KEWAUNEE Scientific Corporation

Environmental Product Declaration

Environmental Product Declaration for epoxy resin countertop products produced by Kewaunee Scientific Corporation at their facility in Statesville, North Carolina

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers epoxy resin countertop products produced by Kewaunee Scientific Corporation. Declared unit: 1 m2 of Kemresin product
Declaration Owner:	Kewaunee Scientific Corporation 2700 West Front Street Statesville, North Carolina www.kewaunee.com
Program Operator:	Labeling Sustainability Address, 11670 W Sunset Blvd. City, State, Los Angeles, CA www.epdregistration.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:	10 May 2024
Period of Validity:	5 years; valid until 10 May 2029
EPD Number:	7a779ebc-507f-4ace-9739-10a87e858261

TABLE OF CONTENTS

COMPANY DESCRIPTION

Kewaunee Scientific Corporation is a recognized global leader in the design, manufacture, and installation of laboratory, healthcare, and technical furniture products. Products include steel and wood casework, fume hoods, adaptable modular systems, moveable workstations, stand-alone benches, and epoxy resin worksurfaces and sinks.

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 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 Kewaunee Scientific Corporation 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 Kewaunee Scientific Corporation 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 Kewaunee Scientific Corporation's license to operate in the community. The intended audience for this LCA report is Kewaunee Scientific Corporation'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

As per the PCR, the product characteristics, along with relevant testing standards when applicable, shall be provided in a manner that facilitates clear identification of the described product.

Table 1: **Product Characteristics.**

Characteristic	Nominal Value	Unit	Test Method
Primary Material Thickness	1	inch	-
Sheet / Slab Length	96	inch	-
Sheet / Slab Width	60	inch	-
Primary material weight	10	(lbs/sq ft)	-
Underlayment included	No	-	-
Underlayment type	N/A	-	-
Additional Characteristics	NULL	-	-
Fungal resistance	Tops are Non Porous	-	-
Bacterial resistance	Tops are Non Porous	-	-
Cleanability / Stain resistance	See chart below	-	-
Visual defects	See chart below	-	-
Water Absorption 2 hour boil	0.00039	-	ASTM D570
Water Absorption 24 hours	0.00013	-	ASTM D570
Water Absorption 7 days	0.00035	-	ASTM D570
Heat Deflection Temperature	203.4 degrees F	-	ASTM D648
Flame Spread	15	-	ASTM E84-18a
Flexural strength	15000 psi	-	ASTM D790
Flexural modulus	2220323 psi	-	ASTM D790
Compressive Strength	32708 psi	-	ASTM D695
Tensile Strength	10519 psi	-	ASTM D638
Hardness, Barcol (Rockwell)	90	-	ASTM D785-08
Specific Gravity	1.94 g/cc	-	ASTM D792

A Chemical Resistance Test Rating Chart serves as a comprehensive guide to understanding how the material performs under specific chemical exposure. This systematic testing offers a clear and concise overview of the resistance levels of different chemicals when interacting with the material in question. Rating Guide: 0 = No Effect: No detectable change in the material surface. 1 = Excellent: Slight detectable change in color or gloss but no change in function or life of the surface. 2 = Good: A clearly discernible change in color or gloss but no significant impairment of surface life or function. 3 = Fair: Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.

Table 2: **Chemical Resistance Test Rating Chart.**

Chemical Reagent	Rating
Amyl Acetate	1
Ethyl Acetate	0
Acetic Acid, 98%	0
Acetone	1
Acid Dichromate, 5%	2
Butyl Alcohol	0
Ethyl Alcohol	0
Methyl Alcohol	0
Aluminum Hydroxide, 28%	0
Benzene	0
Carbon Tetrachloride	0
Chloroform	1
Chromic Acid, 60%	2
Cresol	1
Dichlor Acetic Acid	1
Dimethylformanide	1
Dioxane	1
Ethyl Ether	1
Formaldehyde, 37%	0
Formic Acid, 90%	1
Furfural	1
Gasoline	0
Hydrochloric Acid, 37%	1
Hydrofluoric Acid, 48%	2
Hydrogen Peroxide, 3%	0
Tincture of Iodine	0
Methyl Ethyl Ketone	1
Methylene Chloride	1
Mono Chlorobenzene	0
Naphthalene	0
Nitric Acid, 20%	0
Nitric Acid, 30%	0
Nitric Acid, 70%	1
Phenol, 90%	1
Phosphoric Acid, 85%	0
Silver Nitrate, Saturated	0
Sodium Hydroxide, 10%	0
Sodium Hydroxide, 20%	0
Sodium Hydroxide, 40%	0
Sodium Hydroxide, Flake	0
Sodium Sulfide, Saturated	0
Sulfuric Acid, 33%	0
Sulfuric Acid, 77%	0
Sulfuric Acid, 96%	0
Sulfuric Acid, 77% & Nitric Acid, 70%, Equal Parts	1
Toluene	0

