

# M2.1 / M8.1 / M10 Monitor Arms



## Life Cycle Assessment

Study Completed: January - July, 2020  
Critical Review Completed: September, 2020  
Critical Review Completed By: WAP Sustainability

## LIFE CYCLE ASSESSMENT

<b>Manufacturer</b>	Humanscale				
<b>Product Name(s)</b>	M2.1, M8.1, M10				
<b>Product Type</b>	Monitor Arm				
<b>Product Description</b>	Humanscale’s next generation monitor arm line instantly personalizes any workstation for improved comfort, health and productivity. Designed for unprecedented adaptability, our monitor arms focus on ergonomics and the use of technology, while featuring ultra-sleek aesthetics. M2.1, M8.1 and M10 support a better working posture, creates more usable desktop space and helps maintain a clutter-free environment.				
<b>LCA Scope, Overall</b>	Cradle to Grave				
<b>LCA Scope, Included Life Cycle Modules</b>	<b>Sourcing and Manufacturing Modules</b>	<b>Delivery and Installation Modules</b>	<b>Use Phase Modules</b>		<b>End of life Modules</b>
	☒ A1	☒ A4	☒ B1	☒ B5	☒ C1
	☒ A2	☒ A5	☒ B2	☒ B6	☒ C2
	☒ A3		☒ B3	☒ B7	☒ C3
			☒ B4		☒ C4
	<b>Benefits and Loads beyond System Boundary:</b> <input type="checkbox"/> D				
<b>Functional or Declared Unit</b>	The functional unit is one monitor arm to support one monitor.				
<b>Summary of Impact Categories Measured</b>	☒ Global Warming Potential ☒ Acidification Potential ☒ Eutrophication Potential ☒ Smog Creation		☒ Ozone Depletion Potential ☒ Water Consumption ☒ Fossil Resource Scarcity		

<b>Reference Standards</b>	<input checked="" type="checkbox"/> ISO 14040	<input type="checkbox"/> ISO 21930	<input type="checkbox"/> Others (Specify Below):
	<input checked="" type="checkbox"/> ISO 14044	<input type="checkbox"/> EN 15804	
<b>Reference PCR (If Applicable)</b>	No applicable BIFMA PCR		
<b>LCA Study Conducted by</b>	<b>Date Completed</b>	July, 2020	
	<b>LCA Practitioner</b>	Stephanie Richardson, Sustainability Coordinator, Humanscale	
<b>Independent LCA Review Details</b>	<b>Date of Final Approval</b>	September 21, 2020	
	<b>LCA Reviewer</b>	Manasa Rao, Sustainability Data Manager and Researcher, WAP Sustainability	
	<b>Type of Review</b>	<input type="checkbox"/> Internal	<input checked="" type="checkbox"/> External
<b>LCA Expiration Date</b>	September 20, 2023		
<b>LCA Software and Version</b>	OpenLCA		
<b>LCA Database(s) and Version(s)</b>	Ecoinvent database, version 3.6 APOS unit regionalized		
<b>Applicable Region(s)</b>	Global		
<b>Link to Publicly Available Version of LCA (If Applicable)</b>	<a href="https://www.humanscale.com/resources/designer-toolkit/green-design.cfm">https://www.humanscale.com/resources/designer-toolkit/green-design.cfm</a>		

**M2.1**

Standard Single or Dual  
Monitors 5-15.5 lbs.



**M8.1**

Heavy Single or Dual Monitors  
6-28 lbs.



**M10**

Up to three monitors and &  
large TV formats 20-48 lbs.



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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 June 2019 and a draft was submitted for critical review to WAP Sustainability in August 2020. The final approval of the document took place on September 21, 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 disclose 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 one monitor. Does not include monitor.

The functional unit for this LCA study shall be one unit of monitor arm to support one monitor, maintained for a 10-year period. The warranty for M2.1 and M8.1 is 15 years and is 10 years for M10. Each of these are expected to perform at least as long as its warranty period as such, replacement parts are not required within this 10-year timeframe.

