M/FLEX®

Life Cycle Assessment

Study Completed: November - December, 2020
Critical Review Completed: December 17, 2020
Critical Review Completed By: WAP Sustainability

LIFE CYCLE ASSESSMENT					
Manufacturer	Humanscale				
Product Name(s)	M/Flex® for M2.1, M8.1, M10				
Product Type	Monitor Arm				
Product Description	M/Flex® transforms any workspace with unprecedented flexibility and ergonomic performance. Designed for today's agile work environment, users can easily add or remove monitors without disrupting the originally configured installation. This multi-monitor arm system accommodates endless configurations and is fully compatible with Humanscale's next generation monitor arms — providing all of the cutting-edge features of the line.				
LCA Scope, Overall	Cradle to Grave				
LCA Scope, Included Life Cycle Modules	**Sourcing and Manufacturing Modules**	**Delivery and Installation Modules**	**Use Phase Modules**		**End of life Modules**
	☒ A1 ☒ A2 ☒ A3	☒ A4 ☒ A5	☒ B1 ☒ B2 ☒ B3 ☒ B4	☒ B5 ☒ B6 ☒ B7	☒ C1 ☒ C2 ☒ C3 ☒ C4
	Benefits and Loads beyond System Boundary: ☐ D				
Functional or Declared Unit	The functional unit is one monitor arm system to support two monitors.				
Summary of Impact Categories Measured	☒ Global Warming Potential ☒ Acidification Potential ☒ Eutrophication Potential ☒ Smog Creation	☒ Ozone Depletion Potential ☒Water Consumption ☒ Fossil Resource Scarcity			

Reference Standards	☒ ISO 14040 ☒ ISO 14044	☐ ISO 21930 ☐ EN 15804	☐ Others (Specify Below):
Reference PCR (If Applicable)	No applicable BIFMA PCR		
LCA Study Conducted by	**Date Completed**	December, 2020	
	LCA Practitioner	Stephanie Richardson, Sustainability Coordinator, Humanscale	
Independent LCA Review Details	**Date of Final Approval**	December 17, 2020	
	LCA Reviewer	Manasa Rao, Sustainability Data Manager and Researcher, WAP Sustainability	
	Type of Review	☐ Internal	☒ External
LCA Expiration Date	New expiration: June 16, 2024		
LCA Software and Version	OpenLCA		
LCA Database(s) and Version(s)	Ecoinvent database, version 3.6 APOS unit regionalized		
Applicable Region(s)	Global		
Link to Publicly Available Version of LCA (If Applicable)	https://www.humanscale.com/resources/designer-toolkit/green-design.cfm		

M/Flex® for M2.1

M/Flex® for M8.1

M/Flex® for M10

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1 EXECUTIVE SUMMARY

This critical review is being done by WAP Sustainability. The objective of the critical review is to ensure that this assessment meets the intent of the relevant imperatives within the Living Product Challenge; Water Footprint 04, Energy Footprint 06, and Net Positive Carbon 14, for greenhouse gas calculations for Scope 3, category 1: Purchased Goods and Services and to increase LEED credit contribution for this product.

The results presented herein will not be used as the sole basis for a comparative assertion.

2 GENERAL INFORMATION

2.1 COMPANY PROFILE

Humanscale was founded in 1983 by CEO Bob King with a focus on high-performance tools that support a healthy, more active way of working. Humanscale is now a global ergonomics and furniture leader with a reputation for designing intuitive products which improve the comfort and health of office workers. Humanscale's global headquarters is located in New York, NY and the company has offices and manufacturing throughout North America, Latin America & The Caribbean, Europe, Asia Pacific, Oceania, The Middle East and Africa.

- The LCA commissioner: Humanscale
- The LCA practitioner(s): Stephanie Richardson, Sustainability Coordinator; an employee of Humanscale.

The LCA modeling, results interpretation and report have been conducted according to the relevant requirements of the International Standards on LCA, including ISO 14040 and ISO 14044.

There is no applicable BIFMA PCR available for monitor arms. As such, this LCA does not follow a specific PCR but was set up to follow the general format of available BIFMA PCRs as closely as possible.

2.2 REPORTING DATE

The LCA study was commenced in October 2020 and a draft was submitted for critical review to WAP Sustainability in December 2020. The final approval of the document took place on December 17, 2020.

2.3 GOAL OF THE STUDY AND INTENDED APPLICATION

The intended application of this LCA is to support Humanscale in applying "life cycle thinking" to discover potential ways to further improve the environmental performance of monitor arm products, with a particular focus on one or more of the following impact categories: energy consumption, water consumption, and climate change, including the emissions and the possible sequestration of greenhouse gases.

Additionally, the study was also conducted to support the following certifications, reporting schemes and programs.

1. Living Product Challenge certification:
   Some of the certification criteria within Living Product Challenge, which are referred to as "imperatives", include a requirement related to the characterization of the product's cradle-to-gate footprint on specific impact categories. The required impact categories include climate change, water consumption and energy consumption. Additionally, the imperatives go on to call on manufacturers to identify the five major determinants, referred to as Hotspots, of a product's cradle-to-gate environmental footprints. Ultimately companies are required to establish plans to reduce these footprints and to create positive impacts (called "handprints") which are larger than the remaining footprint. Accomplishing the above requires a company to complete a life cycle assessment (LCA) on the products they are seeking certification for.

2. Greenhouse gas calculations for Scope 3, category 1: Purchased Good and Services:
   The LCA model and results will be used to calculate upstream Greenhouse Gas (GHG) impacts related to the production of Humanscale products. This calculation will then be used to disclosure Scope 3 emissions related to material extraction in Humanscale's annual Carbon Disclosure Project (CDP) submittal.

3. ANSI/BIFMA LEVEL e3 certification:
   LEVEL certification is based on the ANSI/BIFMA e3 standard and includes several credit points for calculation of product impacts through various phases of the life cycle. This LCA will be used to achieve these credits.

4. USGBC LEEDv4.1 MR credit:
   LEEDv4.1 awards point contribution to products that have a third-party verified LCA in accordance to ISO14040. The LCA must be publicly available and include a scope of at least cradle-to-gate. This LCA will be posted publicly and will be used by Humanscale to support their customer's point contribution to this credit.

5. Calculations toward Net Positive impact:
   Humanscale aims to have a net positive impact while manufacturing mass produced goods. Along with reductions in negative impacts from manufacturing, additional positive impacts are created with restorative initiatives. The LCA is used to understand the full amount of negative impacts, and therefore the minimum required amount of positive impacts required to achieve a state of net positive impact.

2.4 TARGET GROUP / AUDIENCE

The intended audience of the study includes:

- Customers, particularly those looking to achieve LEED credits related to product specific LCAs.
- Third-party verification professionals who will confirm compliance to ISO14040/44.
- Third-party verification professionals who will review the documentation to assure conformance to certifications and reporting schemes listed in the Goal and Intended Application section above.
- Employees of Humanscale who will use the LCA information to inform product design and company strategy.

2.5 COMPARATIVE ASSERTIONS AND PUBLIC DISCLOSURE

This LCA will be publicly available; however, this study was not completed with the intent that comparative assertions would be made using its results. Additionally, the study is not comparative in nature and only discloses the impacts associated with single products or groups of products and makes no claims of the environmental performance of the products in the study against other products.

2.6 ISO 14040/44 AND PCR COMPLIANCE

This LCA has been critically reviewed for compliance with;

- ISO 14040/44

There is no applicable BIFMA PCR available for monitor arms. As such, this LCA does not follow a specific PCR but was set up to follow the general format of available BIFMA PCRs as closely as possible.

The critical review statement and checklist are included in the appendix of this document.

3 SCOPE OF THE STUDY

3.1 FUNCTIONAL UNIT

The primary function of the product is to support two monitors. Does not include monitor.

The functional unit for this LCA study shall be one unit of monitor arm to support two monitors, maintained for a 10-year period. The warranty for M/Flex® is 15 years and it is expected to perform at least as long as its warranty period. Replacement parts are not required within this 15-year timeframe.

3.2 PRODUCT DESCRIPTION

3.2.1 Product Description and Specifications

M/Flex® transforms any workspace with unprecedented flexibility and ergonomic performance. Designed for today's agile work environment, users can easily add or remove monitors without disrupting the originally configured installation. This multi-monitor arm system accommodates endless configurations and is fully compatible with Humanscale's next generation monitor arms — providing all of the cutting-edge features of the line.

Model numbers for M/flex® M2.1 begin with 'X2', for M/Flex® M8.1 begin with 'X8' and for M/Flex® M10 begin with 'X10'.

All three products in this LCA have the following features; bracket style: dual bracket for two monitors, mount: two-piece clamp mount, arm style link: 200mm (8") straight link/dynamic link with standard monitor arm tilt, vesa bracket: standard 100mm x 100mm, color: polished aluminum with white trim and 350mm (12") posts.