Trichloroethylene	0
Xylene	0
Zinc Chloride, Saturated	0

Kemresin is "Omni-phobic", meaning that it prevents liquid from spreading, making it very easy to clean and more resistant to stains. Kemresin Epoxy Resin has excellent resistance to practically all acids, alkalines, and solvents, and is highly resistant to heat and normal physical abuse. Resin tops are monolithic, same solid material throughout the thickness of the material. This means the same chemical nature is present throughout the full thickness of the countertop. Kemresin comes in 4 colors: Black, Grey, Slate Grey, and Putty.

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.

EPOXY RESIN COUNTERTOP DESIGN SUMMARY

The following tables provide a list of the epoxy resin countertop products considered in this EPD along with key performance parameters.

Table 3: **Declared products with All declared products considered in this study.**

Prod #	Unique name/ID	Short description	Product type	Unit	Density, dry kg/Unit	bio-carbon content, kg C/FU dry basis	product Group	Length (cm)	Width (cm)	Thickness (cm)
1	Kemresin	Epoxy resin worktops and accessories	Epoxy Resin	m2	50.69	0.00	Epoxy Resin	100	100	2.54

EPOXY RESIN COUNTERTOP DESIGN COMPOSITION

The following figures provide mass breakdown (kg per functional unit) of the material composition of each epoxy resin countertop design considered.

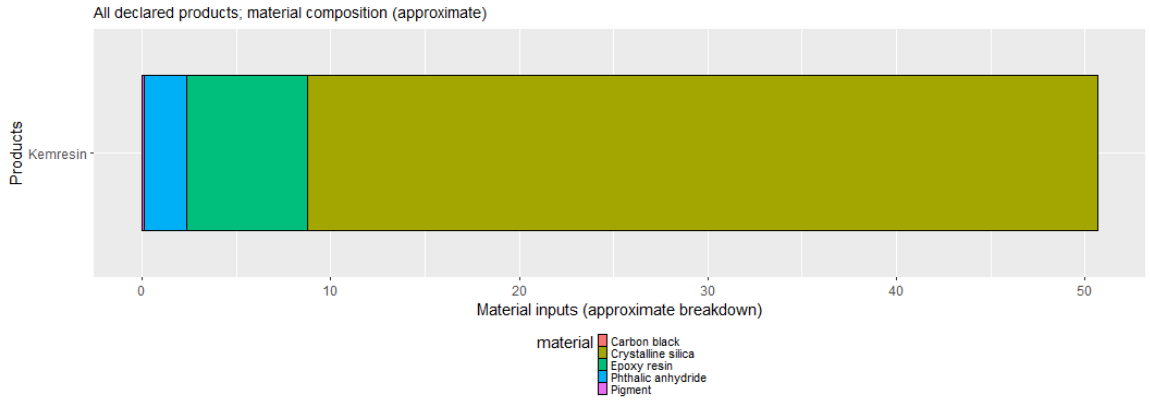

Figure 1: **Material composition - All declared products per 1 m2 of kemresin product**

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

product.name	mix.category	primary. content	post.industrial. content	post.consumer. content	material.losses
Epoxy resin	epoxy resin, liquid	100%	0%	0%	2%
Crystalline silica	silica sand	100%	0%	0%	2%
Pigment	chemical, organic	100%	0%	0%	2%
Phthalic Anhydride	phthalic anhydride	100%	0%	0%	2%
Carbon black	carbon black	100%	0%	0%	2%

SYSTEM BOUNDARIES

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

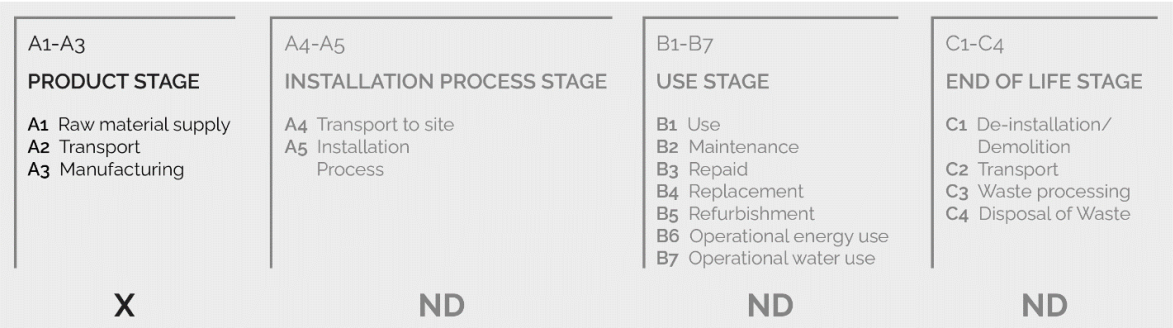

Figure 2: **General life cycle phases for consideration in a construction works system.**

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 manufacturer the declared products and to operate the facility.