## 3.2 PRODUCT DESCRIPTION

### *3.2.1 Product Description and Specifications*

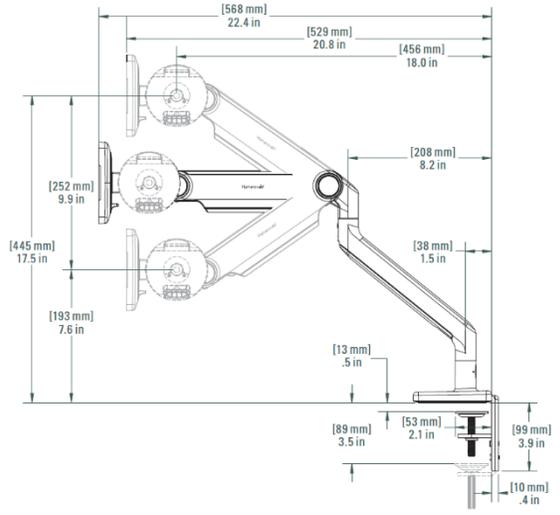
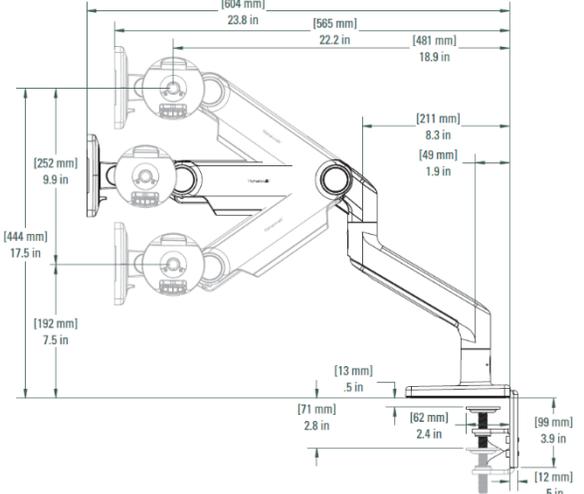
Humanscale's next generation monitor arm line instantly personalizes any workstation for improved comfort, health and productivity. Designed for unprecedented adaptability, our monitor arms focus on ergonomics and the use of technology, while featuring ultra-sleek aesthetics. M2.1 supports a better working posture, creates more usable desktop space and helps maintain a clutter-free environment. It offers quick, simple installation and industry-leading flexibility thanks to patent-pending Quick Release joints that instantly snap together for a secure and robust fit. Fully compatible with traditional desks and sit/stand workstations alike, M2.1 meets a variety of configuration needs for lighter monitors up to 15.5 lbs. M8.1 meets a variety of configuration needs for single monitors from 6 to 28 pounds or – with an optional crossbar support – dual monitors up to 12 pounds each. Built to hold heavier equipment, a strong triple crossbar allows M10 to hold up to three monitors or 48 pounds – all while maintaining a simple and sleek design.

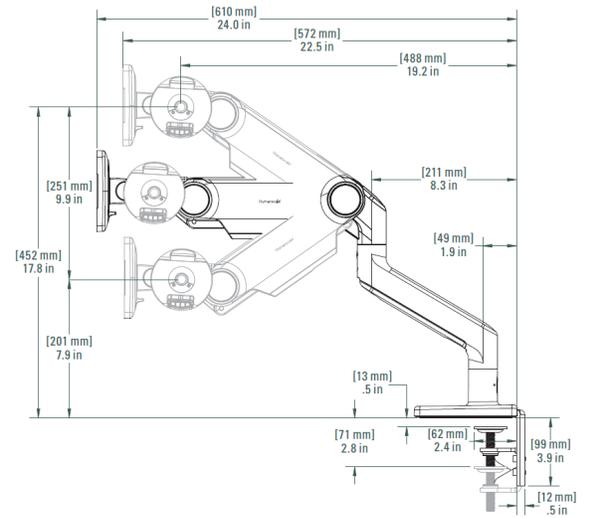
Featuring innovations like Humanscale's patented Weight-Compensating Spring Technology and Smart Stop functionality, M2.1, M8.1 and M10 enable the personalization and flexibility needed for today's evolving workplaces.

Model numbers for M2.1 begin with 'M21CM', for M8.1 begin with 'M81CM', for M10 begin with 'M10CM'.

All three models in this LCA have the following features; arm style: angled link/ dynamic link, two-piece clamp mount base, color: silver with gray trim. Although each of these models can hold more than one monitor, configurations meant to hold one monitor were chosen for consistency per the functional unit.

Table 1: Product Specifications

<b>Monitor Weight Capacity</b>	<p>Standard Single or Dual Monitors 5-15.5 lbs</p>  <p><b>M2.1</b></p>	<p><b>DIMENSIONS</b></p> 
	<p>Single 6-28 lbs</p>  <p><b>M8.1</b></p>	<p><b>DIMENSIONS</b></p> 

	<p>Heavy Single up to 20-40 lbs</p>  <p><b>M10</b></p>	<p><b>DIMENSIONS</b></p> 
<p>Height Adjustment</p>	<p>M2.1: 6.7" - 17.1" M8.1: 7.6" - 17.7" M10: 7.6" - 17.7"</p>	
<p>Product Weight</p>	<p>M2.1: 5.9 lbs (2.7kg) M8.1: 11 lbs (5.0kg) M10: 11.5 lbs (5.2kg)</p>	

3.2.2 Technical Data

Table 2: Technical Details	
Sustainability certification	Declare: HSC-0037, HSC-0041, HSC-0043
	ANSI/BIFMA LEVEL® 3: SCS-SCF-05105
	HPD Label
VOC emission	Indoor Advantage Gold: SCS-IAQ-02892
UL 1286	Certification #: 20180918-E494239, 20190305-E494239

