Environmental Product Declaration

Environmental Product Declaration for SMA cellulose fiber products produced by Advanced Fiber Technology at their facility in Bucyrus, OH

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers SMA cellulose fibers products produced by Advanced Fiber Technology. Declared unit: 1 lb of fiber
Declaration Owner:	Advanced Fiber Technology 100 Crossroads Blvd Bucyrus, Ohio www.advanced-fiber.com
Program Operator:	Labeling Sustainability 757 SE Courances Dr Port St. Lucie, FL, 34984 www.labelingsustainability.com
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 Program Operator: International Organization for Standardization PCR review was conducted by: Technical Committee: ISO/TC 59/SC 17 Sustainability in buildings and civil engineering works
Independent LCA Reviewer and EPD Verifier:	This declaration was independently verified in accordance with ISO 14025:2006. Independent verification of the declaration, according to ISO 14025:2006 Internal ☐ ; External ☐ X Third Party Verifier Geoffrey Guest, Certified 3rd Party Verifier under the Labeling Sustainability Program (www.labelingsustainability.com), CSA Group (www.csaregistries.ca),
Date of Issue:	28 August 2024
Period of Validity:	5 years; valid until 28 August 2029
EPD Number:	b25f9c97-f9ae-437d-b0ca-13e4cbed3732

TABLE OF CONTENTS

COMPANY DESCRIPTION

Advanced Fiber Technology (AFT) converts recycled cellulose fibers into different products primarily for the residential insulation and asphalt paving industries.

STUDY GOAL

The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, www.labelingsustainability.com. This level of study is in accordance with EPD Product Category Rule (PCR) published by the International Standards Organization (ISO) 21930:2017 Sustainability in buildings and civil works - Core rules for EPDs of construction products and services; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing is in alignment with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is intended to be disclosed to the public.

This project report was commissioned to differentiate Advanced Fiber Technology from their competition for the following reasons: generate an advantage for the organization; offer customers information to help them make informed product decisions; improve the environmental performance of AFT by continuously measuring, controlling and reducing the environmental impacts of their products; help project facilitators working on Leadership in Energy and Environmental Design (LEED) projects achieve their credit goal; and to strengthen AFTs license to operate in the community. The intended audience for this LCA report is Advanced Fiber Technology's employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policy makers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.

DESCRIPTION OF PRODUCT AND SCOPE

SMA (Stone Mastic Asphalt) fibers are manufactured by shredding paper and cardboard from recycled sources, with additives to the paper base and mixing the components to a homogeneous blend.

This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-gate study, and therefore, stages extending beyond the plant gate are not included in this LCA. Excluded stages include transportation of the manufactured material to the construction site; on-site construction processes and components; building (infrastructure) use and maintenance; and "end-of-life" effects.

SMA CELLULOSE FIBERS DESIGN SUMMARY

The following tables provide a list of the SMA cellulose fibers products considered in this EPD along with key performance parameters.

Table 1: **Declared products with All declared products considered in this environmental product declaration**

Prod#	Unique name/ID	Short description	Product type	Density, dry kg/Unit
1	SMA Fibers-Big Bales	AFT SMA Cellulose binding fibers for use in asphalt production	SMA Cellulose Fibers	2.205
2	SMA Fibers-40lbs Bags	AFT SMA Cellulose binding fibers for use in asphalt production	SMA Cellulose Fibers	2.205

SMA CELLULOSE FIBERS DESIGN COMPOSITION

The following figures provide mass breakdown (kg per functional unit) of the material composition of each SMA cellulose fibers design considered.

Table 2: **SMA cellulose fibers composition.**

Product Components	Product Components
Recycled Cellulose Fiber	90 – 93 %
Additives Proprietary	0 – 10 %
Total	100 %

A1 RAW MATERIAL RECYCLED CONTENT AND MATERIAL LOSSES

The following table provides a list of the raw material inputs (module A1) across all products considered, their recyclability content and assumed material losses.

