Declaration Owner

Vitra AG
Klünenfeldstrasse 22, Birsfelden, BL CH-4127, Switzerland
info@vitra.com | +41.61.377.0000 | www.vitra.com

Product

- HAL Stool Medium Office Seating
- HAL Tube Stackable Office Seating

Functional Unit

One unit of seating to seat one individual, maintained for a 10-year period

EPD Number and Period of Validity

SCS-EPD-05801
EPD Valid November 11, 2019 through November 10, 2024

Product Category Rule

BIFMA PCR for Seating: UNCPC 3811, Version 3.

Program Operator

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

Declaration Owner:	Vitra AG
Address:	Klünenfeldstrasse 22, Birsfelden, BL CH-4127, Switzerland
Declaration Number:	SCS-EPD-05801
Declaration Validity Period:	November 11, 2019 through November 10, 2024
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell, PhD.
LCA Software:	SimaPro 8.3
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☒ internal ☐ external
LCA Reviewer:	Aditi Suresh (signature) Aditi Suresh, LCA Practitioner, SCS Global Services
Product Category Rule:	BIFMA PCR for Seating: UNCPC 3811, Version 3.
PCR Review conducted by:	Tom Gloria, Ph.D., (Chair) Industrial Ecology Consultants
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria (signature) Tom Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	Product Scope....cover About Vitra....2 Product Description....2 Key Environmental Parameters....2 Material Composition....2 Additional Environmental Information....3 Life Cycle Assessment Stages....3 Product Life Cycle Flow Diagram....4 Life Cycle Inventory....5 Life Cycle Impact Assessment....6 Supporting Technical Information....8 References....11

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

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.*

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

The HAL Stool Medium has a medium-height seat, ideal for tables or counters which are lower than standard. A range of other bar stools is also available in the HAL family of chairs, designed by Jasper Morrison.

The Tube stackable chair was created by the famous designer Jasper Morrison for the HAL collection by Vitra. HAL Tube is a stackable reinterpretation of the classic shell chair.

Final assembly of Vitra HAL seating products occurs in an ISO 9001 and ISO 14001 certified facility in Weil am Rhein, Germany.

KEY ENVIRONMENTAL PARAMETERS

Table 1. *Summary of key environmental parameters.*

Parameter	Unit	HAL Stool Medium	HAL Tube Stackable
Global Warming Potential	kg CO_2e	32.6	27.8
Primary Energy Demand	MJ	582	517
Recycled Content	%	27%	23%

MATERIAL COMPOSITION

Table 2. *Material composition of the HAL seating products. Results are shown per unit of seating and as a percent of total.*

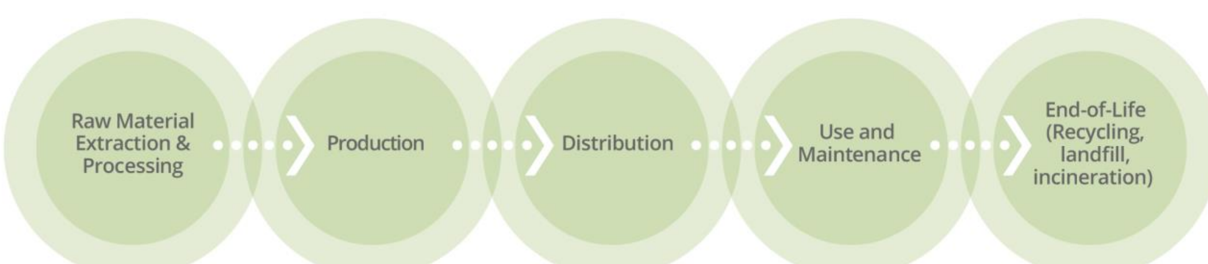
Material Type	Material Resource	HAL Stool Medium	HAL Tube Stackable
Product			
Steel	Virgin non-renewable	3.4 kg	2.3 kg
		58%	48%
Nylon	Virgin non-renewable	0.17 kg	0.17 kg
		2.9%	3.6%
Plastic	Virgin non-renewable	2.3 kg	2.3 kg
		39%	47%
Aluminum	95% Recycled; 5% Virgin non-renewable	$2.4x10^{-2}$ kg	$2.4x10^{-2}$ kg
		0.41%	0.50%
ABS	Virgin non-renewable	$1.2x10^{-2}$ kg	$1.2x10^{-2}$
		0.20%	0.25%
Textile	Virgin non-renewable	$4.0x10^{-3}$ kg	$4.0x10^{-3}$ kg
		0.07%	0.08%
Product Total		**5.9 kg**	**4.8 kg**
		100%	**100%**
Packaging			
Corrugated	Virgin non-renewable	2.1 kg	5.8 kg
		91%	94%
Packaging plastic	Virgin Renewable	0.21 kg	0.36 kg
		9.0%	5.9%
Packaging Total		**2.3 kg**	**6.1 kg**
		100%	**100%**

ADDITIONAL ENVIRONMENTAL INFORMATION

Vitra HAL seating is GREENGUARD GOLD Indoor Air Quality Certified

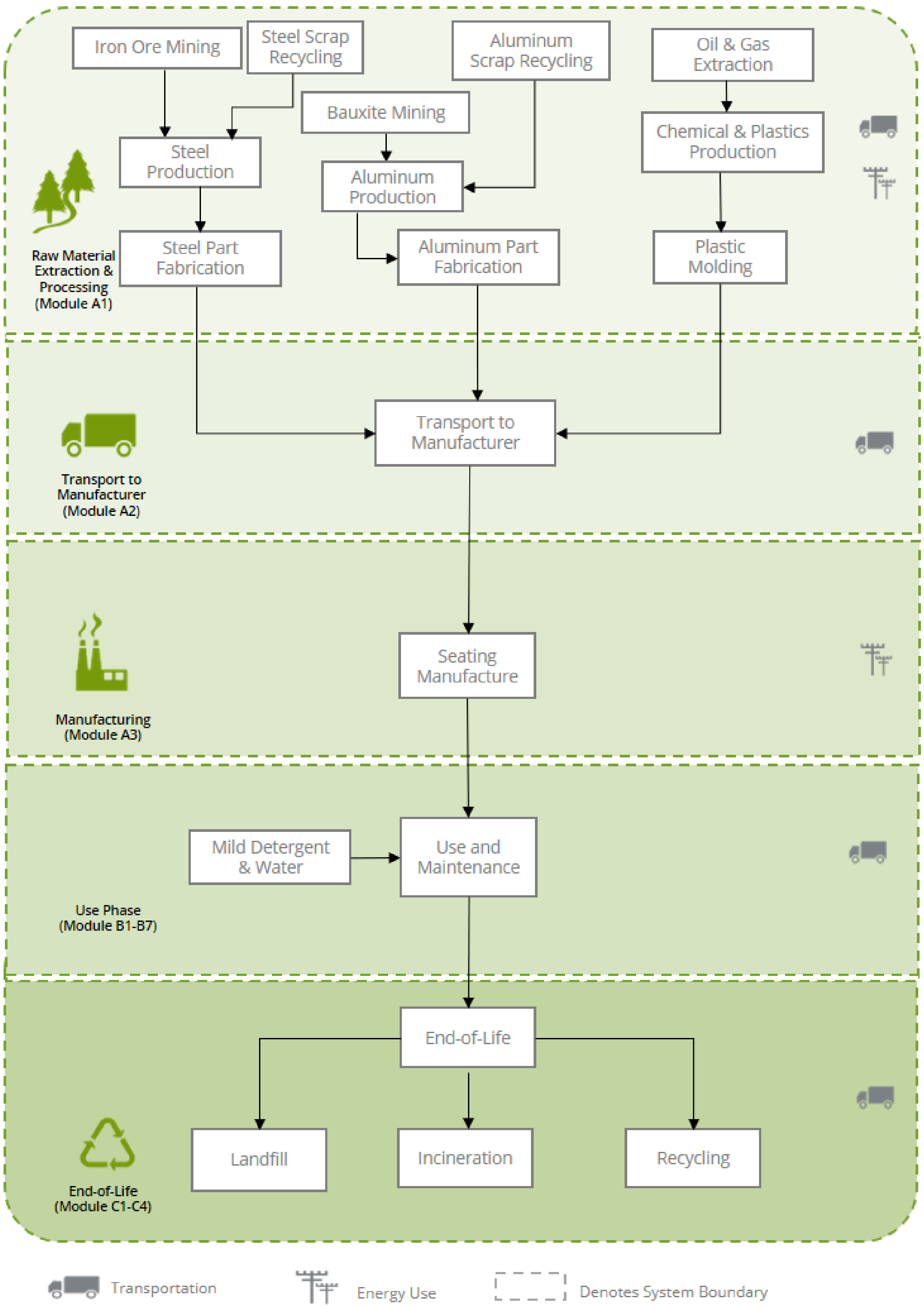
LIFE CYCLE ASSESSMENT STAGES

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.



PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of HAL office seating products. This includes resource extraction, raw material processing, component manufacturing, transportation, assembly of chair, use and maintenance, and end-of-life.



LIFE CYCLE INVENTORY

The resource use and emissions from each step of the product life cycle are summed to obtain the life cycle inventory results. Table 3 summarizes the inventory parameters for energy and water consumption.

Table 3. *Inventory categories for energy and water consumption. Results are shown for one unit of seating to seat one individual over a 10-year time period.*

Parameter	Units	HAL Stool Medium	HAL Tube Stackable
Primary Energy Demand	MJ	582	517
Non-Renewable Energy, Fossil Fuels	MJ	480	425
Non-Renewable Energy, Nuclear	MJ	42.7	38.4
Renewable Energy	MJ	59.4	53.8
Miscellaneous Fuels	MJ	Negligible	Negligible
Freshwater Consumptions	kg	1.49	1.28

LIFE CYCLE IMPACT ASSESSMENT

Impact category indicators are calculated using TRACI 2.1 characterization methods, including acidification potential, eutrophication potential, smog potential, ozone depletion potential, and global warming potential based on IPCC (2013), in accordance with the BIFMA PCR. Additionally, the IPCC GWP result for a 20-year time horizon is reported following the BIFMA PCR requirements for IPCC (2013). Impact category indicators calculated using the CML-IA characterization methodology is also reported. Note, biogenic carbon uptake and biomass CO_2 emissions are not included.

Table 4. *Life cycle impact assessment results for the HAL Stool Medium office seating. Results are shown for one unit of seating to seat one individual over a 10-year period.*

Impact category	Unit	Total	Raw Material Extraction & Processing	Production (Manufacturing & Assembly)	Distribution, Use & Maintenance	End-of-Life
LCIA Results – TRACI 2.1						
Global warming	kg CO_2 eq	33	23	4.1	3.9	1.6
	%	100%	70%	13%	12%	5.0%
Ozone layer depletion	kg CFC-11 eq	$2.6x10^{-6}$	$1.6x10^{-6}$	$4.1x10^{-7}$	$5.2x10^{-7}$	$5.5x10^{-8}$
	%	100%	62%	16%	20%	2.1%
Acidification	kg SO_2 eq	0.17	0.11	$1.4x10^{-2}$	$4.2x10^{-2}$	$1.9x10^{-3}$
	%	100%	65%	8.2%	25%	1.1%
Eutrophication	kg N eq	0.15	$9.4x10^{-2}$	$2.0x10^{-2}$	$1.1x10^{-2}$	$2.3x10^{-2}$
	%	100%	64%	13%	7.2%	16%
Smog	kg O_3 eq	2.2	1.3	0.18	0.69	$5.0x10^{-2}$
	%	100%	58%	8.1%	32%	2.3%
Fossil fuel depletion	MJ surplus	53	38	7.9	6.2	0.67
	%	100%	72%	15%	12%	1.3%
LCIA Results – CML-IA						
Global warming (GWP100a)	kg CO_2 eq	33	23	4.2	4.1	1.6
	%	100%	70%	13%	12%	4.9%
Ozone layer depletion	kg CFC-11 eq	$2.6x10^{-6}$	$1.6x10^{-6}$	$4.1x10^{-7}$	$5.2x10^{-7}$	$5.5x10^{-8}$
	%	100%	62%	16%	20%	2.1%
Acidification potential	kg SO2 eq	0.17	0.11	$1.3x10^{-2}$	$4.1x10^{-2}$	$1.6x10^{-3}$
	%	100%	66%	7.9%	25%	0.94%
Eutrophication potential	kg PO_4^{3-} eq	$7.0x10^{-2}$	$4.5x10^{-2}$	$9.1x10^{-3}$	$7.2x10^{-3}$	$8.6x10^{-3}$
	%	100%	65%	13%	10%	12%
Photochemical oxidation	kg C_2H_4 eq	$1.1x10^{-2}$	$8.0x10^{-3}$	$8.6x10^{-4}$	$1.6x10^{-3}$	$9.3x10^{-5}$
	%	100%	76%	8.2%	15%	0.89%
Abiotic depletion (elements)	kg Sb eq	$1.3x10^{-4}$	$1.2x10^{-4}$	$6.7x10^{-6}$	$4.1x10^{-6}$	$2.3x10^{-7}$
	%	100%	92%	5.1%	3.2%	0.18%
Abiotic depletion (fossil fuels)	MJ	480	370	62	46	4.8
	%	100%	76%	13%	9.7%	1.00%

Table 5. *Life cycle impact assessment results for the HAL Tube Stackable office seating. Results are shown for one unit of seating to seat one individual over a 10-year period.*

Impact category	Unit	Total	Raw Material Extraction & Processing	Production (Manufacturing & Assembly)	Distribution, Use & Maintenance	End-of-Life
LCIA Results – TRACI 2.1						
Global warming	kg CO_2 eq	28	19	4.0	3.6	1.6
	%	100%	67%	14%	13%	5.6%
Ozone layer depletion	kg CFC-11 eq	2.3×10^{-6}	1.4×10^{-6}	4.0×10^{-7}	4.7×10^{-7}	4.6×10^{-8}
	%	100%	60%	18%	20%	2.0%
Acidification	kg SO_2 eq	0.14	8.7×10^{-2}	1.3×10^{-2}	3.8×10^{-2}	1.6×10^{-3}
	%	100%	62%	9.6%	27%	1.1%
Eutrophication	kg N eq	0.12	7.0×10^{-2}	1.9×10^{-2}	1.0×10^{-2}	2.3×10^{-2}
	%	100%	57%	16%	8.3%	19%
Smog	kg O_3 eq	1.8	1.0	0.18	0.61	4.2×10^{-2}
	%	100%	55%	9.6%	33%	2.3%
Fossil fuel depletion	MJ surplus	48	35	7.7	5.5	0.55
	%	100%	71%	16%	11%	1.1%
LCIA Results – CML-IA						
Global warming (GWP100a)	kg CO_2 eq	29	19	4.1	3.8	1.6
	%	100%	67%	14%	13%	5.6%
Ozone layer depletion	kg CFC-11 eq	2.3×10^{-6}	1.4×10^{-6}	4.0×10^{-7}	4.7×10^{-7}	4.6×10^{-8}
	%	100%	60%	18%	20%	2.0%
Acidification potential	kg SO_2 eq	0.14	8.7×10^{-2}	1.3×10^{-2}	3.7×10^{-2}	1.3×10^{-3}
	%	100%	63%	9.4%	26%	0.94%
Eutrophication potential	kg PO_4^{3-} eq	5.8×10^{-2}	3.4×10^{-2}	9.0×10^{-3}	6.6×10^{-3}	8.5×10^{-3}
	%	100%	59%	15%	11%	15%
Photochemical oxidation	kg C_2H_4 eq	8.5×10^{-3}	6.1×10^{-3}	8.4×10^{-4}	1.5×10^{-3}	8.2×10^{-5}
	%	100%	72%	9.9%	17%	0.97%
Abiotic depletion (elements)	kg Sb eq	9.4×10^{-5}	8.4×10^{-5}	6.6×10^{-6}	3.6×10^{-6}	1.9×10^{-7}
	%	100%	89%	7.0%	3.9%	0.20%
Abiotic depletion (fossil fuels)	MJ	420	320	61	41	3.9
	%	100%	75%	14%	9.8%	0.93%