Figure 1: Product Specifications

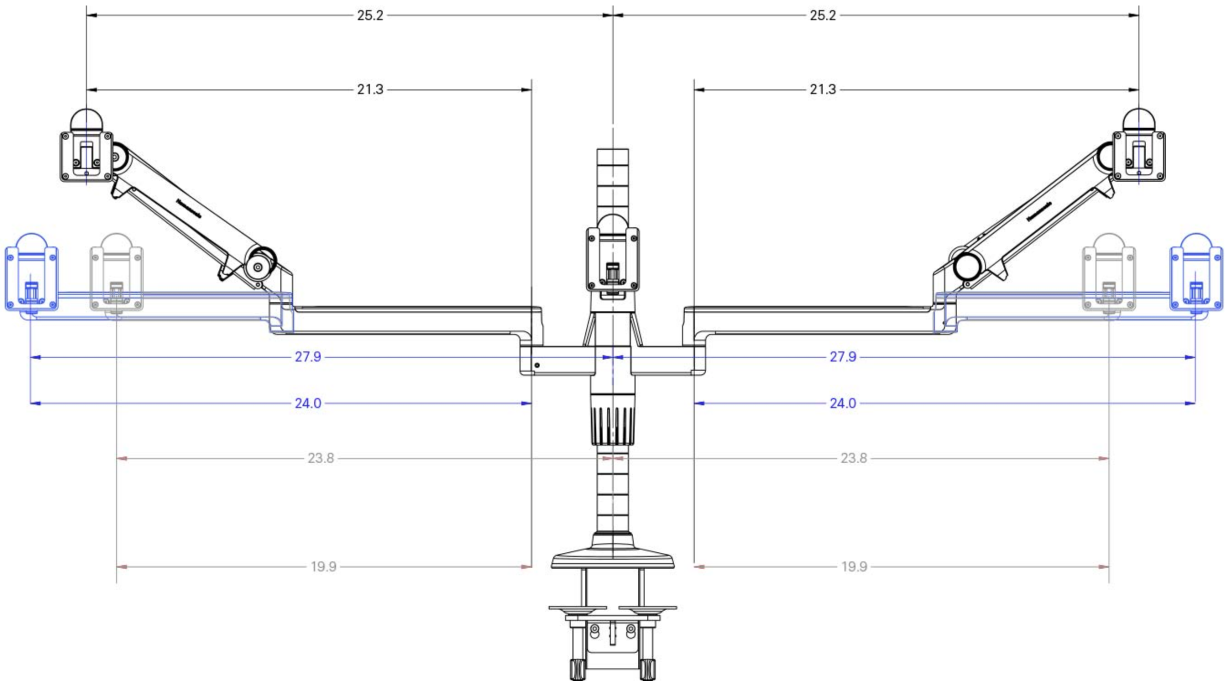


Table 1: Product Specifications	
Weight Capacity	Supports up to 100 lbs
Maximum Arm Reach	Up to 28”
Maximum Height Adjustment	Up to 10” dynamic 30” static
Warranty	15 years, 24/7

3.2.2 Technical Data

Table 2: Technical Details	
Sustainability certification	Declare: HSC-0042
	ANSI/BIFMA LEVEL® 3: SCS-SCF-05105
	HPD Label: M/Flex
VOC emission	Indoor Advantage Gold: SCS-IAQ-02892
UL 1286	Certification #: 20190312-E494239

3.3 SYSTEM BOUNDARY

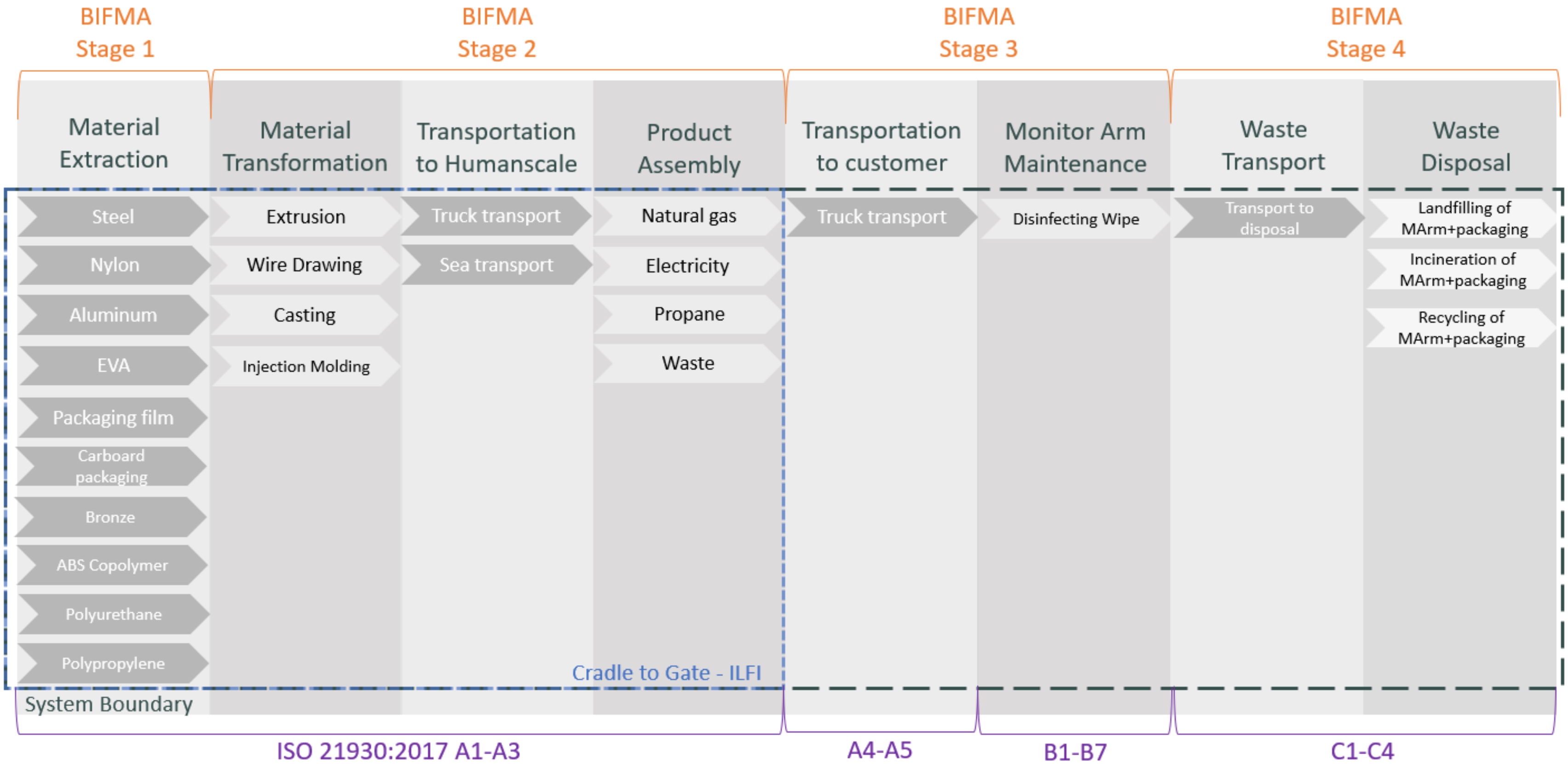
For full cradle-to-grave analysis, the upstream system boundary includes the full cradle-to-gate supply chains of all inputs beginning with material extraction and ending with final assembly of the product by Humanscale. The downstream system boundary begins with shipping of the product to the customer and terminates with product disposal which follows the solid waste treatment percentages of the most current version of the USEPA Municipal Solid Waste data for North America.

Table 3: Summary of Included Life Cycle Stages			
Module Name	BIFMA Life Cycle Stage Name	Analysis Period	Summary of Included Elements
M/Flex M2.1 MatExtract	**Material Acquisition and Pre-processing**	2019	Raw material extraction, transportation and refining including packaging as defined by secondary data.
M/Flex M2.1 MatTrans	**Production (Manufacturing / Assembly)**	2019	Manufacturing of components.
M/Flex M2.1 Trspt to HS	**Production (Manufacturing / Assembly)**	2019	Transportation of product components to Humanscale. Primary data is used.
Assembly	**Production (Manufacturing / Assembly)**	2019	Final assembly and packing at Humanscale facility. Primary data is used for electricity, natural gas and waste.
M/Flex M2.1 Trspt to Cust	**Distribution, storage, and use**	2019	Transportation to customer. Farthest shipping distance via frieght truck is assumed.
Monitor Arm Maintenance	**Distribution, storage, and use**	2019	Cleaning of product.
M/Flex M2.1 EOL Trspt	**End of life**	2019	Transportation of product and product packaging to disposal facility.
M/Flex M2.1 EOL Disposal	**End of Life**	2019	Landfilling and incernerating of packaging and product parts.

Figure 1: System Boundary Diagram shows the full scope of the model which has been developed using primary and secondary data. All secondary data used in the model have multiple inputs from the ecoinvent database, and ultimately the full system (with foreground and background data) contains thousands of unit processes.

The system model includes production of raw materials, as well as all inputs of energy, water, inbound transport, and waste, outbound transportation to customer, use phase, and end of life including transportation and treatment of waste.

Figure 2: System Boundary Diagram



3.4 MATERIAL ACQUISITION AND PRE-PROCESSING STAGE

This stage includes raw material extraction, transportation to suppliers' facilities, material refining including:

- Material extraction including scrap material
- Waste created during material processing, including the transportation of the waste created to landfill or recycling facility
- Material primary processing
- Interfacility transportation
- Materials used in packaging of the final product
- Transportation to the production stage

Table 4: Material Composition (grams)			
	M/Flex M2.1	M/Flex M8.1	M/Flex M10
Plastic	367.80	383.82	677.10
Aluminum	3,928.41	4,933.32	4,904.46
Steel	3,189.84	3,197.32	3,429.08
Bronze	0	0	11
Packaging	1,820.76	1,820.76	1,820.76
Other / Omitted	93.9	132.34	148.85
Total Weight	9,400.70	10,467.56	10,991.25

In this phase, primary data was used for the amount of scrap generated during each process. Humanscale has gathered scrap information from first-tier suppliers. This material has been accounted for in Section 3.4. For waste generation and transportation, default values within the ecoinvent dataset were used.