3.3 SYSTEM BOUNDARY

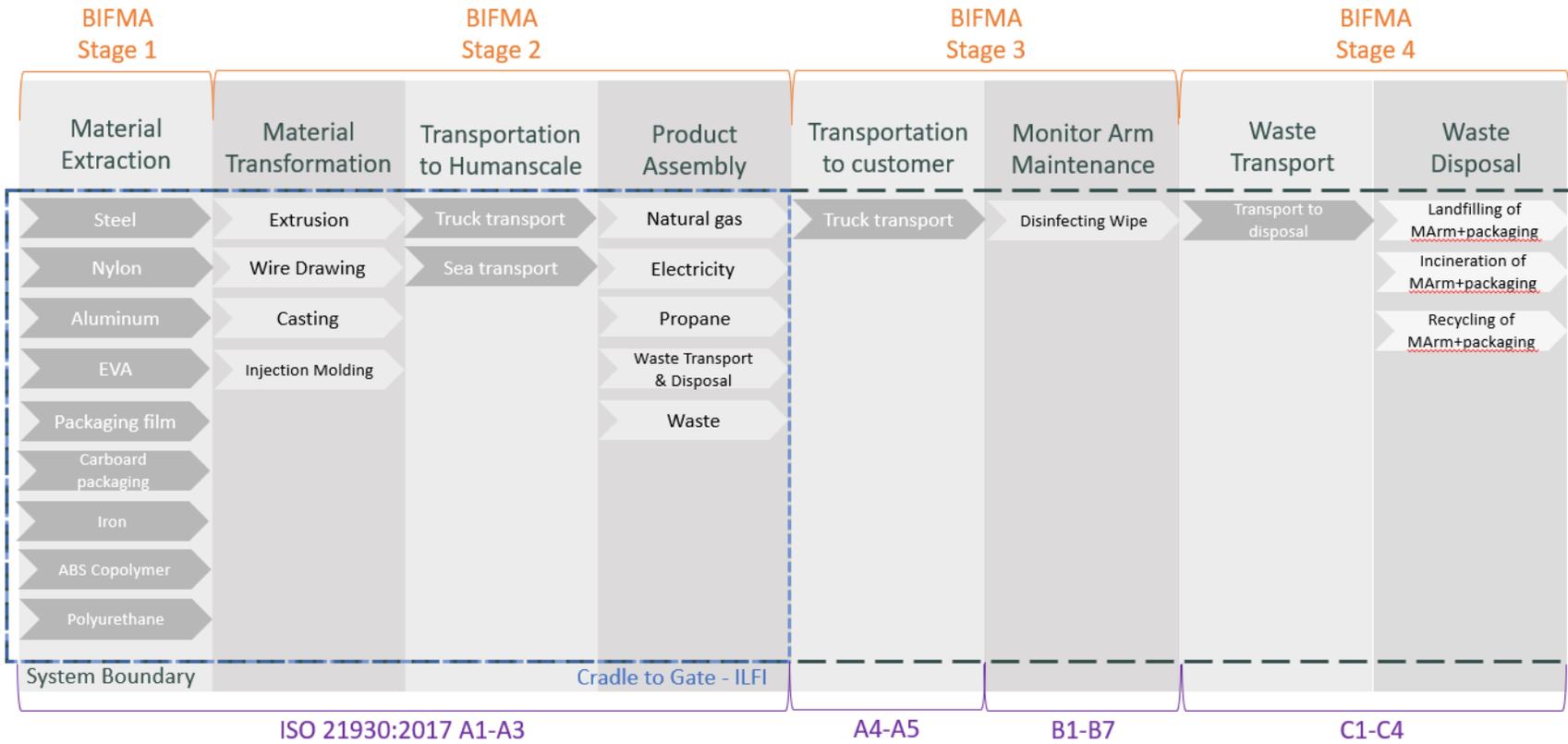
For full cradle-to-grave analysis, the upstream system boundary includes the full cradle-to-gate supply chains of all inputs beginning with material extraction and ending with final assembly of the product by Humanscale. The downstream system boundary begins with shipping of the product to the customer 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
M2.1 MatExtract	<b>Material Acquisition and Pre-processing</b>	2019	Raw material extraction, transportation and refining including packaging as defined by secondary data.
M2.1 MatTrans	<b>Production (Manufacturing / Assembly)</b>	2019	Manufacturing of components.
M2.1 Trspt to HS	<b>Production (Manufacturing / Assembly)</b>	2019	Transportation of product components to Humanscale. Primary data is used.
Assembly	<b>Production (Manufacturing / Assembly)</b>	2019	Final assembly and packing at Humanscale facility. Primary data is used for electricity, natural gas and waste.
M2.1 Trspt to Cust	<b>Distribution, storage, and use</b>	2019	Transportation to customer. Farthest shipping distance via freight truck is assumed.
Monitor Arm Maintenance	<b>Distribution, storage, and use</b>	2019	Cleaning of product.
M2.1 EOL Trspt	<b>End of life</b>	2019	Transportation of product and product packaging to disposal facility.
M2.1 EOL Disposal	<b>End of Life</b>	2019	Landfilling and incinerating 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 1: 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)			
	M2.1	M8.1	M10
Plastic	180.1	195.25	204.2
Aluminum	1,298	2,560.13	2,437.85
Steel	1,657.24	1,861.46	1,847.55
Cast Iron	0	55.04	51.2
Packaging	754	1,834.37	1,834.37
Other / Omitted	71.39	175.49	111.13
Total Weight	3,960.73	6,681.74	6,486.30

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.

There 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 both final assembly locations is 3,689 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.