SUPPORTING TECHNICAL INFORMATION

Unit processes are developed with SimaPro 8.3 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	Material Dataset	Processing Dataset	Data Source	Publication Date
Product Materials				
ABS	Acrylonitrile-butadiene-styrene copolymer {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
Aluminum, 95% post-recycled	Aluminium scrap, post-consumer {GLO} | market; Aluminium, primary, ingot {RoW} | market	Metal working, average for aluminium product manufacturing {GLO}| market	EI v3.3	2016
Expanded Polypropylene	Polypropylene, granulate {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
Felt/Satin	Textile, woven cotton {GLO}| market	Included in dataset	EI v3.3	2016
Polypropylene GF15	Polypropylene, granulate {GLO}| market; Glass fibre {GLO} | market	Injection moulding {GLO}| market	EI v3.3	2016
Polyamides	Nylon 6 {GLO} | market; Nylon 6-6 {GLO} | market; Nylon 6, glass-filled {GLO} | market; Nylon 6-6, glass-filled {GLO} | market	Injection moulding {GLO}| market	EI v3.3	2016
Polyester	Polyethylene terephthalate, granulate, amorphous {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
POM	Polyoxymethylene (POM)/EU-27	Injection moulding {GLO}| market	Industry data 2.05	2015
Polypropylene	Polypropylene, granulate {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
Polyurethane	Polyurethane, flexible foam {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
SEBS	Acrylonitrile-butadiene-styrene copolymer {GLO}| market	Injection moulding {GLO}| market	EI v3.3	2016
Steel	Steel, low-alloyed {GLO}| market	Metal working, average for steel product manufacturing {GLO}| market	EI v3.3	2016
Manufacturing				
Regional electricity grid mix	Electricity, medium voltage, hydro {DE}| market	n/a	EI v3.3	2016
Regional electricity grid mix	Electricity, medium voltage {HU}| market | Alloc Rec, U	n/a	EI v3.3	2016
Natural gas	Heat, central or small-scale, natural gas {Europe without Switzerland}| market heat, central or small-scale, natural gas | Alloc Rec, U	n/a	EI v3.3	2016
Packaging				
Cardboard	Corrugated board box {RER}| production | Alloc Rec, U	Included in dataset	EI v3.3	2016
Packaging film	Packaging film, low density polyethylene {RER}| production	Included in dataset	EI v3.3	2016
Transportation				
Road transport	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market | Alloc Rec	n/a	EI v3.3	2016
Ship transport	Transport, freight, sea, transoceanic ship {GLO}| market | Alloc Rec	n/a	EI v3.3	2016

Data Quality

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 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 2018 and engineering estimates.
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. 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.
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. Representative datasets are used to represent the actual processes, as appropriate.
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. 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.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the seating 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.
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. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.3 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 contained in the regional ecoinvent datasets.
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 Vitra's Weil am Rhein facility 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 v3.5 LCI data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the seating 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.

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 allocated based on the mass of material and distance transported.

System Boundaries

The system boundary of the life cycle assessment for seating product is cradle-to-grave. A description of the system boundaries for this study is as follows:

- ***Raw Material Extraction and Processing*** – 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 seating products, as well as those associated with the processing of raw materials and chair 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.

- ***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 manufacturing facility, as well as the production, transport, and disposal of the product packaging materials.

- ***Distribution, Storage and Use stage*** – This stage includes the delivery of the Vitra seating products to the point of use (downstream transportation), storage of the product and maintenance of the chair for a period of 10 years.

- ***Disposal stage*** – The end-of-life stage includes transport of the Vitra chair to material reclamation or waste treatment facilities. Emissions from disposal of chair components in a landfill or from incineration are included.

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.

REFERENCES

1. BIFMA x5.1. American National Standard for Office Furnishings – General Purpose Office Chairs – tests.
2. Ecoinvent Centre (2016) Ecoinvent data from v3.3. Swiss Center for Life Cycle Inventories, Dubendorf, 2016, http://www.ecoinvent.org
3. IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

1. ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures
2. ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and framework
3. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines
4. Product Category Rule (PCR) Environmental Product Declarations (EPD), BIFMA PCR for Office Furniture Seating products: UNCPC 3814. August 5, 2015.
5. SCS Global Services. Life Cycle Assessment of Vitra Seating Products. September 2019. Final Report. Prepared for Vitra.
6. SCS Type III Environmental Declaration Program: Program Operator Manual v10.0. April 2019. SCS Global Services
7. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). Version 2.1. US Environmental Production Agency.
8. US EPA. Advancing Sustainable Materials Management: 2014 Fact Sheet. Assessing Trends in Material Generation, Recycling and Disposal in the United States. November 2015. https://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf
9. US EPA. WARM Model Transportation Research - Draft. Memorandum from ICF Consulting to United States Environmental Protection Agency. September 7, 2004. http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html#background.

For more information contact:

Vitra AG
Klünenfeldstrasse 22, Birsfelden, BL CH-4127, Switzerland
info@vitra.com | +41.61.377.0000 | www.vitra.com

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