cycle module for all impact categories. Impact is reported for each metric ton of Ace XP™ product.*

Impact Category (units)	Total (A1-A3)	A1	A2	A3
GWP (kg CO_2 eq)	6,923	5,741	149	1,033
AP (kg SO_2 eq)	16.8	12.3	3.02	1.44
EP (kg N eq)	4.22	2.99	0.201	1.04
ODP (kg CFC-11 eq)	4.31×10^{-3}	4.15×10^{-3}	3.29×10^{-5}	1.30×10^{-4}
POCP (kg NMVOC eq)	288	211	56.9	20.1
FF (MJ surplus)	19,458	16,808	295	2,355

2. Declaration Owner and Product Description

2.1 SURFACE TECH LLC

Surface Tech is an innovation-driven company dedicated to providing proven solutions for the construction and building materials industry. By focusing on performance, ease of adoption, sustainability and cost savings, Surface Tech has introduced high-tech products that benefit the asphalt, concrete and specialty products industries.

2.2 PRODUCT DESCRIPTION

Ace XP™

Ace XP™ extends pavement service life by dramatically improving the dynamic modulus of the asphalt layer and increasing the asphalt's resistance to cracking and rutting (distresses that may cause premature failure). To create ACE XP Polymer Fiber™, high-strength man-made "aromatic polyamide" or Aramid Fibers are bundled and coated with Sasobit® wax to create an asphalt concrete additive that is simple to mix with any WMA or HMA in through a drum and or batch asphalt operation. The 3-dimensional reinforcement throughout the asphalt layer increases the asphalt's resistance to cracking, rutting, and fatigue while providing improved ESAL (Equivalent Single Axel Load) capacity.

Engineered Fibers Technology (EFT) produces Surface Tech's Ace XP product at their facility in Rockford, IL.

2.3 ADDITIONAL ENVIRONMENTAL INFORMATION

No regulated substances or materials of very high concern were identified with the production of ACE XP™.

2.4 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at https://surface-tech.com/.

3. Scope of the Study

3.1 FUNCTIONS OF THE PRODUCT SYSTEM

Ace XP™ serves the primary function as a reliably balanced aramid polymer fiber additive to asphalt, where it reduces cracking and rutting, extending the road's life expectancy. In accordance with the PCR, for cradle-to-gate LCAs a declared unit of one metric ton of manufactured and packaged product is used. The reference flow for the modeling of this system is 1 metric ton of Ace XP™ product (**Table 3**).

Table 3. *The declared unit and reference flow used to model the Ace XP™ product.*

Parameter	Value	Unit
Declared Unit	1	Metric ton
Reference Flow	1	Metric ton

3.2 PRODUCT MATERIAL COMPOSITION

The Ace XP™ product is made of Sasobit® wax and aramid fiber, which make up 37% and 63% of the product, respectively.

3.3 SYSTEM BOUNDARY

The system under study includes the cradle-to-gate life cycle of the Ace XP™ product, which includes all inputs required and outputs generated from the production life cycle stage.

The production life cycle stage is subdivided into information modules as prescribed by the PCR. Each module is described in **Table 4**. The Ace XP™ processes incorporated into each life cycle module are described in detail in **Section 4.1**. The major individual unit processes that make up each module of the product stage shown in **Figure 1**.

Table 4. *A description of the life cycle phases included in the ACE XP™ product's system boundary.*

Module	Module Description	Included in System Boundary
A1	Raw Material extraction and upstream production, which includes raw material extraction and processing, as well as processing of secondary material inputs (e.g., recycled or reused materials)	✓
A2	Transport to factory, which covers transport of raw materials and other inputs to the factory and internal transport	✓
A3	Manufacturing, which includes all fuels, electricity, and water used in manufacturing the product; the extraction and upstream production, transport to factory, and manufacturing of product packaging; transport and treatment of all waste generated at the manufacturing facility	✓
A4	Transport to the building site	**MND**
A5	Installation	**MND**
B1	Use stage	**MND**
B2 – B5	Maintenance, repair, replacement, and refurbishment	**MND**
B6 – B7	Operational energy and water use	**MND**
C1	Deconstruction/demolition	**MND**
C2	Transport to waste processing or disposal	**MND**
C3	Waste processing for generation of secondary materials (i.e. recycling)	**MND**
C4	Disposal of waste	**MND**
D	Optional supplementary information about the potential net benefits from reuse, recycling and energy recovery beyond the system boundary of the studied product system	**MND**

