

The Vitra logo is displayed in a bold, black, lowercase sans-serif font.**Declaration Owner**

Vitra Factory GmbH

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ACX Soft Office Seating

**Functional Unit**

The functional unit is one table/chair, serving the function of a typical office chair for a 15-year period. The reference unit used in the study is one complete chair.

**EPD Number and Period of Validity**

SCS-EPD-09596

EPD Valid November 29, 2023 through November 28, 2028



**Product Category Rule**

Product Category Rule for Seats. Product Category

Classification: UN CPC 3811. International EPD® System.  
2009:02. Version 3.0.2. April 2022.**Program Operator**

SCS Global Services

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Declaration Owner:	Vitra Factory GmbH
Address:	Charles-Eames-Str. 2 79576 Weil am Rhein, Germany
Declaration Number:	SCS-EPD-09596
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Program Operator:	SCS Global Services
Declaration URL Link:	<a href="https://www.scsglobalservices.com/certified-green-products-guide">https://www.scsglobalservices.com/certified-green-products-guide</a>
Product:	ACX Soft Office Seating
LCA Practitioner:	Gerard Mansell, PhD., SCS Global Services
LCA Software:	OpenLCA v1.11 & ecoinvent v3.9
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	<input checked="" type="checkbox"/> internal <input type="checkbox"/> external
LCA Reviewer:	 Beth Cassese, SCS Global Services
Product Category Rule:	Product Category Rule for Seats. Product Category Classification: UN CPC 3811. International EPD® System. 2009:02. Version 3.0.2. April 2022.
PCR Review conducted by:	Thomas Gloria Ph.D., Industrial Ecology Consultants
Independent verification of the declaration and data, according to ISO 14025 and the PCR	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
EPD Verifier:	 Thomas Gloria, Ph.D., Industrial Ecology Consultants
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<p><b>Disclaimers:</b> This EPD conforms to ISO 14025, 14040 and 14044.</p> <p><b>Scope of Results Reported:</b> 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.</p> <p><b>Accuracy of Results:</b> Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.</p> <p><b>Comparability:</b> 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.</p>	

## ABOUT VITRA

Vitra is a Swiss family-owned company. It not only makes furniture and creates retail environments, but also has its own Campus with buildings by leading international architects. Creating innovative products and concepts with great designers is Vitra's essence. They are developed in Switzerland and installed worldwide by architects, companies and private users to build inspirational spaces for living, working and shopping as well as public areas. With its classics, Vitra represents groundbreaking 20th century design. Today, in combining technical and conceptual expertise with the creativity of contemporary designers, Vitra seeks to continue pushing the boundaries of the design discipline. A family business for eighty years, Vitra believes in lasting relationships with customers, employees and designers, durable products, sustainable growth and the power of good design. The Vitra Campus with buildings by some of the world's leading architects and the Vitra Design Museum with its exhibitions on design and architecture, design archives and a comprehensive furniture collection are all part of Vitra. They inspire visitors, inform the design process and create an atmosphere in which innovation flourishes.

## PRODUCT DESCRIPTION

ACX is the tenth office swivel chair that Vitra has developed in collaboration with Antonio Citterio. With its automatic synchronous mechanism, the compact ACX offers maximum comfort to a wide range of users without having to adjust anything except the seat height - and yet avoids any technical aesthetics. The design, materials, production, logistics and maintenance of ACX are designed for a long life cycle. Final assembly of Vitra seating products occurs in an ISO 9001 and ISO 14001 certified facility in Weil am Rhein, Germany.