For transportation to the production stage, default values in the ecoinvent database were used.

3.5 PRODUCTION

This stage includes manufacturing of main parts and components, transportation to Humanscale location, final assembly and packaging, including:

- Manufacturing of main furniture components from basic raw materials
- Transportation to Humanscale's factory gate for assembly
- Transportation between Humanscale facilities, if applicable
- Product assembly, including the use of ancillary materials necessary for production, if applicable
- Product packaging
- Waste creation and processing
- Energy inputs

No additional preparation of the final product, including forming, surface treatment, machining and/or other processes occurs.

In this phase, primary data for waste material transportation was calculated using the default value of 32 kilometers (20 miles) since primary data was not available. For secondary data, waste transportation values were embedded in the LCA dataset used.

Waste generated at Humanscale facilities were based on primary data. For secondary data, waste destination parameters were embedded within the datasets used.

The are no additional inputs beyond what has been accounted for in the product's raw materials that are required for the assembly and install of the product.

3.6 DISTRIBUTION, STORAGE, AND USE

This stage includes all materials, energy and waste related to product transport to customer and monitor arm use/maintenance.

- Transportation from manufacturing gate to customer
- Product maintenance (cleaning with disinfecting wipe once monthly)

Except in rare cases, the product is shipped direct to customer. As such, storage is not relevant. Additionally, there is no energy or additional inputs required for operation and use and the product does not change the operational efficiency of the building. This same statement can be said for water. Repair and refurbishment happens infrequently and did not need to be accounted for.

Transportation mode and distances in this phase was based on primary data. The value utilized represents the furthest customer from the assembly location. The average farthest shipping distance for all final assembly locations is 3,624 kilometers.

3.7 END OF LIFE MANAGEMENT

This stage includes transportation of the product and packaging to the end of life facility. Even though Humanscale products are highly recyclable and come with disassembly instructions, the product is assumed to be landfilled, incinerated and recycled based on EPA Recycling Rates for North America. Collection of end of life product and packaging distances are based on the current USEPA WARM Model. All waste materials are assumed to be disposed of in the North America for products assembled in North America facilities. North American EPA data was used for end of life modeling in Dublin as well in absence of European-specific hauling distances and recycling rates.

Geographic specificity of the dataset used to represent product landfilling was global in nature.

Table 5: End of Life Management						
Product	Material Type	Weight (grams)	Recycling Rate*	Weight Recycled (grams)	Weight Incinerated (grams)**	Weight Landfilled (grams)**
M/Flex M2.1	Plastic	387.80	8.37%	32.45	284.28	71.07
	Paperboard	1,800.76	65.92%	1,186.98	491.02	122.76
	Aluminum	3,928.41	16.19%	635.93	2,633.98	658.50
	Ferrous metals	3,189.84	32.66%	1,041.89	1,718.36	429.59
M/Flex M8.1	Plastic	403.82	8.37%	33.79	296.02	74.01
	Paperboard	1,800.76	65.92%	1,186.98	491.02	122.76
	Aluminum	4,933.32	16.19%	798.61	3,307.77	826.94
	Ferrous metals	3,197.32	32.66%	1,044.33	1,722.39	430.60
M/Flex M10	Plastic	697.1	8.37%	58.34	511.01	127.75
	Paperboard	1,800.76	65.92%	1,186.98	491.02	122.76
	Aluminum	4,904.46	16.19%	793.93	3,288.42	822.11
	Ferrous metals	3,429.08	32.66%	1,120.03	1,847.24	461.81
	Non-ferrous metals	11.00	66.09%	7.27	2.98	0.75

*Recycling rates from the 2017 EPA Sustainable Materials Management (SMM) – Materials and Waste Management in the United States Key Facts and Figures.
** 80% of the material not recycled should be modeled using landfill and 20% using incineration.

3.8 CUT-OFF CRITERIA

This LCA follows typical cut-off criteria requirements, which allows flows less than 1% to be omitted if their omission is justified. Cumulatively all mass and energy omitted cannot exceed 5%.

For this study, Humanscale attempted to include all known mass and energy flows. Some flows were omitted due to data quality restrictions. Specially, the following flows were omitted:

- The system model omits all Acetal POM components because the Ecoinvent database does not have this input material nor could we find one that was close enough for use as a substitute. The Acetal POM that was omitted totaled 31.11 grams for M/Flex® for M2.1 (0.33%), 43.29 grams for M/Flex® for M8.1 (0.41%) and 36.89 grams for M/Flex® for M10 (0.34%).
- The system model also omits zinc, totaling 53.71 grams for M/Flex® for M2.1 (0.57%), 79.54 grams for M/Flex® for M8.1 (0.76%), and 106.29 grams for M/Flex® for M10 (0.97%).
- Lastly, the system model omits Acrylic (PMMA) and powder coating, totaling 9.08 grams for M/Flex® for M2.1 (0.1%), 9.47 grams for M/Flex® for M8.1 (0.09%), and 5.66 grams for M/Flex® for M10 (0.05%).
- In total, the system model omits less than 1.4% of each products' total weight.

3.9 ALLOCATION PROCEDURES

For primary data, mass allocation was used to model waste and energy inputs. For this, the total weight of the monitor arm was divided by the total weight of all products produced in the Humanscale facility during the 2019 calendar year to proportionately allocate waste and energy. For background processes we used the Ecoinvent database, version 3.6 APOS, which implements an attributional modeling approach; "APOS" refers to "allocation at the point of substitution."

3.10 DATA QUALITY REQUIREMENTS

3.10.1 Geographical Coverage

Final manufacturing of the product occurs in three Humanscale facilities in North America & Europe, and the product is shipped to customers globally. For the purpose of this report, nine LCA models have been created to represent the impacts of the monitor arms specific to their final assembly location and their supply chains. The model accounts for applicable interfacility transportation.

Unites States

220 Circle Dr N,
Piscataway, NJ 08854

Ireland

IDA Industrial Estate Poppinntree
Finglas
Dublin 11

Mexico

Calzada Industrial de las Maquiladoras
#190
Nueva Nogales 84094

3.10.2 Time Coverage

The study is meant to reflect current conditions, using primary data from the most recent full calendar year available, 2019.

3.10.3 Technical Coverage

Primary data was retrieved from Humanscale utility and waste hauling bills from the most current complete calendar year (2019), is site-specific and considered of good quality. The energy used in manufacturing includes the overhead energy (lighting, heating, etc.) of the entire facility. Sub-metering was not available to extract process energy use from the total energy use. Sub-metering would improve the technological coverage of data quality.

For secondary data, we use the most current version of the Ecoinvent database, version 3.6.

In cases where proxy data must be used, we compare the available options and use the most conservative option (the one which yields higher cradle-to-gate impacts on one or more of the three impact categories indicated in the goal and scope). Secondary data used in this study are listed in Table 6 below. In general, secondary data was of overall good quality, however regional specificity was lacking. This was due to the lack of availability of regionally specific data in the ecoinvent database. No flows were knowingly excluded from the study.

Table 6: Secondary Dataset Reference					
Dataset	Source	Time Coverage	Geographical Coverage	Technical Coverage	Overall Representativeness
market for acrylonitrile-butadiene-styrene copolymer	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography

market for aluminium, cast alloy	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for nylon 6	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
packaging film, low density polyethylene	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for polypropylene, granulate	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for polyurethane, rigid foam	Ecoinvent	Within 5-year period	GLO	Used as proxy for TPU	Good, closest technology, not exact geography
market for steel, unalloyed	Ecoinvent	Within 5-year period	ROW	Appropriate technology	Great, appropriate technology but not exact geography
corrugated board box	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
market for bronze	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for ethylene vinyl acetate copolymer	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
market for impact extrusion of aluminum	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for impact extrusion of steel	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for casting, bronze	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for injection moulding	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
market for wire drawing, steel	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Great, appropriate technology but not exact geography
transport, freight, lorry 16-32 metric ton, EURO4	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Excellent
transport, freight, sea, transoceanic tanker	Ecoinvent	Within 5-year period	GLO	Appropriate technology	Excellent
market for electricity, low voltage	Ecoinvent	Within 5-year period	Mexico	Appropriate technology	Excellent
market for electricity, low voltage	Ecoinvent	Within 5-year period	Ireland	Appropriate technology	Excellent
market for electricity, low voltage	Ecoinvent	Within 10-year period	RFC	Appropriate technology	Excellent
municipal solid waste	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Good, appropriate technology but not exact geography

municipal waste collection service by 21 metric ton lorry	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
market for natural gas, low pressure	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
natural gas production, propane	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
soap	Ecoinvent	Within 5-year period	RoW	Used as proxy for cleaner in disinfecting wipe	Good, closest technology, not exact geography
market for tap water	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
market for textile, non woven polyester	Ecoinvent	Within 5-year period	RoW	Used as proxy for wipe	Good, closest technology, not exact geography
market for polyethylene terephthalate, granulate, bottle grade	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of scrap aluminium, municipal incineration	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of waste aluminium, sanitary landfill	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of waste paperboard, municipal incineration	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of waste paperboard, sanitary landfill	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of scrap steel paperboard, municipal incineration	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography
treatment of scrap steel paperboard, sanitary landfill	Ecoinvent	Within 5-year period	RoW	Appropriate technology	Great, appropriate technology but not exact geography

3.10.4 Treatment of Missing Data

We leave upstream supply chain electricity modeling (embedded within the background database) unaltered. The recycled content amounts are supplied to Humanscale directly from the vendor of each material. We did not have primary data on customer use, however it was assumed that the customer will clean their monitor arm in in accordance with Humanscale's Cleaning Instructions for Humanscale Monitor Arm Products. All Humanscale products come with Disassembly Instructions and are highly recyclable, however the model assumes the product is landfilled, incinerated and recycled based on the current USEPA WARM Model.