Product	Material Type	Weight (grams)	Recycling Rate*	Weight Recycled (grams)	Weight Incinerated (grams)**	Weight Landfilled (grams)**
M2.1	Plastic	200.10	8.37%	16.75	146.68	36.67
	Paperboard	734.00	65.92%	483.82	200.14	50.04

	Aluminum	1,298.00	16.19%	210.12	870.30	217.58
	Ferrous metals	1,657.24	32.66%	541.30	892.75	223.19
M8.1	Plastic	215.25	8.37%	18.01	157.79	39.45
	Paperboard	1,814.37	65.92%	1,195.95	494.73	123.68
	Aluminum	2,560.13	16.19%	414.43	1,716.56	429.14
	Ferrous metals	1,916.50	32.66%	625.98	1,032.41	258.10
M10	Plastic	224.2	8.37%	18.76	164.35	41.09
	Paperboard	1,814.37	65.92%	1,195.95	494.73	123.68
	Aluminum	2,437.85	16.19%	394.64	1,634.57	408.64
	Ferrous metals	1,898.75	32.66%	620.19	1,022.85	255.71

\*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 was 6.4 grams for M2.1 (0.16%), 8.44 grams for M8.1 (0.12%) and 12.0 grams for M10 (0.18%)
- The system model also omits Acrylic (PMMA) and powder coating, zinc and painting totaling 64.99 grams for M2.1 (1.6%), 167.05 grams for M8.1 (2.5%), and 99.13 grams for M10 (1.53%).
- In total, the system model omits less than 2.6% 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 two Humanscale facilities in North America & Europe, and the product is shipped to customers globally. For the purpose of this report, six LCA models have been created to represent the impacts of the monitor arms specific to its 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 Poppintree  
Finglas  
Dublin 11

#### 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.

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 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 cast iron	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 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	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 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
<b>TRACI 2.1</b>			
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
<b>ReCiPe 2016 Midpoint (H)</b>			
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 M2.1

Table 8: M2.1 Piscataway LCA Results						
Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
<b>TRACI 2.1</b>	AP (kg SO2 eq)	2.90E-02	2.90E-02	1.54E-02	1.65E-03	7.50E-02
	EP (kg N eq)	2.34E-02	2.11E-02	7.43E-03	4.25E-03	5.62E-02
	GWP (kg CO2 eq)	7.35E+00	5.96E+00	3.72E+00	6.29E-01	1.77E+01
	OD (kg CFC 11 eq)	5.55E-07	9.21E-07	6.50E-07	6.02E-08	2.19E-06
	Smog (kg O3 eq)	3.56E-01	4.80E-01	3.04E-01	3.31E-02	1.17E+00
<b>ReCiPe 2016 Midpoint (H)</b>	WC (m3)	7.35E-02	3.38E-02	2.91E-02	3.27E-03	1.40E-01
	FS (kg oil-Eq)	1.74E+00	1.73E+00	1.42E+00	8.43E-02	4.98E+00

**Table 9: M2.1 Dublin LCA Results**

Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
<b>TRACI 2.1</b>	AP (kg SO2 eq)	2.90E-02	2.19E-02	1.57E-02	1.65E-03	6.83E-02
	EP (kg N eq)	2.34E-02	1.75E-02	7.52E-03	4.25E-03	5.26E-02
	GWP (kg CO2 eq)	7.35E+00	3.62E+00	3.80E+00	6.29E-01	1.54E+01
	OD (kg CFC 11 eq)	5.55E-07	3.61E-07	6.69E-07	6.02E-08	1.65E-06
	Smog (kg O3 eq)	3.56E-01	2.99E-01	3.12E-01	3.31E-02	9.99E-01
<b>ReCiPe 2016 Midpoint (H)</b>	WC (m3)	7.35E-02	2.89E-02	2.93E-02	3.27E-03	1.35E-01
	FS (kg oil-Eq)	1.74E+00	9.16E-01	1.44E+00	8.43E-02	4.18E+00

Table 10: M8.1 Piscataway LCA Results

Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
TRACI 2.1	AP (kg SO2 eq)	2.72E-02	5.85E-02	2.23E-02	2.90E-03	1.11E-01
	EP (kg N eq)	2.51E-02	4.81E-02	9.29E-03	7.16E-03	8.96E-02
	GWP (kg CO2 eq)	7.83E+00	1.27E+01	5.34E+00	1.20E+00	2.71E+01
	OD (kg CFC 11 eq)	4.38E-07	1.73E-06	1.03E-06	1.01E-07	3.29E-06
	Smog (kg O3 eq)	3.48E-01	9.16E-01	4.67E-01	5.65E-02	1.79E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	7.38E-02	8.15E-02	3.20E-02	5.79E-03	1.93E-01
	FS (kg oil-Eq)	1.92E+00	3.65E+00	1.97E+00	1.45E-01	7.69E+00

**Table 11: M8.1 Dublin LCA Results**

Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
<b>TRACI 2.1</b>	AP (kg SO2 eq)	2.72E-02	4.74E-02	2.29E-02	2.90E-03	1.00E-01
	EP (kg N eq)	2.51E-02	4.24E-02	9.44E-03	7.16E-03	8.41E-02
	GWP (kg CO2 eq)	7.83E+00	9.22E+00	5.47E+00	1.20E+00	2.37E+01
	OD (kg CFC 11 eq)	4.38E-07	8.81E-07	1.06E-06	1.01E-07	2.48E-06
	Smog (kg O3 eq)	3.48E-01	6.36E-01	4.80E-01	5.65E-02	1.52E+00
<b>ReCiPe 2016 Midpoint (H)</b>	WC (m3)	7.38E-02	7.41E-02	3.22E-02	5.79E-03	1.86E-01
	FS (kg oil-Eq)	1.92E+00	2.41E+00	2.02E+00	1.45E-01	6.50E+00