## PRODUCT SPECIFICATIONS

**Table 1.** Product weights for the Vitra ACX Soft chair.

Product name	Product mass (kg)
ACX Soft	15.13

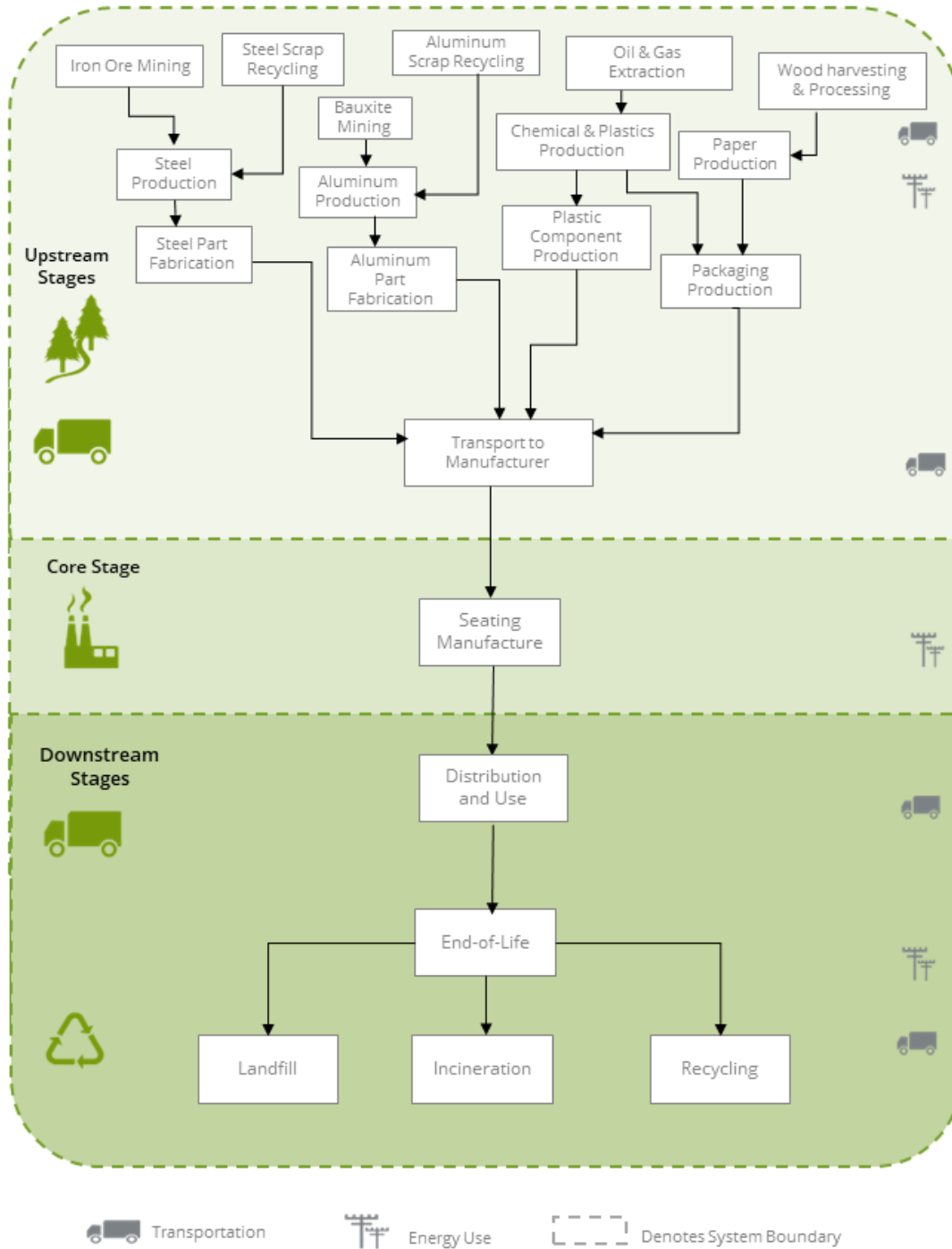
## MATERIAL COMPOSITION

**Table 2.** Material composition of the Vitra **ACX Soft** chair and packaging. Results are shown on a mass basis (kg/unit) and as a percent of total.

Material	Value	Percent of total mass
<b>Product</b>		
Steel	2.88	19%
Aluminum	0.391	2.6%
Plastics	10.7	71%
Fabric	1.17	7.7%
<b>Total Product</b>	<b>15.13</b>	<b>100%</b>
<b>Packaging</b>		
Corrugate	0.290	58%
Plastic film	0.210	42%
<b>Total Packaging</b>	<b>0.500</b>	<b>100%</b>