X = Module Included | MND = Module Not Declared

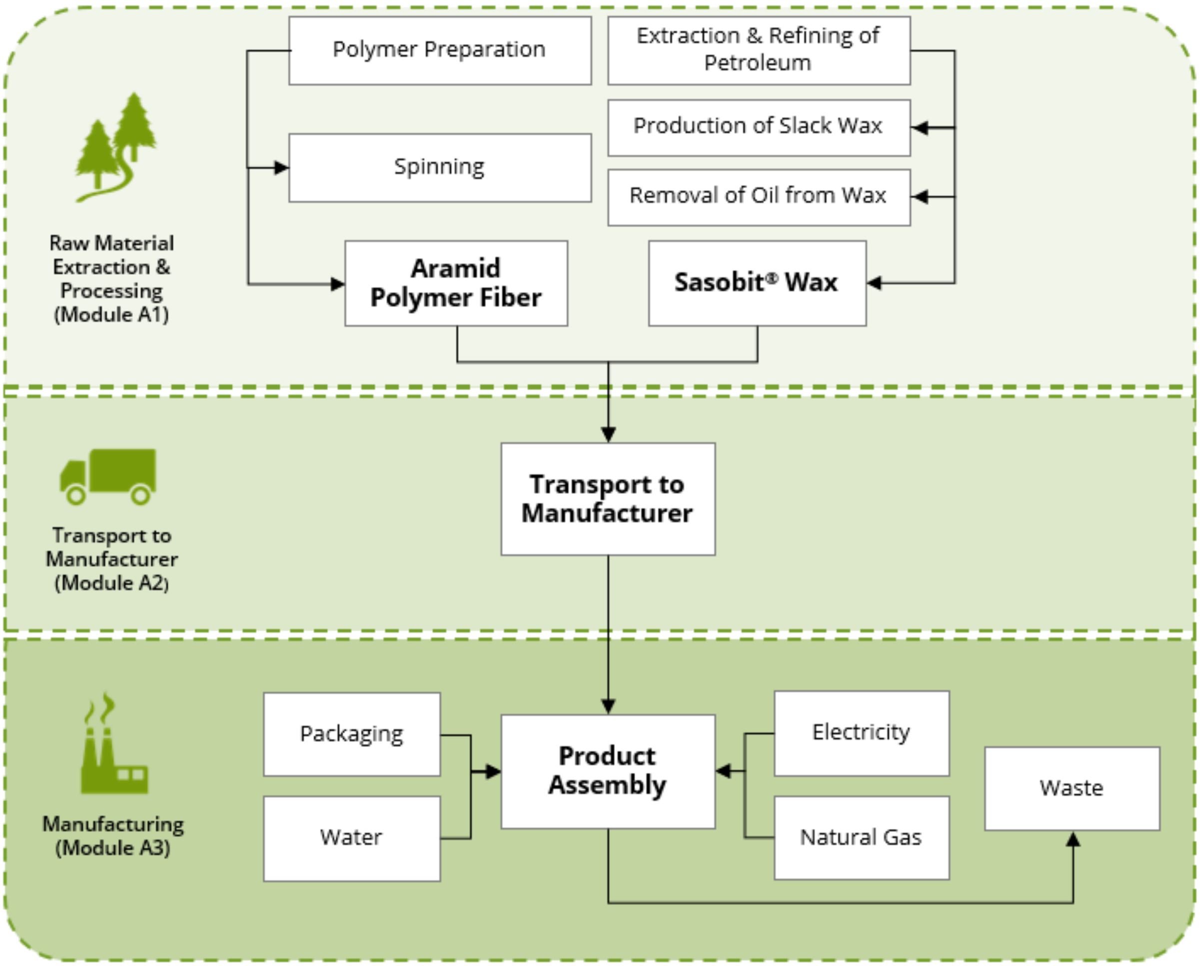

Figure 1. *Flow diagram representing the major processes over the cradle-to-gate life cycle of the Ace XP™ product.*

4. Technical Information and Scenarios

4.1 LIFE CYCLE MODULES

(A1) Raw Material Extraction

This module includes the inputs and outputs required to extract and produce the raw materials—Sasobit® wax and aromatic polyamide (aramid) fibers—that make up 37% and 63% of the Ace XP™ product, respectively. The extraction and production of Sasobit™ was modeled in openLCA v1.10.3 [2] using secondary data on the production of petroleum slack wax within South Africa from the Ecoinvent v3.7.1 database [3], due to lack of primary data. The LCIA values from producing the aramid fiber were provided by the supplier, Teijin.