4 LIFE CYCLE INVENTORY ANALYSIS

4.1 DATA COLLECTION AND CALCULATION PROCEDURES

Primary data was used for all bill-of-material items, as well as all inputs of energy, inbound transport, waste, and outbound transportation.

Primary data were obtained from the following sources. Solidworks CAD models were used to provide a full bill of materials, listing each part, it's material, and part weight. Infor, Humanscale's ERP system, which is used for ordering components, provided the name of supplier, their address, and common shipping method for all components ordered. Trucking distances were calculated using Google Maps, and ocean freight distances were estimated by using Searoutes.com. Amount of scrap was provided by the suppliers directly or estimated. Energy use in the facility of final assembly was calculated based on primary data.

Neither normalization nor weighting have been used in this study. Results are presented at the midpoint level. We include the ISO-required LCIA disclaimer here: "ISO 14044 does not specify any specific methodology or support the underlying value choices used to group the impact categories. Any value-choices and judgments embedded within the grouping procedures are the sole responsibilities of the commissioner of the study (e.g. government, community, organization, etc.)"

4.2 LIMITATIONS OF THE STUDY

LCA is a method used to assess potential rather than actual impacts. Consistent with our Goal and Scope, we obtained primary data for the final manufacturing step, and used secondary data for the background processes including the supply chain processes.

Due to the assumptions and value choices listed above, these do not reflect real-life scenarios and hence they cannot assess actual and exact impacts, but only potential environmental impacts. The results presented here should not be used as-is in a comparative assessment with competing products.

Some limitations to the study have been identified as follows:

- A significant limitation of the study was the availability of geographically appropriate datasets. More accurate datasets would have improved the accuracy of the study.
- Availability of primary data for suppliers' energy use, waste and transportation values would have been ideal but was not available.

5 LIFE CYCLE IMPACT ASSESSMENT

5.1 SELECTION OF IMPACT PARAMETERS

Environmental Impacts were calculated using the OpenLCA software platform. Impact results have been calculated using both TRACI 2.1 and ReCiPe 2016 Midpoint (H) characterization factors. Although there is no BIFMA PCR for this product category, the LCA uses TRACI 2.1 based on the requirements of other PCRs BIFMA has published. ReCiPe 2016 Midpoint (H) is also used as it is required by ILFI. Specific impact parameters were selected based on the requirements of the ILFI Living Product Challenge Certification requirements and requirements listed for LCA in the LEED V4.1 standard. Per ISO 14040/44: LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Table 7: Impact Parameters			
Required By	**Abbreviation**	**Parameter**	**Unit**
TRACI 2.1			
BIFMA	AP	Acidification Potential	kg SO2 eq
BIFMA	EP	Eutrophication Potential	kg N eq
BIFMA / ILFI	GWP	Global Warming Potential	kg CO2 eq
BIFMA	OD	Ozone Depletion	kg CFC-11 eq
BIFMA	Smog	Smog	kg O3 eq
ReCiPe 2016 Midpoint (H)			
ILFI	WC	Water Consumption	m3
ILFI	FS	Fossil Resource Scarcity	kg oil eq

5.2 LCA RESULTS

All results are given per functional unit as stated in in Section 3.1, which is one monitor arm to provide support to one monitor.

5.2.1 M/Flex® for M2.1

Table 8: M/Flex for M2.1 Piscataway LCA Results

		LPC Boundary				
Method	**Impact Category**	**Material Acquisition and Pre-processing**	**Production (Manufacturing / Assembly)**	**Distribution, storage, and use**	**End of Life**	**Cradle to Grave Total**
TRACI 2.1	AP (kg SO2 eq)	3.77E-02	5.44E-02	2.97E-02	4.23E-03	1.26E-01
	EP (kg N eq)	3.67E-02	4.52E-02	1.13E-02	9.60E-03	1.03E-01
	GWP (kg CO2 eq)	1.16E+01	9.20E+00	7.08E+00	1.52E+00	2.94E+01
	OD (kg CFC 11 eq)	5.96E-07	1.01E-06	1.43E-06	1.48E-07	3.19E-06
	Smog (kg O3 eq)	4.98E-01	7.48E-01	6.41E-01	8.19E-02	1.97E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.64E-02	7.77E-02	3.51E-02	8.85E-03	2.18E-01
	FS (kg oil-Eq)	2.64E+00	2.39E+00	2.56E+00	2.13E-01	7.81E+00

Table 9: M/Flex for M2.1 Dublin LCA Results						
		LPC Boundary				
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	3.77E-02	5.27E-02	3.06E-02	4.23E-03	1.25E-01
	EP (kg N eq)	3.67E-02	4.24E-02	1.15E-02	9.60E-03	1.00E-01
	GWP (kg CO2 eq)	1.16E+01	8.83E+00	7.27E+00	1.52E+00	2.92E+01
	OD (kg CFC 11 eq)	5.96E-07	9.05E-07	1.48E-06	1.48E-07	3.13E-06
	Smog (kg O3 eq)	4.98E-01	7.28E-01	6.60E-01	8.19E-02	1.97E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.64E-02	7.56E-02	3.54E-02	8.85E-03	2.16E-01
	FS (kg oil-Eq)	2.64E+00	2.24E+00	2.63E+00	2.13E-01	7.71E+00

Table 10: M/Flex for M2.1 Nogales LCA Results							
		LPC Boundary					
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	3.77E-02	5.48E-02	2.88E-02	4.23E-03	1.26E-01
	EP (kg N eq)	3.67E-02	4.83E-02	1.10E-02	9.60E-03	1.06E-01
	GWP (kg CO2 eq)	1.16E+01	1.07E+01	6.86E+00	1.52E+00	3.07E+01
	OD (kg CFC 11 eq)	5.96E-07	1.15E-06	1.38E-06	1.48E-07	3.28E-06
	Smog (kg O3 eq)	4.98E-01	7.31E-01	6.19E-01	8.19E-02	1.93E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.64E-02	7.93E-02	3.47E-02	8.85E-03	2.19E-01
	FS (kg oil-Eq)	2.64E+00	2.89E+00	2.49E+00	2.13E-01	8.23E+00

5.2.2 M/Flex® for M8.1

Table 11: M/Flex for M8.1 Piscataway LCA Results							
		LPC Boundary					
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	3.50E-02	6.60E-02	3.25E-02	4.91E-03	1.38E-01
	EP (kg N eq)	3.40E-02	5.58E-02	1.20E-02	1.02E-02	1.12E-01
	GWP (kg CO2 eq)	1.09E+01	1.14E+01	7.72E+00	1.64E+00	3.17E+01
	OD (kg CFC 11 eq)	5.45E-07	1.29E-06	1.58E-06	1.68E-07	3.59E-06
	Smog (kg O3 eq)	4.67E-01	9.17E-01	7.05E-01	9.27E-02	2.18E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.26E-02	8.79E-02	3.62E-02	1.06E-02	2.27E-01
	FS (kg oil-Eq)	2.60E+00	3.01E+00	2.78E+00	2.45E-01	8.63E+00

Table 12: M/Flex for M8.1 Dublin LCA Results						
		LPC Boundary				
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	3.50E-02	6.33E-02	3.34E-02	4.91E-03	1.37E-01
	EP (kg N eq)	3.40E-02	5.27E-02	1.23E-02	1.02E-02	1.09E-01
	GWP (kg CO2 eq)	1.09E+01	1.10E+01	7.93E+00	1.64E+00	3.15E+01
	OD (kg CFC 11 eq)	5.45E-07	1.17E-06	1.63E-06	1.68E-07	3.51E-06
	Smog (kg O3 eq)	4.67E-01	8.83E-01	7.26E-01	9.27E-02	2.17E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.26E-02	8.55E-02	3.66E-02	1.06E-02	2.25E-01
	FS (kg oil-Eq)	2.60E+00	2.82E+00	2.85E+00	2.45E-01	8.52E+00

Table 13: M/Flex for M8.1 Nogales LCA Results							
		LPC Boundary					
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	3.50E-02	6.61E-02	3.14E-02	4.91E-03	1.37E-01
	EP (kg N eq)	3.40E-02	5.93E-02	1.17E-02	1.02E-02	1.15E-01
	GWP (kg CO2 eq)	1.09E+01	1.31E+01	7.48E+00	1.64E+00	3.32E+01
	OD (kg CFC 11 eq)	5.45E-07	1.45E-06	1.53E-06	1.68E-07	3.69E-06
	Smog (kg O3 eq)	4.67E-01	8.94E-01	6.81E-01	9.27E-02	2.13E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	9.26E-02	8.97E-02	3.58E-02	1.06E-02	2.29E-01
	FS (kg oil-Eq)	2.60E+00	3.55E+00	2.70E+00	2.45E-01	9.10E+00