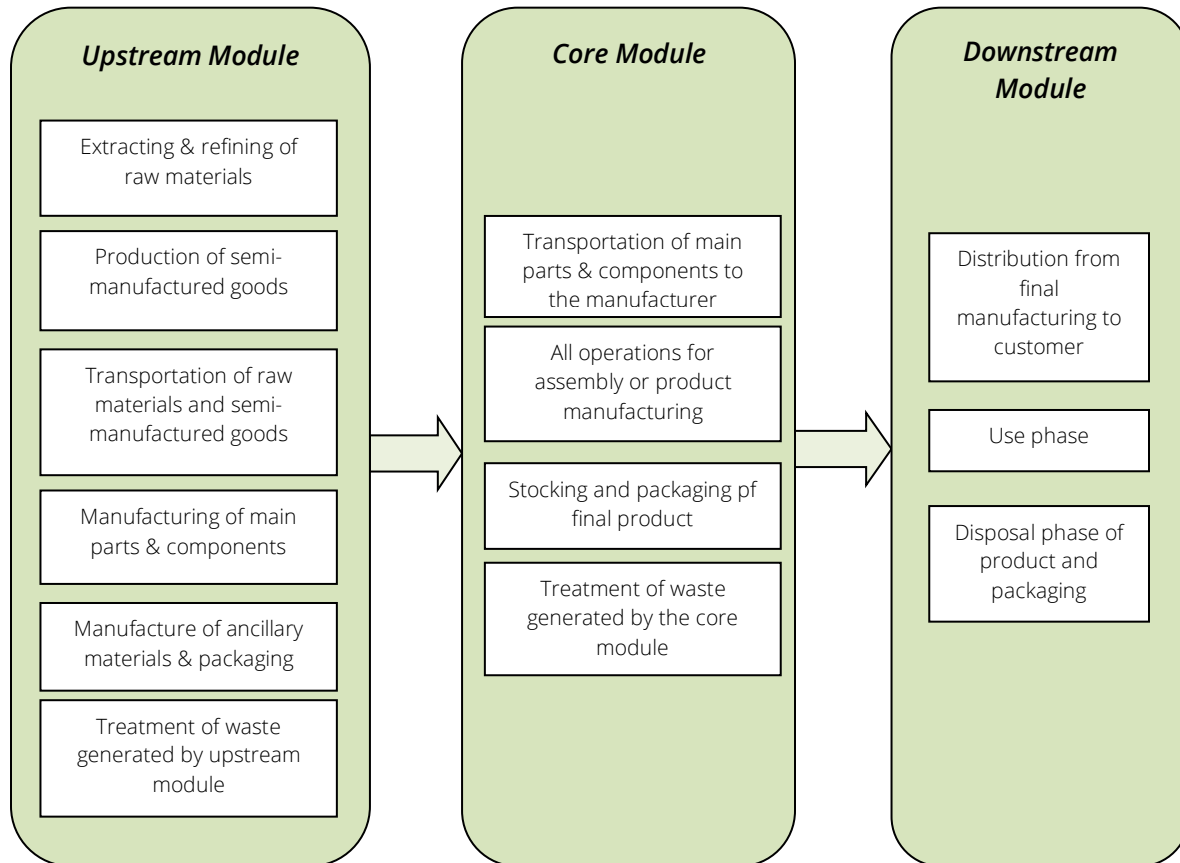
## PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of Vitra ACX Soft Chair seating product.



## LIFE CYCLE ASSESSMENT STAGES

The system boundary is cradle-to-grave and includes resource extraction and processing, product manufacture and assembly, distribution/transport, use and maintenance, and end-of-life. The diagram below illustrates the life cycle stages included in this EPD.



## LIFE CYCLE IMPACT ASSESSMENT

The impact indicators specified under this EPD include:

- Potential for Global Warming,
- Acidification Potential,
- Eutrophication Potential,
- Ozone Depletion Potential,
- Photochemical Ozone (smog) Creation Potential,
- Ecotoxicity,
- Human Toxicity, and
- Land Use/Land Occupation.

Impact category indicators for acidification, eutrophication, ozone depletion potential and photochemical ozone creation are estimated using the characterization factors as prescribed by the PCR, including from the CML-IA , ReCiPe and USEtox methodologies as well as those defined by EN 15804.

The PCR requires that several parameters be reported in the EPD, including resource use, waste categories and output flows, and other environmental information. The results for these parameters per declared unit are also included below.

All results are reported in SI units using English-style formatting for the thousand separator and decimal mark (i.e., 1 234.56)

**Table 3.** Key Life Cycle Impact Assessment Results by life cycle phase for the Vitra **ACX Soft** chair. Results are shown for one chair maintained for 15 years.