(A2) Transport to Factory

This module includes the transport of the Sasobit® wax and aramid fibers from South Africa and The Netherlands, respectively. Transport distance and mode of transport were provided by Surface Tech's assembler of Ace XP™, EFT. Transport was modeled in openLCA v1.10.3 using the Ecoinvent v3.7.1 database. The type of transport, type of vehicle, fuel type, and fuel utilization modeled are reported in **Table 5** below.

Table 5. *The one way distance, fuel utilization, and capacity utilization (percentage of vehicle's freight capacity occupied on the roundtrip) for transport within the A1 and A2 module.*

Transport Specifications	Value	Unit
EURO 4, 16-32 MT Freight Lorry		
Diesel Fuel Utilization	1.92×10^{-2}	kg/tkm
Capacity Utilization	37	%
Sasobit® Wax Transport Distance	635	km
Aramid Fiber Transport Distance	84	km
43,000 Ton, Sea Container Ship		
Heavy Fuel Oil Utilization	2.52×10^{-3}	kg/tkm
Capacity Utilization	70	%
Sasobit® Wax Transport Distance	16,013	km
Aramid Fiber Transport Distance	7,897	km

(A3) Manufacturing

This module includes the steps required to process and formulate the Ace XP™ product at the EFT manufacturing facility and includes any waste generated from these processes, transport of waste, and all inputs and outputs required to produce the Ace XP™ product's packaging (polyethylene bags and wrap, polyester strapping, corrugated boxes, and an HDPE pallet). The mass of the product packaging is displayed in **Table 6** below.

The processing steps are described below:

- Receiving of aramid fiber on spools;
- Loading of spools onto creels;
- Coating the fiber in wax;
- Cutting fiber to specified length; and
- Packing of product into plastic bags and corrugated boxes, which are wrapped and strapped down onto plastic pallets for transport to customers or a holding facility.

These five steps require electricity, freshwater, and natural gas and generate corrugated box waste, which is transported to a recycling facility; note that recycling is not included within the scope of this assessment [1]. The electricity used at the Rockford, Illinois based manufacturing facility is modeled in openLCA using data from the US EPA eGRID database for the US RFC region 2019 grid mix [4].

Transport for recycling of manufacturing waste is based on the EPA WARM model [5], which assumes a distance of 20 miles (~32km) from point of generation of waste to a disposal facility (e.g., landfill, recycling or incineration). Waste is assumed to be transported by the same type of truck used in module A2 (**Table 5**).

Table 6. *The mass of the product packaging.*

Product Packaging	Mass (kg)
Polyethylene bags	6.67
Polyethylene wrap	6.67
Polyester strapping	6.67
Corrugated boxes	66.7
HDPE pallet	16.7

4.2 DATA SOURCES

Table 7. *The LCI datasets from the Ecoinvent v3.7.1 (2020) database used to model the product system for the ACE XP™ product.*

Flow	Dataset
A1. Raw Materials*	
Sasobit® Wax	petroleum slack wax production, petroleum refinery operation | petroleum slack wax | Cutoff, U - ZA
A2. Transport	
Truck Transport	market for transport, freight, lorry 16-32 metric ton, EURO5 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U - RER
Ship Transport	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, U - GLO
A3. Manufacturing	
Electricity	market for electricity, medium voltage | electricity, medium voltage | Cutoff, U (US RFC, EIA 2019) - US-RFC
Natural Gas	heat production, natural gas, at boiler modulating >100kW | heat, district or industrial, natural gas | Cutoff, U - Europe without Switzerland
Waste Transport	market for transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U - RER
A3. Product Packaging	
Polyethylene Bags & Wrap	market for packaging film, low density polyethylene | packaging film, low density polyethylene | Cutoff, U - GLO
Polyester Strapping	market for fibre, polyester | fibre, polyester | Cutoff, U - GLO
Corrugated Boxes	corrugated board box production | corrugated board box | Cutoff, U - RoW
HDPE Pallet	polyethylene production, high density, granulate | polyethylene, high density, granulate | Cutoff, U - RER
A3. Waste Treatment	
Water Discharge	market for wastewater, unpolluted | wastewater, unpolluted | Cutoff, U - CH