Table 12: M10 Piscataway LCA Results

Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
TRACI 2.1	AP (kg SO2 eq)	2.69E-02	5.69E-02	2.20E-02	2.81E-03	1.09E-01
	EP (kg N eq)	2.48E-02	4.67E-02	9.20E-03	7.18E-03	8.78E-02
	GWP (kg CO2 eq)	7.80E+00	1.24E+01	5.26E+00	1.19E+00	2.66E+01
	OD (kg CFC 11 eq)	4.32E-07	1.68E-06	1.01E-06	9.81E-08	3.22E-06
	Smog (kg O3 eq)	3.44E-01	8.90E-01	4.59E-01	5.52E-02	1.75E+00
ReCiPe 2016 Midpoint (H)	WC (m3)	7.29E-02	7.82E-02	3.19E-02	5.58E-03	1.89E-01
	FS (kg oil-Eq)	1.94E+00	3.55E+00	1.94E+00	1.41E-01	7.57E+00

**Table 13: M10 Dublin LCA Results**

Method	Impact Category	LPC Boundary		Distribution, storage, and use	End of Life	Cradle to Grave Total
		Material Acquisition and Pre-processing	Production (Manufacturing / Assembly)			
<b>TRACI 2.1</b>	AP (kg SO2 eq)	2.69E-02	4.61E-02	2.25E-02	2.81E-03	9.83E-02
	EP (kg N eq)	2.48E-02	4.12E-02	9.35E-03	7.18E-03	8.24E-02
	GWP (kg CO2 eq)	7.80E+00	8.95E+00	5.39E+00	1.19E+00	2.33E+01
	OD (kg CFC 11 eq)	4.32E-07	8.57E-07	1.04E-06	9.81E-08	2.43E-06
	Smog (kg O3 eq)	3.44E-01	6.18E-01	4.72E-01	5.52E-02	1.49E+00
<b>ReCiPe 2016 Midpoint (H)</b>	WC (m3)	1.94E+00	2.34E+00	1.99E+00	1.41E-01	6.41E+00
	FS (kg oil-Eq)	7.29E-02	7.09E-02	3.21E-02	5.58E-03	1.81E-01

### 5.3 TOP 5 PROCESSES CONTRIBUTING TO ENERGY CONSUMPTION

In connection with the Living Product Challenge Imperative 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 M2.1, M8.1 and M10. From the results below, it is clear that the top contributors are related to raw material sourcing. Specifically, steel used in the arms' base clamp and vesa, and aluminum for the arm and base, are significant contributors. Furthermore, the relative impacts of the top contributors are roughly the same across both final assembly locations for all three monitor arms, however, overall impacts are slightly less for the products manufactured in Dublin due to shorter transportation distances.

Table 14: Top 5 Processes Contributing to Energy Consumption ReCiPe 2016 Midpoint (H)				
	Final Assembly Location	Process	%	Kg oil-Eq
<b>M2.1</b>	Piscataway, NJ	transport, freight, lorry 16-32 metric ton	23.47%	8.16E-01
		market for steel, unalloyed	17.44%	6.06E-01
		market for aluminium, cast alloy	16.83%	5.85E-01
		market for acrylonitrile-butadiene-styrene copolymer	10.67%	3.71E-01
		market for impact extrusion of steel	8.86%	3.08E-01
	Dublin, IE	market for steel, unalloyed	22.82%	6.06E-01
		market for aluminium, cast alloy	22.01%	5.85E-01
		market for acrylonitrile-butadiene-styrene copolymer	13.95%	3.71E-01
		market for impact extrusion of steel	11.59%	3.08E-01
		market for impact extrusion of aluminium	11.43%	3.04E-01
<b>M8.1</b>	Piscataway, NJ	transport, freight, lorry 16-32 metric ton	23.86%	1.33E+00
		market for steel, unalloyed	13.59%	7.58E-01
		market for casting, steel	12.65%	7.05E-01
		market for impact extrusion of aluminium,	12.59%	7.02E-01
		market for acrylonitrile-butadiene-styrene copolymer	10.11%	5.64E-01
	Dublin, IE	market for steel, unalloyed	26.51%	4.52E+00
		market for impact extrusion of aluminium,	17.24%	2.94E+00
		market for casting, steel, lost-wax	15.09%	2.57E+00
		market for impact extrusion of steel,	10.88%	1.86E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.15%	1.22E+00
<b>M10</b>	Piscataway, NJ	transport, freight, lorry 16-32 metric ton	23.57%	1.29E+00
		market for steel, unalloyed	13.63%	7.48E-01
		market for impact extrusion of aluminium	12.18%	6.68E-01
		market for casting, steel	12.16%	6.67E-01
		market for acrylonitrile-butadiene-styrene copolymer	11.44%	6.28E-01
	Dublin, IE	market for steel, unalloyed	17.46%	7.48E-01
		market for impact extrusion of aluminium,	15.60%	6.68E-01
		market for casting, steel	15.58%	6.67E-01
		market for acrylonitrile-butadiene-styrene copolymer	14.65%	6.28E-01
		market for impact extrusion of steel	10.18%	4.36E-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 M2.1, M8.1 and M10. From the results below, it is clear that the top contributors are related to raw material sourcing. Specifically, steel used in the arms' base clamp and vesa, and aluminum for the arm and base, are significant contributors. Furthermore, the relative impacts of the top contributors are roughly the same across both final assembly locations for all three monitor arms, however, overall impacts are slightly less for the products manufactured in Dublin due to shorter transportation distances.