Table 3: **Module A1 raw material inputs, the recyclability content and assumed material losses (dry basis)**

Product.name	Mix.category	Primary.content	Material.losses
Cellulose fiber	Cellulose fiber	90%	2%

SYSTEM BOUNDARIES

The following figure depicts the cradle-to-gate system boundary considered in this study:

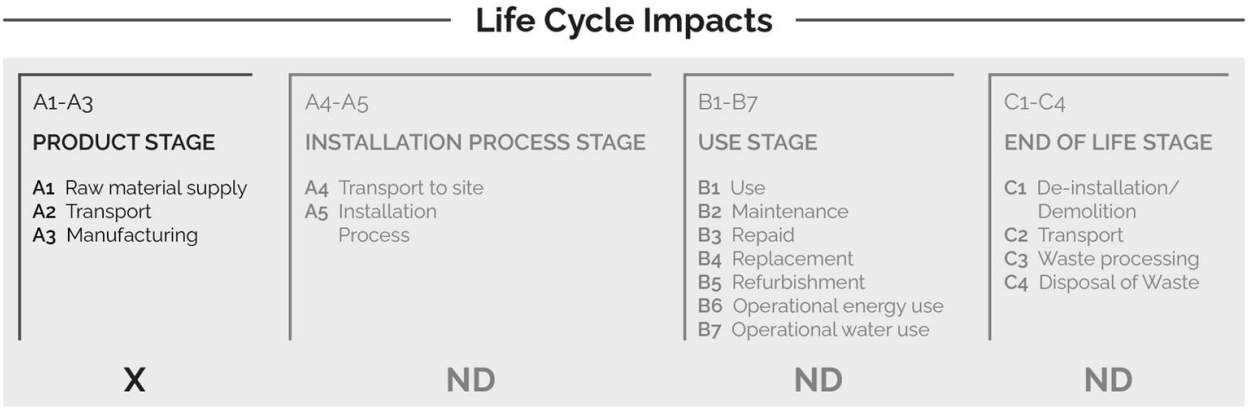

Figure 1: **General life cycle phases for consideration in a construction works system.**

This is a Cradle-to-gate life cycle assessment, and the following life cycle stages are included in the study:

- A1: Raw material supply (upstream processes) - Extraction, handling, and processing of the materials used in manufacturing the declared products in this LCA.
- A2: Transportation - Transportation of A1 materials from the supplier to the "gate" of the manufacturing facility (i.e. A3).
- A3: Manufacturing (core processes)- The energy and other utility inputs used to store, move, and manufacture the declared products and to operate the facility.

According to the PCR, the following figure illustrates the general activities and input requirements for producing SMA cellulose fibers products and is not necessarily exhaustive.