*Note that the production of the aramid fiber used as a raw material was not modeled. Instead, the impact results from the production of the aramid fiber were provided by Teijin, whom calculated these results using the impact methods required by the PCR

4.3 DATA QUALITY

The data quality assessment is discussed in **Table 8** below for each of the data quality parameters. No data gaps were allowed which were expected to significantly affect the outcome of the impact indicator or LCI resource results.

Table 8. *Data quality assessment of the ACE XP™ product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old (typically 2015 or more recent). All of the data used represented an average of at least one year's worth of data collection. Manufacturer-supplied data (primary data) are based on annual production for 2019.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily European. Surrogate data used in the assessment are representative of European operations. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the Ace XP™ product. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. However, the LCIA values from the aramid fiber (which comprise 67% of the Ace XP™ product) were provided directly by the supplier. All secondary inventory data are from the Ecoinvent v3.7.1 database and are of similar quality and age.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at EFT's manufacturing facility represent an annual average and are considered of high quality due to the length of time over which these data are collected (one year), as compared to a snapshot that may not accurately reflect fluctuations in production. The Ecoinvent v3.7.1 database is used for secondary LCI datasets.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the Ace XP™ product is low. Primary data for the production of the aramid fiber was provided by the supplier (Teijin). Other upstream operations were modeled using background data and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) and were generally geographically representative. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

4.4 ALLOCATION

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR and minimized the use of allocation wherever possible.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of the Ace XP™ product. Primary data for resource use (e.g., electricity, natural gas, water) and waste generation were allocated on a mass-basis as a fraction of total annual production.

The transportation from primary producer of material components (e.g., the raw materials required for manufacturing) to the manufacturing facility is based on primary data provided by EFT, including the mode, location, and amount of material transported from each supplier. Transportation was allocated based on the mass and distance the material was transported.

4.5 CUT-OFF RULES

The cut-off criteria for including or excluding materials, energy, and emissions data from the study are in accordance with the PCR and are listed below:

- All inputs and outputs to a unit process are included in the LCA calculation for which data are available. Any data gaps are filled with representative data. Assumptions used for filling data gaps are documented in the LCA report.
- Where there is a data gap or insufficient data, criteria for exclusion of inputs and outputs is 1% of primary energy usage (renewable and non-renewable energy) and 1% on a mass basis for the specific unit process. The maximum criteria for exclusion of inputs and outputs is 5% of primary energy usage and mass across all modules included in the LCA.
- If a flow meets the above criteria for exclusion but is considered to have a significant potential environmental impact, it is included.
- Excluded processes include processing of waste relegated to recycling or recovery; note that recycling and recovery of all waste is outside of the system boundary [1].

4.6 SUMMARY OF ASSUMPTIONS

The assessment relied on several assumptions, described below:

- Representative inventory data for the Sasobit® wax was modeled with unit process data taken from Ecoinvent (**Table 7**);
- Representative inventory data from Ecoinvent, detailed in **Table 7**, was used to model the production of electricity, use of natural gas, and the production of packaging;
- Representative inventory data from Ecoinvent was used to model all transport (**Table 7**);
- The transport distance of all waste from the point of generation to a treatment facility is based on the EPA WARM model assumption of 20 miles (~32 km); and
- Mass allocation was used to estimate the quantity of electricity, natural gas, and water used, as well as the waste generated to produce one metric ton of Ace XP™.

4.7 PERIOD UNDER REVIEW

The period of review is January 1, 2019 through December 31, 2019.

4.8 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

5. LCA Results

In accordance with the PCR, the required impact categories—global warming potential (GWP), acidification potential (AP), eutrophication potential (EP), ozone depletion potential (ODP), and smog potential (POCP)—are reported. One additional impact category, fossil fuel depletion (FF), is also reported. As required by the PCR [1], the impact methods for North America, TRACI 2.1, are used.