As according to the PCR, the following figure illustrates the general activities and input requirements for producing epoxy resin countertop products and is not necessarily exhaustive.

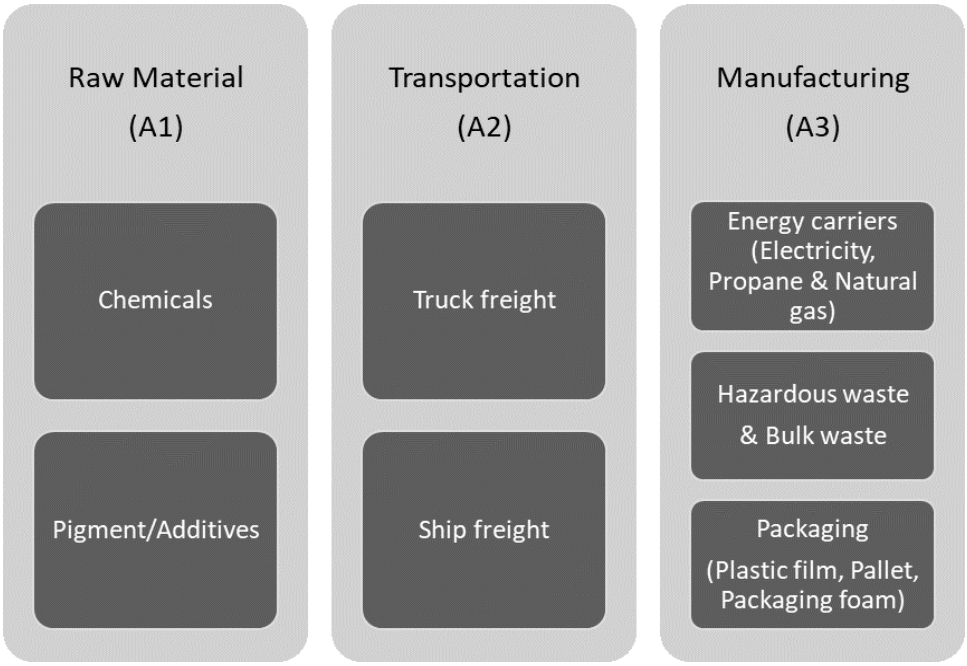

Figure 3: **General system inputs considered in the product system and categorized by modules in scope.**

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 Kewaunee Scientific Corporation, is located at their Countertop facility in Statesville, NC. All operating data is formulated using the actual data from Kewaunee Scientific Corporation'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 Kewaunee Scientific Corporation 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.

No known flows are deliberately excluded from this EPD.

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.

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

Raw material transport: Kewaunee provided all the raw material data for the reference year 2022. Raw material transportation is based on the actual distance from the manufacturer/distributor. The transportation was reported using Kewaunee's primary data that consisted of the actual distance, mode of transport, and location in the city, state, and country.

Electricity: The reported electricity consumption is based on the Kewaunee primary information from utility bills for the reporting period. Since Kewaunee produces various product lines within its manufacturing facility, therefore electricity usage for Kemresin products was allocated based on the sales volume of Kemresin products.

Process/space heating: The facility incorporates both natural gas and propane within its production processes. The reported consumptions of natural gas and propane are based on the Kewaunee primary information derived from utility bills for the reporting period. The conversion factor used for mmBTU to MJ to represent the natural gas heating values in Mega joules (MJ) was, 1 mmBTU equating to 1055.055 MJ. Similarly, for propane the conversion factor was determined as 1m3 of propane = 93.1 MJ of energy.

Fuel required for machinery: No on-site machinery fuel used.

Waste generation: Waste generation values for both hazardous and non-hazardous waste are reported directly from Kewaunee's operational activities. Transportation defaults were used because the driver's route and ultimate final destination are unknown. Therefore, the exact mileage could not be confirmed by the waste hauler. Transportation for waste in the end-of-life modules also uses default distances set by the PCR.

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

Recycled/reused material/components: No material for re-use or recycling was quantified leaving from the facility.

Module A1 material losses: Default material losses, 2% were used unless otherwise specified in the PCR.