Table 15: Top 5 Processes Contributing to Carbon Footprint TRACI 2.1				
	Final Assembly Location	Process	%	Kg CO2-Eq
<b>M2.1</b>	Piscataway, NJ	market for steel, unalloyed	27.18%	3.62E+00
		market for aluminium, cast alloy	18.00%	2.39E+00
		transport, freight, lorry 16-32 metric ton	17.95%	2.39E+00
		market for impact extrusion of steel	10.08%	1.34E+00
		market for impact extrusion of aluminium	9.56%	1.27E+00
	Dublin, IE	market for steel, unalloyed	32.97%	3.62E+00
		market for aluminium, cast alloy	21.83%	2.39E+00
		market for impact extrusion of steel, cold,	12.23%	1.34E+00
		market for impact extrusion of aluminium	11.60%	1.27E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.31%	8.02E-01
<b>M8.1</b>	Piscataway, NJ	market for steel, unalloyed	21.97%	4.52E+00
		transport, freight, lorry 16-32 metric ton	18.93%	3.90E+00
		market for impact extrusion of aluminium	14.28%	2.94E+00
		market for casting, steel	12.50%	2.57E+00
		market for impact extrusion of steel,	9.01%	1.86E+00
	Dublin, IE	market for steel, unalloyed	26.51%	4.52E+00
		market for impact extrusion of aluminium,	17.24%	2.94E+00
		market for casting, steel	15.09%	2.57E+00
		market for impact extrusion of steel	10.88%	1.86E+00
		market for acrylonitrile-butadiene-styrene copolymer	7.15%	1.22E+00
<b>M10</b>	Piscataway, NJ	market for steel, unalloyed	22.12%	4.46E+00
		transport, freight, lorry 16-32 metric ton,	18.77%	3.79E+00
		market for impact extrusion of aluminium	13.88%	2.80E+00
		market for casting, steel	12.07%	2.43E+00
		market for impact extrusion of steel	9.42%	1.90E+00
	Dublin, IE	market for steel, unalloyed	19.16%	2.89E-02
		market for impact extrusion of aluminium,	17.57%	2.65E-02
		market for casting, steel	14.62%	2.21E-02
		market for acrylonitrile-butadiene-styrene copolymer	11.65%	1.76E-02
		corrugated board box production	10.39%	1.57E-02

## 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 M2.1, M8.1 and M10. From the results below, it is clear that the top contributors are related to raw material sourcing. Specifically, steel used in the arms' base clamp and vesa, and aluminum for the arm and base, are significant contributors. Furthermore, the relative impacts of the top contributors are roughly the same across both final assembly locations for all three monitor arms, however, overall impacts are slightly less for the products manufactured in Dublin due to shorter transportation distances.

Table 16: Top 5 Processes Contributing to Water Footprint ReCiPe 2016 Midpoint (H)				
	Final Assembly Location	Process	%	m3
<b>M2.1</b>	Piscataway, NJ	market for aluminium, cast alloy	29.71%	3.19E-02
		market for steel, unalloyed	21.87%	2.35E-02
		market for impact extrusion of aluminium	11.25%	1.21E-02
		market for acrylonitrile-butadiene-styrene copolymer	9.69%	1.04E-02
		market for impact extrusion of steel	9.40%	1.01E-02
	Dublin, IE	market for aluminium, cast alloy	31.13%	3.19E-02
		market for steel, unalloyed	22.91%	2.35E-02
		market for impact extrusion of aluminium	11.78%	1.21E-02
		market for acrylonitrile-butadiene-styrene copolymer	10.16%	1.04E-02
		market for impact extrusion of steel	9.84%	1.01E-02
<b>M8.1</b>	Piscataway, NJ	market for steel, unalloyed	18.88%	2.93E-02
		market for impact extrusion of aluminium	17.95%	2.79E-02
		market for casting, steel	15.03%	2.34E-02
		market for acrylonitrile-butadiene-styrene copolymer	10.18%	1.58E-02
		corrugated board box production	10.10%	1.57E-02
	Dublin, IE	market for steel, unalloyed	19.83%	2.93E-02
		market for impact extrusion of aluminium	18.85%	2.79E-02
		market for casting, steel	15.79%	2.34E-02
		market for acrylonitrile-butadiene-styrene copolymer	10.69%	1.58E-02
		corrugated board box production	10.61%	1.57E-02
<b>M10</b>	Piscataway, NJ	market for steel, unalloyed	19.16%	2.89E-02
		market for impact extrusion of aluminium	17.57%	2.65E-02
		market for casting, steel	14.62%	2.21E-02
		market for acrylonitrile-butadiene-styrene copolymer	11.65%	1.76E-02
		corrugated board box production	10.39%	1.57E-02
	Dublin, IE	market for steel, unalloyed	26.65%	4.46E+00
		market for impact extrusion of aluminium	16.72%	2.80E+00
		market for casting, steel	14.54%	2.43E+00
		market for impact extrusion of steel	11.34%	1.90E+00
		market for acrylonitrile-butadiene-styrene copolymer	8.11%	1.36E+00