It should be noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. In addition, 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.

It should also be noted that Teijin purchases renewable energy certificates (RECs) for its facility, which were included by the Teijin LCA practitioner in the aramid model to reduce the impact from their use of electricity in the production process. This model was used to produce the LCIA results provided to SCS.

Any comparison of EPDs shall be subject to the requirements of ISO 21930:2017 [1]. 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.

The PCR requires the calculation of biogenic carbon emissions and removals. While the product packaging includes a small mass of corrugated boxes which contain biogenic carbon the disposal and treatment of this packaging is not considered within this cradle-to-gate LCA, and since the forest which supplied the wood has not been verified to be sustainably managed, the biogenic carbon content of the packaging is not assessed within this LCA.

5.1 CRADLE-TO-GATE IMPACT

The cradle-to-gate impact for each LCIA category is reported in **Table 9** below. **Figure 2** shows the percent contribution of each life cycle module to the total cradle-to-gate impact.

Table 9. *The cradle-to-gate impact of the Ace XP™ product, reported by life cycle module for all impact categories. The second row of each impact category shows the percent contribution of each life cycle module to the total cradle-to-gate impact. Impact is reported for one metric ton of Ace XP™ product.*

Impact Category (units)	Total (A1-A3)	A1	A2	A3
GWP (kg CO_2 eq)	6,923	5,741	149	1,033
	100%	83%	2%	15%
AP (kg SO_2 eq)	16.8	12.3	3.02	1.44
	100%	73%	18%	9%
EP (kg N eq)	4.22	2.99	0.201	1.04
	100%	71%	5%	25%
ODP (kg CFC-11 eq)	4.31×10^{-3}	4.15×10^{-3}	3.29×10^{-5}	1.30×10^{-4}
	100%	96%	1%	3%
POCP (kg NMVOC eq)	288	211	56.9	20.1
	100%	73%	20%	7%
FF (MJ surplus)	19,458	16,808	295	2,355
	100%	86%	2%	12%