Impact Category	Unit	Upstream Processes	Core Processes	Downstream Processes	Total
<b>Key Indicators</b>					
Climate change	kg CO <sub>2</sub> eq	97.0	1.62	9.51	108
	%	90%	1.5%	8.8%	100%
Climate change - Biogenic	kg CO <sub>2</sub> eq	0.184	-1.03x10 <sup>-2</sup>	0.328	0.501
	%	37%	-2.1%	65%	100%
Climate change - Fossil	kg CO <sub>2</sub> eq	96.8	1.61	9.18	108
	%	90%	1.5%	8.5%	100%
Climate change - Land use and LU change	kg CO <sub>2</sub> eq	7.47x10 <sup>-2</sup>	2.41x10 <sup>-2</sup>	1.35x10 <sup>-3</sup>	0.100
	%	75%	24%	1.3%	100%
Acidification	mol H <sup>+</sup> eq	0.417	5.52x10 <sup>-3</sup>	2.28x10 <sup>-2</sup>	0.445
	%	94%	1.2%	5.1%	100%
Eutrophication, freshwater	kg P eq	1.96x10 <sup>-2</sup>	7.56x10 <sup>-4</sup>	2.26x10 <sup>-4</sup>	2.06x10 <sup>-2</sup>
	%	95%	3.7%	1.1%	100%
Eutrophication, marine	kg N eq	9.09x10 <sup>-2</sup>	1.81x10 <sup>-3</sup>	1.58x10 <sup>-2</sup>	0.108
	%	84%	1.7%	15%	100%
Eutrophication, terrestrial	mol N eq	0.909	1.21x10 <sup>-2</sup>	9.73x10 <sup>-2</sup>	1.02
	%	89%	1.2%	9.6%	100%
Ozone depletion	kg CFC11 eq	8.14x10 <sup>-6</sup>	2.00x10 <sup>-8</sup>	7.89x10 <sup>-8</sup>	8.24x10 <sup>-6</sup>
	%	99%	0.24%	0.96%	100%
Photochemical ozone formation	kg NMVOC eq	0.315	5.16x10 <sup>-3</sup>	3.28x10 <sup>-2</sup>	0.353
	%	89%	1.5%	9.3%	100%
Particulate matter	disease inc.	4.37x10 <sup>-6</sup>	6.14x10 <sup>-8</sup>	2.51x10 <sup>-7</sup>	4.68x10 <sup>-6</sup>
	%	93%	1.3%	5.4%	100%

**Table 4.** Life Cycle Impact Assessment Results by life cycle phase for the Vitra **ACX Soft** chair. Results are shown for one chair maintained for 15 years.

Impact Category	Unit	Upstream Processes	Core Processes	Downstream Processes	Total
<b>Other Indicators</b>					
Freshwater ecotoxicity	PAF.m <sup>3</sup> .day	643 000	30 600	242 000	915 000
	%	70%	3.3%	26%	100%
Human toxicity, cancer	cases	3.03x10 <sup>-5</sup>	1.02x10 <sup>-7</sup>	3.34x10 <sup>-7</sup>	3.08x10 <sup>-5</sup>
	%	99%	0.33%	1.1%	100%
Human toxicity, non-cancer	cases	1.39x10 <sup>-5</sup>	3.14x10 <sup>-7</sup>	3.05x10 <sup>-6</sup>	1.73x10 <sup>-5</sup>
	%	81%	1.8%	18%	100%
Land use	species.yr	1.81x10 <sup>-8</sup>	3.24x10 <sup>-9</sup>	8.75x10 <sup>-10</sup>	2.23x10 <sup>-8</sup>
	%	81%	15%	3.9%	100%
Abiotic Depletion Potential, fossils	MJ	1 290	30.6	66.4	1 380
	%	93%	2.2%	4.8%	100%
Abiotic Depletion Potential, minerals and metals	kg Sb eq	9.92x10 <sup>-4</sup>	3.97x10 <sup>-6</sup>	7.46x10 <sup>-6</sup>	1.00x10 <sup>-3</sup>
	%	99%	0.4%	0.74%	100%
Water Deprivation Potential (WDP)	m <sup>3</sup> depriv.	21.8	0.374	0.389	22.5
	%	97%	1.7%	1.7%	100%



**Table 5.** Resource use and waste flows by life cycle phase for the Vitra **ACX Soft** chair. Results are shown for one chair maintained for 15 years.