## 5.6 SENSITIVITY ANALYSIS

Factor	BIFMA Life Cycle Stage Name	Model	GWP (kg CO2 eq)		% Change
			Original	After Change	
Shipping Distance: half the mileage. (Original model assumes farthest shipping distance to customer)	Distribution, storage, and use	M2.1	1.77E+01	1.64E+01	-6.84%
		M8.1	2.71E+01	2.51E+01	-7.44%
		M10	2.66E+01	2.46E+01	-7.43%
Allocation method: economic instead of mass allocation	Production (Manufacturing / Assembly)	M2.1	1.77E+01	1.81E+01	2.61%
		M8.1	2.71E+01	2.78E+01	2.41%
		M10	2.66E+01	2.74E+01	2.93%
Electricity used in assembly: GLO instead of RFC electrical grid.	Production (Manufacturing / Assembly)	M2.1	1.77E+01	1.77E+01	0.23%
		M8.1	2.71E+01	2.72E+01	0.26%
		M10	2.66E+01	2.67E+01	0.25%
Electricity used in assembly: reduced by 10%	Production (Manufacturing / Assembly)	M2.1	1.77E+01	1.76E+01	-0.16%
		M8.1	2.71E+01	2.71E+01	-0.17%
		M10	2.66E+01	2.66E+01	-0.17%
Waste shipping: half the distance at end of life	End of Life	M2.1	1.77E+01	1.76E+01	-0.45%
		M8.1	2.71E+01	2.70E+01	-0.49%
		M10	2.66E+01	2.65E+01	-0.49%

## 6 INTERPRETATION

As shown in Section 5.3, 5.4 and 5.5, the top five processes within the cradle-gate (as defined by the International Living Future Institute) life cycle stages of M2.1, M8.1 and M10, that rank highest in terms of their total contributions to carbon, energy and water consumption, all 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. Only 3% of the aluminum in M8.1 and M10 comes from virgin sources and only 26% for M2.1. 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. On average, steel extraction is responsible for 18.58% of the product's upstream energy consumption, 24.99% of its upstream carbon footprint and 21.55% of its upstream water consumption. Like aluminum, increasing the amount of recycled steel content would have a beneficial impact to the products 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 7.24% in the products' 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 2.61% change to the Global Warming Potential for M2.1, a 2.41% change for M8.1 and a 2.93% change 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 M2.1, M8.1 and M10 by 0.23%, 0.26%, and 0.25% 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 averaged 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](http://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](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:**

M2.1, M8.1, M10 Monitor Arms Life Cycle Assessment

**Products Included in LCA Report:**

M2.1, M8.1, M10 Monitor Arms

**Review Completed:**

September 21, 2020



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## CONFORMANCE STATEMENT

In September of 2020, WAP Sustainability Consulting commenced an LCA critical review and verification of the Life Cycle Assessment of the M2.1, M8.1, M10 Monitor Arms. 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 September 2020.

The review process was conducted over a few weeks and included multiple rounds 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 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 <small>(Reviewer Comments in Black, LCA Practitioner Comments in Red)</small>	Approval Date
1	<b>Review of General Elements of Report</b>				
1.1	Name of commissioner of study.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2	9/4/2020
1.2	Name of practitioner of study.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2	9/4/2020
1.3	Date study was conducted.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.2	9/4/2020
1.4	Does study include a Goal and Scope section?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.3 Confirmed appropriate in interviews with practitioner.	9/4/2020
1.5	Does study include an Inventory Analysis section?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 4	9/4/2020
1.6	Does study include an Impact Assessment Section?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5	9/4/2020
1.7	Does the study include an interpretation of results?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 6.	9/17/2020
1.8	Does the study include a discussion on limitations?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 4.2	9/4/2020
1.9	Does the study include a data quality assessment? Are these sufficient to enable goal and scope to be met?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Section 3.10 Limitations and data quality discussed with practitioner throughout the project. Table number still not aligned. 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020

1.10	Does the study include a statement on ISO compliance?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.6	9/4/2020
1.11	Goal clearly defined and consistent with intended application?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.3	9/4/2020
1.12	Reason for study stated?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.3	9/4/2020
1.13	Intended application stated?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.3	9/4/2020
1.14	Function of product system clearly described.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3.1 – 1 unit of monitor arm to support one monitor over 10 years	9/4/2020
1.15	Functional unit adequately described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3.1 – 1 unit of monitor arm to support one monitor over 10 years	9/4/2020
1.16	System boundary adequately described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3.3 – Defined in Section 3.3.	9/17/2020
1.18	Are allocation procedures described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3.9 – discussed with practitioner.	9/17/2020
1.18	Geographical coverage stated and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, some limitations due to data but appropriate based on data availability.	9/4/2020
1.19	Is the cut-off criteria stated and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3.8	9/4/2020
1.20	Are the impact categories described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.1.	9/17/2020
1.21	Are the impact assessment and interpretation methods described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.1.	9/17/2020
1.22	Source of background data stated and clear?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Table 5/4. See comment 1.9 (table number issue). 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020

1.23	Are the data quality requirements of background data described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Table 5/4. See comment 1.9 (table number issue). 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020
1.24	Source of foreground data stated and clear?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Please add a total row to show the total weight of products on Table 4 (Material Composition). 9/21/2020 HS: Complete 9/21/2020 WAP: Section 3 and in supplemental information provided by practitioner. Accepted.	9/21/2020
1.25	Are the data quality requirements of foreground data described and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 3 and in supplemental information provided by practitioner.	9/4/2020
1.26	Were assumptions and limitations adequately described?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 4 and discussed with practitioner.	9/4/2020
1.27	Did the report include an appropriate statement on critical review?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 2.6	9/4/2020
1.28	Is the report format described (i.e. table of contents, list of figures, etc)?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Update Table numbers 9/21/2020 HS: Complete 9/21/2020 WAP: Yes, TOC, TOF, TOT. Accepted	9/21/2020
1.29	Were any additional functions of product system omitted? If so, were the reasons for the omission stated?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	No functions omitted.	9/9/2020
1.30	Did the review find that the justification to be appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	No functions omitted.	9/9/2020
1.31	Were unit processes described adequately?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, also described during the verification and review process directly with reviewer.	9/9/2020
1.32	Did the reviewer find that the methods used were scientifically and technically valid?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, Several rounds of refinement to methods, model and report but technical validity was reached.	9/9/2020
1.33	If the LCA was comparative in nature, were the product systems of the compared products deemed to be equivalent?	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Not Applicable	<input type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance		