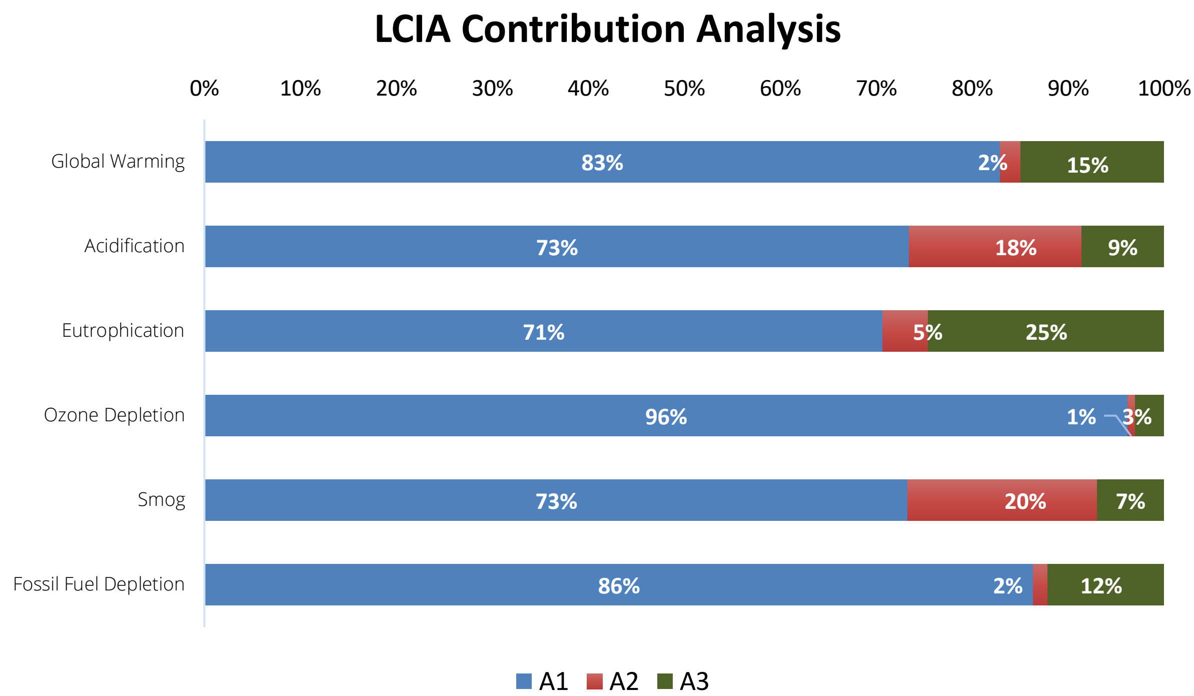

Figure 2. *The contribution of each life cycle module to the total impact of each impact category.*

6. LCI Results

The following life cycle inventory (LCI) parameters specified by the PCR, shown in **Table 10**, are reported in **Table 11,** below.

Table 10. *The full name, abbreviation, and unit of additional LCI indicators required by the PCR.*

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	**CRU:** Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	**MFR:** Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Table 11. *The cradle-to-gate inventory impacts of each inventory indicator category reported for each metric ton of Ace XP™ product. The second row of each inventory category shows the percent contribution of each life cycle module to the total cradle-to-gate impact.*

Impact Category (units)	Total (A1-A3)	A1	A2	A3
RPRe (MJ)	39,561	37,495	29.8	2,036
	100%	95%	0%	5%
RPRm (MJ)	1.491	0.00	0.00	1.49
	100%	0%	0%	100%
NRPRe (MJ)	139,361	119,887	2,026	17,448
	100%	86%	1%	13%
NRPRm (MJ)	$1.5109x10^{4}$	$1.5109x10^{4}$	0.00	0.00
	100%	100%	0%	0%
SM (kg)	0.00	0.00	0.00	0.00
	-	-	-	-
RSF/NRSF (MJ)	neg.	neg.	neg.	neg.
	-	-	-	-
FW (m^3)	98.1	97.2	0.527	0.3283
	100%	99%	1%	0%
HWD (kg)	$9.046x10^{-3}$	$5.1436x10^{-3}$	$3.042x10^{-3}$	$8.79672x10^{-4}$
	100%	57%	34%	10%
NWHD (kg)	131	77.4	37.4	165.08
	100%	59%	29%	12%
HLRW (kg)	$5.478x10^{-3}$	$1.8218x10^{-4}$	$7.50495x10^{-5}$	$5.222x10^{-3}$
	100%	3%	1%	95%
ILLRW (kg)	0.661	0.624	$1.38x10^{-2}$	$2.31x10^{-2}$
	100%	94%	2%	3%
CRU (kg)	0.00	0.00	0.00	0.00
	-	-	-	-
MR (kg)	0.00	0.00	0.00	0.00
	-	-	-	-
MER (MJ)	neg.	neg.	neg.	neg.
	-	-	-	-
RE (MJ)	neg.	neg.	neg.	neg.
	-	-	-	-

7. References

1. ISO 21930: 2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.

2. GreenDelta, 2021. openLCA 1.10.3. https://www.openlca.org/openlca/

3. Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8>

4. US EPA, 2021. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/egrid

5. US EPA, 2004. "WARM Model Transportation Research - Draft." Memorandum from ICF Consulting to United States Environmental Protection Agency.http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html#background

6. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.

7. ISO 14040: 2006/Amd 1:2020 Environmental Management – Life cycle assessment – Principles and Framework

8. ISO 14044: 2006/Amd 1:2017/Amd 2:2020 Environmental Management – Life cycle assessment – Requirements and Guidelines.

9. SCS Type III Environmental Declaration Program: Program Operator Manual. V11.0 November 2021. SCS Global Services.

10. Bare, J. C. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), Version 2.1 - User's Manual; EPA/600/R-12/554 2012. https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci

11. European Joint Research Commission. International Reference Life Cycle Data System handbook. *General guide for Life Cycle Assessment – Detailed Guidance.* © European Union, 2010.

SURFACE TECH™

For more information, contact:

Surface Tech LLC
888 Prospect Street, #200
La Jolla, California 92037
Phone: +1.619.880.0265 | https://surface-tech.com/

SCSglobal SERVICES

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.510.452.8000 | fax +1.510.452.8001