Impact Category	Unit	Upstream Processes	Core Processes	Downstream Processes	Total
<b>Resources</b>					
Use of renewable primary energy	MJ, LHV	14.9	0.00	0.00	14.9
	%	100%	0%	0%	100%
Use of renewable primary energy resources used as raw materials	MJ, LHV	0.00	0.00	0.00	0.00
	%	0%	0%	0%	0%
Total Renewable primary energy	MJ, LHV	14.9	0.00	0.00	14.9
	%	100%	0%	0%	100%
Use of nonrenewable primary energy	MJ, LHV	1,070	30.7	66.4	1,160
	%	92%	2.6%	5.7%	100%
Use of nonrenewable primary energy resources used as raw materials	MJ, LHV	222	0.00	0.00	222
	%	100%	0%	0%	100%
Total Nonrenewable primary energy	MJ, LHV	1 290	30.7	66.4	1 380
	%	93%	2.2%	4.8%	100%
Use of secondary materials	MJ, LHV	5.28	0.00	0.00	5.28
	%	100%	0%	0%	100%
Use of Renewable secondary fuels	MJ, LHV	0.00	0.00	0.00	0.00
Use of Nonrenewable secondary fuels	MJ, LHV	0.00	0.00	0.00	0.00
Use of net fresh water	m <sup>3</sup>	3.98	8.84x10 <sup>-2</sup>	4.11x10 <sup>-2</sup>	4.11
	%	97%	2.2%	1%	100%
<b>Wastes</b>					
Hazardous waste	kg	2.93x10 <sup>-3</sup>	5.30x10 <sup>-5</sup>	4.39x10 <sup>-4</sup>	3.43x10 <sup>-3</sup>
	%	86%	1.5%	13%	100%
Nonhazardous waste	kg	7.82	0.413	7.17	15.4
	%	51%	2.7%	47%	100%
Radioactive waste	kg	8.98x10 <sup>-4</sup>	3.10x10 <sup>-5</sup>	8.94x10 <sup>-6</sup>	9.38x10 <sup>-4</sup>
	%	96%	3.3%	0.95%	100%
Components for re-use	kg	0.00	0.00	0.00	0.00
Materials for recycling	kg	0.00	0.00	7.89	7.89
	%	0%	0%	100%	100%
Materials for energy recovery	kg	0.00	0.00	0.00	0.00
Exported energy, electrical	MJ, LHV	0.00	0.00	0.00	0.00
Exported energy, thermal	MJ, LHV	0.00	0.00	0.00	0.00

INA = Indicator Not Assessed

## ADDITIONAL ENVIRONMENTAL INFORMATION



Vitra seating products are GREENGUARD GOLD Indoor Air Quality Certified



## SUPPORTING TECHNICAL INFORMATION

Unit processes were developed with OpenLCA v1.11 software, drawing upon data from multiple sources. Primary data were provided by Vitra for their manufacturing processes. The primary sources of secondary LCI data are from the Ecoinvent Database.