5.2.3 M/Flex® for M10

Table 14: M/Flex for M10 Piscataway LCA Results

Method	Impact Category	LPC Boundary: Material Acquisition and Pre-processing	LPC Boundary: Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	4.73E-02	7.36E-02	3.38E-02	5.07E-03	1.60E-01
	EP (kg N eq)	4.11E-02	6.36E-02	1.24E-02	1.31E-02	1.30E-01
	GWP (kg CO2 eq)	1.34E+01	1.31E+01	8.03E+00	1.81E+00	3.63E+01
	OD (kg CFC 11 eq)	6.11E-07	1.47E-06	1.66E-06	1.75E-07	3.92E-06
	Smog (kg O3 eq)	5.66E-01	1.02E+00	7.37E-01	9.70E-02	2.42E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	1.28E-01	1.08E-01	3.68E-02	1.09E-02	2.84E-01
	FS (kg oil-Eq)	3.81E+00	3.48E+00	2.89E+00	2.54E-01	1.04E+01

Table 15: M/Flex for M10 Dublin LCA Results						
		LPC Boundary				
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	4.73E-02	7.07E-02	3.48E-02	5.07E-03	1.58E-01
	EP (kg N eq)	4.11E-02	6.01E-02	1.26E-02	1.31E-02	1.27E-01
	GWP (kg CO2 eq)	1.34E+01	1.26E+01	8.25E+00	1.81E+00	3.60E+01
	OD (kg CFC 11 eq)	6.11E-07	1.34E-06	1.71E-06	1.75E-07	3.84E-06
	Smog (kg O3 eq)	5.66E-01	9.79E-01	7.59E-01	9.70E-02	2.40E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	1.28E-01	1.06E-01	3.72E-02	1.09E-02	2.82E-01
	FS (kg oil-Eq)	3.81E+00	3.27E+00	2.97E+00	2.54E-01	1.03E+01

Table 16: M/Flex for M10 Nogales LCA Results						
		LPC Boundary				
Method	Impact Category	Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)	Distribution, storage, and use	End of Life	Cradle to Grave Total
TRACI 2.1	AP (kg SO2 eq)	4.73E-02	7.08E-02	3.27E-02	5.07E-03	1.56E-01
	EP (kg N eq)	4.11E-02	6.65E-02	1.21E-02	1.31E-02	1.33E-01
	GWP (kg CO2 eq)	1.34E+01	1.42E+01	7.78E+00	1.81E+00	3.72E+01
	OD (kg CFC 11 eq)	6.11E-07	1.49E-06	1.60E-06	1.75E-07	3.88E-06
	Smog (kg O3 eq)	5.66E-01	9.25E-01	7.11E-01	9.70E-02	2.30E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	1.28E-01	1.09E-01	3.63E-02	1.09E-02	2.85E-01
	FS (kg oil-Eq)	3.81E+00	3.84E+00	2.80E+00	2.54E-01	1.07E+01

5.3 TOP 5 PROCESSES CONTRIBUTING TO ENERGY CONSUMPTION

In connection with the Living Product Challenge Impetrative 06 Energy Footprint, the table below presents the five processes that make the largest contributions to the cradle-to-gate (as defined by the ILFI) energy footprint of M/Flex® for M2.1, M8.1 and M10. From the results below, it is clear that the top contributors to the energy footprint of the products are related to raw material sourcing and pre-processing. Specifically, steel used in the L-bracket, bracket clamp and vesa plate, and aluminum for the straight link and post are significant contributors. Furthermore, the relative impacts of the top contributors are roughly the same across all final assembly locations for all three monitor arms.

Table 17: Top 5 Processes Contributing to Energy Consumption ReCiPe 2016 Midpoint (H)

	Final Assembly Location	Process	%	Kg oil-Eq
M/Flex M2.1	Piscataway NJ	market for steel, unalloyed	27.83%	1.40E+00
		market for impact extrusion of aluminium	16.46%	8.28E-01
		market for acrylonitrile-butadiene-styrene copolymer	13.81%	6.95E-01
		market for impact extrusion of steel, cold	12.56%	6.32E-01
		corrugated board box production	6.31%	3.17E-01
	Dublin IE	market for steel, unalloyed	28.73%	1.40E+00
		market for impact extrusion of aluminium	17.00%	8.28E-01
		market for acrylonitrile-butadiene-styrene copolymer	14.26%	6.95E-01
		market for impact extrusion of steel, cold	12.97%	6.32E-01
		corrugated board box production	6.52%	3.17E-01
	Nogales MX	market for steel, unalloyed	25.34%	1.40E+00
		market for impact extrusion of aluminium	15.00%	8.28E-01
		market for electricity, low voltage	12.65%	6.99E-01
		market for acrylonitrile-butadiene-styrene copolymer	12.58%	6.95E-01
		market for impact extrusion of steel, cold	11.44%	6.32E-01
M/Flex M8.1	Piscataway NJ	market for steel, unalloyed	22.94%	1.29E+00
		market for impact extrusion of aluminium	21.40%	1.20E+00
		market for acrylonitrile-butadiene-styrene copolymer	14.64%	8.21E-01
		market for impact extrusion of steel, cold	11.71%	6.57E-01
		transport, freight, sea	5.77%	3.24E-01
	Dublin IE	market for steel, unalloyed	23.71%	1.29E+00
		market for impact extrusion of aluminium	22.12%	1.20E+00
		market for acrylonitrile-butadiene-styrene copolymer	15.14%	8.21E-01
		market for impact extrusion of steel, cold	12.11%	6.57E-01
		corrugated board box production	5.85%	3.17E-01
	Nogales MX	market for steel, unalloyed	20.90%	1.29E+00
		market for impact extrusion of aluminium	19.49%	1.20E+00
		market for acrylonitrile-butadiene-styrene copolymer	13.34%	8.21E-01
		market for electricity, low voltage	12.61%	7.76E-01
		market for impact extrusion of steel, cold	10.67%	6.57E-01

M/Flex M10	Piscataway NJ	market for acrylonitrile-butadiene-styrene copolymer	27.90%	2.03E+00
		market for impact extrusion of aluminium	19.13%	1.39E+00
		market for steel, unalloyed	16.76%	1.22E+00
		market for impact extrusion of steel, cold	8.50%	6.19E-01
		market for injection moulding	5.83%	4.25E-01
	Dublin IE	market for acrylonitrile-butadiene-styrene copolymer	28.70%	2.03E+00
		market for impact extrusion of aluminium	19.68%	1.39E+00
		market for steel, unalloyed	17.24%	1.22E+00
		market for impact extrusion of steel, cold	8.75%	6.19E-01
		market for injection moulding	6.00%	4.25E-01
	Nogales MX	market for acrylonitrile-butadiene-styrene copolymer	26.58%	2.03E+00
		market for impact extrusion of aluminium	18.23%	1.39E+00
		market for steel, unalloyed	15.97%	1.22E+00
		market for electricity, low voltage	10.65%	8.14E-01
		market for impact extrusion of steel, cold	8.10%	6.19E-01

5.4 TOP 5 PROCESSES CONTRIBUTING TO CARBON FOOTPRINT

In connection with the Living Product Challenge Impetrative 14 Net Positive Carbon, the table below presents the five processes that make the largest contributions to the cradle-to-gate (as defined by the ILFI) carbon footprint of M/Flex® for M2.1, M8.1 and M10. From the results below, it is clear that the top contributors to the carbon footprint of the products are related to raw material sourcing and pre-processing. Specifically, steel used in the L-bracket, bracket clamp and vesa plate, and aluminum for the straight link and post are significant contributors. Furthermore, the relative impacts of the top contributors are roughly the same across all final assembly locations for all three monitor arms.