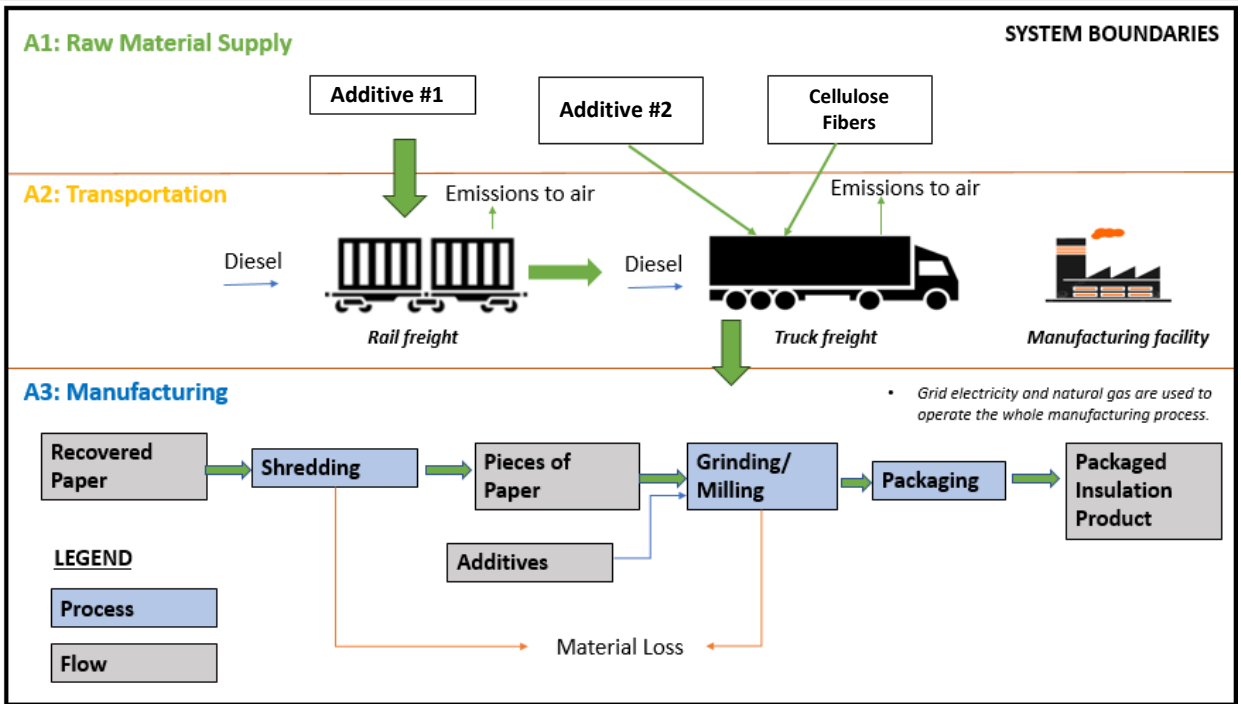

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

In addition, as according to the relevant PCR, the following requirements are excluded from this study:

- Production, manufacture and construction of A3 building/capital goods and infrastructure;
- Production and manufacture of steel production equipment, steel delivery vehicles, earth-moving equipment, and laboratory equipment;
- Personnel-related activities (travel, furniture, office supplies);
- Energy use related to company management and sales activities.

For this LCA the manufacturing plant, owned and operated by Advanced Fiber Technology, is located in Bucyrus, Ohio. All operating data is formulated using the actual data from Advanced Fiber Technology's plant at the above location, including water, energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

This life cycle inventory was organized in a spreadsheet and was then input into an RStudio environment where pre-calculated LCIA results for relevant products/activities stemming from the ecoinvent v3.10 database and a local EPD database in combination with primary data from Advanced Fiber Technology were utilized. Explanations of the contribution of each data source to this study are outlined in the section 'Data Sources and Quality'. Further LCI details for each declared product are provided in the sections 'Detailed LCI tables' and 'Transport tables' of the detailed LCA report. A parameter uncertainty analysis was also performed where key statistical results (e.g. min/mean/max etc.) are provided in the detailed LCA report.

CUT-OFF CRITERIA

ISO 14044:2006 and the focus PCR requires the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off criteria were applied to all other processes unless otherwise noted above as follows. A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the total of the neglected inputs does not exceed 5%.

DATA SOURCES AND DATA QUALITY ASSESSMENT

No recovered on-site energy occurs at this facility.

Table 4: **Reused or recycled components/materials at the A3 facility site**

Component/material for re-use/recycling	Value	Units	Re-used/recycled on-site or off-site
Pallets	101,576.9	kg	On-site

The following statements explain how the above facility requirements/generation were derived:

Raw material transport: AFT provided all the raw material data for the reference year 2023. Raw material transportation is based on the actual distance from the manufacturer. The transportation was reported using AFT primary data that consisted of the actual distance, mode of transport, and location in the city, state, and country. AFT SMA fibers are manufactured by shredding paper and cardboard from recycled sources, adding fire-retardant chemicals and other additives to the paper base and mixing the components to a homogeneous blend. The provision of raw materials relies on two modes of transportation: truck freight and rail freight.

Electricity: Electricity consumption values are for AFT. These values were direct reported from AFT records.

Process/space heating: No fuel is used for space heating at this plant.

Fuel required for machinery: Truck-related fuel requirements were determined from direct AFT information.

Waste generation: No waste generation was recorded.

Recovered energy: No on-site energy is recovered on site.

Recycled/reused material/components: No recycling is assumed based on information in this cradle-to-gate study. pallets are reused on site."