**Table 6.** Data sources used for the LCA study.

Component	Dataset	Data Source	Publication Date
<b>PRODUCT</b>			
<b>Steel</b>			
Steel - BOF	steel production, converter, low-alloyed   steel, low-alloyed   Cutoff, S/RoW	EI v3.9	2022
Steel fabrication	metal working, average for steel product manufacturing   metal working, average for steel product manufacturing   Cutoff, S/RoW	EI v3.9	2022
<b>Plastics</b>			
POM, PP, Nylon, PET	nylon 6 production   nylon 6   Cutoff, S/RoW; glass fibre production   glass fibre   Cutoff, S/RoW	EI v3.9	2022
	nylon 6-6 production   nylon 6-6   Cutoff, S/RoW	EI v3.9	2022
	Polyoxymethylene (POM) PlasticsEurope/EU-27	EI v3.9	2022
	polypropylene production, granulate   polypropylene, granulate   Cutoff, S/RoW	EI v3.9	2022
	polyethylene terephthalate production, granulate, amorphous   polyethylene terephthalate, granulate, amorphous   Cutoff, S/RoW	EI v3.9	2022
	polypropylene production, granulate   polypropylene, granulate   Cutoff, S/RoW	EI v3.9	2022
	injection moulding   injection moulding   Cutoff, S/RoW	EI v3.9	2022
<b>Aluminum</b>			
Recycled Aluminum	aluminium, recycled, 95% post-consumer   aluminium, recycled   Cutoff, S/GLO	EI v3.9	2022
Aluminum fabrication	metal working, average for aluminium product manufacturing   metal working, average for aluminium product manufacturing   Cutoff, S/RoW	EI v3.9	2022
<b>Textile</b>			
Nylon fabric, PET fabric	Nylon fabric; nylon 6 production   nylon 6   Cutoff, S/RoW; market for electricity, medium voltage   electricity, medium voltage   Cutoff, S/DE	EI v3.9	2022
	PET fabric; polyethylene terephthalate production, granulate, amorphous   polyethylene terephthalate, granulate, amorphous   Cutoff, S/RoW; market for electricity, medium voltage   electricity, medium voltage   Cutoff, S/DE	EI v3.9	2022
<b>PACKAGING</b>			
Corrugate	containerboard production, linerboard, kraftliner   containerboard, linerboard   Cutoff, S/RoW	EI v3.9	2022
Plastics	packaging film production, low density polyethylene   packaging film, low density polyethylene   Cutoff, S/RoW	EI v3.9	2022
<b>TRANSPORT</b>			
Road transport	market for transport, freight, lorry 16-32 metric ton, EURO4   transport, freight, lorry 16-32 metric ton, EURO4   Cutoff, S/RoW	EI v3.9	2022
Rail transport	transport, freight train, diesel   transport, freight train   Cutoff, S/RoW	EI v3.9	2022
Air transport	transport, freight, aircraft, all distances to generic market for transport, freight, aircraft, unspecified   transport, freight, aircraft, unspecified   Cutoff, S/GLO	EI v3.9	2022
<b>RESOURCES</b>			
Grid electricity	market for electricity, medium voltage, hydro only   electricity, medium voltage   Cutoff, U - LCI/DE	EI v3.9	2022
Heat – natural gas	heat production, natural gas, at industrial furnace >100kW   heat, district or industrial, natural gas   Cutoff, S/RoW	EI v3.9	2022

## Data Quality

Data Quality Parameter	Data Quality Discussion
<b>Time-Related Coverage:</b> 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 2016). All of the secondary data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2022.
<b>Geographical Coverage:</b> 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. Electricity use for product manufacture is modeled using representative data for hydroelectricity. Surrogate data used in the assessment are representative of European or global operations. Data representative of global operations are considered sufficiently similar to actual processes. Data representing product disposal are based on US statistics.
<b>Technology Coverage:</b> Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative datasets are used to represent the actual processes, as appropriate.
<b>Precision:</b> Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Secondary data for operations are typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
<b>Completeness:</b> Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. 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. In total, these missing data represent less than 5% of the mass or energy flows.
<b>Representativeness:</b> 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.
<b>Consistency:</b> 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. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.9 data where available. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in the United States.
<b>Reproducibility:</b> 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.
<b>Sources of the Data:</b> Description of all primary and secondary data sources	Data representing energy use at Vitra's Weil am Rhein, Germany facilities represent an annual average and are considered of medium to high quality due to the length of time over which these data are collected for the existing production processes. For secondary LCI datasets, Ecoinvent v3.9 LCI data are used.
<b>Uncertainty of the Information:</b> Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations was not available and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. 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.

## LCIA Methodology

Category Indicator	Method & Version	Units	Impact Category and Environmental Mechanism
Global Warming Potential (GWP)	GWP100, <u>EN 15804</u> , August 2021.	kg CO <sub>2</sub> eq.	<p>Anthropogenic emissions of greenhouse gases and short-lived climate forcers have led to increased radiative forcing, which has in turn increased the global mean temperature by above 0.99°C since pre-industrial times. All IPCC scenarios project an increase to 1.5°C in the near term, occurring between 2021 to 2040. The projection for the SSP2-4.5 scenario estimates an increase of 2.0°C occurring between 2043-2062, with 3°C occurring between 2061-2080. As global mean temperatures continue to climb, global climate change will result. Some of the predicted impacts include reductions in food and food supplies, water supplies, and sea level rise.</p> <p>Note: WMO Statement of the Global Climate 2021 (18 May 2022) is reporting as an update to the IPCC AR6 WGI, that the average global temperature in 2021 was ~1.11 (±0.13) °C above pre-industrial levels.<sup>1</sup></p>
Ozone Layer Depletion (ODP)	ODP, <u>EN 15804</u> , August 2021.	kg CFC-11 eq.	<p>Emissions of ozone depleting substances such as chlorofluorocarbons contribute to a thinning of the stratospheric ozone layer. This can lead to increased cases of skin cancer, and effects on crops, other plants, marine life, and human-built materials. All chlorinated and brominated compounds stable enough to reach the stratosphere can have an effect. CFCs, halons and HCFCs are the major causes of ozone depletion. Damage to the ozone layer reduces its ability to prevent ultraviolet (UV) light entering the earth's atmosphere, increasing the amount of carcinogenic UVB light reaching the earth's surface.</p> <p>Due to the international ban on ozone depleting chemicals, the stratospheric ozone layer has begun to recover; U.S. EPA projects that the ozone layer will recover within about 50 years.</p>
Photochemical Oxidant Creation Potential (POCP)	POCP, LOTOS-EUROS as applied in ReCiPe, <u>EN 15804</u> , August 2021.	kg NMVOC eq	<p>Photochemical ozone, also called "ground level ozone", is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. If ozone concentrations reach above certain critical thresholds, health effects in humans can result, including bronchitis, asthma, and emphysema. The impact category depends largely on the amounts of carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxide (NO), ammonium and NMVOC (non-methane volatile organic compounds).</p>
Acidification (AP)	AP, accumulated exceedance, <u>EN 15804</u> , August 2021	kg SO <sub>2</sub> eq.	<p>Acidification is the increasing concentration of hydrogen ion (H<sup>+</sup>) within the local environmental and occurs as a result of adding acids such as nitric acid and sulfuric acids into the environment. Acid precursor emissions transport in the atmosphere and deposit as acids. These acids may deposit in soils which are sensitive, or insensitive, to the increased acid burden; sensitivity can depend on a number of factors. In acid-sensitive soils, the deposition can decrease the soil pH (acidification) and increase the mobility of heavy metals in the environment, such as aluminum. This acidification can affect the pH of local soils and freshwater bodies, by increasing local hydrogen ion concentrations, causing endpoints such as tree die-offs and dead lakes. Emissions of sulfur dioxide and nitrogen oxides from the combustion of fossil fuels have been the greatest contributor to acid rain.</p>

<sup>1</sup> <https://public.wmo.int/en/media/press-release/four-key-climate-change-indicators-break-records-2021>