Table 18: Top 5 Processes Contributing to Carbon Footprint TRACI 2.1

	Final Assembly Location	Process	%	Kg CO2-Eq
M/Flex M2.1	Piscataway NJ	market for steel, unalloyed	40.10%	8.35E+00
		market for impact extrusion of aluminium	16.67%	3.47E+00
		market for impact extrusion of steel, cold	13.22%	2.75E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.22%	1.50E+00
		corrugated board box production	5.30%	1.10E+00
	Dublin IE	market for steel, unalloyed	40.83%	8.35E+00
		market for impact extrusion of aluminium	16.97%	3.47E+00
		market for impact extrusion of steel, cold	13.46%	2.75E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.35%	1.50E+00
		corrugated board box production	5.39%	1.10E+00
	Nogales MX	market for steel, unalloyed	37.39%	8.35E+00
		market for impact extrusion of aluminium	15.54%	3.47E+00
		market for impact extrusion of steel, cold	12.33%	2.75E+00
		market for electricity, low voltage	10.09%	2.25E+00
		market for acrylonitrile-butadiene-styrene copolymer	6.73%	1.50E+00

M/Flex M8.1	Piscataway NJ	market for steel, unalloyed	34.27%	7.67E+00
		market for impact extrusion of aluminium	22.45%	5.03E+00
		market for impact extrusion of steel, cold	12.78%	2.86E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.93%	1.78E+00
		corrugated board box production	4.93%	1.10E+00
	Dublin IE	market for steel, unalloyed	34.96%	7.67E+00
		market for impact extrusion of aluminium	22.90%	5.03E+00
		market for impact extrusion of steel, cold	13.03%	2.86E+00
		market for acrylonitrile-butadiene-styrene copolymer	8.09%	1.78E+00
		corrugated board box production	5.02%	1.10E+00
	Nogales MX	market for steel, unalloyed	31.88%	7.67E+00
		market for impact extrusion of aluminium	20.89%	5.03E+00
		market for impact extrusion of steel, cold	11.89%	2.86E+00
		market for electricity, low voltage	10.40%	2.50E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.38%	1.78E+00
M/Flex M10	Piscataway NJ	market for steel, unalloyed	27.54%	7.28E+00
		market for impact extrusion of aluminium	22.08%	5.84E+00
		market for acrylonitrile-butadiene-styrene copolymer	16.62%	4.40E+00
		market for impact extrusion of steel, cold	10.20%	2.70E+00
		market for injection moulding	4.93%	1.31E+00
	Dublin IE	market for steel, unalloyed	28.06%	7.28E+00
		market for impact extrusion of aluminium	22.50%	5.84E+00
		market for acrylonitrile-butadiene-styrene copolymer	16.94%	4.40E+00
		market for impact extrusion of steel, cold	10.39%	2.70E+00
		market for injection moulding	5.03%	1.31E+00
	Nogales MX	market for steel, unalloyed	26.41%	7.28E+00
		market for impact extrusion of aluminium	21.17%	5.84E+00
		market for acrylonitrile-butadiene-styrene copolymer	15.94%	4.40E+00
		market for impact extrusion of steel, cold	9.78%	2.70E+00
		market for electricity, low voltage	9.52%	2.63E+00

5.5 TOP 5 PROCESS CONTRIBUTING TO WATER DEPLETION

In connection with the Living Product Challenge Impetrative 04 Water Footprint, the table below presents the five processes that make the largest contributions to the cradle-to-gate (as defined by the ILFI) water footprint of M/Flex® for M2.1, M8.1 and M10. From the results below, it is clear that the top contributors to the water footprint of the products are related to raw material sourcing and pre-processing. Furthermore, the relative impacts of the top contributors are roughly the same across all final assembly locations for all three monitor arms.

Table 19: Top 5 Processes Contributing to Water Footprint ReCiPe 2016 Midpoint (H)				
	Final Assembly Location	**Process**	**%**	**Kg CO2-Eq**
M/Flex M2.1	Piscataway NJ	market for steel, unalloyed	31.11%	5.42E-02
		market for impact extrusion of aluminium	18.90%	3.29E-02
		market for impact extrusion of steel	11.88%	2.07E-02
		market for acrylonitrile-butadiene-styrene copolymer	11.19%	1.95E-02
		corrugated board box production	8.94%	1.56E-02
	Dublin IE	market for steel, unalloyed	31.50%	5.42E-02
		market for impact extrusion of aluminium	19.13%	3.29E-02
		market for impact extrusion of steel, cold	12.03%	2.07E-02
		market for acrylonitrile-butadiene-styrene copolymer	11.33%	1.95E-02
		corrugated board box production	9.06%	1.56E-02
	Nogales MX	market for steel, unalloyed	30.83%	5.42E-02
		market for impact extrusion of aluminium	18.73%	3.29E-02
		market for impact extrusion of steel, cold	11.77%	2.07E-02
		market for acrylonitrile-butadiene-styrene copolymer	11.09%	1.95E-02
		corrugated board box production	8.86%	1.56E-02
M/Flex M8.1	Piscataway NJ	market for steel, unalloyed	27.57%	4.98E-02
		market for impact extrusion of aluminium	26.40%	4.76E-02
		market for acrylonitrile-butadiene-styrene copolymer	12.76%	2.30E-02
		market for impact extrusion of steel, cold	11.91%	2.15E-02
		corrugated board box production	8.63%	1.56E-02
	Dublin IE	market for steel, unalloyed	27.95%	4.98E-02
		market for impact extrusion of aluminium	26.76%	4.76E-02
		market for acrylonitrile-butadiene-styrene copolymer	12.93%	2.30E-02
		market for impact extrusion of steel, cold	12.07%	2.15E-02
		corrugated board box production	8.75%	1.56E-02
	Nogales MX	market for steel, unalloyed	27.30%	4.98E-02
		market for impact extrusion of aluminium	26.14%	4.76E-02
		market for acrylonitrile-butadiene-styrene copolymer	12.63%	2.30E-02
		market for impact extrusion of steel, cold	11.79%	2.15E-02
		corrugated board box production	8.55%	1.56E-02
M/Flex M10	Piscataway NJ	market for acrylonitrile-butadiene-styrene copolymer	24.10%	5.70E-02
		market for impact extrusion of aluminium	23.41%	5.54E-02
		market for steel, unalloyed	19.98%	4.73E-02
		market for impact extrusion of steel, cold	8.57%	2.03E-02
		corrugated board box production	6.59%	1.56E-02
	Dublin IE	market for acrylonitrile-butadiene-styrene copolymer	24.37%	5.70E-02
		market for impact extrusion of aluminium	23.67%	5.54E-02
		market for steel, unalloyed	20.20%	4.73E-02
		market for impact extrusion of steel, cold,	8.67%	2.03E-02
		corrugated board box production	6.66%	1.56E-02

	Nogales MX	market for acrylonitrile-butadiene-styrene copolymer	24.02%	5.70E-02
		market for impact extrusion of aluminium	23.33%	5.54E-02
		market for steel, unalloyed	19.91%	4.73E-02
		market for impact extrusion of steel, cold	8.54%	2.03E-02
		corrugated board box production	6.56%	1.56E-02

5.6 SENSITIVITY ANALYSIS

Table 20: Sensitivity Analysis Results

Factor	BIFMA Life Cycle Stage Name	Model	GWP (kg CO2 eq)		% Change
			Original	After Change	
Allocation method: economic instead of mass allocation	Production (Manufacturing / Assembly)	M/Flex M2.1	2.94E+01	2.87E+01	-2.54%
		M/Flex M8.1	3.17E+01	3.09E+01	-2.69%
		M/Flex M10	3.63E+01	3.54E+01	-2.49%
Electricity used in assembly: GLO instead of RFC electrical grid.	Production (Manufacturing / Assembly)	M/Flex M2.1	2.94E+01	2.95E+01	0.34%
		M/Flex M8.1	3.17E+01	3.18E+01	0.35%
		M/Flex M10	3.63E+01	3.64E+01	0.32%
Electricity used in assembly: reduced by 10%	Production (Manufacturing / Assembly)	M/Flex M2.1	2.94E+01	2.94E+01	-0.23%
		M/Flex M8.1	3.17E+01	3.17E+01	-0.23%
		M/Flex M10	3.63E+01	3.62E+01	-0.21%
Shipping Distance: half the mileage. (Original model assumes farthest shipping distance to customer)	Distribution, storage, and use	M/Flex M2.1	2.94E+01	2.65E+01	-9.82%
		M/Flex M8.1	3.17E+01	2.85E+01	-10.11%
		M/Flex M10	3.63E+01	3.29E+01	-9.27%
Waste shipping: half the distance at end of life	End of Life	M/Flex M2.1	2.94E+01	2.92E+01	-0.64%
		M/Flex M8.1	3.17E+01	3.15E+01	-0.66%
		M/Flex M10	3.63E+01	3.61E+01	-0.61%

6 INTERPRETATION

As shown in Section 5.3, 5.4 and 5.5, most of the top five processes within the cradle-gate (as defined by the International Living Future Institute) life cycle stages of M/Flex® for M2.1, M8.1 and M10, that rank highest in terms of their total contributions to carbon, energy and water consumption, take place during the Extraction and Pre-Processing life cycle stage. Increasing the amount of recycled content could have a significant benefit to the product's cradle to gate environmental footprint. All three products have a high content of recycled aluminum (99-100%). The amount of recycled steel used in these products however, is far lower. The extraction of virgin steel is a top contributor to all three products' cradle to gate footprint, contributing on average, 22.16% of the product's energy footprint, 33.49% of its carbon footprint and 26.26% of its water footprint. Like aluminum, increasing the amount of recycled steel content would have a beneficial impact to the product's cradle to gate environmental footprint.

As stated earlier, the models in this report assume that the monitor arms are being shipped to the furthest customer relative to their manufacturing location. In the Sensitivity Analysis, the shipping distance was reduced by 50% which had a significant impact to the Global Warming Potential of the product. The results show an average reduction of 9.73% in the product's cradle to grave carbon footprint when shipped to a customer half as far.

The Sensitivity Analysis shows that the model is not sensitive to the Allocation Method used; mass or economic. The models in this report use mass allocation to account for their contribution to the waste and energy inputs during assembly at Humanscale's manufacturing location. The analysis shows only a 2.54% change to the Global Warming Potential for M/Flex® for M2.1, a 2.69% change for M/Flex® for M8.1 and a 2.49% change for M/Flex® for M10, when using an economic allocation method over a mass allocation method.

Limitations of the study include the following:

Availability of primary data for suppliers' energy use, waste generated, and transportation values would have been ideal but was not available. Using primary data could have adjusted the results slightly.