Module A1 material losses: Due to lack of data, default loss factors of 2% were assumed.

Direct A3 emissions accounting: Direct emissions were modeled with the best available ecoinvent processes (see LCI list).

The following tables depict a list of assumed life cycle inventory utilized in the LCA modeling to generate the impact results across the life cycle modules in scope. An assessment of the quality of each LCI activities utilized from various sources is also provided.

Table 5: **LCI inputs assumed for module A1 (i.e., raw material supply)**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Additive #2	Proprietary	ecoinvent v3.10 in 2024	Multiple Regions	2024	2	3	2	3	3
Additive #1	Proprietary	ecoinvent v3.10 in 2024	Multiple Regions	2024	2	3	2	3	3
Cellulose fiber	cellulose fiber production/cellulose fiber/RoW/kg	ecoinvent v3.10 in 2024	Multiple Regions	2024	1	3	2	3	3

Table 6: **LCI inputs assumed for module A2 (i.e. transport of A1 inputs))**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Additive #1	market for transport, freight train/transport, freight train/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Additive #1	market for transport, freight, lorry 16-32 metric ton, EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Cellulose fiber- freight transport via Truck	market for transport, freight, lorry 16-32 metric ton, EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Diesel burning-freight	market for transport, freight, lorry 16-32 metric ton,	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3

transport via Truck	EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm								
Additive #2	market for transport, freight, lorry 16-32 metric ton, EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Plastic bag-freight transport via Truck	market for transport, freight, lorry 16-32 metric ton, EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Plastic wrap (Bales)-freight transport via Truck	market for transport, freight, lorry 16-32 metric ton, EURO6/transport, freight, lorry 16-32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3

Table 7: **LCI inputs assumed for module A3**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Diesel burning	diesel, burned in building machine/diesel, burned in building machine/GLO/MJ	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3
Electricity	market for electricity, medium voltage/electricity, medium voltage/US-RFC/kWh	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3
Pallets	EUR-flat pallet production/EUR-flat pallet/RoW/unit	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3
Plastic bag	extrusion, plastic film/extrusion, plastic film/RoW/kg	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3

Plastic wrap (Bales)	packaging film production, low density polyethylene/packaging film, low density polyethylene/RoW/kg	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3

DATA QUALITY ASSESSMENT

Data quality/variability requirements, as specified in the PCR, are applied. This section describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged based on its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

Precision: Through measurement and calculation, the manufacturers collected and provided primary data on their annual production. For accuracy, the LCA practitioner and 3rd Party Verifier validated the plant gate-to-gate data.

Completeness: All relevant specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared products. The majority of relevant background materials and processes were taken from ecoinvent v3.10 LCI datasets where relatively recent region-specific electricity inputs were utilized. The most relevant EPDs requiring key A1 inputs were also utilized where readily available.

Consistency: To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned and recovered SMA Cellulose Fiber materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the ecoinvent v3.10 database were used across all product systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process levels to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a machine-readable project file for all foreground and background processes, and in Labeling Sustainability's proprietary SMA Cellulose Fibers LCA calculator* for all production facility and product-specific calculations. A considerable level of transparency is provided throughout the detailed LCA report as the specifications and material quantity make-up for the declared products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed publicly accessible data to allow full external reproducibility was not possible due to reasons of confidentiality.

*Labeling Sustainability has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for SMA Cellulose Fibers product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e. 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in any typical LCA software like openLCA or SimaPro. The tool was tested against several LCAs performed in openLCA and the tool generated identical results to those realized in openLCA across every impact category and inventory metric (where comparisons could be readily made).

Representativeness: The representativeness of the data is summarized as follows.

- Time related coverage of the manufacturing processes' primary collected data from 2023-07-01 to 2024-06-30.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets as found in the country-adjusted ecoinvent v3.10 database.
- Geographical coverage for inputs required by the A3 facility(ies) is representative of its region of focus; other upstream and background processes are based on US, North American, or global average data and adjusted to regional electricity mixes when relevant.
- Technological coverage is typical or average and specific to the participating facilities for all primary data.

ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment indicators and inventory metrics as listed in the tables below. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized as they provide a North American context for the mandatory category indicators to be included in the EPD. Additionally, the PCR requires a set of inventory metrics to be reported with the LCIA indicators (see tables below).

Table 8: **Life cycle impact categories and life cycle inventory metrics**

ID	LCIA.indicators	Abbreviations	Units
1	Climate change: global warming potential (GWP100)	GWP100	kg CO2-eq
2	Ozone depletion: ozone depletion potential (ODP)	ODP	kg CFC-11-eq
3	Acidification: acidification potential (AP)	AP	kg SO2-eq
4	Eutrophication: eutrophication potential	EP	kg N-eq
5	Smog formation potential	SFP	kg O3-eq
6	Energy resources: non-renewable: abiotic depletion potential (ADP): fossil fuels	ADPfossil	MJ
Inventory metrics			
7	Inventory indicators ISO21930: Cumulative Energy Demand - renewable energy resources	RPRE	MJ
8	Inventory indicators ISO21930: Renewable primary resources with energy content used as material (i.e., PERM)	PRM	MJ
9	Inventory indicators ISO21930: Cumulative Energy Demand - non-renewable energy resources	NRPRE	MJ
10	Inventory indicators ISO21930: Non-renewable primary resources with energy content used as material (i.e., PENRM)	NRPRM	kg
11	Inventory indicators ISO21930: use of secondary material	SM	MJ
12	Inventory indicators ISO21930: use of renewable secondary fuels	RSF	MJ
13	Inventory indicators ISO21930: recovered energy	RE	MJ
14	Inventory indicators ISO21930: use of net fresh water	FW	m3
15	Inventory indicators ISO21930: hazardous waste disposed	HWD	kg

16	Inventory indicators ISO21930: non-hazardous waste disposed	NHWD	kg
17	Inventory indicators ISO21930: high-level radioactive waste disposed	HLRW	kg
18	Inventory indicators ISO21930: intermediate and low-level radioactive waste disposed	ILLRW	kg
19	Inventory indicators ISO21930: materials for recycling	MR	kg
20	Inventory indicators ISO21930: materials for energy recovery	MER	kg
21	Inventory indicators ISO21930: exported energy - electricity	EEel	MJ
22	Inventory indicators ISO21930: exported energy - heat	EEheat	MJ

It should be noted that 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 any of the following categories.

- Renewable primary energy resources as energy (fuel);
- Renewable primary resources as material;
- Non-renewable primary resources as energy (fuel);
- Non-renewable primary resources as material;
- Secondary Materials;
- Renewable secondary fuels;
- Non-renewable secondary fuels;
- Recovered energy;
- Abiotic depletion potential for non-fossil mineral resources.
- Land use related impacts, for example on biodiversity and/or soil fertility;
- Toxicological aspects;
- Emissions from land use change [GWP 100 (land-use change)];
- Hazardous waste disposed;
- Non-hazardous waste disposed;
- High-level radioactive waste;
- Intermediate and low-level radioactive waste;
- Components for reuse;
- Materials for recycling;
- Materials for energy recovery;
- Recovered energy exported from the product system.

TOTAL IMPACT SUMMARY

Interpretation

In the life cycle analysis of Advance Fiber Technology products, SMA fiber, key environmental hotspots include cellulose fiber production in Module A1, which contributes 39.1% of the total impact for SMA Fibers-Big Bales and 37.9% for SMA Fibers-40lbs Bags. Additionally, electricity usage in Module A3 accounts for 33.3% of the total impact for SMA Fibers-Big Bales and 32.3% for SMA Fibers-40lbs Bags.

The freight transport of cellulose fiber via truck in Module A2 also plays a notable role, contributing 15.9% for SMA Fibers-Big Bales and 15.4% for SMA Fibers-40lbs Bags. Mitigation strategies should focus on reducing the impact of cellulose fiber production and electricity consumption during production and transportation. This can involve seeking alternative materials, optimizing production processes, and improving transportation efficiency. For products like 'SMA Fibers-Big Bales' and 'SMA Fibers-40lbs Bags,' strategies should concentrate on these major contributing components while considering sustainable practices in their production and application.