Direct A3 emissions accounting: Direct emissions were modeled with 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
Carbon black	carbon black production/carbon black/GLO/kg	ecoinvent v3.10 in 2024	Michigan	2024	2	3	2	3	3
Crystalline silica	silica sand production/silica sand/RoW/kg	ecoinvent v3.10 in 2024	Tennessee	2024	2	3	2	3	3
Epoxy resin	epoxy resin production, liquid/epoxy resin, liquid/RoW/kg	ecoinvent v3.10 in 2024	Chonburi	2024	2	3	2	3	3
Pigment	chemical production, organic/chemical, organic/GLO/kg	ecoinvent v3.10 in 2024	Ohio	2024	0	3	2	3	3
Phthalic Anhydride	phthalic anhydride production/phthalic anhydride/RoW/kg	ecoinvent v3.10 in 2024	Pennsylvania	2024	2	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
Bulk waste- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Carbon black- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Crystalline silica- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Epoxy resin- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Foam- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Hazardous waste- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Phthalic Anhydride- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Pigment- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >32 metric ton, EURO6/RoW/tkm	ecoinvent v3.10 in 2024	RoW	2024	2	3	1	3	3
Plastic wrap- freight transport via Truck	market for transport, freight, lorry >32 metric ton, EURO6/transport, freight, lorry >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
Bulk waste	process-specific burdens, residual material landfill/process-specific burdens, residual material landfill/RoW/kg	ecoinvent v3.10 in 2024	North Carolina	2024	1	3	1	3	3
Electricity	market for electricity, medium voltage/electricity, medium voltage/US-SERC/kWh	ecoinvent v3.10 in 2024	Multiple Regions	2024	1	3	1	3	3
Foam	polyurethane production, flexible foam, MDI-based/polyurethane, flexible foam/RoW/kg	ecoinvent v3.10 in 2024	North Carolina	2024	2	3	2	3	3
Hazardous waste	process-specific burdens, hazardous waste incineration plant/process-specific burdens, hazardous waste incineration plant/RoW/kg	ecoinvent v3.10 in 2024	North Carolina	2024	1	3	1	3	3
Natural gas	market for heat, district or industrial, natural gas/heat, district or industrial, natural gas/RoW/MJ	ecoinvent v3.10 in 2024	Multiple Regions	2024	2	3	1	3	3
Pallet	market for EUR-flat pallet/EUR-flat pallet/RoW/unit	ecoinvent v3.10 in 2024	North Carolina	2024	2	3	2	3	3
Plastic wrap	market for packaging film, low density polyethylene/packaging film, low density polyethylene/GLO/kg	ecoinvent v3.10 in 2024	North Carolina	2024	2	3	2	3	3
Propane	propane, burned in building machine/propane, burned in building machine/GLO/MJ	ecoinvent v3.10 in 2024	North Carolina	2024	2	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 Epoxy resin countertop 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 level 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 Epoxy resin countertop 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 Epoxy resin countertop 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 2022-01-01 to 2022-12-31.

- 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

The lifecycle analysis of Kemresin identifies several major contributors to its overall carbon footprint:

1. **Epoxy Resin (Module A1):** This component is the largest contributor, accounting for 48.4% of the total impact per square meter of Kemresin product. Epoxy resin production is significant due to its high energy and resource usage.

2. **Electricity (Module A3):** Utilized in various stages of the manufacturing process, electricity contributes 24.5% to the total impact. This highlights the energy-intensive nature of the production processes.
3. **Natural Gas (Module A3):** Natural gas usage is another critical factor, contributing 10% of the impact, primarily due to its role in heating and possibly other thermal processes in manufacturing.

The analysis shows that the concentration of impacts is in the A1, raw material, and A3, manufacturing stages. Mitigation strategies should focus on finding more sustainable raw material alternatives or improving energy efficiency to reduce dependence on natural gas and electricity.

The following table reports the total LCA results for each product produced at the given epoxy resin countertop facility on a per 1 m2 of Kemresin product 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 m2 of Kemresin product 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**
Kemresin	81.6	1.97e-06	0.249	0.306	3.64	1340

b) Resource Inventory Metrics:

Indicator/LCI Metric	RPRE	PRM	NRPRE	NRPRM	SM	RSF	RE	FW
Unit	**MJ**	**MJ**	**MJ**	**kg**	**MJ**	**MJ**	**MJ**	**m3**
Kemresin	64	0.673	64.9	139	0.288	0.0247	1.26	0.431

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**
Kemresin	5.08	122	0.000576	0.00212	0.0218	0.000189	0.802	0.446

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:

- Labeling Sustainability (2021) ISO 21930:2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services and Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 32 33 00, http://labelingsustainability.com/.
- 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