In general, secondary data was of overall good quality, however the data was of poor geographic coverage. This was due to the lack of availability of regionally-specific data in the ecoinvent database. For many inputs, Global averages were used. In section 5.6, the Sensitivity Analysis compares the Global Warming Potential of the model when using Global geographical coverage for electricity instead of an electricity input specific to the manufacturing location. Using Global electricity increased the total impacts for M/Flex® for M2.1, M/Flex® for M8.1 and M/Flex® for M10 by 0.34%, 0.35%, and 0.32% respectively. Although the model was not very sensitive to the geographical coverage of the electricity input, it is possible that having regional datasets for each of the inputs in which Global averages were used could have impacted the results as whole.

7 WORKS CITED

ISO (the International Organization for Standardization) ISO 14040 Environmental management — Life cycle assessment — Principles and framework 2006

ISO (the International Organization for Standardization) ISO 14044 Environmental management — Life cycle assessment — Requirements and guidelines 2006

RIVM, Radboud University, Norwegian University of Science and Technology and PRé Consultants ReCiPe 2016 Midpoint (H)

Sea Routes. [online] Available from www.searoutes.com

U.S. Environmental Protection Agency (2017) Waste Reduction Model (WARM). Available from http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

U.S. Environmental Protection Agency Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI 2.1)

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <http://link.springer.com/10.1007/s11367-016-1087-8> [Accessed 19 16 2020].

APPENDIX B. VERIFICATION DOCUMENTS

LCA VERIFICATION REPORT

Client:
Humanscale

Name of Study:
M/FLEX® Life Cycle Assessment

Products Included in LCA Report:
M/Flex® for M2.1, M8.1, M10 Monitor Arm

Review Completed:
December 17, 2020

WAP SUSTAINABILITY CONSULTING

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EXTENSION STATEMENT

Humanscale has requested for an extension on the MFlex LCA. They are currently in the process of updating their data and LCA. The projected changes are not believed to have a significant change in current results.

Given this, Humanscale's LCA is being granted an extension of 6-months.

Previous expiration: December 16, 2023
New expiration: June 16, 2024

CONFORMANCE STATEMENT

In December of 2020, WAP Sustainability Consulting commenced an LCA critical review and verification of the Life Cycle Assessment of the M/Flex for M2.1, M8.1, M10 Monitor Arm. The Life Cycle Assessment (LCA) was commissioned by Humanscale. Stephanie Richardson from Humanscale was the lead LCA practitioner.

The LCA was conducted as a cradle-to-grave assessment with the goal that the LCA would be submitted for Living Product Challenge (LPC) certification and LEED 2.1 MRc point contribution. After several rounds of reviews and modifications, the critical review was finalized in December 2020.

The review process was conducted over a week and included one round of comments and responses. WAP Sustainability reviewed the LCA to ISO14040/44. No additional PCR review was conducted because there currently is no available PCR for the product category under review. However, the report and model generally follow available BIFMA PCRs. In addition to the LCA report, primary data and calculation methods were provided to and reviewed by WAP Sustainability. The LCA model, which was created in OpenLCA, was reviewed as well. All data that was requested by WAP Sustainability was provided in a timely manner.

Critical inputs and assumptions were discussed in depth. Concerns related to these critical assumptions were alleviated through additional information provided by both the manufacture and the LCA practitioner. Additionally, a sensitivity analysis was conducted to compare allocation methods, dataset choices, and shipping and waste assumptions.

The full LCA review checklists are included in the following pages of the report. In summary, the report is a well-written LCA that does not exclude material impacts that would be expected within the life cycle of Humanscale's M/Flex M2.1, M8.1, M10 Monitor Arms. It is our opinion that the LCA study and LCA report were found to be in compliance with LCA to ISO14040/44. Additionally, the requirements for compliance with ILFI's Living Product Challenge and USGBC LEED 2.1 Material Resources Credits have been met.

W. Brad McAllister
Director
WAP Sustainability Consulting

Manasa Rao, LCACP
LCA Reviewer
WAP Sustainability Consulting

ISO 14044:2006

	Element	Applicability	Conformance Status	Review Comments (Reviewer Comments in Black. LCA Practitioner Comments in Red)	Approval Date
1	**Review of General Elements of Report**				
1.1	Name of commissioner of study.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.1	12/17/2020
1.2	Name of practitioner of study.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.1	12/17/2020
1.3	Date study was conducted.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.2	12/17/2020
1.4	Does study include a Goal and Scope section?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.3 Confirmed appropriate in interviews with practitioner.	12/17/2020
1.5	Does study include an Inventory Analysis section?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 4	12/17/2020
1.6	Does study include an Impact Assessment Section?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 5	12/17/2020
1.7	Does the study include an interpretation of results?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 6.	12/17/2020
1.8	Does the study include a discussion on limitations?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 4.2	12/17/2020
1.9	Does the study include a data quality assessment? Are these sufficient to enable goal and scope to be met?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.10 Limitations and data quality discussed with practitioner throughout the project.	12/17/2020
1.10	Does the study include a statement on ISO compliance?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.6	12/17/2020

1.11	Goal clearly defined and consistent with intended application?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.4	12/17/2020
1.12	Reason for study stated?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.4	12/17/2020
1.13	Intended application stated?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.4	12/17/2020
1.14	Function of product system clearly described.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.1 – 1 unit of monitor arm to support one monitor over 10 years	12/17/2020
1.15	Functional unit adequately described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.1 – 1 unit of monitor arm to support one monitor over 10 years	12/17/2020
1.16	System boundary adequately described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.3 – Defined in Section 3.3.	12/17/2020
1.18	Are allocation procedures described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.9 – discussed with practitioner.	12/17/2020
1.18	Geographical coverage stated and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, some limitations due to data but appropriate based on data availability.	12/17/2020
1.19	Is the cut-off criteria stated and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.8	12/17/2020
1.20	Are the impact categories described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 5.1.	12/17/2020
1.21	Are the impact assessment and interpretation methods described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 5.1.	12/17/2020
1.22	Source of background data stated and clear?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.10.3	12/17/2020
1.23	Are the data quality requirements of background data described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.10.3	12/17/2020

1.24	Source of foreground data stated and clear?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3.4, 3.5, 3.6.	12/17/2020
1.25	Are the data quality requirements of foreground data described and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 3 and in supplemental information provided by practitioner.	12/17/2020
1.26	Were assumptions and limitations adequately described?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 4 and discussed with practitioner.	12/17/2020
1.27	Did the report include an appropriate statement on critical review?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 2.7	12/17/2020
1.28	Is the report format described (i.e. table of contents, list of figures, etc)?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
1.29	Were any additional functions of product system omitted? If so, were the reasons for the omission stated?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	No functions omitted.	12/17/2020
1.30	Did the review find that the justification to be appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	No functions omitted.	12/17/2020
1.31	Were unit processes described adequately?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, also described during the verification and review process directly with reviewer.	12/17/2020
1.32	Did the reviewer find that the methods used were scientifically and technically valid?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, technical validity was achieved.	12/17/2020
1.33	If the LCA was comparative in nature, were the product systems of the compared products deemed to be equivalent?	☐ Requirement ☒ Not Applicable	☐ Conformance ☐ Non-Conformance		
1.34	If the LCA was comparative in nature, were the functional units of the compared products deemed to be equivalent?	☐ Requirement ☒ Not Applicable	☐ Conformance ☐ Non-Conformance		
1.35	If the LCA was comparative in nature were the data collection and use choices reasonable to allow for a fair and equivalent comparison?	☐ Requirement ☒ Not Applicable	☐ Conformance ☐ Non-Conformance		

1.36	If the LCA was comparative in nature, were the environmental impact category choices reasonable to allow for a fair and equivalent comparison?	☐ Requirement ☒ Not Applicable	☐ Conformance ☐ Non-Conformance		
2	**Review of General Elements of Report**				
2.1	Are the collection methods used for primary data described and reasonable?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, throughout the report, supplemental information and discussion with practitioner.	12/17/2020
2.2	Are sources/published literature adequately referenced?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
2.3	Is the reference unit of data stated for each input?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
2.4	Is the geographical representativeness of data for each input clear?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, Section 3.10.3.	12/17/2020
2.5	Is the technological representativeness of the data for each input clear?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, Section 3.10.3.	12/17/2020
2.6	Is data relevant and appropriate for the allocation among co-products?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	No co-products.	12/17/2020
2.7	Is the period of data collection clear and appropriate?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Table 2	12/17/2020
2.8	What time period does the data represent and is it consistent for all inputs? If it is inconsistent across all inputs, is the reason for the inconsistency stated and reasonable?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes - 2019	12/17/2020
2.9	Were any data excluded? If yes, what is the justification of the excluded data. Is the justification adequate and warranted?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, however within cut-off criteria of below 5% by mass.	12/17/2020
2.10	Is the source of each data input clear?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, Table 5	12/17/2020
2.11	Did the practitioner state data quality requirements? Does all data meet initial stated quality requirements?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes Section 3.10 and discussed.	12/17/2020