The following table reports the total LCA results for each product produced at the given SMA cellulose fibers facility on a per 1 lb of fiber basis.

Table 9: **Total life cycle (across modules in scope) impact results for All declared products, assuming the geometric mean point values on a per 1 lb of fiber basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	GWP100	ODP	AP	EP	SFP	ADPfossil
Unit	kg CO2-eq	kg CFC-11-eq	kg SO2-eq	kg N-eq	kg O3-eq	MJ
Minimum	0.13	1.14e-09	0.000534	0.000498	0.00678	1.48
Maximum	0.134	1.29e-09	0.00055	0.000532	0.00705	1.61
Mean	0.132	1.22e-09	0.000542	0.000515	0.00691	1.54
Median	0.132	1.22e-09	0.000542	0.000515	0.00691	1.54
SMA Fibers-Big Bales	0.134	1.29e-09	0.00055	0.000532	0.00705	1.61
SMA Fibers-40lbs Bags	0.13	1.14e-09	0.000534	0.000498	0.00678	1.48

b) Resource Inventory Metrics:

Indicator/LCI Metric	RPRE	PRM	NRPRE	NRPRM	SM	RSF	RE	FW
Unit	MJ	MJ	MJ	kg	MJ	MJ	MJ	m3
Minimum	0.085	0.00013	0.0851	0.0184	0.161	8.35e-05	0.00183	0.000736
Maximum	0.0957	0.0041	0.0959	0.0828	0.161	0.000173	0.0019	0.000765
Mean	0.0904	0.00212	0.0905	0.0506	0.161	0.000128	0.00186	0.00075
Median	0.0904	0.00212	0.0905	0.0506	0.161	0.000128	0.00186	0.00075
SMA Fibers-Big Bales	0.0957	0.0041	0.0959	0.0828	0.161	0.000173	0.0019	0.000765
SMA Fibers-40lbs Bags	0.085	0.00013	0.0851	0.0184	0.161	8.35e-05	0.00183	0.000736

c) Waste/output Inventory Metrics:

Indicator/LCI Metric	HWD	NHWD	HLRW	ILLRW	MR	MER	EEel	EEheat
Unit	**kg**	**kg**	**kg**	**kg**	**kg**	**kg**	**MJ**	**MJ**
Minimum	0.0141	0.244	1.31e-06	4.84e-06	4.41e-05	9.13e-08	0.00164	0.000167
Maximum	0.0143	0.276	1.33e-06	4.89e-06	4.53e-05	1.06e-07	0.00168	0.000198
Mean	0.0142	0.26	1.32e-06	4.86e-06	4.47e-05	9.86e-08	0.00166	0.000182
Median	0.0142	0.26	1.32e-06	4.86e-06	4.47e-05	9.86e-08	0.00166	0.000182
SMA Fibers-Big Bales	0.0143	0.276	1.33e-06	4.89e-06	4.53e-05	1.06e-07	0.00168	0.000198
SMA Fibers-40lbs Bags	0.0141	0.244	1.31e-06	4.84e-06	4.41e-05	9.13e-08	0.00164	0.000167

ADDITIONAL ENVIRONMENTAL INFO

No regulated substances of very high concern are utilized on site.

REFERENCES

ISO Standards:

- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14067:2018 Greenhouse Gases – Carbon Footprint of Products – Requirements and Guidelines for Quantification
- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

EN Standards:

- EN 16757 Sustainability of construction works - Environmental product declarations – Product Category Rules for concrete and concrete elements

- EN 15804 Sustainability of construction works - Environmental product declarations -Core rules for the product category of construction products

Other References:

- USGBC LEED v4 for Building Design and Construction, 11 Jan 2019 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b
- USGBC PCR Committee Process & Resources: Part B, USGBC, 7 July 2017 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b.
- US EPA (2020) Advancing Sustainable Materials Management: 2018 Fact Sheet, https://www.epa.gov/sites/production/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf