Life-Cycle Assessment of Seating

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Document Summary

The following table identifies the relevant details of the Life Cycle Assessment (LCA) for use in various certification programs.

Manufacturer	Stylex
Product(s)	F4
Declared Unit	One unit of seating to seat one individual
Reference Service Life (RSL)	10+ Years
Reference Standards	☒ ISO 14040 ☒ ISO 14044 ☒ ISO 14025:2006
Reference PCR	BIFMA PCR for Seating: UN Central Product Classification system, Class is 3811 for Seats
LCA Scope	Cradle-to-Grave
LCA Study Details	Complete: August 2023 LCA Practitioner: Sahil Akolawala, Foresight Management
LCA Review Details	Completed: LCA Reviewer: Beth Cassese, SCS Global Services ☐ INTERNAL ☒ EXTERNAL
Program Operator	NSF International
Year of Primary Data	2022
LCA Software	openLCA 2.0.0
LCA Database(s)	EcoInvent 3.8
LCIA Methodology	TRACI 2.1
Applicable Region(s)	North America

Contents

1. Context

As the demand for product transparency increases, customers and manufacturers are beginning to inquire on the environmental impacts of products through its various stages of life. A Life Cycle Assessment (LCA) can be an invaluable tool that allows these impacts to be quantified, from raw material extraction to end of life. Quantifying environmental impacts allows manufacturers to respond to market pressures and optimize possible opportunities for the product's design and manufacturing. Stylex wishes to provide customers with information on the environmental impacts of the product they are purchasing and provide transparency on the overall environmental impacts of their products.

1.1 Goal of the Study

In accordance with the international standards that guide the LCA process (ISO 14040 and ISO 14044), the goal and scope of this study need to be clearly outlined. First, this LCA will be used to better understand the processes that cause the largest environmental impacts in the products life and identify possible opportunities for improvement using study parameters such as Global Warming Potential (GWP) and Energy Intensities. Secondly, it will be used to generate an Environmental Product Declaration (EPD) for the product under study. The EPD will require a critical review from an independent third party. This is done to ensure that the LCA meets all applicable standards and is plausible. This review does not guarantee the results can be directly compared to other LCAs of similar products.

1.2 Scope Defined

In order to help normalize the results of Stylex's products, a declared unit of 1 F4 chair was chosen to align with the applicable product category rules (PCR). Since the product comes in many options and configurations, the most popular model was chosen to represent the product line and model numbers and technical data were provided.

Key input streams that were included in the study were energy carriers (electricity, natural gas), transportation, raw materials, generated waste, auxiliary utilities, and end-of-life considerations. Transportation includes transportation of raw materials to the manufacturing site, distribution and use of the product, and waste transportation of generated waste and end-of-life. All packaging sourcing and disposal is also included in the study.

1.3 List of Units

The following units were used throughout this study:

i. [hr] - hours
ii. [kg] – kilograms
iii. [linear m] – linear meters
iv. [m] – meters
v. [m3] – cubic meters
vi. [km] – kilometers
vii. [MJ] – megajoules
viii. [MJ, LHV] – megajoules, lower heating value

1.4 LCA Findings

Table 1.1 shows the Life Cycle Impact Assessment (LCIA) results for a declared unit of a single Stylex F4.

Table 1.1: LCIA Results for declared unit of studied product.

	Extraction And Upstream Production	Transport to factory	Manufacturing	Transport to site	Maintenance	Transport to waste Processing or Disposal	Disposal of Waste	Total
Impact Category	**A1**	**A2**	**A3**	**A4**	**B2**	**C2**	**C4**	
GWP IPCC AR6 [kg CO2eq]	8.29E+01	7.38E-01	6.00E+01	2.89E+00	2.46E+00	6.27E-02	1.37E+00	1.51E+02
ODP [kg CFC-11eq]	3.76E-06	1.64E-07	7.67E-06	6.48E-07	1.50E-07	1.41E-08	3.88E-08	1.24E-05
AP [kg SO2eq]	4.65E-01	6.06E-03	2.52E-01	1.42E-02	8.39E-03	3.09E-04	2.02E-03	7.48E-01
EP [kg Neq]	3.93E-01	9.06E-04	1.74E-01	3.43E-03	8.63E-02	7.45E-05	2.55E-02	6.83E-01
SFP [kg O3 eq]	5.16E+00	1.32E-01	2.90E+00	3.54E-01	9.88E-02	7.69E-03	5.12E-02	8.70E+00

Raw material acquisition of aluminum, textiles, and plastic were the largest contributors to the product's environmental impact. Within the gate-to-gate (production) boundary, natural gas is the largest contributor.

For any process where data quality was in question or proxy data was used, a sensitivity analysis was conducted.

To reduce environmental impact associated with their products, Stylex should increase the amount of recycled content in the aluminum they source, investigate energy efficiency and reduction projects, and explore adding onsite renewable generation or source electricity from renewable sources.

2. General Objective and Description of the Investigated System

This LCA report represents a systematic and comprehensive summary of project documentation and shows all data and information important to the results and required by the product category rules (PCR) listed below.

2.1 Company Profile

In 1956, the Golden family launched Stylex to address opportunities they perceived for more refined seating. Their idea was not simply to be a better seating manufacturer, but also to understand better how seating is used and how it complements its surrounding environment.

Today, the company is owned and run by Bruce and John Golden. While much has changed over more than 50 years, the foundation and vision on which the company was built remains. Our goal is to apply our experience together with an enterprising, inventive spirit. There's no 'second string' at Stylex, and everyone from our CEO to our receptionist works with customers, specifiers, and designers every day. That, in turn, lets us better understand and more rapidly refine the aesthetics, performance, value, and service that create truly engaging products.

2.2 LCA Commissioner and Practitioner

Stylex has commissioned this LCA and report. Primary data was provided by Stylex's employees from the Delanco, NJ, site where the study was based. Foresight Management was contracted to develop the LCA model using openLCA software and prepare this report. Bradley Van Valkenburg, Senior Sustainability Manager at Foresight Management, served as the Project Manager, and Sahil Akolawala, Project Manager at Foresight Management served as the LCA Practitioner. Primary data validation was done in tandem with Stylex and Foresight Management.

2.3 Reporting Date

This LCA project was initiated in May 2023 and was concluded in September 2023.

2.4 Intended Application and Reasons for the Study

This LCA was conducted for the development and preparation of an Environmental Product Declaration (EPD) based on the following PCRs.

- BIFMA PCR for Seating: UNCPC 3811.

2.5 Target Group/Audience

The intended audience of this report includes third party critical LCA reviews by a certifying body and used by Stylex internal management. The possible EPD created from this report can be used to communicate the environmental impacts to other businesses or consumers. Both the LCA and the subsequent EPD are to be certified by an External Expert via a 3rd Party Certifying Body.

2.6 Comparative Assertions and Public Disclosure

This study was not completed with the intent for comparative assertions with external products or disclosures. The results of this report can be used for product optimization, communication of potential

environmental impacts of the product, and to be used to develop EPDs. The resulting EPD can be publicly disclosed and shared. Comparability of EPDs is limited to those applying a functional unit.

2.7 Standards and PCR Conformance

This LCA is intended to be critically reviewed for conformance with ISO 14040, ISO 14044, ISO 21930:2017 and the PCR listed in Section 2.4. The critical review will confirm that this LCA meets the requirements of these standards, and the verification statement and checklist will be included in Appendix C when available.

2.8 Product Description

2.8.1 Product Classification and Description

F4 represents an evolution in user-responsive seating, a graceful, lightweight appearance, and timeless styling. Through thoughtful material selection and component design, F4 was created to comfortably and effortlessly move with its user and support a broad range of seated gestures without requiring manual adjustments.

Figure 1: Product Image of Stylex F4.

2.8.2 Applicability

The declared product is a seating product intended for use in an office setting. This study is applicable to this product and other seating products listed in Section 6.3.1 and Appendix B.

2.8.3 Technical Data

All products fall under UN CPC 43812 *"Other furniture, of a kind used in offices"*. Additional technical data for each product system can be found in Table 2.1. Stylex has conducted ANSI/BIFMA x5.1 Testing on all products under study. Stylex has also conducted ANSI/BIFMA M7.1-2011 (R-2016) on all products under study. Specifications of the product under study are: F4.

Table 2.1: Performance and technical data for each product system included.

Product System	Mass (kg)	Intended User (seating)	Kg/Seating	M7.1-2011 (R-2016) Certificate	Expected Life Span
F4	14.59	1	14.59	SCS-IAQ-92105-420	10+

Since the product passed the appropriate ANSI/BIFMA Product Safety and Performance standard, the Reference Service Life of the product is assumed to be 10 years, applying to reference in-use conditions only.

2.9 Additional Environmental Information

There is no additional environmental information that will be included in the EPD.

3. Scope of the Study

3.1 LCA Methodological Framework

This LCA was conducted with an attributional approach.

3.2 Functional Unit

As per the BIFMA PCR for Seating UNCPC 3811, the functional one unit of seating to seat one individual, maintained for a 10-year period. Functional Unit, Performance characteristics, and RSL can be found in Section 2.8.3. For any additional products included in this study can be found in Section 2.8.3 or Appendix B

The product system is produced within Stylex's Delanco, NJ facility.

3.3 System Boundary

This LCA includes a Cradle-to-Grave scope of study. An overview of these boundaries and module declaration can be seen below in Figure 1 and Table 3.1. All relative mass and energy flows from each process listed in the Flow diagram were included in this study.

Figure 2: Flow Diagram of manufacturing of Stylex's F4.

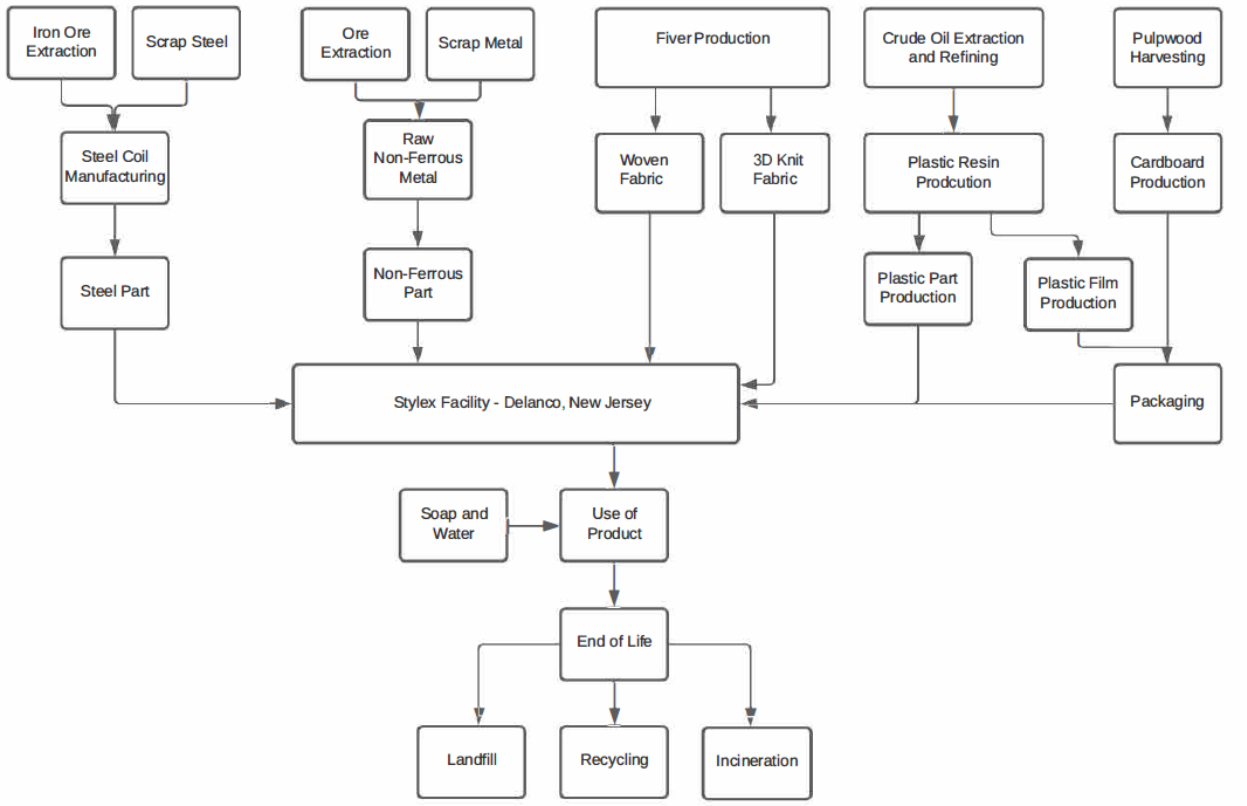


Table 3.1: Module declaration for stages included in this study.

Production			Construction		Use							End of Life				Benefits & Loads Beyond System Boundary
Raw Material Supply	Transport	Manufacturing	Transport to Site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste Processing	Disposal	Reuse, Recovery, Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X[1]	X[1]	X	X[1]	X[1]	X[1]	X[1]	X[1]	X[1]	X	X[1]	X	MND

X = Module Included, MND = Module Not Declared

All primary and secondary data was modelled in OpenLCA using Ecoinvent datasets to calculate the potential environmental impacts during each stage of the product's life. For any processes that were not available in the Ecoinvent database, proxy data was used. Details for any proxy data used are outlined in Section 6.2.2.

This study follows the following principles:

- *Modularity Principle*: This study was done attributably, where all environmental aspects and potential impacts are attributed to each process and flow in the life cycle module that they occur.
- *Polluter Pays Principle*: This study used the cut-off method regarding waste treatment, where the creator of the waste stream is responsible for all transportation and processing of all waste generated within the system boundary.

3.3.1 Material Acquisition & Pre-Processing (A1-A2)

This stage includes all extraction, processing, and transportation of all the raw material. Table 3.2 shows more detail on what is included and excluded:

Table 3.2: Inclusion and exclusion of processes in the Material Acquisition stage.

Included	Excluded
Extraction and additional processing of all raw materials	Construction of all facilities.
Processing of any recycled feed streams from outside systems (Open Loop)	Manufacturing of operating equipment
Transportation of secondary processes included within A.	Production or any co-products leaving the system
Inbound Transportation of all raw materials to the location of manufacturing.	Manufacturing of transportation equipment
Production of all fuels required for transportation	

[1] Theses module have been declared, however through the LCA and assumptions outlined in the PCR, no activity was expected and therefore no results were reported. Any modules not represented in Section 5 have no contribution (0.00E+00) to the results.

A list of all raw materials for each product system is shown in Table 3.3. A list of the raw materials for each product system, inclusive of scrap, is shown in Table 3.4. The recycled content of each material used in this study is shown in Table 3.5. The product has an overall material efficiency of 74.33%, therefore, 19.63 kg of raw materials is required to produce the functional unit of 14.59 kg. Material efficiency was applied on the facility level, so all materials have the applied material efficiency. The 5.04 kg of waste associated with this is included in Module A3.

Table 3.3 Material Composition per Declared Unit (exclusive of scrap)

Part	Mass (kg)	Weight %
Aluminum	8.56	58.65
Caster	0.46	3.17
Gas Spring	1.08	7.38
High Density Polyethylene	0.03	0.22
Nylon	1.22	8.33
Nylon Fabric	0.02	0.12
POM	0.09	0.62
Polypropylene	1.08	7.37
Polyurethane Foam	0.98	6.73
Steel	0.72	4.91
Textile	0.36	2.49
Total (kg/seating)	14.59	100.00

Table 3.4: Material Composition per Declared Unit (inclusive of scrap)

Part	Mass (kg)	Weight %
Aluminum	11.51	58.65
Caster	0.62	3.17
Gas Spring	1.45	7.38
High Density Polyethylene	0.04	0.22
Nylon	1.64	8.33
Nylon Fabric	0.02	0.12
POM	0.12	0.62
Polypropylene	1.45	7.37
Polyurethane Foam	1.32	6.73
Steel	0.96	4.91
Textile	0.49	2.49
Total (kg/seating)	19.63	100.00

Table 3.5: Recycled content of materials used in this study.

Material	PC Recycled Content	PI Recycled Content
Aluminum	Industry Average[2]	
Caster	Industry Average[1]	
Gas Spring	Industry Average[1]	
High Density Polyethylene	Industry Average[1]	
Nylon	Industry Average[1]	
Nylon Fabric	Industry Average[1]	
POM	Industry Average[1]	
Polypropylene	Industry Average[1]	
Polyurethane Foam	Industry Average[1]	
Steel	Industry Average[1]	
Textile	Industry Average[1]	

All weights of raw materials needed are based on a bill of materials (BOM) and technical data supplied by Stylex. More information regarding the datasets representing the raw materials used in the products can be found in Appendix A.

All materials were delivered to Stylex's Delanco facility via truck and sea freight. The distances of the transportation were determined by distance from the supplier to Stylex's facility. If multiple suppliers were identified for a material, then a weighted average of distance was determined based on mass supplied. The average distances based on commodity can be seen in Table 3.6

Table 3.6 Inbound Material Transportation Distance

Material	Truck [km]	Rail [km]	Ship [km]
Raw Materials			
Aluminum	4427	-	11680
Caster	445	-	-
Gas Spring	4427	-	10122
High Density Polyethylene	464	-	-
Nylon	4427	-	-
Nylon Fabric	829	-	-
POM	29	-	-
Polypropylene	830	-	-
Polyurethane Foam	830	-	-
Steel	105	-	-
Textile	473	-	9631

[2] Since supply chain includes multiple geographic sources for each material, a weighted flow was used. All datasets chosen use the industry average reported in Ecoinvent, and are weighted appropriately.

3.3.2 Manufacturing (A3)

This stage includes all processes that occur at Stylex's manufacturing processes and production of any additional energy, utilities, or materials that are not considered raw materials. This also includes any intermediary transportation of these materials. See Table 3.7 for more specific information about what is included in this boundary. The finished product does not contain any materials that are required to be labelled as hazardous or dangerous substances in its Bill of Materials.

Table 3.7: Inclusion and exclusion of processes in the Production stage.

Included	Excluded
All manufacturing processes occurring at Stylex's facility.	Construction of all facilities.
Extraction and additional processing of raw materials for packaging	Manufacturing of operating equipment
Processing of any recycled feed streams from outside systems (Open Loop) for packaging.	Production or any co-products leaving the system
Transportation of intermediary materials and packaging to production facility	Manufacturing of transportation equipment
Generation of any utilities, materials, and additional fuels.	Construction of any warehousing
Transportation and treatment of any waste associated with production of product and packaging.	
Outbound Transportation of finished product to the location of warehousing or usage.	
Production of all fuels required for transportation	
Additional resources included in warehousing of product.	
Generation of additional resources used in warehousing of product.	

All energy resources used in the production process are accounted for in the model. Electricity is associated to the correct grid and includes no additional renewable sources. The Ecoinvent dataset was used for the appropriate USA Grid subregion (New Jersey). All other energy and fuel sources can be seen in Appendix A. Stylex's energy usage was normalized to one (1) kg based on the 2022 production numbers the normalized energy and utility data can be seen in Table 3.8. The eGrid used was RFC East. Raw data provided for facilities can be seen in Table 3.9. All waste was classified based on US EPA Municipal Waste for Durable Goods.

Stylex Manufactures specific parts from commodities and assembles them with pre-fabricated parts from suppliers.

Packaging involves corrugated cardboard, foam inserts, and plastic wrapping. Packaging weights can be seen in Table 3.10

Stylex keeps track of all recycling and landfilled material over the data collection period. All recycled waste is recycled by regional recycling companies, one specializing in metals, and another in mixed recycling. All additional waste is treated as municipal solid waste. All waste transportation is determined by using EPA WARM data, which is estimated at 20 miles (32km). Both waste streams are included in this boundary and the datasets used can be seen in Appendix A.