2.12	Was the choice of data unbiased so that it did not favor those participating in or financing study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes, reviewer found that that the choice of data did not bias the study.	12/17/2020
2.13	Were quality assurance and validation procedures used? Does the reviewer consider them to be adequate to meet the goal of the study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Discussed and found to be appropriate.	12/17/2020
2.14	Were the results of validation methods reviewed by someone other than the LCA practitioner?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Reviewed by reviewers in critical review process.	12/17/2020
2.15	Overall, is data reasonable and appropriate in relation to the goal of the study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
2.16	If allocation was used, was the basis of allocation clear (i.e physical or economical)?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – mass based and checked in sensitivity analysis while comparing with economic allocation.	12/17/2020
2.17	If allocation was used, were the allocation methods described, documented and justified for each unit process in which allocation was made?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
2.18	If allocation was used, were the allocation methods applied in a way that did not bias the study so that it did not favor those participating in or financing study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes	12/17/2020
2.20	Was a sensitivity analysis conducted to compare alternative allocation methods?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Section 5.6. Yes - mass based and checked in sensitivity analysis with economic allocation.	12/17/2020
2.20	If allocation was used, were the allocation methods used consistently across the entire product system? Did the LCA Reviewer find the inconsistencies to be warranted?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – found to be consistent.	12/17/2020
3	Review of Impact Assessment				
3.1	Is there a statement that explains the relative expression of results?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 5.1.	12/17/2020
3.2	Are the chosen impact categories justified and valid?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 5.1.	12/17/2020

3.3	Was the impact assessment carried out in a way that is scientifically and technically valid?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – TRACI and ReCiPe	12/17/2020
3.4	Were methods, such as weighting, used to group or analyze results? If used were the methods described adequately? Additionally, were the methods applied in a way that did not bias the results of the study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – weighting not used.	12/17/2020
3.5	Does the interpretation include a data quality assessment or a discussion of the data quality assessment?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 6	12/17/2020
3.6	Does the interpretation include a sensitivity analysis or a discussion of a sensitivity analysis that was conducted, if necessary?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 5.6	12/17/2020
3.7	Did the LCA reviewer find that significant findings were discussed adequately.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 5 and 6	12/17/2020
3.8	Did the LCA reviewer find that the role of excluded elements was evaluated and discussed adequately.	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 3.10.4	12/17/2020
3.9	Did the LCA reviewer find that the study included an adequate discussion of the consistency and reproducibility of the methods applied in the LCA?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 3 and 4.	12/17/2020
3.10	Did the LCA reviewer find that the study included an adequate discussion of the precision, completeness and representativeness of data used in the study?	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 3.10.3	12/17/2020
3.11	Did the LCA reviewer find that the study included an adequate discussion related to the impact of value judgments on the results	☒ Requirement ☐ Not Applicable	☒ Conformance ☐ Non-Conformance	Yes – Section 5.6, sensitivity analysis has been conducted.	12/17/2020

COMPLIANCE TO LIVING PRODUCT CHALLENGE 2.0 LCA-BASED REQUIREMENTS

	Element	Applicability	Conformance Status	Review Comments (Reviewer Comments in Black. LCA Practitioner Comments in Red)	Approval Date
1	G-04 Life Cycle Assessment General Requirements				
1.1	All manufacturers must produce and maintain an LCA Model demonstrating the product's cradle-to-grave impacts.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Model collected and reviewed.	12/17/2020
1.2	Performed in accordance with a relevant product category rule (PCR) to ISO 14040/44.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	ISO compliance confirmed. No PCR available for product under review. However, report and model follows general BIFMA PCR format as closely as possible.	12/17/2020
1.3	Critically reviewed by a third party for conformance with IS0 14044.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Review conducted and passed.	12/17/2020
1.4	Has either been performed by an LCA Certified Practitioner certified by ACLCA (https://aclca.org/lcacp-certification/) or by an ILFI-approved LCA practitioner or consultancy?	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Yes, ACLCA Certified Practitioner	12/17/2020
1.5	Has either been performed by an LCA Certified Practitioner certified by ACLCA (https://aclca.org/lcacp-certification/) or by an ILFI-approved LCA practitioner or consultancy?	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Hotspots identified. 5.3,5.4,5.5	12/17/2020
1.6	The LCA should clearly demonstrate the product's contributions to, at minimum, fossil-based energy, water, and greenhouse gas (GHG) emissions	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	LCA valid for 3 years.	12/17/2020
1.7	LCA models must be valid at the time of certification and for the duration of the 3-Year certification period. If the LCA will expire before recertification, an updated LCA must be resubmitted at the next annual check-in following its expiration.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Any updates in the LCA will be communicated to the reviewer and verified before applying for recertification.	12/17/2020

2	**I04-5 Water Hotspot Identification**				
2.1	A table of process contributions to cradle-to-gate life cycle water consumption, listing at least the top 5 processes ranked in terms of water consumption.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.5	12/17/2020
2.2	A brief 1-2 paragraph narrative that interprets the main results and identifies the 5 main drivers of the product's water consumption footprints.	☐ Requirement ☒ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.5	12/17/2020
3	**I06-6 Energy Hotspot Identification**				
3.1	A table of process contributions to cradle-to-gate life cycle water consumption, listing at least the top 5 processes ranked in terms of energy consumption.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.3	12/17/2020
3.2	A brief one- to two-page narrative that interprets the results and identifies the five main drivers of the product's cradle-to-gate fossil energy consumption footprints.	☐ Requirement ☒ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.3	12/17/2020
4	**I14-4 Carbon Hotspot Identification**				
4.1	A table of process contributions to cradle-to-gate life cycle water consumption, listing at least the top 5 processes ranked in terms of GHG emissions.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.4	12/17/2020
4.2	A brief narrative that interprets the results and identifies the 5 main drivers of the product's cradle-to-gate carbon Footprints, and their relevance.	☐ Requirement ☒ Recommendation	☒ Conformance ☐ Non-Conformance	Section 5.4	12/17/2020

COMPLIANCE TO LEED V4.1 LCA-BASED REQUIREMENTS

	Element	Applicability	Conformance Status	Review Comments (Reviewer Comments in Black. LCA Practitioner Comments in Red)	Approval Date
1	**BPDO - Environmental Product Declaration – Public Life Cycle Assessment Option (1 pt.)**				
1.1	Publicly Available	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	https://www.humanscale.com/resources/designer-toolkit/green-design.cfm	12/17/2020
1.2	Critically Reviewed	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Yes.	12/17/2020
1.3	ISO14044 Compliant	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Critical review confirmed conformance.	12/17/2020
1.4	At Least Cradle to Gate in Scope	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Yes, cradle to grave in scope.	12/17/2020
1.5	Cover or Summary Sheet that includes: -All requirements outlined in LEED v4 reference guide for this section -The type of LCA software used to conduct the assessment; -Date of assessment with period of validity or expiration date of life cycle assessment, -URL link to the publicly available version of the document.	☒ Requirement ☐ Recommendation	☒ Conformance ☐ Non-Conformance	Yes, pages 2 and 3 of the document.	12/17/2020

LCA MODEL REVIEW CHECKLIST

	Plan Hierarchy	Process Name	Appropriate Inputs/outputs	Connection Check	Mass Balance Check	Datasets Appropriate	Notes
	Name of final plan: ecoinvent_36_humanscale_mflex.zolca						
1	M/Flex for M10	M/Flex M10 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
2		M/Flex M10 Cradle to Gate (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
3		M/Flex M10 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
4		M/Flex M10 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
5		M/Flex M10 Cradle to Grave (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
6		M/Flex M10 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
7		M/Flex M10 EOL Disposal (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
8		M/Flex M10 EOL Ttspt (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
9		M/Flex M10 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
10		M/Flex M10 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
11		M/Flex M10 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
12		M/Flex M10 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
13		M/Flex M10 Trspt to HS (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
14		M/Flex M10 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
15		M/Flex M10 Trspt to Cust (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
16		M/Flex M10 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
17	M/Flex for M2.1	M/Flex M2.1 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
18		M/Flex M2.1 Cradle to Gate (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
19		M/Flex M2.1 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	

20		M/Flex M2.1 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
21		M/Flex M2.1 Cradle to Grave (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
22		M/Flex M2.1 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
23		M/Flex M2.1 EOL Disposal (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
24		M/Flex M2.1 EOL Ttspt (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
25		M/Flex M2.1 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
26		M/Flex M2.1 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
27		M/Flex M2.1 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
28		M/Flex M2.1 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
29		M/Flex M2.1 Trspt to HS (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
30		M/Flex M2.1 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
31		M/Flex M2.1 Trspt to Cust (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
32		M/Flex M2.1 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
33	M/Flex for M8.1	M/Flex M8.1 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
34		M/Flex M8.1 Cradle to Gate (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
35		M/Flex M8.1 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
36		M/Flex M8.1 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
37		M/Flex M8.1 Cradle to Grave (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
38		M/Flex M8.1 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	

39		M/Flex M8.1 EOL Disposal (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
40		M/Flex M8.1 EOL Ttspt (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
41		M/Flex M8.1 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
42		M/Flex M8.1 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
43		M/Flex M8.1 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
44		M/Flex M8.1 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
45		M/Flex M8.1 Trspt to HS (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
46		M/Flex M8.1 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
47		M/Flex M8.1 Trspt to Cust (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
48		M/Flex M8.1 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
49		Assembly (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
50		Assembly (Nog)	Confirmed	Confirmed	Confirmed	Confirmed	
51		Assembly (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
52		Monitor Arm Maintenance	Confirmed	Confirmed	Confirmed	Confirmed	
53		Disenfecting Wipes (85 ct)	Confirmed	Confirmed	Confirmed	Confirmed	