Category Indicator	Method & Version	Units	Impact Category and Environmental Mechanism
Eutrophication (EP)	EP, aquatic freshwater, EUTREND model; EP, aquatic marine, EUTREND model; EP, terrestrial, accumulated exceedance <u>EN 15804</u> . August 2021.	kg P eq. kg N eq.	Eutrophication is the build-up of a concentration of chemical nutrients in an ecosystem which leads to abnormal productivity. In some regions, emissions of excess nutrients (including phosphorus and nitrogen) into water can lead to increased algal blooms. These blooms can reach such a severity that waterways become choked, with no other plant life able to establish itself. If algal blooms are intense enough, the decaying algae consumes dissolved oxygen in the water column starving other organisms of needed oxygen. Whereas phosphorous is mainly responsible for eutrophication in freshwater systems, nitrogen is mainly responsible for eutrophication in ocean water bodies. Emissions of ammonia, nitrates, nitrogen oxides and phosphorous to air or water all have an impact on eutrophication.
Abiotic Depletion, elements (ADPE)	ADP minerals & metals, <u>EN 15804</u> . August 2021.	kg Sb eq.	This impact category refers to the consumption of non-biological resources such as minerals and metals. The value of the abiotic resource consumption of a substance is a measure of the scarcity of a substance and depends on the amount of resources and the extraction rate. The indicator is calculated as the amount of resources that are depleted and measured in antimony equivalents for mineral depletion.
Abiotic Depletion, fossil fuels (ADPF)	ADP fossil resources, <u>EN 15804</u> . August 2021.	MJ	This impact category refers to the consumption of fossil fuels. The value of the abiotic resource consumption of a substance (e.g., lignite or coal) is a measure of the scarcity of a substance and depends on the amount of resources and the extraction rate. It is calculated as the amount of resources that are depleted and measured in equivalent MJ of fossil fuels.
Ecotoxicity	USEtox 2.02, 2008	CTUe	This category concerns effects of toxic substances on the fresh water aquatic environment. The characterization factor of ecotoxicity accounts for the environmental persistence (fate) and toxicity (effect) of a chemical. The damage (endpoint) level ecotoxicity potential [PDF m <sup>3</sup> d] or comparative damage units [CDUe] per kg chemical emitted represents an increase in the fraction of species potentially disappearing as a consequence of an emission in a compartment
Human Toxicity	USEtox 2.02, 2008	CTUh	This category concerns effects of toxic substances on the human environment. The USEtox model calculates characterization factors for carcinogenic impacts, non-carcinogenic impacts, and total impacts (Carc + non-carc) for chemical emissions to urban air, rural air, freshwater, sea water, agricultural soil and/or natural soil. The characterization factors for human toxicity are expressed in cases/kg.
Land Occupation	ReCiPe 2016, v 1.13 November 2016	species-yr	This impact category quantifies the amount of agricultural, urban or natural land occupied for a certain time.
Water Deprivation Potential (AWARE)	AWARE. <u>EN 15804</u> . August 2021	m <sup>3</sup> depriv	The AWARE method is based on the inverse of the difference between water availability per area and demand per area. It quantifies the potential of water deprivation, to either humans or ecosystems, and serves in calculating the impact score of water consumption at midpoint in LCA or to calculate a water scarcity footprint as per ISO 14046. It is based on the available water remaining (AWARE) per unit of surface in a given watershed relative to the world average, after human and aquatic ecosystem demands have been met. The resulting CF ranges between 0.1 and 100 and is meant to be multiplied with the local water consumption inventory.

## Allocation

Resource use at the Weil am Rhein, Germany facility (e.g., water and energy) was allocated to the product based on the product mass as a fraction of the total facility production volume.

The seating products include recycled materials, which are allocated using the recycled content allocation method (also known as the 100-0 cut off method). Using the recycled content allocation approach, system inputs with recycled content do not receive any burden from the previous life cycle other than reprocessing of the waste material. At end of life, materials which are recycled leave the system boundaries with no additional burden.

Impacts from transportation were attributed to the product based on the mass of material and distance transported.

### System Boundaries

The system boundaries of the life cycle assessment was cradle-to-grave. A description of the system boundaries for this EPD are as follows:

- **Raw Material Extraction and Processing stage** – This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. This includes the extraction of all raw materials, including the transport to the manufacturing site. Resource use and emissions associated with both the extraction of the raw materials used in the products, as well as those associated with the processing of raw materials and product component manufacturing are included. Impacts associated with the transport of the processed raw materials to manufacturing facilities (upstream transport) are also included in this stage.
- **Core - Production stage** – This stage includes all the relevant manufacturing processes and flows, excluding production of capital goods, infrastructure, production of manufacturing equipment, and personnel-related activities. This stage includes the impacts from energy use and emissions associated with the processes occurring at the Vitra facility, as well as the production of the product consumer packaging materials.
- **Downstream** –
  - **Distribution, Storage and Use stage** – This stage includes the delivery of the products to the point of use (downstream transportation), storage of the product and maintenance of the product for a period of 15 years.
  - **Disposal stage** – The end-of-life stage includes transport of the product to material reclamation or waste treatment facilities. Emissions from disposal of product components in a landfill or from incineration are included. Packaging disposal is also included in this phase.

Electricity use in both upstream and downstream processes is modeled using ecoinvent datasets representing the electricity mix for regional and global markets.

### Cut-off criteria

According to the PCR, cumulative omitted mass or energy flows within the product boundary shall not exceed 5%. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.

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For more information contact:

The Vitra logo consists of the word "vitra." in a bold, lowercase, sans-serif font. The period at the end is a solid black circle.

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