Table 3.8: Stylex facility inputs/outputs per functional unit.

Input/Output Data Category	Units per 1 functional unit
Electricity [MJ]	47.85
Natural Gas [MJ]	140.36
Process Water [m^3]	0.05
Wastewater [m^3]	0.05
Municipal Solid Waste [kg]	1.22
Recycled Material [kg]	3.82
Hazardous Waste [kg]	N/A
Refrigerants [kg]	0.00002
Shielding Gas [CF]	0.04

Table 3.9 Results of facility data allocation.

Input/Output Data Category	Units per year
Electricity [MJ]	5.71E+06
Natural Gas [MJ]	1.68+07
Process Water [m^3]	6.28E+03
Waste Water [m^3]	6.28E+03
Municipal Solid Waste [kg]	1.46E+05
Recycled Material [kg]	4.55E+05
Hazardous Waste [kg]	N/A
Refrigerants [kg]	2.88E+01
Shielding Gas [CF]	1.74E+04
Mass Shipped [kg]	1.74E+06

Table 3.10 Stylex's Packaging per functional unit.

Material	kg per 1 functional unit
Corrugate	1.07
Foam	0.05
LDPE Bag	0.05

3.3.3 Distribution (A4)

Type and distance of transportation was determined by developing a weighted average for all shipping data from calendar year 2022 based on sales. Distances for each type of transportation can be seen in Table 3.11.

No products under study undergo any warehousing.

Table 3.11: Outbound Transportation Distance

	Truck [km]	Rail [km]	Ship [km]
Finished Product	1483	-	-

3.3.4 Use (B2)

This stage includes the use of the product. Table 3.12 shows more details on what is included and excluded.

Table 3.12: Inclusion and exclusion of processes in the Production stage.

Included	Excluded
Generation and use of any energy or materials for usage or maintenance of the product.	Replacement of Products to meet requirements of PCR.

For all products, it was assumed that a mild soaping agent was used for maintenance of the product. It was assumed that a standard 16oz bottle was used over the product's lifespan. For products that included energy to operate, total energy was determined by the products specifications. And replacement of products that are required to meet the 10-year RSL outlined in the PCR are represented in modules A and B. All use phase assumptions are listed in Table 3.13

Table 3.13: Use phase assumptions.

Energy/Material Flow	Unit	Amount
Electricity	MJ	-
Soaping Agent	kg	1.07

3.3.5 End Of Life (C2-C4)

This stage includes the shipment to waste treatment facilities and treatment of the waste. Table 3.14 shows more detail on what is included and excluded:

Table 3.14 Inclusion and exclusion of processes in the End-of-Life stage.

Included	Excluded
Waste processing for reuse, recycling, energy recovery, and/or reclamation	Production of the end-of-life facilities.
Waste Disposal including all resource inputs and management activities of the disposal site	
Transportation of the product and packaging to the end-of-life facility.	

The distance to the final disposal location was determined to be 20 miles as per the EPA WARM model. The fate of the product and packaging was determined based on market methods and values from Ecoinvent[3]. The disposal methods and ratios can be seen in Table 3.15. All waste was classified based on US EPA Municipal Waste for Durable Goods.

[3] Market values of % Recycled, Landfilled, and Incineration calculated from table 5 in the following report: Advancing Sustainable Materials Management: 2018 Fact Sheet (epa.gov)

Table 3.15 End of Life ratios of all materials used.

Material	Recycled %	Landfilled %	Incineration %
Steel[2]	33%	55%	12%
Aluminum[2]	17%	68%	14%
Wood[2]	17%	67%	16%
Plastics[2]	9%	76%	16%
Foam[2]	18%	54%	27%
Textiles[2]	15%	66%	19%

3.4 Cut-off Criteria

Any material present at or above 1 wt% of the final product was included within the scope of this study. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impacts.

No materials or energy inputs were excluded in this study.

3.5 Allocation Procedure

General principles of allocation were based on ISO 14040/14044. Since there are no other co-products, no allocation based on co-products is required.

To derive a per-unit for manufacturing inputs and outputs such as electricity, thermal energy, and waste streams, allocation based on Total Mass Production by unit was adopted. As a default, secondary Ecoinvent datasets use a mass basis for allocation.

The method in which recycled materials were handled is relevant to the defined system boundary. Throughout the study, recycled materials were accounted for via the cut-off method. In this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at the end of life are also excluded (i.e. production into a third life or energy generation from incineration). The study does include the impacts associated with reprocessing and preparation of recycled materials feed streams that are included in the studied product.

3.6 Data Quality Requirements

Secondary data sets used in the model are disclosed in Appendix A along with data quality indicators related to the geographical, time representation, and technological coverage of the datasets. If any proxy data was used, it is also included if applicable.

3.6.4 Geographical Coverage

The geographical scope of the production stage of this study is United States. All primary data was collected from the manufacturer; therefore, the geographical coverage of primary data is considered to be fully representative.

The geographical scope of all remaining stages is in North America, except for the materials sourced from Asian Markets (see section 3.3.1). In selecting secondary data from Ecoinvent, priority was given to technological representativeness of the data. Of the sets that were deemed of high enough quality, then the most representative geographical data was used. This led to Global, European, and Rest of World being used when North American data was not available. The geographical coverage of all secondary datasets can be seen in Appendix A. Overall geographical data quality is considered partially representative with a score of 2.61/5.00.

3.6.5 Time Coverage

Primary data was provided by the manufacturer and represents all data for 2022 calendar year. Time coverage of primary data is considered fully representative.

Secondary dataset time coverage varies and is based on when the data was collected. Therefore, the most recent data set was chosen. Overall time coverage is considered to be 5.00/5.00 and meets the PCR requirements of being no older than 10 years. More specific time coverage can be seen in Appendix A.

3.6.6 Technological Coverage

Primary data provided by the manufacturer is specific to the technology that they use in their processes and products. Given that this study is for products manufactured at the Delanco, New Jersey facility, the technological coverage is completely representative. All facility data was allocated to the product using mass allocation.

Secondary data was used to fill the gaps throughout the supply chain to address all inputs from Cradle-to-Gate. Technological coverage of these datasets is considered to be representative of the actual supply chain with a score of 4.49/5.00. Improving primary data in the supply chain would increase the technological coverage, but the use of secondary data sets for generic processes meets the goal and scope of the LCA.

3.6.7 Treatment of Missing Data

Primary data was used for the final manufacturing processes. Stylex provided all inputs and outputs from their facility, it is considered to be a complete inventory. No supplier data was available for their manufacturing processes, therefore, secondary data for raw material production and component manufacturing were obtained using Ecoinvent databases, which are shown in Appendix A. Any proxies used for materials have also been documented in section 6.2.2 and a sensitivity analysis was done for any proxy materials.

3.6.8 Data Quality Assessment

Appendix A shows an assessment for the data quality of all secondary datasets used in the model. The following section shows details on the data quality of the model itself.

3.6.8.1 Precision

The precision of the data is considered good. The Stylex facility team provided the data for a full year of operations. Their team provided a list of suppliers and a Bill of Materials for all products in the scope of the study. All inbound transportation data is a weighted average of all suppliers for each material, which was determined by mass supplied by each supplier for a year. All outbound transportation data is a weighted average of sales. Proxy data was used for end-of-life processes where secondary data was not available for that material. Materials and proxy data used can be found in section 6.2.2. A sensitivity analysis was done on these processes.

3.6.8.2 Completeness

The data included is considered complete. The LCA model included all known materials and energy flows except for specified materials outlined in Section 3.4. As stated, no known material flows above 1% were excluded and the sum of all exclusions is below 5% when evaluated against mass, energy, and environmental impact.

3.6.8.3 Representativeness

The data used in the assessment represent typical or average processes as currently reported from multiple data sources to Ecoinvent and are therefore generally representative of the actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis, though such a determination would require detailed data collection at each node upstream.

3.6.8.4 Consistency

The consistency of this model is considered high. Stylex tracks all relevant inputs and outputs of their processes over a year, any other primary data used was collected with similar methods and time frame. Modelling assumptions are consistent across the model.

3.6.8.5 Reproducibility

This study is considered to be reproducible. All assumptions and secondary datasets are described in this report and would allow an LCA practitioner to use an LCA tool to generate the results for the declared unit.

3.6.8.6 Uncertainty

Uncertainty of any primary data provided by Stylex is dependent on how the data was allocated to each product. This allocation came from the yearly totals of product produced and utility data. Sub metered processes would decrease the uncertainty of the primary data. For secondary data, all uncertainty is outlined and published by Ecoinvent for Ecoinvent 3.8 datasets.

3.6.8.7 Ecoinvent data quality system

Additionally, within openLCA, there is an ecoinvent data quality system constructed to align with USLCI data quality assessments. The matrix is constructed as follows:

Table 3.16: Ecoinvent data quality assessment

Score	Reliability (R)	Completeness (C)	Temporal Correlation (T)	Geographical Correlation (G)	Further Technical Correlation (F)
1	Verified Data based on measurements	Representative data from all sites relevant for the market considered, over and adequate period to even out normal fluctuations	Less than 3 years of difference to the time period of the data set	Data from area under study	Data from enterprises, processes and materials under study
2	Verified data partly based on assumptions or non-verified data based on measurements	Representative data from > 50% of the sites relevant for the market considered, over an adequate period to even out normal fluctuations	Less than 6 years of difference to the time period of the data set	Average data from larger area in which the area under study is included	Data from processes and materials under study (i.e. identical technology) but from different enterprises
3	Non-verified data parly based on qualified estimates	Representative data from only some sites (<< 50%) relevant for the market considered or > 50% of sites but from shorter periods	Less than 10 years of difference to the time period of the data	Data from area with similar production conditions	Data from area with similar production conditions
4	Qualified estimate	Representative data from only one site relevant for the market considered or some sites but from shorter periods	Less than 15 years of difference to the time period of the data set	Data from area with slightly similar production conditions	Data on related processes or materials

5	Non-qualified Estimates	Representativeness unknown or data from a small number of sites and from shorter periods	Age of data unknown or more than 15 years of difference to the time period of the data set	Data from unknown or distinctly different area	Data on related process on laboratory scale or from different technology

Scores were assigned to datasets in the model, and an overall score was generated for the TRACI 2.1 LCIA indicators. The results are as follows:

Table 9: Ecoinvent Data Quality Assessment of TRACI indicators

Name	Category	R	C	T	G	F	Average
Acidification	TRACI 2.1	3	3	4	3	2	3
Eutrophication	TRACI 2.1	3	3	4	4	3	3.4
Global warming	TRACI 2.1	2	2	4	2	1	2.2
Ozone depletion	TRACI 2.1	2	3	5	5	3	3.6
Smog	TRACI 2.1	3	3	4	3	2	3

4 Life Cycle Inventory Analysis

Primary data was collected from Stylex associates. All calculations adhere to the ISO 14044 standard. Collection and processing of the major data is described below. All primary data was collected over a period of 1 year.

- Electrical, Fuels, and Water Consumption
  - Data was collected over 2022 calendar year. The totals over the collection period were divided by the mass of total production during that period to derive a usage-per-mass unit for use in this model.
- Raw Materials and Purchasing
  - Stylex provided all bills of materials and supplier names. Inbound shipping distances were calculated using Google Maps and Searoutes.
- Waste amounts
  - Stylex tracks all waste streams associated with manufacturing of the product over the data collection period. All waste was characterized, disposed of, and treated appropriately as outlined in Section 3.3.
- Outbound Shipping Distance
  - A weighted average of the distances to all states where Stylex products are shipped was calculated based on sales shipped. It was found that on average, the shipping distance was 1483 km by truck.
- End of Life (EoL) Scenarios
  - No primary data for the fate of the product was available. Waste from products and packaging was disposed of based on EPA data. No credits were taken for energy recovery from waste. Cut-off criteria for recycling were applied.

Data was reviewed for accuracy and completeness and any gaps were filled with primary or justifiable estimates.

Secondary datasets were collected from EcoInvent for any processes that primary data was not collected for. All secondary datasets used can be seen in Annex A.

5 Life Cycle Impact Assessment (LCIA)

5.1 Selection of Impact Categories

The following environmental impact categories and associated category indicators were used in this study as results reported in the LCA report for the declared unit. Note: The TRACI 2.1 impact assessment method does not include biogenic carbon in the quantification of GWP.

- GWP 100 - Global Warming Potential [kg CO2-eq] – IPCC (AR6)
- GWP 100 – Global Warming Potential [kg CO2-eq] – TRACI 2.1
- AP - Acidification Potential [kg SO2-eq] – TRACI 2.1
- SFP - Photochemical Smog Formation [kg O3-eq] – TRACI 2.1
- EP - Eutrophication potential [kg N eq] – TRACI 2.1
- ODP - Ozone Depletion Air [kg CFC 11-eq] – TRACI 2.1

Quantities for each impact category were calculated for each stage of the product's life.

IPCC (AR6) method was used to calculate global warming potential and TRACI 2.1's characterization method was used to calculate the remaining categories in the study as outlined in the PCR. The results presented are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins, or risks. In addition to the environmental impacts described above, the following resource and waste categories are also disclosed in accordance with ISO 21930. Biogenic carbon was quantified by the EI Climate Change GWP biogenic indicator from EN15804+A2. All waste was classified based on US EPA Municipal Waste for Durable Goods.

- RPR_E – Renewable primary resources used as an energy carrier (fuel) [MJ, LHV]
- RPR_M – Renewable primary resources with energy content used as a material [MJ, LHV]
- RPR_T – Renewable primary resources with energy content, total [MJ, LHV]
- $NRPR_E$ – Non-renewable primary resources used as an energy carrier (fuel) [MJ, LHV]
- $NRPR_M$ – Non-renewable primary resources with energy content used as a material [MJ, LHV]
- $NRPR_T$ – Non-renewable primary resources with energy content, total [MJ, LHV]
- SM – Secondary Materials used [kg]
- RSF – Renewable Secondary Fuels [MJ, LHV]
- NRSF – Non-renewable Secondary Fuels [MJ, LHV]
- FW – Net use of fresh water [m^3]
- HWD – Hazardous waste disposed [kg]
- NHWD – Non-Hazardous waste disposed [kg]
- HLRW – High Level Radioactive waste, conditioned, to final repository [kg]
- ILLRW – Intermediate/Low Level Radioactive waste, conditioned, to final repository [kg]
- CRU – Components for reuse [kg]
- MR – Material for recycling [kg]
- MER – Materials for energy recovery [kg]
- EE – Exported energy [MJ, LHV]
- $GWP_{Biogenic}$ – Biogenic Carbon: Biogenic Carbon entering the system = -1kg, Biogenic Carbon leaving the system - +1kg [kg CO_2e]
- BCRK – Biogenic Carbon removed by packaging [kg CO_2e]
- BCEK – Biogenic Carbon emitted by packaging [kg CO_2e]

5.2 LCA Results

All results are given per declared unit outlined in Section 3.2, which is a seating product for 1 person. Results are reported for each life cycle stage. The results can be seen in Tables 5.1-5.3.

The relevance of the LCIA results were not decreased due to any allocation methods used. No by-products were produced so the LCIA results reflect the impact of a declared unit.

IPCC (AR6) and TRACI 2.1 Life Cycle Impact Assessment results were calculated using the LCA software, OpenLCA, and are presented in Table 5.1. A brief description of each impact category can be found below. The definitions were taken directly from IPCC[4] and EPA's TRACI Version 2.1 User's Manual, and the EPA Website

- Acidification (AP) is the increasing concentration of hydrogen ions (H+) within a local environment. This can be the result of the addition of acids (e.g., nitric acid and sulfuric acid) into the environment, or by the addition of other substances (e.g., ammonia) which increase the acidity of the environment due to various chemical reactions and/or biological activity, or by natural circumstances such as the change in soil concentrations because of the growth of local plant species.
- Eutrophication (EP) is the enrichment of an aquatic ecosystem with nutrients (nitrates, phosphates) that accelerate biological productivity (growth of algae and weeds) and an undesirable accumulation of algal biomass.
- Global Warming Potential (GWP 100) is an index that attempts to integrate the overall climate impacts of a specific action (e.g., emissions of CH4, NOx or aerosols). It relates the impact of emissions of gas to that of emission of an equivalent mass of CO2. The duration of the perturbation is included by integrating radiative forcing over a time horizon (e.g., standard horizons for IPCC have been 20, 100, and 500 years). The time horizon thus includes cumulative climate change and the decay of the perturbation.
- Ozone Depletion (ODP): Ozone within the stratosphere provides protection from radiation, which can lead to an increased frequency of skin cancers and cataracts in human populations. Additionally, ozone has been documented to have effects on crops, other plants, marine life, and human-built materials. Substances which have been reported and linked to decreasing the stratospheric ozone level are chlorofluorocarbons (CFCs) which are used as refrigerants, foam blowing agents, solvents, and halons which are used as fire extinguishing agents.
- Photochemical Smog Formation (SFP): Ground level ozone is created by various chemical reactions, which occur between nitrogen oxides (NOx) and volatile organic compounds (VOCs) in sunlight. Human health effects can result in a variety of respiratory issues including increasing symptoms of bronchitis, asthma, and emphysema. Permanent lung damage may result from prolonged exposure to ozone. Ecological impacts include damage to various ecosystems and crop damage. The primary sources of ozone precursors are motor vehicles, electric power utilities and industrial facilities.

[4] Intergovernmental Panel on Climate Change (IPCC), Aviation and the Global Atmosphere

Table 5.1.1: LCIA Results for One Seating of F4.

Impact Category	Unit	A1	A2	A3	A4	B2	C2	C3	C4	Total
IPCC AR6 GWP 100	[kg CO_2eq]	8.29E+01	7.38E-01	6.00E+01	2.89E+00	2.46E+00	6.27E-02	0.00E+00	1.37E+00	1.51E+02
GWP, Biomass	[kg CO_2eq]	1.43E+00	8.81E-03	3.23E+00	3.90E-02	3.22E+00	8.47E-04	0.00E+00	2.89E-01	8.21E+00
TRACI GWP	[kg CO_2eq]	8.20E+01	7.37E-01	5.93E+01	2.88E+00	2.40E+00	6.25E-02	0.00E+00	1.36E+00	1.50E+02
TRACI ODP	[kg CFC 11-eq]	3.76E-06	1.64E-07	7.67E-06	6.48E-07	1.50E-07	1.41E-08	0.00E+00	3.88E-08	1.24E-05
TRACI AP	[kg SO_2eq]	4.65E-01	6.06E-03	2.52E-01	1.42E-02	8.39E-03	3.09E-04	0.00E+00	2.02E-03	7.48E-01
TRACI EP	[kg N-eq]	3.93E-01	9.06E-04	1.74E-01	3.43E-03	8.63E-02	7.45E-05	0.00E+00	2.55E-02	6.83E-01
TRACI SFP	[kg O_3eq]	5.16E+00	1.32E-01	2.90E+00	3.54E-01	9.88E-02	7.69E-03	0.00E+00	5.12E-02	8.70E+00

GWP 100: Global Warming Potential (IPCC 2013 AR5, GWP 100yrs) (Fossil). **GWP**: Global Warming Potential. **ODP:** Ozone Depletion Potential (stratospheric). **AP:** Acidification Potential (land and water). **EP:** Eutrophication Potential (land and water). **SFP:** Smog Formation Potential.

Table 5.1.1: LCIA Results for One Seating of F4 grouped by Module.

Impact Category	Unit	Material Acquisition and Refining	Manufacturing	Distribution and Use	End of Life	Total
IPCC AR6 GWP 100	[kg CO_2eq]	8.36E+01	6.00E+01	5.35E+00	1.43E+00	1.51E+02
GWP, Biogenic	[kg CO_2eq]	1.44E+00	3.23E+00	3.26E+00	2.90E-01	8.21E+00
TRACI GWP	[kg CO_2eq]	8.27E+01	5.93E+01	5.28E+00	1.42E+00	1.50E+02
TRACI ODP	[kg CFC 11-eq]	3.92E-06	7.67E-06	7.98E-07	5.29E-08	1.24E-05
TRACI AP	[kg SO_2eq]	4.71E-01	2.52E-01	2.26E-02	2.33E-03	7.48E-01
TRACI EP	[kg N-eq]	3.94E-01	1.74E-01	8.97E-02	2.56E-02	6.83E-01
TRACI SFP	[kg O_3eq]	5.29E+00	2.90E+00	4.53E-01	5.89E-02	8.70E+00

Tables 5.2 and 5.3 show life cycle indicators as outlined by EN 15804+A2.

Table 5.2.1: LCI Results for One Seating of F4.

Parameter	Unit	A1	A2	A3	A4	B2	C2	C3	C4	Total
RPR_E	[MJ, LHV]	6.09E+01	9.35E-02	4.78E+01	3.99E-01	3.94E+00	8.66E-03	0.00E+00	2.24E-01	1.13E+02
RPR_M	[MJ, LHV]	4.56E+01	7.97E-02	2.50E+01	3.51E-01	3.76E+01	7.61E-03	0.00E+00	8.10E-02	1.09E+02
RPR_T	[MJ, LHV]	1.07E+02	1.73E-01	7.28E+01	7.50E-01	4.15E+01	1.63E-02	0.00E+00	3.05E-01	2.22E+02
$NRPR_E$	[MJ, LHV]	7.09E+02	1.36E+00	5.18E+02	5.83E+00	7.46E+00	1.27E-01	0.00E+00	5.52E-01	1.24E+03
$NRPR_M$	[MJ, LHV]	5.66E+02	9.76E+00	4.43E+02	3.88E+01	5.61E+00	8.41E-01	0.00E+00	2.23E+00	1.07E+03
$NRPR_T$	[MJ, LHV]	1.28E+03	1.11E+01	9.61E+02	4.46E+01	1.31E+01	9.68E-01	0.00E+00	2.78E+00	2.31E+03
SM	[kg]	1.05E+01	8.63E-03	3.51E+00	3.52E-02	2.07E-01	7.63E-04	0.00E+00	4.41E-02	1.43E+01
RSF	[MJ, LHV]	1.89E-01	1.34E-03	6.49E-01	5.73E-03	8.88E-03	1.24E-04	0.00E+00	6.02E-03	8.60E-01
NRSF	[MJ, LHV]	5.82E-01	2.86E-03	1.50E+00	1.23E-02	1.08E+00	2.68E-04	0.00E+00	1.06E+00	4.23E+00
FW	[kg]	7.96E+03	1.42E+00	4.83E+02	6.13E+00	2.30E+02	1.33E-01	0.00E+00	4.22E+00	8.68E+03

RPR_E: Renewable Primary Energy Used as Energy Carrier (excluding raw materials). **RPR_M:** Renewable primary energy resources used as raw materials. **$NRPR_E$:** Non-renewable Primary Energy Used as Energy Carrier (excluding raw materials). **$NRPR_M$:** Non-renewable primary energy resources used as raw materials. **SM**: Use of secondary materials. **RSF:** Use of renewable secondary fuels. **NRSF:** Use of non-renewable secondary fuels. **FW:** Use of net freshwater resources

Note: Fresh water usage from electricity generation is included in this study. Total freshwater usage from electricity generation is 8.73kg.

Table 5.2.2: LCI Results for One Seating of F4 grouped by Module.

Parameter	Unit	Material Acquisition and Refining	Manufacturing	Distribution and Use	End of Life	Total
RPR_E	[MJ, LHV]	6.10E+01	4.78E+01	4.34E+00	2.33E-01	1.13E+02
RPR_M	[MJ, LHV]	4.57E+01	2.50E+01	3.80E+01	8.86E-02	1.09E+02
RPR_T	[MJ, LHV]	1.07E+02	7.28E+01	4.23E+01	3.21E-01	2.22E+02
$NRPR_E$	[MJ, LHV]	7.10E+02	5.18E+02	1.33E+01	6.79E-01	1.24E+03
$NRPR_M$	[MJ, LHV]	5.76E+02	4.43E+02	4.44E+01	3.07E+00	1.07E+03
$NRPR_T$	[MJ, LHV]	1.29E+03	9.61E+02	5.77E+01	3.75E+00	2.31E+03
SM	[kg]	1.05E+01	3.51E+00	2.42E-01	4.49E-02	1.43E+01
RSF	[MJ, LHV]	1.90E-01	6.49E-01	1.46E-02	6.14E-03	8.60E-01
NRSF	[MJ, LHV]	5.85E-01	1.50E+00	1.09E+00	1.06E+00	4.23E+00
FW	[kg]	7.96E+03	4.83E+02	2.36E+02	4.35E+00	8.68E+03

Table 5.3.1: LCI results for One Seating of F4 regarding use of resources.

Parameter	Units	A1	A2	A3	A4	B2	C2	C3	C4	Total
HWD	[kg]	1.18E+02	2.80E-01	8.82E+01	1.20E+00	1.85E+00	2.60E-02	0.00E+00	1.23E-01	2.10E+02
NHWD	[kg]	4.41E+00	6.57E-01	3.87E+00	2.99E+00	1.84E-01	6.49E-02	0.00E+00	8.19E+00	2.04E+01
HLRW	[kg]	1.46E-04	5.88E-07	3.25E-04	2.53E-06	4.42E-06	5.50E-08	0.00E+00	7.27E-07	4.80E-04
ILLRW	[kg]	2.08E-02	1.65E-04	6.16E-02	6.82E-04	7.18E-04	1.48E-05	0.00E+00	1.59E-04	8.41E-02
CRU	[kg]	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
MR	[kg]	1.97E+00	1.26E-02	2.95E+00	5.00E-02	2.21E-01	1.08E-03	0.00E+00	3.00E+00	8.22E+00
MER	[kg]	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RE	[MJ, LHV]	N/A	N/A	6.79E-01	N/A	0.00E+00	N/A	N/A	N/A	6.79E-01
EE	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

HWD: Hazardous waste disposed. **NHWD:** Non-hazardous waste disposed. RWD: Radioactive waste disposed. **HLRW:** High Level Radioactive waste, conditioned, to final repository. **ILLRW**: Intermediate/Low Level Radioactive waste, conditioned, to final repository **CRU:** Components for reuse. **MR**: Materials for recycling. **MER:** Materials for energy recovery. **RE:** Recovered Energy. **EE:** Exported Energy.

Table 5.3.2: LCI results for One Seating of F4 regarding use of resources grouped by Module.

Parameter	Units	Material Acquisition and Refining	Manufacturing	Distribution and Use	End of Life	Total
HWD	[kg]	1.18E+02	8.82E+01	3.05E+00	1.49E-01	2.10E+02
NHWD	[kg]	5.07E+00	3.87E+00	3.17E+00	8.25E+00	2.04E+01
HLRW	[kg]	1.47E-04	3.25E-04	6.95E-06	7.82E-07	4.80E-04
ILLRW	[kg]	2.10E-02	6.16E-02	1.40E-03	1.74E-04	8.41E-02
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	[kg]	0.00E+00	2.95E+00	2.71E-01	3.00E+00	8.22E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	[MJ, LHV]	N/A	6.79E-01	0.00E+00	N/A	6.79E-01
EE	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 5.4.1: LCI biogenic carbon results for One Seating of F4. All carbon entering the system boundary is quantified as -1kg CO_2e. All carbon leaving the system is quantified as +1kg CO_2e

Parameter	Units	A1	A2	A3	A4	B2	C2	C3	C4	Total
$GWP_{Biogenic}$	[kg CO_2e]	4.54E-01	5.40E-03	2.49E-01	1.20E-02	7.56E-03	2.61E-04	0.00E+00	1.38E-03	7.30E-01
BCRK	[kg CO_2e]	N/A	N/A	3.13E-03	N/A	N/A	N/A	N/A	N/A	3.13E-03
BCEK	[kg CO_2e]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.31E-08	7.31E-08

$GWP_{Biogenic}$: Global Warming Potential, including biogenic carbon. **BCRK:** Biogenic Carbon Removed by Packaging
BCEK: Biogenic Carbon Emitted by Packaging.

Table 5.4.2: LCI biogenic carbon results for One Seating of F4 grouped by module. All carbon entering the system boundary is quantified as -1kg CO_2e. All carbon leaving the system is quantified as +1kg CO_2e

Parameter	Units	Material Acquisition and Refining	Manufacturing	Distribution and Use	End of Life	Total
$GWP_{Biogenic}$	[kg CO_2e]	4.59E-01	2.49E-01	2.69E-01	1.64E-03	7.30E-01
BCRK	[kg CO_2e]	N/A	3.13E-03	N/A	N/A	3.13E-03
BCEK	[kg CO_2e]	N/A	N/A	N/A	7.31E-08	7.31E-08

No substances required to be reported as hazardous, other than the classified hazardous waste, which is disposed of in accordance with local regulations, are associated with the production of this product. All reported numbers for HWD are from auxiliary processes from secondary datasets. Stylex does not produce any hazardous waste in any of their operations. There are no releases of any dangerous or regulated substances associated with the production of this product. All substances that may be considered dangerous or regulated are treated appropriately before they are released.

6 Interpretation

Within this section, the results of the Life Cycle Assessment were interpreted in accordance with the goal and scope of this study. This interpretation included a dominance analysis, a sensitivity analysis, a scenario analysis, and a data quality analysis. All of which help form the conclusion of the study.

6.1 Dominance Analysis

A dominance analysis was done to show which of the life cycle stages contributes to the majority of the environmental impacts. As seen in the previous section and in Figure 6.1, the typical highest contributor is raw material acquisition. The high level of ozone depletion seen in module A3 is due to the natural gas consumption at Stylex's manufacturing site.

Figure 6.1: Relative contribution of each life cycle stage

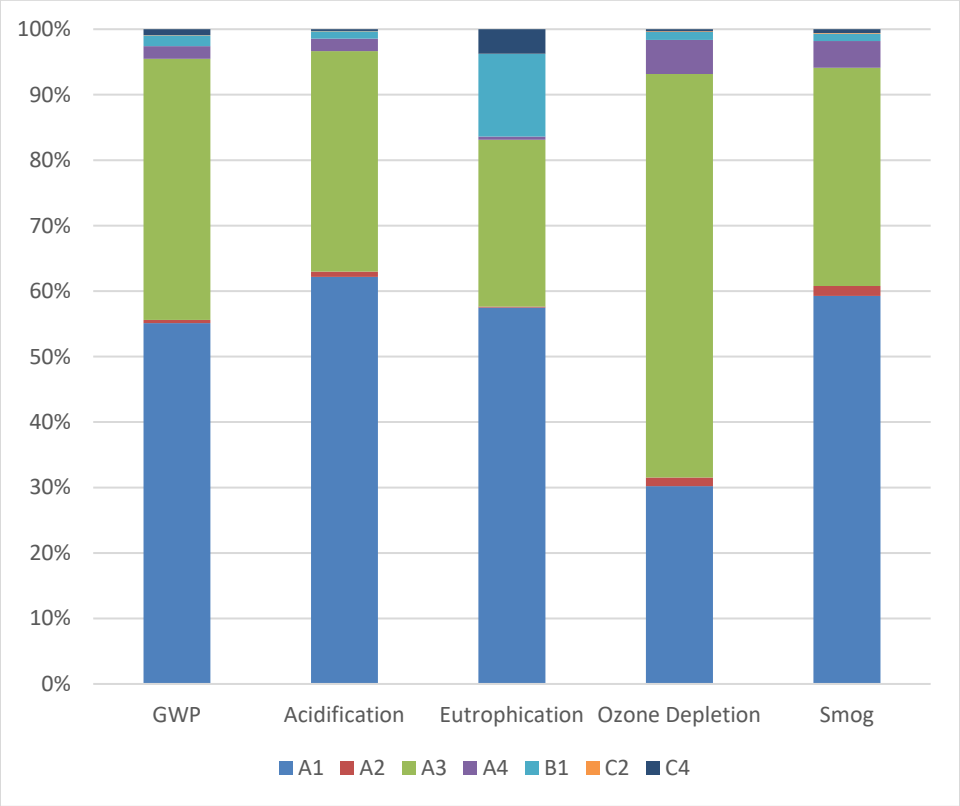
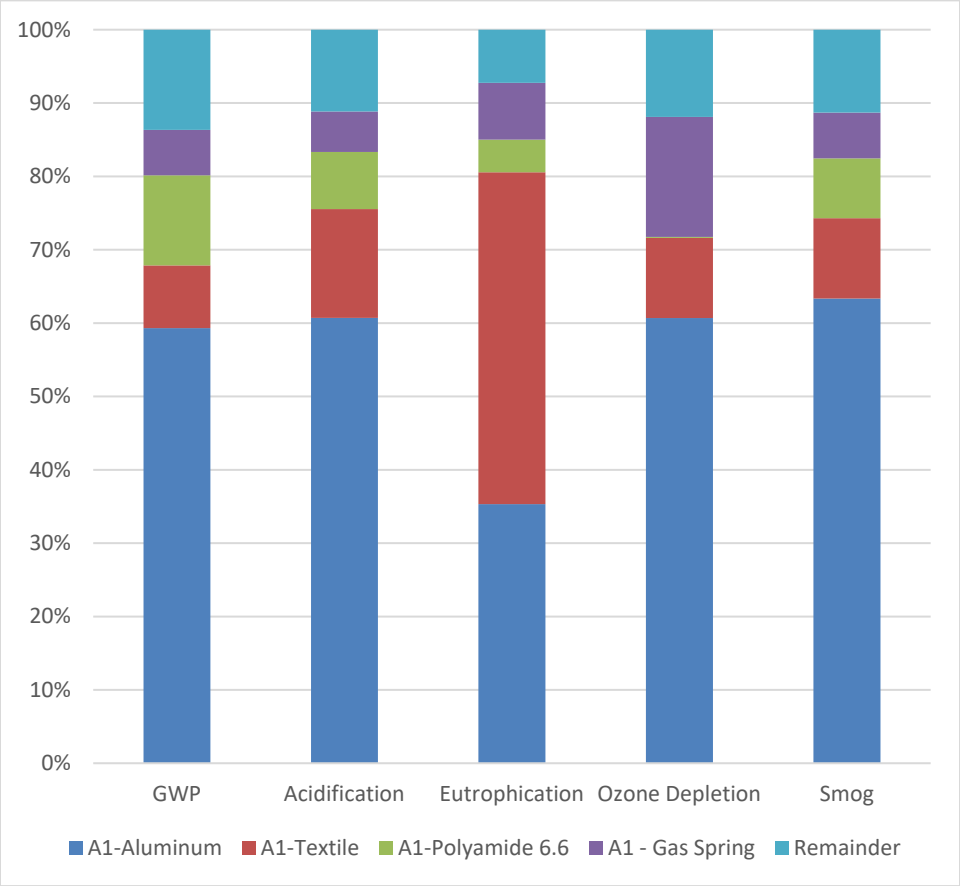


Figure 6.2 shows the relative contribution of raw material acquisition (Module A1) which was often the largest contributor. Module A1 is broken out by the processes that were the most impactful within those stages. Of these, aluminum was often the most dominant contributor. It was expected that aluminum would be the most impactful material for GWP since it makes up the majority of the product.

Figure 6.2: Relative Impacts within the top 4 processes in Module A1.



6.2 Further LCIA Indicator Interpretation

In further examination of Global Warming Potential LCA Indicators, there are a few items of note. IPCC AR6 is considered a more up to date calculation of the estimated GWP associated with the life cycle of the F4 product, as TRACI 2.1 was initially published in 2012. However, the overall results are not significantly different between the two, and within the sensitivity band of +/- 10%. Additionally, the GWP from Biomass can largely be attributed to three modules, material acquisition, production (due to packaging), and Maintenance (the soaping agents used to clean the product.

6.3 Sensitivity Analysis

A sensitivity analysis was done in the model to see how sensitive the results are to the assumptions that were made in the modelling process.

6.3.1 Manufacturing Input Allocation

To study how the decision of mass allocation of inputs per unit of finished product affected the results, all inputs other than raw materials were increased and decreased by +/- 50%. The results of this analysis can be seen in Table 6.1.

Table 6.1: Variance of impact categories based on allocation sensitivity analysis.

+/- 50% Change to all Allocated Manufacturing Flows	Change from Baseline
GWP100	+/- 6.52%
ODP	+/- 20.41%
AP	+/- 3.41%
EP	+/- 2.21%
SFP	+/- 3.21%

Based on the above results, it can be determined that the model is sensitive to the allocation process with respect to ODP. This is driven by the sub-process of long-distance transport of natural gas, which is a sub-process consisting of secondary data in ecoinvent 3.8.

6.3.2 Proxy Data

Table 6.2: Materials and Processes for which Proxy Data was utilized.

Material	Proxy Data Used	Source
N/A	N/A	N/A

No proxy data was used in this study. The results of this analysis can be seen in Table 6.3

Table 6.3 Sensitivity Analysis Results

Sensitivity Adjustment	-50%	+200%
N/A	0.00%	0.00%

The model is not considered sensitive to the above material and process datasets, as the deviations contribute to less than a 10% fluctuation from the baseline.

6.4 Scenario Analysis

Scenarios were run for all other products included in this study. Specific results can be seen in the sections below.

6.3.1 End of Life Scenarios

End of Life (EoL) was modelled based on a typical scenario based national and market-based data. Due to this, a scenario analysis was done to show the impact of full recycle and full landfill end of life scenarios where all materials are disposed of with the respective methods. Results of this analysis can be found in Table 6.4. Based on these results, the full recycling scenario is the best overall from an environmental impact standpoint. Additionally, since the product EoL process includes the disposal of the pallets used in the shipping module, for every indicator besides ODP, the Full Landfill scenario is less impactful. This is due to the exclusion of incineration processes.

Table 6.4: End of Life Scenarios for F4 based on market data, full recycle, and full landfill.

Indicator	Unit	Baseline	Full Recycle	% Change	Full Landfill	% Change
GWP100	kg CO2 eq	1.51E+02	1.51E+02	-0.05%	1.51E+02	0.01%
AP	kg SO2 eq	7.48E-01	7.47E-01	-0.14%	7.48E-01	0.00%
EP	kg N eq	6.83E-01	6.83E-01	-0.03%	6.83E-01	0.00%
ODP	kg CFC-11 eq	1.24E-05	1.24E-05	-0.19%	1.24E-05	0.04%
SFP	kg O3 eq	8.70E+00	8.68E+00	-0.26%	8.70E+00	-0.06%

6.3.2 Additional Scenarios from EoL (C4).

As outlined in reporting frameworks, some additional scenarios must be included for any module that is not declared. End of Life scenario for all packaging is included in Table 6.6. Treatment of waste is modelled by market datasets for the corresponding materials.

Table 6.6: End of Life Scenarios for F4 packaging per declared unit.

Module	Parameter	Unit	Value
C4	Mass of packaging waste. 92% Cardboard 4% Foam 4% LDPE	[kg]	1.16E+00
C4	$GWP_{Biogenic}$ from packaging[5]	[kg CO_2e]	7.31E-08

The disposition pathway for packaging material is as follows:
Waste Corrugate: 53.65% Open Dump, 25.65% Landfill, 12.52% Incineration, 8.19% Open Burning.
Waste Expanded Polystyrene Foam: 100% Incineration
Waste LDPE Plastic: 31.16% Open Dump, 48.33% Landfill, 10.76% Incineration, 9.74% Open Burning.

6.5 Consistency Check

A consistency check was conducted on this study. Consistency is considered to be great. All primary data was collected over the same period and was allocated on a mass basis. All secondary data were chosen on the same assumptions based on geographic, technological, and time applicability as well as utilizing mass allocation. All flows are accounted for and treated appropriately. All Impact Assessment was done using TRACI 2.1 and EN15804+A2 as outlined by the PCR. Additional Consistency Check can be found in Section 3.6.

6.6 Completeness Check

The data that lead to the results in this section is considered complete. The LCA model included all known materials and energy flows except for specified materials outlined in Section 3.4. As stated, no

[5] Sum of all biogenic carbon from packaging production and treatment. Refer to Table 5.4 for breakdown of biogenic inputs and outputs from packaging.

known material flows above 1% were excluded and the sum of all exclusions is below 5% when evaluated against mass, energy, and environmental impact.

6.7 Data Quality Assessment

Data Quality for each data point utilized in this study can be viewed in Section 3.6 of this report. Overall data quality is considered great. Improvements could be made in finding more regional data sets or primary data for any Rest of World (RoW) or Global (GLO) data sets. Additionally, Stylex could submeter specific processes and collect more supplier primary data to produce a more representative data set. However, the data quality is considered to be sufficient in relation to the goal, scope, and budget of the project. The Overall Data Quality score was 8.07/10.

Primary data from energy, fuel, and water consumption were normalized based on a per mass unit of production over the data collection window. The resulting energy and water per mass was used at all facilities where Stylex has operational control. Overall, the primary data collected was considered excellent.

Stylex also provided primary data regarding the materials used in their products as well as upstream data from their suppliers' locations. This data is considered excellent, but it can be improved by collecting more primary facility data from their suppliers.

6.8 Transparency Decisions that may have Affected the Model

Throughout the report, choices and judgments that may have affected the LCA have been described. These decisions are summarized below:

- This LCA was conducted with an attributional approach.
- All primary and secondary data was modelled in OpenLCA using Ecoinvent datasets to calculate the potential environmental impacts during each stage of the product's life. For any processes that were not available in the Ecoinvent database, proxy data was used. Details for any proxy data used are outlined in Section 6.2.2.
- If multiple suppliers were identified for a material, then a weighted average of distance was determined based on mass supplied.
- Stylex's energy usage was normalized to one (1) Kilogram based on the 2022 production data collected.
- Stylex keeps track of all recycling and landfilled material over the data collection period. All scrap aluminum is recycled by a regional recycling company that specializes in metals. All additional waste is treated as municipal solid waste. All waste transportation is determined by using EPA WARM data, which is estimated at 20 miles (32km).
- The fate of the product and packaging was determined using EPA Data.
- Type and distance of transportation was determined by developing a weighted average for all shipping data from calendar year 2022 based on sales.
- Any material present at or above 1 wt% of the final product was included within the scope of this study. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impacts. No materials or energy inputs were excluded in this study.

- To derive a per-unit for manufacturing inputs and outputs such as electricity, thermal energy, and waste streams, allocation based on total mass by unit was adopted. As a default, secondary Ecoinvent datasets use a mass basis for allocation.
- The method in which recycled materials were handled is relevant to the defined system boundary. Throughout the study, recycled materials were accounted for via the cut-off method. In this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary.
- Secondary data sets used in the model are disclosed in Appendix A along with data quality indicators related to the geographical, time representation, and technological coverage of the datasets. If any proxy data was used, it is also included if applicable.
- LCIA Summary from Section 4:
    - Electrical, Fuels, and Water Consumption
        - Data was collected over 2022 calendar year. The totals over the collection period were divided by the mass of total production during that period to derive a usage-per-mass unit for use in this model.
    - Raw Materials and Purchasing
        - Stylex provided all bills of materials and supplier names. Inbound shipping distances were calculated using Google Maps and Searoutes.
    - Waste amounts
        - Stylex tracks all waste streams associated with manufacturing of the product over the data collection period. All waste was characterized, disposed of, and treated appropriately as outlined in Section 3.3.
    - Outbound Shipping Distance
        - A weighted average of the distances to all states where Stylex products are shipped was calculated based on sales shipped. It was found that on average, the shipping distance was 1483 km by truck.
    - End of Life (EoL) Scenarios
        - No primary data for the fate of the product was available. Waste from products and packaging was disposed of based on EPA Data. No credits were taken for energy recovery from waste. Cut-off criteria for recycling was applied.

Furthermore, additional decisions are summarized below:

- The use and selection of secondary datasets from Ecoinvent to represent an aspect of the supply chain is a significant value choice. These datasets were chosen by the LCA Practitioner after discussions with Stylex and review of the Ecoinvent datasets. It should be noted that no generic data is a perfect fit. Obtaining primary data from the supply chain data would improve the accuracy of results, however, budget and time constraints were considered.
- All declared product systems were modelled using the same assumptions within this study and the results can be applied to all systems using the performance characteristics in Section 2.8.3. All systems are made from the same materials and processed identically. The only variations of the systems are how the material composition of the systems.
- Worldsteel and IAI/EAA datasets were not used for steel and aluminum, respectively, as they were not available to the practitioners at the time of the study for use in openLCA.

The following limitations to this study have been identified:

- Proxy data was used for specific processes, see Section 6.2.2
- Availability of more regionally appropriate data sets would improve accuracy.
- Since this LCA uses the cut-off approach to model recycled material in the product, no credit is given to the end of the product system. Instead, the manufacturer realized reduced environmental impacts through the absence of the burden of virgin material.
- Only known and quantifiable environmental impacts are considered.
- Due to the assumptions and value choices listed above, these results do not reflect the real-life impact scenarios and hence, they cannot assess actual and exact impacts. Instead, it only represents potential environmental impacts.

6.9 Conclusion

The potential environmental impacts associated with Stylex's F4 product are driven primarily by the raw material acquisitions, specifically aluminum, textiles, and plastics. Stylex could reduce the impact of this by specifying higher recycled content for their products.

To improve the results, Stylex should begin consistently measuring primary data over the course of the year, and track shipments per SKU by mass to have a consistent normalization metric across the model. This would help fill gaps in primary data and give a better understanding of the production impacts of their product.

Within their own facilities, natural gas is the largest contributor. If Stylex wishes to reduce these impacts, they would need to research more efficient electric heating technologies that are less energy intensive or begin sourcing renewable energy.

7 References

- ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
- ISO 14044:2006/ Amd 1:2017 Environmental management – Life cycle assessment – Requirements and Guidelines – Amendment 1.
- ISO 14044:2006/ Amd 2:2020 Environmental management – Life cycle assessment – Requirements and Guidelines – Amendment 2.
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
- IPCC, 2023: *Climate Change 2023: Synthesis Report.* Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 35-115, doi: 10.59327/IPCC/AR6-9789291691647.
- TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 – User Guide -https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf. 2012.
- Ecoinvent. Ecoinvent. https://ecoinvent.org. 2021.
- EPA WARM, Facts, and Figures about Materials, Waste, and Recycling. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/guide-facts-and-figures-report-about#Materials. 2018.
- EPA, Environmental Protection Agency. www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics#:~:text=air%20emission%20sources.-,How%20does%20ground%2Dlevel%20ozone%20form%3F,volatile%20organic%20compounds%20(VOC). 2023.
- BIFMA PCR for Seating: UNCPC 3811 – Version 3. Valid through September 30, 2024.

Appendix A

Table A1: List of all secondary datasets used to construct the model and their data quality assessment. The following Appendix encompasses some datasets that are not relevant to the F4 product, however, the model is constructed in order to accommodate future LCA studies on Stylex's products. The model is also constructed for the possibility of opening up to GLO or European markets, and hence some duplicates of datasets for various geographical locations have also been included.

Material	Data Set	Source	Reference Year	Time Coverage	Location	Tech Coverage	Overall Rep (15)	Data Quality
Aluminum - Metal Work	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Metal Work	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Aluminum - Metal Work	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Metal Work	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Aluminum - Metal Work	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Metal Work	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Aluminum - Powder Coated	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Powder Coated	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Aluminum - Powder Coated	powder coat, aluminium sheet	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good

Aluminum - Powder Coated	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Powder Coated	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Aluminum - Powder Coated	powder coat, aluminium sheet	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Aluminum - Powder Coated	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Aluminum - Powder Coated	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Aluminum - Powder Coated	powder coat, aluminium sheet	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Fabric	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Fabric	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Fabric	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Fabric	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Fabric	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Fabric	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Foam Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good

Foam Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Partially Representative	13	Great
Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Foam Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Foam Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Foam	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Foam	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Foam	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Fire Resistant Foam	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Fire Resistant Foam	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good

Fire Resistant Foam	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Gas Spring	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	lubricating oil	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	aluminium, cast alloy	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Gas Spring	electricity, high voltage	ecoinvent 3.8	2021	Within 10-year Period	KR	Completely Representative	15	Excellent
Gas Spring	hazardous waste, for incineration	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	wastewater, average	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	zinc	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Gas Spring	tap water	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Gas Spring	metal working, average for aluminium product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	metal working, average for metal product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Gas Spring	metal working, average for steel product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good

Gas Spring	steel, low-alloyed	ecoinvent 3.8	2021	Within 10-year Period	IN	Completely Representative	14	Excellent
Mesh	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Mesh	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Mesh	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Mesh	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Mesh	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Mesh	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Nylon - AS	electricity, high voltage	Primary Data	2022	Within 10-year Period	CN-SGCC	Completely Representative	15	Excellent
Nylon - AS	municipal solid waste	Primary Data	2022	Within 10-year Period	RoW	Completely Representative	11	Good
Nylon - AS	nylon 6	Primary Data	2022	Within 10-year Period	RoW	Completely Representative	11	Good
Nylon - AS	refrigerant R134a	Primary Data	2022	Within 10-year Period	GLO	Completely Representative	13	Great
Nylon - AS	wastewater, average	Primary Data	2022	Within 10-year Period	RoW	Completely Representative	11	Good
Nylon - AS	tap water	Primary Data	2022	Within 10-year Period	GLO	Completely Representative	13	Great
Nylon – NA	electricity, high voltage	Primary Data	2022	Within 10-year Period	CA-ON	Completely Representative	15	Excellent
Nylon – NA	hazardous waste, for incineration	Primary Data	2022	Within 10-year Period	Europe without Switzerland	Completely Representative	13	Great

Nylon – NA	nylon 6	Primary Data	2022	Within 10-year Period	RER	Completely Representative	13	Great
Plastic (General)	electricity, high voltage	ecoinvent 3.8	2021	Within 10-year Period	CN-SGCC	Partially Representative	13	Great
Plastic (General)	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Plastic (General)	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Plastic (General)	wastewater, average	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Plastic (General)	tap water	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Plastic (General)	transport, freight, lorry 16-32 metric ton, EURO4	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Polyester	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Polyester	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Polyester	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Polyester	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Polyester	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Polyester	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Polypropylene	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Polypropylene	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good

Polypropylene	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Polypropylene	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Polypropylene	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Polypropylene	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Rubber	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Rubber	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Rubber	synthetic rubber	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Rubber	wax, lost-wax casting	Rubber Molding	2021	Within 10-year Period	GLO	Not Representative	9	Good
Syntex	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Syntex	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Syntex	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Syntex	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Syntex	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Syntex	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Steel - CNC	steel removed by turning, average, computer	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good

	numerical controlled							
Steel - CNC	steel removed by turning, average, computer numerical controlled	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Steel - CNC	steel removed by turning, average, computer numerical controlled	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Steel - Metal Worked	metal working, average for steel product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Steel - Metal Worked	steel, low-alloyed	ecoinvent 3.8	2021	Within 10-year Period	IN	Completely Representative	14	Excellent
Steel - Metal Worked	metal working, average for steel product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Steel - Metal Worked	steel, low-alloyed	ecoinvent 3.8	2021	Within 10-year Period	Europe without Switzerland and Austria	Completely Representative	13	Great
Steel - Metal Worked	metal working, average for steel product manufacturing	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Steel - Metal Worked	steel, low-alloyed	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Upholstered Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Upholstered Assembly	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Upholstered Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good

Upholstered Assembly	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Upholstered Assembly	injection moulding	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Partially Representative	13	Great
Upholstered Assembly	weaving, synthetic fibre	ecoinvent 3.8	2021	Within 10-year Period	GLO	Partially Representative	11	Good
Upholstered Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Upholstered Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Foam Assembly	polyurethane, flexible foam	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Upholstered Assembly	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	nylon 6	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Upholstered Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	polyester resin, unsaturated	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RoW	Partially Representative	9	Good
Upholstered Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good
Upholstered Assembly	polypropylene, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Partially Representative	11	Good

Inbound Transportation	transport, freight train	ecoinvent 3.8	2021	Within 10-year Period	CN	Completely Representative	15	Excellent
Inbound Transportation	transport, freight, sea, container ship	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Inbound Transportation	transport, freight, lorry 16-32 metric ton, EURO4	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	scrap steel	ecoinvent 3.8	2021	Within 10-year Period	and	Completely Representative	13	Great
End of Life	waste aluminium	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
End of Life	waste expanded polystyrene	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste paperboard	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste plastic, mixture	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste polystyrene isolation, flame-retardant	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste polyurethane foam	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste rubber, unspecified	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste wood, untreated	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste yarn and waste textile	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great

End of Life	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	scrap steel	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste aluminium	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste expanded polystyrene	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste paperboard	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste plastic, mixture	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste polystyrene isolation, flame-retardant	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste polyurethane foam	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste rubber, unspecified	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste wood, untreated	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
End of Life	waste yarn and waste textile	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good
Inbound Transportation	transport, freight train	ecoinvent 3.8	2021	Within 10-year Period	and	Completely Representative	13	Great
Inbound Transportation	transport, freight, sea, container ship	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Inbound Transportation	transport, freight, lorry 16-32 metric ton, EURO4	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great

Inbound Transportation	transport, freight train	ecoinvent 3.8	2021	Within 10-year Period	US	Completely Representative	15	Excellent
Inbound Transportation	transport, freight, sea, container ship	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Inbound Transportation	transport, freight, lorry 16-32 metric ton, EURO4	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Packaging	extrusion, plastic film	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Packaging	corrugated board box	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Electricity	electricity, high voltage	ecoinvent 3.8	2021	Within 10-year Period	US-RFC East	Completely Representative	15	Excellent
Hazardous Waste Treatment	hazardous waste, for incineration	ecoinvent 3.8	2021	Within 10-year Period	Europe without Switzerland	Completely Representative	13	Great
Natural Gas	heat, district or industrial, natural gas	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
MSW	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Water	tap water	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Waste Water	wastewater, average	ecoinvent 3.8	2021	Within 10-year Period	Europe without Switzerland	Completely Representative	13	Great
Packaging	plywood	ecoinvent 3.8	2021	Within 10-year Period	CA-QC	Completely Representative	15	Excellent
Packaging	polyethylene, low density, granulate	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Packaging	polystyrene foam slab	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great
Packaging EoL	municipal solid waste	ecoinvent 3.8	2021	Within 10-year Period	RoW	Completely Representative	11	Good

Use Phase - Electricity	electricity, medium voltage	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Use Phase - Maintenance	soap	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Outbound Transportation	transport, freight train	ecoinvent 3.8	2021	Within 10-year Period	US	Completely Representative	15	Excellent
Outbound Transportation	transport, freight, sea, container ship	ecoinvent 3.8	2021	Within 10-year Period	GLO	Completely Representative	13	Great
Outbound Transportation	transport, freight, lorry 16-32 metric ton, EURO4	ecoinvent 3.8	2021	Within 10-year Period	RER	Completely Representative	13	Great

Critical Review of Life Cycle Assessment of Seating for Stylex, According to ISO 14044, ISO 21930, BIFMA PCR for Seating

Prepared for:
Stylex

Date Completed:
May 30, 2024

Reviewer:
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Introduction

This report contains a summary of the critical review of the report titled *Life Cycle Assessment of Seating*, dated March 27, 2024 completed by *Sahil Akolawala of Foresight Management*. The LCA study was commissioned by *Stylex*.

The critical review was conducted by an independent life cycle practitioner with no involvement with the execution of the LCA. The self-declaration of reviewer independence and competencies has been provided to the relevant parties in a separate document. The critical review assessed the LCA Report for conformance to the ISO 14044:2006[1] standard and conforms with the ISO 14071:2014 standard[2]. As the intent of the study is to support the development of Environmental Product Declarations (EPDs), the LCA Report was also reviewed for conformance to any additional requirements of the applicable PCR and the ISO 21930 standard, as appropriate. This critical review is considered an 'external critical review' under ISO 14044. The review excludes an assessment of the life cycle inventory (LCI) model and excludes an assessment of individual data sets.

When compared to the requirements of ISO 14044, ISO 21930, and the BIFMA[3] Product Category Rules, the Life Cycle Assessment report is consistent with requirements. All non-conformities and opportunities for improvement have been addressed and closed.

[1] ISO 14044:2006 Environmental management – Life Cycle Assessment – Requirements and guidelines
[2] ISO 14071:2014 Environmental management – Life cycle assessment – Critical review processes and reviewers competencies: Additional requirements and guidelines to ISO 14044:2006.
[3] BIFMA PCR for Seating, Version 3. Valid through September 30, 2024. NSF.

ISO 14044 Critical Review Checklist *(for non-Comparative Studies)*

Standard Reviewed:	ISO 14044				
Report Title:	Life Cycle Assessment of Seating for Stylex				
Report Date/Version:	March 27, 2024				
Report Author:	Sahil Akolawala, Foresight Management				
Review performed concurrently:	No		Review performed end of study:	Yes	
Date of Initial Review:	04/04/24		Date of Second Review:	05/23/24	
Date of Final Review:	05/30/24				
Reviewer Organization:	SCS Global Services				
Reviewer Name:	Beth Cassese				
Internal Expert:	No	External Expert:	Yes	Review Panel:	No

Finding Summary			
	Verified (Conforms with requirement)	Opportunity for improvement	Non-conformity with requirement
Number of Findings:	V	OFI	NCR
Initial Review	150	3	6
Second Review	155	2	2
Final Review	159	0	0

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
General Requirements					
4.1	LCA studies shall include the goal and scope definition, inventory analysis, impact assessment and interpretation of results.		V		Requirement met.
4.1	LCI studies shall include definition of the goal and scope, inventory analysis and interpretation of results. The requirements and recommendations of this international standard, with the exception of those provisions regarding impact assessment, also apply to life cycle inventory studies.		N/A		Not applicable.
5.1.1	The results, data, methods, assumptions and limitations shall be transparent and presented in sufficient detail to allow the reader to comprehend the complexities and trade-offs inherent in the LCA.		V		Requirement met.
5.2	When results of the LCA are to be communicated to any third party, regardless of the form of communication, a third-party report shall be prepared.		V		Requirement met.
5.2	The third-party report constitutes a reference document, and shall be made available to any third party to whom the communication is made. The third part report shall cover the following aspects:				
	LCA commissioner, practitioner of LCA (internal or external)		V		Requirement met.
	Date of report		OFI	V	Page headers give date as March 2023, should this be 2024? Updated

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
					Acknowledged.
		Statement that the study has been conducted according to the requirements of ISO 14044	V		Requirement met.
		Goal of the study	V		Requirement met.
		Scope of the study	V		Requirement met.
		Life cycle inventory analysis	V		Requirement met.
		Life cycle impact assessment	V		Requirement met.
		Life cycle interpretation	V		Requirement met.
		Critical review	V		Requirement met.
Goal of the Study					
4.2.1	The goal of an LCA shall be clearly defined and shall be consistent with the intended application.		V		Requirement met.
4.2.2 5.2	In defining the goal of an LCA, the following items shall be unambiguously stated:				
		The intended application	V		Requirement met.
		The reasons for carrying out the study	V		Requirement met.
		The intended audience	V		Requirement met.
		Whether the results are intended to be used in comparative assertions intended to be disclosed to the public.	V		Requirement met.
4.2.3.1	In some cases, the goal and scope of the study may be revised due to unforeseen limitations, constraints or as a result of additional information. Such modifications, together with their justification, should be documented.		V		Requirement met.
Scope of the Study					
4.2.1	The scope of an LCA shall be clearly defined and shall be consistent with the intended application.		V		Requirement met.
4.2.3.1	In defining the scope of an LCA, the following items shall be considered and clearly described:				
		The product system to be studied	V		Requirement met.
		The functions of the product system	V		Requirement met.
		The functional or declared unit	V		Requirement met.
		The system boundary	NCR	V	Please update Table 3.1 to reflect cradle-to-grave study; all modules are declared for cradle-to-grave Table 3.1 has been updated. Requirement met.
		Allocation procedures	V		Requirement met.
		LCIA methodology and types of impacts	V		Requirement met.
		Interpretation to be used	V		Requirement met.
		Data requirements	V		Requirement met.
		Assumptions	V		Requirement met.
		Value choices and optional elements	V		Requirement met.
		Limitations	V		Requirement met.
		Data quality requirements	V		Requirement met.
		Type of critical review, if any	V		Requirement met.
5.1.1	The type and format of the report shall be defined in the scope phase of the study.		V		Requirement met.
Functional or Declared Unit					

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
4.2.3.2 5.2	The scope of an LCA shall clearly specify the functions (performance characteristics) of the system being studied.		V		Requirement met.
4.2.3.2 5.2	The functional unit shall be consistent with the goal and scope of the study.		V		Requirement met.
4.2.3.2	The functional unit shall be clearly defined and measurable.		V		Requirement met.
4.2.3.2	The reference flow shall be defined.		V		Requirement met.
System Boundary					
4.2.3.3.1	The system boundary determines which unit processes shall be included within the LCA.		V		Requirement met.
4.2.3.3.1	The selection of the system boundary shall be consistent with the goal of the study.		V		Requirement met.
4.2.3.3.1	The criteria used in establishing the system boundary shall be identified and explained.		V		Requirement met.
4.2.3.3.1	Decisions shall be made regarding which unit processes to include in the study and the level of detail to which these unit processes shall be studied.		V		Requirement met.
4.2.3.3.1	The deletion of life cycle stages, processes, inputs or outputs is only permitted if it does not significantly change the overall conclusions of the study.		NCR	V	Please update Table 3.1 to reflect cradle-to-grave study; all modules are declared for cradle-to-grave Requirement met.
4.2.3.3.1	Any decisions to omit life cycle stages, processes, inputs or outputs shall be clearly stated, and the reasons and implications for their omission shall be explained.		V		Requirement met.
4.2.3.3.1	Decisions shall also be made regarding which inputs and outputs shall be included and the level of detail of the LCA shall be clearly stated.		V		Requirement met.
4.2.3.3.2	It is helpful to describe the system using a process flow diagram showing the unit processes and their inter-relationships.		V		Requirement met.
4.2.3.3.2	Each of the unit processes should be initially described to define:				
		Where the unit process begins, in terms of the receipt of raw materials or intermediate products	V		Requirement met.
		The nature of the transformations operations that occur as part of the unit process	V		Requirement met.
		Where the unit process ends, in terms of the destination of the intermediate or final products	V		Requirement met.
4.2.3.3.2	Energy inputs and outputs shall be treated as any other input or output to an LCA.		V		Requirement met.
4.2.3.3.2	The various types of energy inputs and outputs shall include inputs and outputs relevant for the production and delivery of fuels, feedstock energy and process energy used within the system being modelled.		V		Requirement met.
4.3.3.4	Reflecting the iterative nature of LCA, decisions regarding the data to be included shall be based on a sensitivity analysis to determine their significance.		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
4.3.3.4	The initial system boundary shall be revised, as appropriate, in accordance with the cut-off criteria established in the definition of the scope. The results of this refining process and the sensitivity analysis shall be documented.		V		Requirement met.
4.2.3.3.3	The cut-off criteria for initial inclusion of inputs and outputs and the assumptions on which the cut-off criteria are established shall be clearly described.		V		Requirement met.
4.2.3.3.3	The effect on the outcome of the study of the cut-off criterial selected shall also be assessed and described in the final report.		V		Requirement met.
Allocation					
4.3.4.1	The inputs and outputs shall be allocated to the different products according to clearly stated procedures that shall be documented and explained together with the allocation procedure.		V		Requirement met.
4.3.4.1	The sum of the allocated inputs and outputs of a unit process shall be equal to the inputs and outputs of the unit process before allocation.		NCR	V	On Page 11, it is indicated that 0.98 kg of waste is associated with material efficiency, yet the amount of waste declared in A3 and the difference between inputs and outputs in A1 equals 5.04. Please correct. Value has been corrected in Section 3.3.1. Requirement met.
4.3.4.1	Whenever several alternative allocation procedures seem applicable, a sensitivity analysis shall be conducted to illustrate the consequences of the departure from the selected approach.		N/A		Not applicable.
4.3.4.2	The study shall identify the processes shared with other product systems and deal with them according to the procedure presented below: 1) Wherever possible, allocation should be avoided by dividing the unit process to be allocated into two or more sub-processes and collecting the input and output data related to these sub-processes or expanding the product system to include the additional functions related to the co-products. 2) Where allocation cannot be avoided, the inputs and outputs of the system should be partitioned between its different products or function in a way that reflects the underlying physical relationships between them. 3) Where physical relationship alone cannot be established or used as the basis for allocation,		N/A		Not applicable.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	the inputs should be allocated between the products and functions in a way that reflects other relationships between them.				
4.3.4.2	Some outputs may be partly co-products and partly waste. In such cases, it is necessary to identify the ratio between co-products and waste since the inputs and outputs shall be allocated to the co-products part only.		N/A		Not applicable.
4.3.4.2	Allocation procedures shall be uniformly applied to similar inputs and outputs of the system under consideration.		V		Requirement met.
4.3.4.3.1	The allocation principle and procedures in 4.3.4.1 and 4.3.4.2 also apply to reuse and recycling situations.		V		Requirement met.
4.3.4.3.1	In reuse and recycling situations, changes in the inherent properties of the materials shall be taken into account.		V		Requirement met.
4.3.4.3.1	In reuse and recycling situations, particularly for the recovery processes between the original and subsequent product system, the system boundary shall be identified and explained, ensuring that the allocation principles are observed as described in 4.3.4.2		V		Requirement met.
Data Collection and Calculation					
4.3.2.1	The qualitative and quantitative data for inclusion in the inventory shall be collected for each unit process that is included in the system boundary.		V		Requirement met.
4.3.2.1	When data have been collected from public sources, the source shall be referenced.		NCR	V	Please include reference for Ecoinvent data. Reference Added to Section 7 Requirement met.
4.3.2.1	For those data that may be significant for the conclusions of the study, details about the relevant data collection process, the time when data have been collected, and further information about data quality indicators shall be referenced.		NCR	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been provided in Appendix A. No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
4.3.2.1	If such data do not meet the data quality requirements, this shall be stated.		V		Requirement met.
4.3.2.1	To decrease the risk of misunderstandings, a description of each unit process shall be recorded.		V		Requirement met.
4.3.2.2	Since data collection may span several reporting locations and published references, measures should be taken to reach uniform and consistent understanding of the product systems to be modelled. These measures should include the following:				
	Drawing unspecific process flow diagrams that outline all the unit processes to be modelled, including their interrelationships		V		Requirement met.
	Describing each unit process in detail with respect to factors influencing inputs and outputs		V		Requirement met.
	Listing of flows and relevant data for operating conditions associated with each unit process		V		Requirement met.
	Developing a list that specifies the units used		V		Requirement met.
	Describing the data collection and calculation techniques needed for all data		OFI	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
	Providing instructions to document clearly and special cases, irregularities or other items associated with the data provided		OFI	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					Acknowledged.
4.3.3.1	All calculation procedures shall be explicitly documented and the assumptions made shall be clearly stated and explained.		V		Requirement met.
4.3.3.1		The same calculation procedures should be consistently applied throughout the study.	V		Requirement met.
4.3.3.1		When determining the elementary flows associated with production, the actual production mix should be used whenever possible, in order to reflect the various types of resources that are consumed.	V		Requirement met.
4.3.3.1	Inputs and outputs related to a combustible material can be transformed into an energy input or output by multiplying them by the relevant heat of combustion. In this case, it shall be reported whether the higher heating value or the lower heating value is used.		V		Requirement met.
4.3.3.2	A check on data validity shall be conducted during the process of data collection to confirm and provide evidence that the data quality requirements for the intended application have been fulfilled. (mass balance, energy balance, and/or comparative analyses of release factors)		V		Requirement met.
4.3.3.3	An appropriate flow shall be determined for each unit process. The quantitative input and output data of the unit process shall be calculated in relation to this flow.		V		Requirement met.
4.3.3.3	Care should be taken when aggregating the inputs and outputs in the product system. The level of aggregation shall be consistent with the goal of the study.		V		Requirement met.
4.3.3.3		Data should only be aggregated if they are related to equivalent substances and to similar environmental impacts.	V		Requirement met.
4.3.3.3	If more detailed aggregation rules are required, they should be explained in the goal and scope definition phase of the study or should be left to a subsequent impact assessment phase.		V		Requirement met.
Data Quality					
4.2.3.6.1	Data quality requirements shall be specified to enable the goal and scope of the LCA to be met.		V		Requirement met.
4.2.3.6.2		The data quality requirements should address the following:			
		Time related coverage: age of data and the minimum length of time over which data should be collected.	V		Requirement met.
		Geographical coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study.	V		Requirement met.
		Technology coverage: specific technology or technology mix.	V		Requirement met.
		Precision: measure of the variability of the data values for each data expressed.	V		Requirement met.
		Completeness: percentage of flow that is measured or estimated.	V		Requirement met.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
		Representativeness: qualitative assessment of the degree to which the data set reflects the true population of interest.	V		Requirement met.
		Consistency: qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis.	V		Requirement met.
		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.	V		Requirement met.
		Sources of the data.	V		Requirement met.
		Uncertainty of the information.	V		Requirement met.
4.2.3.6.3	The treatment of missing data shall be documented.		V		Requirement met.
4.2.3.6.3	For each unit process and for each reporting location where missing data are identified, the treatment of missing data and data gaps should results in: - A "non-zero" data value that is explained, or - A "zero" data value if explained, or - A calculated value based on the reported values from unit processes employing similar technology		V		Requirement met.
4.2.3.6.3		Data quality should be characterized by both quantitative and qualitative aspects as well as by the methods used to collect and integrate those data.	V		Requirement met.
4.2.3.6.3		Data from specific sites or representative averages should be used for those unit processes that contribute the majority of the mass and energy flows in the systems being studied.	V		Requirement met.
4.2.3.6.3		Where possible, data from specific sites should also be used for unit processes that are considered to have environmentally relevant inputs and outputs.	V		Requirement met.
Life Cycle Impact Assessment (LCIA)					
4.2.3.4	The selection of impact categories, category indicators, and characterization models used in the LCIA methodology shall be consistent with the goal and scope of the study and considered as described in 4.4.2.2.		V		Requirement met.
4.4.1	The LCIA phase shall be coordinated with other phases of the LCA to take into account the following possible omissions and sources of uncertainty:				
		Whether the quality of the LCI data and results is sufficient to conduct the LCIA in accordance with the study goal and scope definition	V		Requirement met.
		Whether the system boundary and data cut-off decisions have been sufficiently reviewed to ensure the availability of LCI results necessary to calculate indicator results for the LCIA	V		Requirement met.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
		Whether the environmental relevance of the LCIA results is decreased due to the LCI functional unit calculation, system wide averaging, aggregation and allocation.	V		Requirement met.
4.4.2.1	The LCIA phase shall include the following mandatory elements:				
		Selection of impact categories, category indicators and characterization models	V		Requirement met.
		Assignment of LCI results to the selected impact categories (classification)	V		Requirement met.
		Calculation of category indicator results (characterization)	V		Requirement met.
4.4.2.2.1	Whenever impact categories, category indicators and characterization models are selected in an LCA, the related information and sources shall be referenced.		NCR	V	In Section 5.1 IPCC AR6 is indicated for GWP, but IPPC AR5 is referenced. Please correct. Page 21 indicates CML indicators are used, but results table shows these as EN 15804. Please correct and ensure EN 15804 is referenced. Mention of AR5 is corrected and updated to AR6. Acknowledged. Additional language for EN14804 indicators has been included in Section 5.1. CML Indicators have been included in Table 5.1 below the EN15804 indicators. There are no EN 15804 or CML LCIA indicators in the results tables? The scope of the study has been pared back to encompass only North America. EN15804 and CML indicators have since been removed. Requirement met.
4.4.2.2.1	Accurate and descriptive names shall be provided for the impact categories and category indicators.		V		Requirement met.
4.4.2.2.1	The selection of impact categories, category indicators and characterization models shall be both justified and consistent with the goal and scope of the LCA.		V		Requirement met.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
4.4.2.2.1	The selection of impact categories shall reflect a comprehensive set of environmental issues related to the product system being studied, taking the goal and scope into consideration.		V		Requirement met.
4.4.2.2.1	The environmental mechanism and characterization model that relate the LCI results to the category indicator and provide a basis for characterization factors shall be described.		V		Requirement met.
4.4.2.2.1	The appropriateness of the characterization model used for deriving the category indicator in the context of the goal and scope of the study shall be described.		V		Requirement met.
4.4.2.2.1	LCI results other than mass and energy flow data included in an LCA shall be identified and their relationship to corresponding category indicators shall be determined.		V		Requirement met.
4.4.2.2.2	For each impact category, the necessary components of the LCIA include:				
	Identification of the category endpoints		V		Requirement met.
	Definition of the category indicator for given category endpoints		V		Requirement met.
	Identification of appropriate LCI results that can be assigned to the impact category, taking into account the chosen category indicator and identified category endpoints		V		Requirement met.
	Identification of the characterization model and the characterization factors		V		Requirement met.
4.4.2.2.3		The following recommendations apply to the selection of impact categories, category indicators and characterization models:			
	The impact categories, category indicators and characterization models should be internationally accepted		V		Requirement met.
	The impact categories should represent the aggregated impacts of inputs and outputs of the product system on the category endpoints through the category indicators		V		Requirement met.
	Value-choices and assumptions made during the selection of impact categories, category indicators and characterization models should be minimized		V		Requirement met.
	The impact categories, category indicators and characterization models should avoid double counting unless required by the goal and scope definition		V		Requirement met.
	The characterization model for each category indicator should be scientifically and technically valid and based upon a distinct identifiable environmental mechanism and reproducible empirical observation		V		Requirement met.
	The extent to which the characterization model and the characterization factors are scientifically and technically valid should be identified		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
		The category indicators should be environmentally relevant	V		Requirement met.
	Depending on the environmental mechanism and the goal and scope, spatial and temporal differentiation of the characterization model relating the LCI results to the category indicator should be considered.		V		Requirement met.
	The fate and transport of the substances should be part of the characterization model.		V		Requirement met.
4.4.2.2.4	The environmental relevance of the category indicator or characterization model should be clearly stated in the following terms:				
		The ability of the category indicator to reflect the consequences of the LCI results on the category endpoints, at least qualitatively	V		Requirement met.
		The additional of environmental data or information to the characterization model with respect to the category endpoint, including the condition of the category endpoints, the relative magnitude of the assessed change in the category endpoint, the spatial aspects, the temporal aspects, the reversibility of the environmental mechanism, and the uncertainty of the linkages between the category indicators and the category endpoints	V		Requirement met.
4.4.2.3	Assignment of LCI results to impact categories should consider the following, unless otherwise required by the goal and scope:				
		Assignment of LCI results that are exclusive to one impact category	V		Requirement met.
		Identification of LCI results that relate to more than one impact category	V		Requirement met.
4.4.2.4	The method of calculating indicator results shall be identified and documented, including the value-choices and assumptions used.		V		Requirement met.
Life Cycle Interpretation					
4.5.1.1	The results of the LCI or LCIA phases shall be interpreted according to the goal and scope of the study.		V		Requirement met.
4.5.1.1	The interpretation shall include an assessment and a sensitivity check of the significant inputs, outputs, and methodological choices in order to understand the uncertainty of the results.		V		Requirement met.
4.5.1.2	The interpretation shall also consider the following in relation to the goal of the study:				
		The appropriateness of the definitions of the system functions, the functional unit and system boundary	V		Requirement met.
		Limitations identified by the data quality assessment and the sensitivity analysis	V		Requirement met.
4.5.2.1	All relevant results available at the time shall be gathered and consolidated for further analysis, including information on data quality.		V		Requirement met.
4.5.3.1	The results of the evaluation should be presented in a manner that gives the commissioner or any other		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	interested party a clear and understandable view of the outcome of the study.				
4.5.3.1	The evaluation shall be undertaken in accordance with the goal and scope of the study.		V		Requirement met.
4.5.3.1	During the evaluation, the use of the following three techniques shall be considered:				
	Completeness check		V		Requirement met.
	Sensitivity check		V		Requirement met.
	Consistency check		V		Requirement met.
4.5.3.1	The results of uncertainty analysis and data quality should supplement these checks.		V		Requirement met.
4.5.3.1	The evaluation should take into account the final intended use of the study results.		V		Requirement met.
4.5.3.2	If any relevant information is missing or incomplete, the necessity of such information for satisfying the goal and scope of the LCA shall be considered in the completeness check. This finding and its justification shall be recorded.		V		Requirement met.
4.5.3.2	If any relevant information, considered necessary for determining the significant issues, is missing or incomplete, the preceding phases (LCI, LCIA) should be revisited or, alternatively, the goal and scope definition should be adjusted. If the missing information is considered unnecessary, the reason for this should be recorded.		V		Requirement met.
4.5.3.3	The sensitivity check shall include the results of the sensitivity analysis and uncertainty analysis, if performed in the preceding phases (LCI, LCIA).		V		Requirement met.
4.5.3.3	In a sensitivity check, consideration shall be given to:				
	The issues predetermined by the goal and scope of the study		V		Requirement met.
	The results from all other phases of the study		V		Requirement met.
	Expert judgements and previous experiences		V		Requirement met.
4.5.3.4	If relevant to the LCA or LCI study the following questions shall be addressed:				
	Are differences in data quality along a product system life cycle and between different product systems consistent with the goal and scope of the study?		V		Requirement met.
	Have regional and/or temporal differences, if any, been consistently applied?		V		Requirement met.
	Have allocation rules and the system boundary been consistently applied to all product systems?		V		Requirement met.
	Have the elements of impact assessment been consistently applied?		V		Requirement met.
5.1.1	The report shall also allow the results and interpretation to be used in a manner consistent with the goals of the study.		V		Requirement met.
Conclusions, Limitations, & Recommendations					
4.5.4	Conclusions shall be drawn from the study.		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
4.5.4	Recommendations shall be based on the final conclusions of the study, and shall reflect a logical and reasonable consequence of the conclusions.		V		Requirement met.
4.5.4		Whenever appropriate to the goal and scope of the study, specific recommendations to decision-makers should be explained.	V		Requirement met.
4.5.4		Recommendations should relate to the intended application.	V		Requirement met.
5.1.1	The results and conclusions of the LCA shall be completely and accurately reported without bias to the intended audience.		V		Requirement met.
Critical Review					
4.2.3.8	The scope of the study shall define:				
		Whether a critical review is necessary and if so, how to conduct it	V		Requirement met.
		The type of critical review needed	V		Requirement met.
		Who would conduct the review, and their level of expertise	V		Requirement met.

ISO 21930 Critical Review Checklist

Standard Reviewed:	ISO 21930				
Report Title:	Life Cycle Assessment of Seating for Stylex				
Report Date/Version:	March 27, 2024				
Report Author:	Sahil Akolawala, Foresight Management				
Review performed concurrently:	No	Review performed end of study:	Yes		
Date of Initial Review:	04/04/24	Date of Second Review:	05/23/24		
Date of Final Review:	05/30/24				
Reviewer Organization:	SCS Global Services				
Reviewer Name:	Beth Cassese				
Internal Expert:	No	External Expert:	Yes	Review Panel:	No

Finding Summary			
	Verified (Conforms with requirement)	Opportunity for improvement	Non-conformity with requirement
Number of Findings:	V	OFI	NCR
Initial Review	138	9	17
Second Review	158	0	6
Final Review	164	0	0

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
General Requirements					
5.2	The environmental information shall be subdivided into the four life cycle stages: Production Stage, Construction Stage, Use Stage, and End-of-Life stage. As a minimum, the EPD shall contain the production stage information modules, A1 to A3.		N/A		Not applicable. PCR specifies different sub-division.
5.2	For construction products that require activity during the use stage information modules B2 to B5, for example, cleaning or refurbishment of parts, the provision of technical information for the relevant module(s) shall be mandatory.		V		Requirement met.
5.2	For construction products that use energy and/or water in the use stage, the provision of technical information for the relevant information module(s) B6 and B7 shall be mandatory.		N/A		Not applicable.
5.6	The result from an EPD project shall be presented as an EPD and a project report.		V		Requirement met.
5.6	The project report shall contain data and information that is of importance to the data published in the EPD and shall meet the requirements of this document.		V		Requirement met.
8.4.1	The declaration of material content of the finished product shall list, as a minimum, the substances contained in the construction product that are identified as hazardous according to normative requirements in standards or regulations applicable in the market for which the EPD is valid.		V		Requirement met.
8.4.2	In markets where the release of dangerous substances is regulated, such information is a mandatory part of additional information required about health and		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	environmental aspects. The methodology and reporting format shall be declared according to standards applicable in the market.				
10.1	The project report shall contain any data and information of importance to the results published in the EPD and as required by this document.		V		Requirement met.
10.1	The report shall demonstrate in a transparent way that the data and information declared in the EPD results form the LCA study and how the RSL has been established.		V		Requirement met.
10.2	The results, data, methods, assumption, limitations and conclusions of the LCA shall be completely and accurately reported without bias.		V		Requirement met.
10.2	They shall be reported in a transparent manner and presented in sufficient detail to allow independent verification and to permit an understanding of the complexities and trade-offs inherent in the LCA.		V		Requirement met.
10.2	The project report shall state the following:				
	Commissioner of the LCA study, internal or external practitioner of the LCA study		V		Requirement met.
	Date of report		OFI	V	Page headers give date as March 2023, should this be 2024? Header has been corrected. Acknowledged.
	Statement that the study has been conducted according to the requirements of this document		V		Requirement met.
Goal of the Study					
10.2	The project report shall state the following:				
	Goal of the study		V		Requirement met.
	Reasons for carrying out the study		V		Requirement met.
	Intended application		V		Requirement met.
	Intended audience		V		Requirement met.
Average Groups of Similar Products					
5.3	Average EPDs shall describe what they represent. Such information shall give the user an indication, either qualitatively or quantitively of the range of results that are likely for the products covered by the average EPD.		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed. No additional products are under study at this time, however the LCA model has been built such that other product models could be ran in the future.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					Acknowledged.
5.3	When there is a selection of sites or products assessed, they type of average and what it represents shall be clearly stating in the EPD.		N/A		Not applicable.
5.3	To ensure an average EPD is representative, the information provided in the LCA report shall include:				
	a technical description of the average product group		V		Requirement met.
	the number of manufacturing plants included		V		Requirement met.
	the names of manufacturing companies or brands or associations		N/A		Not applicable.
	a description of the relative production representativeness covered		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed. At this time, no additional products are included. The model is constructed for use in the future. Acknowledged.
	the geographical coverage		V		Requirement met.
	the range of products		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed. At this time, no additional products are included. The model is constructed for use in the future. Acknowledged.
	the information on restrictions to the use of the average EPD		V		Requirement met.
	description of how the selection of the sites/products was done and how the average was determined		V		Requirement met.
	information on parameters in the LCA having the most influence		N/A		Not applicable.
5.3	A sensitivity analysis should be conducted on the differences between the similar products in the grouped system.		OFI	V	As is, the report is specific to the F4

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					product. If other product models are to be represented by this study they will need to be listed and sensitivity completed to show they are within the acceptable range. At this time, no additional products are included. The model is constructed for use in the future. This OFI has been noted. Acknowledged.
5.3	Where an average composition, representative composition or worst case environmental indicators are used, the products included in an average EPD shall not differ in their environmental impact indicators by more than ±10 %.		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed and sensitivity completed to show they are within the acceptable range. At this time, no additional products are included. The model is constructed for use in the future. This OFI has been noted. Acknowledged.
5.3		Similar products included in other average EPDs should not differ in their environmental impact indicators by more than ±10 %.	OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed and sensitivity completed to show they are within the acceptable range. At this time, no additional products are included. The model is constructed for use in

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					the future. This OFI has been noted. Acknowledged.
5.3	Where larger impact differences are found for the products evaluation, these need to be justified in the project report or the system separated.		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed and sensitivity completed to show they are within the acceptable range. At this time, no additional products are included. The model is constructed for use in the future. This OFI has been noted. Acknowledged.
7.1.9	Products from more than one factory or manufacturer shall be calculated using representative average data of the products declared.		N/A		Not applicable.
7.1.9	The additional technical information for the development of scenarios of the construction works' life cycle stages shall be specific or specific average information, when an average product is declared.		N/A		Not applicable.
10.2	The project report shall state the calculation rule for averaging data for a group of similar products or the same product produced at different production sites.		V		Requirement met.
Functional or Declared Unit					
5.2.2	For cradle to gate studies, the LCA results shall be reported based on a declared unit. For cradle to gate with options studies, the LCA results shall be reported based on either a declared unit or a functional unit, as appropriate.		N/A		Not applicable.
7.1.2	The description of the functional unit of a construction product shall include, but not be limited to:				
	the quantified function and performance characteristics of the construction product when integrated into a construction works, taking into account the intended use of the product with respect to the functional equivalent of the works		V		Requirement met.
	the product's RSL under defined reference in-use conditions or specific in-use conditions		V		Requirement met.
7.1.3	The declared unit in the EPD shall be one of the following: — an item, an assemblage of items — mass (kg or metric tonne) — length (m) — area (m2)		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	— volume (m3)				
7.1.3	A different unit may be declared for reasons that shall be explained and, in such cases, information shall be provided on how to convert this unit to one or more of the required unit types.		V		Requirement met.
7.1.3	The following information is the minimum that shall be provided together with the declared unit for the construction product or component:				
	intended application, where relevant		V		Requirement met.
	statement that comparability of EPDs is limited to those applying a functional unit		V		Requirement met.
7.1.3	For the development of, for example, transport and disposal scenarios, conversion factors to mass per declared unit shall be provided.		V		Requirement met.
10.2	The project report shall stat the declared/functional unit, including a definition and relevant technical specifications.		V		Requirement met.
Reference Service Life					
7.1.4	The RSL information to be declared in an EPD covering the use stage shall be provided by the manufacturer.		V		Requirement met.
7.1.4	The RSL shall refer to the declared technical and functional performance of the product within a construction works.		V		Requirement met.
7.1.4	It shall be established in accordance with any specific rules given in product standards and shall take into account ISO 15686-1, ISO 15686−2, ISO 15686−7 and ISO 15686−8.		V		Requirement met.
7.1.4	Where product standards provide guidance on deriving the RSL, such guidance shall have priority.		V		Requirement met.
7.1.4	The RSL is dependent on the properties of the product and reference in-use conditions. Information on the product's RSL, therefore, requires specification of compatible scenarios for the production stage, construction stage and use stage. These conditions shall be declared together with the RSL		V		Requirement met.
7.1.4	It shall be stated that the RSL applies for the reference in-use conditions only.		NCR	V	Please include statement that RSL applies to reference in-use conditions only. Added to 2.8.3 Requirement met.
7.1.4	For the RSL, default values shall be provided and be based on published references.		V		Requirement met.
7.1.4	If longer RSLs are used, they shall be guaranteed by the signature of the most senior officer of the product manufacturer.		N/A		Not applicable.
System Boundary					
5.2.2	Information modules C1 to C4 shall be declared when module D is declared.		N/A		Not applicable.
7.1.1	The setting of the system boundary for the product system shall follow two principles:		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	— The “modularity principle”: Where processes influence the construction product’s environmental performance during its life cycle, they are assigned to the information module of the life cycle stage where they occur; all environmental aspects and potential impacts are declared in the life cycle stage where they can be attributed. — The “polluter pays principle”: Processes relevant to waste processing are assigned to the product system that generates the waste until the system boundary between product systems is reached.				
7.1.6	A conservative approach shall be used, meaning that if there is uncertainty as to whether a substance has reached the system boundary between product systems, it should be included in the studied product system in the relevant life cycle stage.		V		Requirement met.
7.1.6	Additionally, if wastes are used for energy or material recovery and do not have a clearly defined point when they cross the system boundary between product systems in all regions, the most conservative figures shall be specified in the communication of the LCA results in information modules A1 to A3 and shall include the environmental impacts caused by the emissions including processing, incineration and/or co-incineration of waste (gross figure).		N/A		Not applicable.
7.1.6	For the end-of-life stage, any waste treatment or recovery process that occurs before the system boundary between product systems is reached shall be included in information module C3 or C4.		V		Requirement met.
7.1.7.2.1	Information modules A1 to A3 shall be included in every EPD.		V		Requirement met.
7.1.7.2.1	The system boundary with nature shall include those technical processes that provide the material and energy inputs into the system and the subsequent manufacturing and transport processes up to the factory gate, as well as the processing of any waste arising from those processes.		V		Requirement met.
7.1.7.2.7	The output of waste during the production stage may become a useable output flow, such as a secondary material/fuel or recovered energy, when it has been through a recovery process and complies with the conditions described in the system boundary between product systems (see 7.1.6). These useable output flows shall not be considered as co-products but shall be considered waste and no allocation to secondary material, secondary fuels or recovered energy shall be permitted.		N/A		Not applicable.
7.1.7.5	Loads (e.g. emissions) from all end-of-life information modules (C1-C4) shall be considered part of the product system under study, according to the “polluter pays principle”.		V		Requirement met.
7.1.7.5	The loads associated with the use of secondary fuels shall always be part of the product system using the secondary fuel.		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
7.1.7.5	If the discarded product does not cross the system boundary, it is considered as waste and all waste treatment processes including those of disposal shall be assigned to the product system under study.		V		Requirement met.
7.1.8	Cut-off rules shall not be applied in order to hide data.		V		Requirement met.
7.1.8	Any application of the criteria for the exclusion of inputs and outputs shall be documented.		V		Requirement met.
7.1.8	When impacts are assessed and reported, the cut-off rules shall be based on the environmental impacts related to the respective material flows.		V		Requirement met.
7.1.8	The cut-off rules shall be justified and documented in the EPD and project report.		V		Requirement met.
7.1.8	The following procedure shall be followed for the inclusion and exclusion of inputs and outputs.				
	All inputs and outputs to a (unit) process shall be included in the calculation of the pre-set parameters results, for which data are available.		V		Requirement met.
	Data gaps shall be filled by conservative assumptions with average, generic or proxy data.		V		Requirement met.
	Any assumptions for such choices shall be documented.		V		Requirement met.
	In cases of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1 % of renewable primary resource (energy), 1 % nonrenewable primary resource (energy) usage, 1 % of the total mass input of that unit process and 1 % of environmental impacts.		V		Requirement met.
	The total of neglected input flows per module shall be a maximum of 5 % of energy usage, mass and environmental impacts.		V		Requirement met.
	When assumptions are used in combination with plausibility considerations and expert judgement to demonstrate compliance with these criteria, the assumptions shall be conservative.		V		Requirement met.
	All substances with hazardous and toxic properties that can be of concern for human health and/or the environment shall be identified and declared according to normative requirements in standards or regulation applicable in the market for which the EPD is valid, even though the given process unit is under the cut-off criterion of 1 % of the total mass.		V		Requirement met.
10.2	The project report shall state the following:				
	system boundary according to the modular approach		V		Requirement met.
	omissions of life cycle stages, processes, or data needs		V		Requirement met.
	quantification of energy and material inputs and outputs, taking into account how plant level data are allocated to the declared products		V		Requirement met.
	assumptions about electricity production and other relevant background data		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
10.2	The project report shall state the following:				
	Cut-off criteria for initial inclusion of inputs and outputs		V		Requirement met.
	Description of the application of cut-off criteria and assumptions		V		Requirement met.
	List of excluded processes.		V		Requirement met.
Technical Scenarios					
5.2.2	Modules beyond the gate shall be based on scenarios that shall be described according to Section 7.1.7.3 and 7.1.7.5.		V		Requirement met.
5.2.2	If no activity is expected in an information module, then the scenario and assessment of the module should reflect this rather than declaring the module not relevant or not applicable for a cradle-to-grave EPD.		OFI	V	Please update Table 3.1 to reflect cradle-to-grave study; all modules are declared for cradle-to-grave Updated language to say no activity Expected. Requirement met.
5.2.2	Any mandatory information module shall have the scenarios defined.		V		Requirement met.
7.1.7.1	Scenarios shall be realistic and be representative of one of the most likely alternatives.		V		Requirement met.
7.1.7.1	A scenario shall allow users to scale the results to assess realistic options.		V		Requirement met.
7.1.7.1	The scenarios used shall be justified in the project report.		V		Requirement met.
7.1.7.1	Scenarios shall not include processes or procedures that are not in current use or which have not been demonstrated to be practical.		V		Requirement met.
7.1.7.1	The technical scenario information provided in the EPD shall be detailed so as to enable the user of the EPD to assess whether the scenario assumptions are applicable to the context for which the EPD information is to be used.		V		Requirement met.
7.1.7.1	The indicators declared in the individual information modules of a product life cycle (i.e. A1 to A5, B1 to B7, C1 to C4) and the optional supplementary information beyond the life cycle (module D) shall not be aggregated in any combination of the individual information modules into a total or subtotal of the life cycle stages. As an exception, individual indicators for information modules A1, A2 and A3 may be aggregated to a total for each indicator in the production stage.		V		Requirement met.
7.1.7.2.8 7.1.7.3.4	To support the development of the end-of-life scenarios for packaging at the construction works level where the information module A5 is not declared, data shall be provided about any packaging used for the product as specified in 7.1.7.3 (Table 2).		V		Requirement met.

<table>
<tr><th colspan="5">Detailed Findings</th></tr>
<tr><th rowspan="2">Section</th><th colspan="2">Requirement</th><th rowspan="2">Original Finding</th><th rowspan="2">Final Finding</th><th rowspan="2">Comments</th></tr>
<tr><th>Shall Clause</th><th>Should Clause</th></tr>
<tr><td></td><td colspan="2">Table 2 — A5 product packaging waste
<table><tr><th>Module</th><th>Parameter</th><th>Unit (expressed per functional unit or per declared unit)</th><th>Value</th></tr><tr><td>A5 Installation of the product</td><td>Mass of packaging waste
Specify by type</td><td>kg or other unit as appropriate</td><td></td></tr><tr><td>A5 Installation of the product</td><td>GWP based in biogenic carbon content of packaging, specify by type, (where relevant)</td><td>kg CO_2e</td><td></td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td>7.1.7.3.2</td><td colspan="2">Transport distance (A4) should be as specific as possible. The distance to the construction site may be estimated based on weighted average distance to the market of the product.</td><td>NCR</td><td>V</td><td>Transport is limited to truck, yet European market is claimed. If European market is correct, please include adequate ocean freight shipping for distribution to Europe.

The market scope has been adjusted to NA only.

Page 18, paragraph 1 still indicates European/ Global market

This paragraph has been fixed.

Requiremet met.</td></tr>
<tr><td>7.1.7.3.4</td><td colspan="2">End of life scenarios for packaging shall only model processes, for example recycling systems that have been proven to be economically and technically viable.</td><td>NCR</td><td>V</td><td>Please add end-of-life scenario for packaging.

End of life scenario for packaging has been included in section 6.3.3

Requirement met.</td></tr>
<tr><td>7.1.7.4.1</td><td colspan="2">Any deviation from the categorization of aspects and impacts into modules B1 to B5 and B6 to B7 shall be reported in a transparent manner and justified.</td><td>N/A</td><td></td><td>Not applicable.</td></tr>
<tr><td>7.1.7.4.2.3</td><td colspan="2">Water and energy usage (including production and distribution) required for cleaning, as part of maintenance shall be included in this module (B2) and not in modules B6 and B7.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>7.1.7.5</td><td colspan="2">Waste processing shall be considered as part of the product system under study.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>7.1.7.5</td><td colspan="2">If there are, for example three different recovery and disposal options, the most commonly used one, or all three scenarios, shall be declared separately.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>7.1.7.5</td><td colspan="2">A scenario based on a typical end-of-life, for example a mix of recovery and disposal options based on a national situation, shall only be provided if the scenarios for the separate individual options are also provided.</td><td>V</td><td></td><td>Requirement met.</td></tr>
</table>

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
7.1.7.5	Energy recovery shall be based on existing technology and current practice.		N/A		Not applicable.
7.1.7.5	Waste processing shall be modelled and the elementary flows shall be included in the inventory.		V		Requirement met.
7.1.7.5	Processes where energy is recovered from waste with an efficiency rate below 60 % shall be considered as disposal processes and modelled in information module C4.		N/A		Not applicable.
7.1.7.5	The process of energy recovery from landfill gas shall be considered as part of the disposal process in information module C4.		N/A		Not applicable.
7.1.7.5	Loads and benefits of the recovered energy may be considered in optional module D.		N/A		Not applicable.
7.1.7.6	The LCA results from module D shall always be reported separately.		N/A		Not applicable.
7.1.7.6	If module D includes the result from an LCA, the following shall be applied:				
	The potential environmental loads and benefits of the net output flow are calculated by: — identifying the point of substituted functional equivalence where the secondary material or fuel or recovered energy substitutes primary production; — adding the loads associated with any further processing occurring beyond the system boundary that is required to reach the point of substituted functional equivalence; — subtracting the impacts resulting from the substituted production of the product or generation of the energy; — applying a justified correction factor to reflect the difference in functional equivalence where the processed net output flow does not reach the functional equivalence of the substituting process.		N/A		Not applicable.
	In the case of recovered energy, the average production mix shall be substituted. In cases where the substituted production primary process is not clear, as a conservative approach, the typical production mix, rather than primary product, should be substituted so that the benefit of recovery is not overstated. This is usually the case for electricity and heat generation.		N/A		Not applicable.
	Even though module D deals with the future (e.g. after end-of-life of the construction product or the construction works), current practice shall be used for the scenario setting in order to achieve a verifiable result. If today's average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used.		N/A		Not applicable.
10.2	The project report shall state the qualitative/quantitative description of unit processes necessary to model the life cycle stages of the declared unit.		V		Requirement met.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
Allocation					
7.1.7.2.6	Co-products from unit processes leaving the system at the production stage (A1 to A3) shall be allocated in accordance with 7.2.5.		N/A		Not applicable.
7.1.7.2.6	Loads and benefits from allocated co-products shall not be declared in module D.		N/A		Not applicable.
7.1.7.4.3.2	If relevant for the product group, regarding integrated technical systems equipment:				
	aspects related to the production of integrated technical systems equipment shall be assigned to information modules A1 to A3, for example radiators, boiler, ventilation system.		V		Requirement met.
	Aspects related to transportation and installation of integrated technical systems equipment shall be assigned to information modules A4 to A5.		V		Requirement met.
	Energy use and other impacts for integrated technical systems equipment during maintenance, repair, replacement or refurbishment activities for the equipment shall be assigned to information modules B2 to B5.		V		Requirement met.
	Aspects related to the waste processing and final disposal of integrated technical equipment shall be assigned to information modules C1 to C4.		V		Requirement met.
7.2.4	The inputs and outputs shall be allocated to the different products according to clearly stated procedures that shall be documented and explained together with the allocation procedure.		V		Requirement met.
7.2.4	For all allocation situations, the sum of the allocated inputs and outputs of a unit process shall be equal to the inputs and outputs of the unit process before allocation. This means no double counting or omission of inputs or outputs through allocation is permitted.		NCR	V	On Page 11, it is indicated that 0.98 kg of waste is associated with material efficiency, yet the amount of waste declared in A3 and the difference between inputs and outputs in A1 equals 5.04. Please correct. Requirement met.
7.2.4	Irrespective of the allocation approach chosen for a co-production process or for secondary flows crossing the system boundary between product systems, specific inherent properties of such coproducts or flows, for example calorific content, composition [biogenic carbon content, CaO/Ca(OH)2 content etc.], shall not be allocated but always reflect the physical flows.		V		Requirement met.
7.2.4	Allocation to co-products shall respect the main purpose of the processes studied, allocating all relevant products and functions appropriately.		N/A		Not applicable.
7.2.4	The purpose of a plant and therefore of the related processes is generally declared in its permit and shall be taken into account.		V		Requirement met.

Detailed Findings						
Section	Requirement			Original Finding	Final Finding	Comments
	Shall Clause		Should Clause			
7.2.4	Where the revenue from a process is a significant reason for its existence, the proportion of revenue associated with each coproduct should be broadly reflected in whichever allocation approach is used for co-products. This is to avoid disproportionate allocation of impacts to co-products.			N/A		Not applicable.
7.2.4	In situations where it is unclear if an output is a co-product, by-product or a waste, a conservative approach of allocating burdens to the primary product system under consideration shall be used. The final disposal of wastes is included in the system boundary of the process that generated them.			V		Requirement met.
7.2.4	Consistent allocation procedures shall be uniformly applied to similar inputs and outputs of the system under consideration.			V		Requirement met.
7.2.4	Impacts from allocated co-products shall not be included in module D.			N/A		Not applicable.
7.2.4	The use of upstream data that do not respect the allocation principles described in this document shall be:					
		clearly identified		V		Requirement met.
		subjected to a sensitivity analysis conducted and documented so as to illustrate the likely influence on the results with the upstream data used		V		Requirement met.
		justified in the project report		V		Requirement met.
		as a minimum, be in line with ISO 14044 allocation rules and attributional LCA		V		Requirement met.
7.2.5.2	Co-product allocation shall be performed in the order of the following steps:					
		Identify whether the unit process is a joint co-production process; if each of the co-products can be produced without the other(s) or the ratio of the co-products typically varies in normal production, then it is not a joint co-production process. By-products cannot be avoided and processes producing by-products are therefore joint co-production processes.		N/A		Not applicable.
		If the unit process is not a joint co-production process, then the unit process should be subdivided (see 7.2.5.5) into two or more unit processes (one of which represents the studied product) having separate input and output data for each individual unit process.		N/A		Not applicable.
		If the unit process is not a joint co-production process and the unit process should be subdivided (see 7.2.5.5) but if respective data are not available, the inventory of the unit process under study should be allocated between its different products or functions in a way that reflects the underlying physical relationships between them.		N/A		Not applicable.
		In other cases, such as joint co-production processes, the inventory of the process should be allocated between the products and co-products in a way that reflects underlying physical relationships between them, i.e. they should reflect the way in which the inputs and outputs are		N/A		Not applicable.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
		changed by quantitative changes in the products or functions delivered by the system.			
		In all other cases, including joint co-production processes, where no relevant underlying physical relationships between the products and co-products can be identified, the inventory of the process should be allocated between the products and co-products in a way that reflects the economic value of the co-products when they leave the unit process.	N/A		Not applicable.
7.2.5.2	Allocation on a purely economic basis shall not be used so as to avoid impacts to any co-products that are either produced or used in the manufacture of construction products.		V		Requirement met.
7.2.5.4	System expansion shall not be used to avoid the allocation of impacts to any co-products which are produced or used in the manufacture of construction products.		V		Requirement met.
7.2.5.5	The LCA study shall first identify any unit process that produce more than one product, then determine whether it is possible to divide the unit process into one or more subprocesses that each have a single output. Segregation shall be described and justified in the project report.		V		Requirement met.
10.2	The project report shall state the allocation principles and procedures including:				
		Documentation and justification of allocation procedures	V		Requirement met.
		Uniform application of allocation procedures	V		Requirement met.
Data Collection and Calculation					
7.1.9	As a general rule, specific data derived from specific production processes shall be the first choice as the basis for calculating an EPD.		V		Requirement met.
7.1.9	A specific product shall be calculated using specific data for at least the processes over which the manufacturer of the specific product has influence. Generic and proxy data may be used for the processes over which the manufacturer has no influence		V		Requirement met.
7.1.10	SI units shall be used. Primary resources used as energy or material input shall have the same unit.		V		Requirement met.
7.2.2	The same calculation procedures shall be applied consistently throughout the study.		V		Requirement met.
7.2.2	When transforming the inputs and outputs of combustible material into inputs and outputs of energy, the net calorific value of fuels shall be applied according to scientifically based and accepted values specific to the combustible material.		V		Requirement met.
10.2	The project report shall state the sources of generic or proxy data or literature used to conduct the LCA.		NCR	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
Data Quality					
7.1.9	The quality of the data used to calculate an EPD shall be addressed in the project report.		V		Requirement met.
7.1.9	Data sets used for calculations shall have been updated within the last 10 years for background data and within the last 5 years for producer-specific (foreground) data; deviations shall be justified.		V		Requirement met.
7.1.9	Manufacturer-specific data sets shall be based on average data from 12 consecutive months; deviations shall be justified in the project report.		V		Requirement met.
7.1.9	The time period over which inputs to and outputs from the system shall be accounted for is 100 years from the year for which the data set is deemed representative. A longer time period shall be used if relevant and shall be justified in the project report.		V		Requirement met.
7.1.9	Technological coverage shall reflect the physical reality for the declared product or product group.		V		Requirement met.
10.2	The project report shall state a validation of data and discussion considering the dimensions of data quality set out in ISO 14044, including:				
		Data quality assessment	V		Requirement met.
		Treatment of missing data	V		Requirement met.
Life Cycle Inventory (LCI)					
7.2.7	The mass flows to and from nature and biogenic carbon removal(s) and emissions throughout the product system shall be reported as a flow of biogenic carbon expressed in CO2 in the LCI.		V		Requirement met.
7.2.7	When entering the product system, this biogenic carbon flow shall be characterized in the LCIA with −1 kg CO2e/kg CO2 of biogenic carbon in the calculation of the GWP.		V		Requirement met.
7.2.7	When this bio-based material, partly or as a whole, is converted to emissions, for example, by combustion or biodegradation, it shall be accounted for as emitted biogenic CO2 and other emissions such as biogenic CH4 in the information module where they occur, depending on the end-of-life scenario.		V		Requirement met.
7.2.7	Emissions of biogenic CO2 shall be characterized with +1 kg CO2e/kg CO2 of biogenic carbon in the calculation of the GWP.		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
7.2.7	Any import of bio-based material into the product system as secondary fuel or secondary material is reported as an input of biogenic carbon removal(s) expressed in CO2 in the LCI and shall be characterized with −1 kg CO2e/kg CO2 of biogenic carbon in the calculation of the GWP.		V		Requirement met.
7.2.7	The amount of biogenic carbon contained within bio-based material leaving the product system shall be declared as technical scenario information in the module where the material is leaving the product system, irrespective of whether the environmental impacts and aspects of this module are declared.		V		Requirement met.
7.2.7	For bio-based packaging material, the quantity of biogenic carbon (expressed in kg CO2) contained within the packaging for the declared unit shall be documented in information module A5 as technical scenario information.		V		Requirement met.
7.2.7	For construction products, the quantity of removals of biogenic carbon (expressed in kg CO2) within the declared unit of the product (excluding packaging) shall be documented at the end-of-life stage in information modules C3/C4 technical scenario information.		V		Requirement met.
7.2.8	Environmental impacts considered during the production, use and end-of-life stages shall include carbonation.		N/A		Not applicable.
7.2.8	Environmental benefits attributed to carbonation in a product shall not be allocated to co-products or secondary materials.		N/A		Not applicable.
7.2.8	The quantification of carbonation as a part of the GWP shall be based on recognized methods for the calculation of carbonation and the underlying methodology shall be referenced in the project report and results interpreted with respect to uncertainty of calculations.		N/A		Not applicable.
7.2.9	If a manufacturer wishes to declare quantitative or qualitative information on delayed emissions within the EPD, the information shall be reported under “Additional environmental information” and the underlying methodology shall be referenced.		N/A		Not applicable.
7.2.10	The declaration of use of renewable and non-renewable primary resources (energy and materials), along with the use of secondary resources (secondary materials, secondary fuels and recovered energy), shall be derived from LCI and specified for all information modules.		V		Requirement met.
7.2.10	To provide transparency, when declaring the use of primary and secondary resources, the individual inventory indicators shall not be combined, aggregated or amalgamated.		V		Requirement met.
7.2.10	These indicators shall always be provided for the foreground system according to the cut-off criteria. The following indicators shall be included:				
		Renewable primary resources used as an energy carrier (fuel), RPRE, are (first use) bio-based materials used as an energy source. Hydropower, solar and wind power used in the technosphere are also included in this indicator.	V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
		Renewable primary resources with energy content used as material, RPRM, are (first use) biobased materials used as materials (e.g. wood, hemp, etc.).	V		Requirement met.
		Non-renewable primary resources used as an energy carrier (fuel), NRPRE, are (first use) materials such as peat, oil, gas, coal, uranium used as an energy source.	V		Requirement met.
		Non-renewable primary resources with energy content used as material, NRPRM, are (first use) primary resources such as oil, gas and coal, used for products (e.g. plastic-based products).	V		Requirement met.
		Secondary materials, SM, are materials recycled from previous use or waste (e.g. scrap metal, broken concrete, broken glass, plastic and wood) that are used as a material input from another product system. These include both renewable and non-renewable resources, with or without energy content, depending on the status of the material when it was originally extracted from the environment.	V		Requirement met.
		Renewable secondary fuels, RSF, are renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. biomass residue pellets, chipped waste wood).	V		Requirement met.
		Non-renewable secondary fuels, NRSF, are non-renewable materials with energy content that have crossed the system boundary between product systems and are used as fuel input (energy source) in another product system (e.g. processed solvents, shredded tyres).	V		Requirement met.
		Recovered energy, RE, is energy recovered from disposal of waste in previous systems, such as energy recovery from combustion of landfill gas or energy recovered from other systems using energy sources.	NCR	V	RE can be calculated using ACLCA ISO 21930 Guidance, please do not use INA. Also consider moving RE to the Resources table results. RE has been added based on ACLCA ISO 21930 Guidance Requirement met.
		The abiotic depletion potential for fossil resources (ADPfossil) shall be reported.	V		Requirement met.
7.2.10	Considering the cut-off criteria (7.1.8) such missing data should be estimated to calculate these indicators (resource use indicators) for background data or the lack of inventory shall be described in the project report and EPD.		NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930

Detailed Findings						
Section	Requirement		Original Finding	Final Finding	Comments	
	Shall Clause	Should Clause				
					Guidance. Please do not use INA. Remaining Indicators have been added based on ACLCA ISO 21930 Guidance Requirement met.	
7.2.12	The following indicators on the uptake and emissions of CO2 shall be separately reported, where relevant and available, if included in the quantification of the GWP:					
		biogenic CO2, reporting the removals and emissions associated with biogenic carbon content contained within bio-based products, occurring in each module	N/A		Not applicable.	
		biogenic CO2, reporting the removals and emissions associated with biogenic carbon content contained within bio-based packaging, occurring in each module	V		Requirement met.	
		CO2 from calcination and carbonation, reporting the emissions and uptake of CO2 from calcination and carbonation occurring in the relevant module	N/A		Not applicable.	
		biogenic CO2, reporting the emissions from combustion of waste from renewable sources used in production processes	N/A		Not applicable.	
		CO2 emissions from combustion of waste from non-renewable sources used in production processes.	N/A		Not applicable.	
7.2.13	Consumption (or net use) of freshwater as LCI indicator shall be calculated in compliance with ISO 14046. For each process, the water consumed is the sum of the water that is lost from a drainage basin as a result of human activity (including evaporation, transpiration, irrigation, etc.)		V		Requirement met.	
7.2.14	The following waste categories shall be declared and specified for all information modules included in the EPD:					
		hazardous waste disposed, in kg	V		Requirement met.	
		non-hazardous waste disposed, in kg	V		Requirement met.	
		radioactive waste disposed; — high-level radioactive waste, conditioned, to final repository, in kg or m3; — intermediate- and low-level radioactive waste, conditioned, to final repository, in kg or m3	NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930 Guidance. Please do not use INA. Requirement met.	
7.2.14	The following output flow categories shall be declared and specified for all information modules included in the EPD:					
		components for reuse	NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930	

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
					Guidance. Please do not use INA. Requirement met.
		materials for recycling, i.e. secondary material for use in the next product system	NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930 Guidance. Please do not use INA. Requirement met.
		materials for energy recovery, i.e. secondary fuels for use in the next product system	NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930 Guidance. Please do not use INA. Requirement met.
		recovered energy exported from the product system	NCR	V	All indicators that are reported as INA can be calculated using the ACLCA ISO 21930 Guidance. Please do not use INA. Requirement met.
Life Cycle Impact Assessment (LCIA)					
7.2.11	When significant, the greenhouse gases (GHG) emissions occurring as a result of land-use change shall be included in the quantification of the GWP. They should be assessed in accordance with internationally recognized methods such as the IPCC.		N/A		Not applicable.
7.2.11	When reported, the land-use change GHG emissions contribution to GWP shall be reported separately in the EPD as GWP (land-use change) as additional environmental information, including a short interpretation of the data.		N/A		Not applicable.
7.3	An EPD developed using this document shall, as a minimum, report the set of impact categories stated in Table 5: **Impact category and abbreviation** Global warming potential (GWP 100) Ozone depletion potential (ODP) Eutrophication potential (EP) Acidification potential (AP) Photochemical oxidant creation potential (POCP)		V		Requirement met.
7.3	For European-market EPDs developed with this document as the core PCR, the characterization method included in the latest edition of EN 15804 shall be used.		NCR	V	Page 21 indicates CML indicators are used, but results table shows these as EN 15804. Please

<table>
<tr><th colspan="5">Detailed Findings</th></tr>
<tr><th rowspan="2">Section</th><th colspan="2">Requirement</th><th rowspan="2">Original Finding</th><th rowspan="2">Final Finding</th><th rowspan="2">Comments</th></tr>
<tr><th>Shall Clause</th><th>Should Clause</th></tr>
<tr><td></td><td colspan="2"></td><td></td><td></td><td>correct. Be sure to include GWP for EN 15804.

EN Indicators have been included. CML indicators were included to capture ADPe and ADPff.

No LCIA indicators for EN 15804 are reported.

The scope of the study has been pared back to encompass only North America. EN15804 and CML indicators have since been removed.

Acknowledged.</td></tr>
<tr><td>7.3</td><td colspan="2">The EPD results shall be developed using one of the relevant, commonly used characterization methods. In the absence of specificity or preference regarding a characterization method, the default references provided in Table 5 shall be used.
Table 5 — Mandatory impact categories and default characterization methods<table><tr><th>Impact category and abbreviation</th><th>Default international characterization method</th><th>Default North American market characterization method</th><th>Default European market characterization method as provided in</th></tr><tr><td>Global warming potential (GWP 100)</td><td>IPCC[30]</td><td>TRACI</td><td>EN 15804</td></tr><tr><td>Ozone depletion potential (ODP)</td><td>WMO[34]</td><td>TRACI</td><td>EN 15804</td></tr><tr><td>Eutrophication potential (EP)</td><td>Heijungs et al.[31]</td><td>TRACI</td><td>EN 15804</td></tr><tr><td>Acidification potential (AP)</td><td>Hauschild and Wenzel[32]</td><td>TRACI</td><td>EN 15804</td></tr><tr><td>Photochemical oxidant creation potential (POCP)</td><td>Goedkoop et al.[41]</td><td>TRACI</td><td>EN 15804</td></tr></table></td><td>NCR</td><td>V</td><td>Page 21 indicates CML indicators are used, but results table shows these as EN 15804. Please correct. Be sure to include GWP for EN 15804.

EN Indicators have been included. CML indicators were included to capture ADPe and ADPff.

No EN 15804 LCIA indicators are reported.

The scope of the study has been pared back to encompass only North America. EN15804 and CML indicators have since been removed.

Acknowledged.</td></tr>
<tr><td>7.3</td><td colspan="2">Impact category results may be provided using more than one characterization method including the default references. Results shall be reported separately for each method that is used.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>7.3</td><td colspan="2">Impact category results may be reported that are in addition to those minimum results mandated in Table 5. Scientifically</td><td>V</td><td></td><td>Requirement met.</td></tr>
</table>

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	developed characterization methods should be used for these additional indicators.				
7.3	In order to evaluate and use EPDs at a construction works level, the impact categories relevant for that particular market shall be used.		NCR	V	Page 21 indicates CML indicators are used, but results table shows these as EN 15804. Please correct. Be sure to include GWP for EN 15804. GWP for EN has been included. Additional language has been included in section 5.1. to capture all indicators included. No EN 15804 LCIA indicators are reported. The scope of the study has been pared back to encompass only North America. EN15804 and CML indicators have since been removed. Acknowledged.
8.2	If additional LCIA indicators that is not part of the pre-set LCIA indicators are included, the LCA report shall include a written discussion of the results, including the limitations related to the LCIA-type methods used.		NCR	V	Please include discussion of results for additional LCIA indicators, ADPelements and IPCC GWP. In section 5.2, Does the description of GWP cover both IPCC and TRACI 2.1 versions? The description is ok, but this is asking for additional discussion on the results for the additional indicators. Additional discussion has been included in section 5.1 and 5.2 of all indicators included. This requirement is for a discussion of the results of the additional

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					indicators. Suggest to include in the Interpretation section. Understood. Elements have since been removed, and IPCC has been elaborated on in the interpretation section 6.2 Acknowledged.
10.2	The project report shall state the following:				
	The LCIA procedures, calculation and results of the study		V		Requirement met.
	The relationship of the LCIA results to the LCI results		V		Requirement met.
	Reference to all characterization models, characterization factors and methods used, as defined in this document		NCR	V	In Section 5.1 IPCC AR6 is indicated for GWP, but IPPC AR5 is referenced. Please correct. Please include reference for EN 15804 method. Corrections have been made in sections 5.1 and 7. Requirement met.
	A statement that the LCIA results are relative expressions and do not predict impacts on category endpoints, the exceedance of thresholds, safety margins or risks		V		Requirement met.
Life Cycle Interpretation					
7.2.11	When reported, the project report shall include an interpretation of the results for the GWP land-use change, reflecting the influence of data and availability and the underlying methodology shall be referenced.		N/A		Not applicable.
10.2	The project report shall state the following:				
	The results		V		Requirement met.
	Assumptions and limitations associated with the interpretation of results as declared in the EPD, both methodology and data related		V		Requirement met.
	Data quality assessment		V		Requirement met.
	Full transparency in terms of value-choices, rationales and expert judgements		V		Requirement met.
Comparisons					
5.2.3	If a comparison of products is required to be conducted at the construction works level, it shall consider life cycle stages that occur beyond the production stage within the product system.		N/A		Not applicable.

Detailed Findings						
Section	Requirement			Original Finding	Final Finding	Comments
	Shall Clause		Should Clause			
5.5	Comparison of construction products using an EPD shall be carried out in the context of the construction works.			N/A		Not applicable.
5.5	Comparison of the environmental performance of construction products using the EPD shall consider all the relevant information modules over the full life cycle of the products within the construction works.			N/A		Not applicable.
5.5	In all cases of comparing construction products, the principle that the basis for comparison of the assessment is the construction works level shall be maintained by ensuring that the same functional requirements are met and:					
		the products/systems shall have the same functional performance		N/A		Not applicable.
		the comparison is based on the same functional unit		N/A		Not applicable.
		the environmental performance and technical performance of any excluded elements of the construction works (e.g. assembled systems, components, construction products or construction services) are the same		N/A		Not applicable.
		the type and amount of any materials excluded are exactly the same		N/A		Not applicable.
		any excluded processes and life cycle stages are the same		N/A		Not applicable.
		equivalent scenarios are used		N/A		Not applicable.
		the elementary flows related to material inherent properties such as biogenic carbon, the potential to carbonate or the net calorific value of a material, are considered completely and consistently within the scope of comparison		N/A		Not applicable.
		the influence of the product systems on the use stage of the construction works, including operational aspects and impacts of the construction works, are taken into account or are the same		N/A		Not applicable.
		module D shall not be aggregated with the life cycle information modules A1 to C4 to assess the total impact of the products or construction works being compared, as it is outside the system boundary. It can be taken into consideration as optional supplementary environmental information using equivalent scenarios.		N/A		Not applicable.
5.5	The information provided for any comparison shall be transparent to allow a clear understanding of the limitations of comparability.			N/A		Not applicable.

BIFMA PCR for Seating: Critical Review Checklist

Standard Reviewed:	BIFMA PCR for Seating				
Date/Version of Standard:	Version 3, valid through September 30, 2024				
Report Title:	Life Cycle Assessment of Seating for Stylex				
Report Date/Version:	March 27, 2024				
Report Author:	Sahil Akolawala, Foresight Management				
Review performed concurrently:	No	Review performed end of study:	Yes		
Date of Initial Review:	04/05024	Date of Second Review:	05/23/24		
Date of Final Review:	05/30/24				
Reviewer Organization:	SCS Global Services				
Reviewer Name:	Beth Cassese				
Internal Expert:	No	External Expert:	Yes	Review Panel:	No

Finding Summary			
	Verified (Conforms with requirement)	Opportunity for improvement	Non-conformity with requirement
Number of Findings:	V	OFI	NCR
Initial Review	59	3	16
Second Review	71	2	5
Final Review	78	0	0

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
General					
8	References shall be the most recent version required at the time of the LCA.		V		Requirement met.
Product Description					
2	The product description shall include:				
	the name of the product		V		Requirement met.
	product manufacturer		V		Requirement met.
	model number		V		Requirement met.
	general description of the product		V		Requirement met.
	picture of the product		NCR	V	Please include picture of product. Image has been included in section 2.8.1 Requirement met.
2	Similar products can be included in the same declaration, provided that the range of variation within each impact category does not exceed +/- 10% of impact categories.		OFI	V	As is, the report is specific to the F4 product. If other product models are to be represented by this study they will need to be listed. No other products are currently included. The model is designed to

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					accommodate future LCAs of other product lines. Acknowledged.
8.1	Product specifications, consisting of material composition of the reference product, in kg per functional unit and in percentage of total weight shall be reported.		NCR	V	Please include material composition in kg per functional unit. Added to section 3.3.1 Requirement met.
Goal and Scope					
1.1	The scope of the LCA shall be from cradle to grave.		NCR	V	Please update Table 3.1 to reflect cradle-to-grave study; all modules are declared for cradle-to-grave Updated language to say no activity Expected. Requirement met.
Functional/Declared Unit					
3	The functional unit shall be one unit of seating to seat one individual, maintained for a 10 year period.		V		Requirement met.
3	For chairs with a service life of more than 10 years, the entire impact shall be allocated to the 10 year period.		V		Requirement met.
3	For chairs with a service life of less than 10 years, a fractional approach may be used.		N/A		Not applicable.
3	The ANSI/BIFMA X5.1 method is an agreed upon and approved test methodology to show a chair remains useable for a period of 10 years. Products that have been documented to meet ANSI/BIFMA X5.1 can be deemed to meet the 10 year service life.		V		Requirement met.
3	If the product does not meet ANSI/BIFMA X5.1 or equivalent, and the warranty period is 5 years or more, the maximum service life shall be 5 years. For product warranties less than 5 years, the service life shall equal the warranty period.		V		Requirement met.
3	The number of chairs required shall be clearly stated and unit values shall not be less than one.		V		Requirement met.
System Boundary					
3.1	All known mass and energy flows should be included.		V		Requirement met.
3.1	Any flows that are knowingly omitted shall be justified and must meet the criteria as follows.				
		Any mass and energy flows within the product boundary that consist of less than 1% may be omitted where justified and documented	V		Requirement met.
		Cumulative omitted mass or energy flows shall not exceed 5%	V		Requirement met.
4	The entire life cycle is to be covered from cradle to grave, including all industrial processes from raw material		NCR	V	Please update Table 3.1 to reflect cradle-to-grave

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	acquisition and pre-processing, production, product distribution and storage, use and maintenance, and end-of-life management.				study; all modules are declared for cradle-to-grave Updated language to say no activity Expected. Requirement met.
4	Production of capital goods, infrastructure, and personnel-related activities should not be included.		V		Requirement met.
4.1	Waste and scrap created during raw material acquisition and pre-processing shall be accounted for along with emissions associated with transporting the material to recycling or landfill centers.		V		Requirement met.
4.1	Primary data for the raw material acquisition stage shall be used, if available, otherwise secondary data shall be used.		NCR	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been added to Appendix A. No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
4.1	Secondary data shall be used for industry processes, and may come from the USLCI for US based processes, the ELCD database for European based processes, the Japanese LCI Database, or other available data that are representative of geography, time and technology inventory data.		V		Requirement met.
4.1	If waste materials are recycled, landfilled, combusted, or composted, the transport distances shall be reported in the LCA.		V		Requirement met.
4.1	In the US, the EPA WARM model gives an average transport end-of-life distance as 32 km (20 miles). This value shall be used for US based processes when primary data or other representative data are not available and when transport distance is not integrated into the dataset.		V		Requirement met.

<table>
<tr><th colspan="5">Detailed Findings</th></tr>
<tr><th rowspan="2">Section</th><th colspan="2">Requirement</th><th rowspan="2">Original Finding</th><th rowspan="2">Final Finding</th><th rowspan="2">Comments</th></tr>
<tr><th>Shall Clause</th><th>Should Clause</th></tr>
<tr><td>4.1</td><td colspan="2">All transportation, including interfacility transport, prior to the material being shipped to the production stage shall be included.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>4.1</td><td colspan="2">Transportation from the raw material stage to the production stage shall be included.</td><td>V</td><td></td><td>Requirement met.</td></tr>
<tr><td>4.1</td><td colspan="5">If using an LCA tool where transportation data are not included, and primary data do not exist, transportation distances listed in Table 1 shall be used for North American based process transportation of the extracted raw materials within the acquisition and preprocessing.</td></tr>
<tr><td></td><td colspan="2">
Table 1
North American default material transport distances, material acquisition, and pre-processing stage to North American production stage
<table>
<tr><th colspan="2" rowspan="2">Raw Material/ Classification grouping</th><th colspan="3">Distance (miles)</th></tr>
<tr><th>Rail</th><th>Truck*</th><th>Water</th></tr>
<tr><td>Veneer</td><td>26 Wood Products</td><td>162 miles</td><td>332 miles</td><td>5982 Miles Picking 5 Ports for an average of all water transport (Asia, Australia, Africa, Europe & South America)</td></tr>
<tr><td>Particle Board</td><td>26 Wood Products</td><td>162 miles</td><td>332 miles</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td></tr>
<tr><td>MDF</td><td>26 Wood Products</td><td>162 miles</td><td>332 miles</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td></tr>
<tr><td>Paper Backer</td><td>27 Pulp, newsprint, paper, and paperboard</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge) [837 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code "Table 7"]</td><td>742 miles</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td></tr>
<tr><td>Solid Wood</td><td>26 Wood Products</td><td>162 miles</td><td>332 miles</td><td>5982 Miles Picking 5 Ports for an average of all water transport (Asia, Australia, Africa, Europe & South America)</td></tr>
<tr><td>Plywood</td><td>26 Wood Products</td><td>162 miles</td><td>332 miles</td><td>5982 Miles Picking 5 Ports for an average of all water transport (Asia, Australia, Africa, Europe & South America)</td></tr>
<tr><td>Plastic (inc. polymer-based materials; exc. textiles)</td><td>24 Plastics & Rubber</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td><td>757 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 13</td><td>960 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td></tr>
<tr><td>Steel</td><td>32 Base metal in prim. or semifin. forms & in finished basic shapes</td><td>562 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td><td>932 miles</td><td>833 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td></tr>
<tr><td>Extruded Aluminum</td><td>32 Base metal in prim. or semifin. forms & in finished basic shapes</td><td>562 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td><td>932 miles</td><td>833 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td></tr>
<tr><td>Cast Aluminum</td><td>32 Base metal in prim. or semifin. forms & in finished basic shapes</td><td>562 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td><td>932 miles</td><td>833 miles in 2007 U.S. DOT Shipment Characteristics by SCTG*** Code Table 7</td></tr>
<tr><td>Glass</td><td>31 Nonmetallic mineral products</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td><td>126 miles</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td></tr>
<tr><td>Fabric Leather</td><td>30 Textiles, leather, and articles of textiles or leather</td><td>0 miles (NA due to this mode of transport not being significant for this commodity, to our knowledge)</td><td>294 miles</td><td>5982 Miles Picking 5 Ports for an average of all water transport (Asia, Australia, Africa, Europe & South America)</td></tr>
<tr><td>Other</td><td>This includes all other non-specified material (fiberglass, organics, etc.)</td><td>208 miles**</td><td>531 miles**</td><td>2,282 miles**</td></tr>
</table>
</td><td>N/A</td><td></td><td>Not applicable.</td></tr>
<tr><td>4.1</td><td colspan="2">For processes outside of North America, an appropriate regional or national transportation distance and mode shall be used where primary data does not exist.</td><td>N/A</td><td></td><td>Not applicable.</td></tr>
<tr><td>4.1</td><td colspan="2">If more than one transportation was required, then the usage of multiple transportation data sets shall be reflected in the LCA.</td><td>NCR</td><td>V</td><td>Transport is limited to truck, yet European market is claimed. If European market is correct, please include adequate ocean freight</td></tr>
</table>

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					shipping for distribution to Europe. It was determined that the European market is not to be included. Are we to only include TRACI indicators as per the Seating PCR? If European market is to be removed, only the NA LCIA indicators in ISO 21930 and the PCR are required. If pursuing this, there are also a few sectional where language needs to be updated to reflect NA only. European market is to be removed. Acknowledged.
4.2	Any co-products or wastes formed during production shall be considered in the production stage.		V		Requirement met.
4.2	Materials used in packaging of the final product shall be included.		V		Requirement met.
4.2	Waste and scrap created during production shall be included in the LCA model.		V		Requirement met.
4.2	Primary data shall be used if these are available.		NCR	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been added to Appendix A. No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					LCA Studies on Stylex's Products. Acknowledged.
4.2	If waste materials are recycled, landfilled, combusted, or composted, the transport distances shall follow the current version of the US EPA WARM model unless primary data are used, currently 20 miles (32 km)		V		Requirement met.
4.2	The amount of waste material sent to landfill versus recycling, shall be based on EPA Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for Durable Goods (current version), within North America, or other appropriate regionally or nationally applicable model for production outside of North America		NCR	V	Please change waste classification in A3 to be consistent with EPA MSW. Section A3 has been updated accordingly. Requirement met.
4.2	Transportation of parts, semi-finished and finished products, to the place of final assembly and/or distribution, shall be included.		N/A		Not applicable.
4.2	Intercompany movement of parts, semi-finished and finished parts, shall be accounted for where facilities fall under operational control of the reporting company.		N/A		Not applicable.
4.2		For facilities not under operational control of the reporting company, intercompany movement of goods should be included.	N/A		Not applicable.
4.3	Transportation mode and distances shall be based on primary data (Distribution, Storage, and Use stage)		NCR	V	Transport is limited to truck, yet European market is claimed. If European market is correct, please include adequate ocean freight shipping for distribution to Europe. It was determined that the European market is not to be included. Are we to only include TRACI indicators as per the Seating PCR? See note above. European Market is to be removed. Acknowledged.
4.4	In the absence of primary data on actual end-of-life treatment for the product, the most current version of the		V		Requirement met.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
	US EPA Municipal Solid Waste data shall be used for solid waste treatment percentages.				
4.4	The US EPA WARM model shall be used for end-of-life transportation distances.		V		Requirement met.
4.4	For products that reach end-of-life outside of North America, the practitioner shall use primary data, or justify the usage or other appropriate regional or national model that has an established waste disposal treatment model that documents the percent of each material in the product that can be recycled versus landfilled, in addition to the distances associated with the material travel to end of life stage. If neither primary nor justified data sets are available, then North America data shall be used.		V		Requirement met.
4.4		The amount of each material in the product that can be assumed to be recycled is determined by multiplying the EPA MSW within North America, or other appropriate regionally or nationally applicably model recycling rate (%), by the amount of each homogenous material type that is able to be disassembled. The remaining materials that are not recycled should be modeled for end of life using 80% landfill and 20% incineration.	V		Requirement met.
Allocation					
5	Allocation procedures shall be uniformly applied to similar inputs and outputs of the system under consideration.		V		Requirement met.
5	If allocation cannot be avoided, the following hierarchy of allocation methods are preferred: -Mass or other physical relationship -Economic value Deviation from these allocation rules shall be documented and justified.		V		Requirement met.
5	For allocation due to recycled, companies shall use the Recycled Content Method.(cut-off or 100-0 method)		V		Requirement met.
Data					
6	International System of Units (SI) shall be used for both the LCA and EPD.		V		Requirement met.
6	Quantities shall be represented with a maximum of 3 significant digits.		V		Requirement met.
7.1	Primary data shall be used for facilities and processes under operational control of the reporting company unless representative industry data are available.		V		Requirement met.
7.1		The origin of the data should be identified.	OFI	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been added to Appendix A

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
7.1	If a product or component is produced at more than one facility within the operational control of the company, representative data gathered from one facility, or an average, may be used for facility operations that contribute less than 10% of the total product output.		N/A		Not applicable.
7.1	For facilities and processes outside of the operational control of the reporting company, it is recommended that primary data be used for production processes, although secondary data may be used.		OFI	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been added to Appendix A No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
7.1	Electrical energy data shall use eGRID, or subregion, or similar data to represent electrical energy production for the U.S. Preference shall be given to datasets that include transmission and distribution losses.		NCR	V	Please include appropriate eGRID used. eGrid has been added to section 3.3.2 Requirement met.
7.1	Outside the U.S., the most reasonable and justified processes shall be used for energy production.		N/A		Not applicable.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
7.1	Primary data shall be used for unit processes that contribute to the majority of the mass and energy flows, or which have the most relevant environmental emissions.		V		Requirement met.
7.2	A data quality assessment shall be made for the system under study.		V		Requirement met.
7.2	All data shall be accurate, complete, and representative of the manufacturing process, current technology, and current measurement capability.		V		Requirement met.
7.2	The primary data obtained from the manufacturing processes shall be based upon averages for the year of the study and documented as such in addition to the year used for the data.		V		Requirement met.
7.2	Data should represent the technology and process in current use.		V		Requirement met.
7.2	Data quality assessment shall address the following:				
	Time related coverage: age of data and the minimum length of time over which data should be collected		V		Requirement met.
	Geographical coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study		V		Requirement met.
	Technology coverage: specific technology or technology mix		V		Requirement met.
7.2	The data shall be consistent with data quality assessments such as USLCI, ILCD or WRI		NCR	V	Please include if the data quality assessment used is consistent with one of the recommendations. The ecoinvent data quality assessment is consistent with USLCI. Section 3.6.8.7 has been included to cover the results. Requirement met.
7.2	The data shall be consistent with representative data should always be used in the upstream phases. Information from databases may be regarded as representative data, if they fulfill the following requirements:				
	Representative of the geographical area		V		Requirement met.
	Technological system equivalence		V		Requirement met.
	Boundaries towards nature; technosphere		V		Requirement met.
7.3	The source of the input data shall be transparent.		NCR	V	There are a number of sources listed in Appendix A as primary data, yet no description or reference to these primary data points exists in the study. Elaboration has been added to Appendix A.

Detailed Findings					
Section	Requirement		Original Finding	Final Finding	Comments
	Shall Clause	Should Clause			
					No elaboration found. The Appendix encompasses some secondary datasets that are not relevant to the F4 product, as the model is constructed with the intention to accommodate future LCA Studies on Stylex's Products. Acknowledged.
7.4	Where primary data are available for the electrical power grid for a given unit process, it shall be used to model the electricity source.		V		Requirement met.
7.4	If data are not available at the electrical power grid, the next highest aggregation of electrical grid data shall be used, with a preference of local, regional, national, and then multi-national.		NCR	V	Please include appropriate eGRID used. eGrid has been added to section 3.3.2 Requirement met.
7.4	Carbon offsets or Renewable Energy Credits or Certificates shall not be used in the inventory. These refer to credits purchased for processes not under the control of the purchaser.		V		Requirement met.
7.4	On-site renewable energy may only be included in the inventory if the renewable energy attributes are not transferred to another party.		N/A		Not applicable.
7.4	When using an LCI database that does not account for water use, this shall be noted in the EPD.		N/A		Not applicable.
LCI & LCIA					
7.5	The following environmental impact categories shall be disclosed in the EPD, per functional unit. The following methodologies shall be used regardless of the location of the manufacturer; other methodologies may be reported in addition to the requirements.				
		Global warming potential, 100 years, kg CO2 eq (TRACI 2.1)	NCR	V	Please include TRACI GWP. Updated in table 5.1 Requirement met.
		Acidification potential, kg SO2 eq (TRACI 2.1)	V		Requirement met.
		Photochemical ozone creation potential, smog, kg O3 eq (TRACI 2.1)	V		Requirement met.
		Eutrophication potential, kg N eq (TRACI 2.1)	V		Requirement met.
		Ozone depletion air, kg CFC 11 eq (TRACI 2.1)	V		Requirement met.
7.5	The impact categories shall also be divided up into quantity of each impact category for material acquisition and refining,		NCR	V	Please update results tables for the categories described.

Detailed Findings					
Section	Requirement: Shall Clause	Requirement: Should Clause	Original Finding	Final Finding	Comments
	production (manufacture and assembly), distribution and use, and end of life.				Tables have been added to reflect the categories described. Original tables maintained for granularity. Requirement met.
8.2	Inventory assessment categories shall reported in total:				
	Net fresh water usage, kg		V		Requirement met.
	The EPD shall indicate if water usage from electricity generation is not included		V		Requirement met.
	Primary energy demand in total (renewable and non-renewable energy), MJ		NCR	V	Please include totals for primary energy demand indicators. Updated in table 5.2 Requirement met.
8.3	Impact assessment categories shall be reported by life cycle stage and in total. Impact categories shall use the characterization models specified in Section 7.5.				
	Global warming potential		V		Requirement met.
	Acidification potential (total for water and air)		V		Requirement met.
	Photochemical ozone creation potential		V		Requirement met.
	Eutrophication potential (total for water and air)		V		Requirement met.
	Ozone depletion air		V		Requirement met.
Sensitivity Analysis					
7.6	A sensitivity analysis shall be performed and detailed in the LCA report, suggesting an appropriate model was used.		V		Requirement met.