1.34	If the LCA was comparative in nature, were the functional units of the compared products deemed to be equivalent?	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Not Applicable	<input type="checkbox"/> Conformance <input type="checkbox"/> 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?	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Not Applicable	<input type="checkbox"/> Conformance <input type="checkbox"/> 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?	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Not Applicable	<input type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance		
<b>2 Review of General Elements of Report</b>					
2.1	Are the collection methods used for primary data described and reasonable?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, throughout the report, supplemental information and discussion with practitioner	9/9/2020
2.2	Are sources/published literature adequately referenced?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes	9/17/2020
2.3	Is the reference unit of data stated for each input?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes	9/9/2020
2.4	Is the geographical representativeness of data for each input clear?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Table 5/4. See comment 1.9 (table number issue). 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020
2.5	Is the technological representativeness of the data for each input clear?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Table 5/4. See comment 1.9 (table number issue). 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020
2.6	Is data relevant and appropriate for the allocation among co-products?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	No co-products	9/9/2020
2.7	Is the period of data collection clear and appropriate?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Table 3	9/9/2020
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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes - 2019	9/9/2020

2.9	Were any data excluded? If yes, what is the justification of the excluded data. Is the justification adequate and warranted?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, however within cut-off criteria of below 5% by mass.	9/9/2020
2.10	Is the source of each data input clear?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: Table 5/4. See comment 1.9 (table number issue). 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020
2.11	Did the practitioner state data quality requirements? Does all data meet initial stated quality requirements?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes Section 3 and discussed.	9/9/2020
2.12	Was the choice of data unbiased so that it did not favor those participating in or financing study?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, reviewer found that that the choice of data did not bias the study.	9/9/2020
2.13	Where quality assurance and validation procedures used? Does the reviewer consider them to be adequate to meet the goal of the study?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Discussed and found to be appropriate.	9/9/2020
2.14	Were the results of validation methods reviewed by someone other than the LCA practitioner?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Reviewed by reviewers in critical review process.	9/9/2020
2.15	Overall, is data reasonable and appropriate in relation to the goal of the study?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes	9/9/2020
2.16	If allocation was used, was the basis of allocation clear (i.e physical or economical)?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – mass based and checked in sensitivity analysis while comparing with economic allocation.	9/9/2020
2.17	If allocation was used, were the allocation methods described, documented and justified for each unit process in which allocation was made?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes	9/9/2020
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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes	9/9/2020
2.20	Was a sensitivity analysis conducted to compare alternative allocation methods?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.6. Yes - mass based and checked in sensitivity analysis with economic allocation.	9/9/2020

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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – found to be consistent.	9/9/2020
3	Review of Impact Assessment				
3.1	Is there a statement that explains the relative expression of results?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 5.1.	9/17/2020
3.2	Are the chosen impact categories justified and valid?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 5.1.	9/17/2020
3.3	Was the impact assessment carried out in a way that is scientifically and technically valid?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – TRACI	9/9/2020
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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – weighting not used.	9/9/2020
3.5	Does the interpretation include a data quality assessment or a discussion of the data quality assessment?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 6	9/9/2020
3.6	Does the interpretation include a sensitivity analysis or a discussion of a sensitivity analysis that was conducted, if necessary?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 5.6	9/9/2020
3.7	Did the LCA reviewer find that significant findings were discussed adequately.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 5 and 6	9/9/2020
3.8	Did the LCA reviewer find that the role of excluded elements was evaluated and discussed adequately.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 3.10.4	9/9/2020
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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 3 and 4.	9/17/2020

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?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	9/17/2020 WAP: No. Please add these to Section 3.10 9/21/2020 HS: Complete 9/21/2020 WAP: Accepted	9/21/2020
3.11	Did the LCA reviewer find that the study included an adequate discussion related to the impact of value judgments on the results	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Not Applicable	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes – Section 5.6, sensitivity analysis has been conducted.	9/9/2020

## COMPLIANCE TO LIVING PRODUCT CHALLENGE 2.0 LCA-BASED REQUIREMENTS

Element	Applicability	Conformance Status	Review Comments <small>(Reviewer Comments in Black, LCA Practitioner Comments in Red)</small>	Approval Date	
<b>1 G-04 Life Cycle Assessment General Requirements</b>					
1.1	All manufacturers must produce and maintain an LCA Model demonstrating the product's cradle-to-grave impacts.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Model collected and reviewed.	9/21/2020
1.2	Performed in accordance with a relevant product category rule (PCR) to ISO 14040/44.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> 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.	9/9/2020
1.3	Critically reviewed by a third party for conformance with ISO 14044.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Review conducted and passed.	9/21/2020
1.4	Has either been performed by an LCA Certified Practitioner certified by ACLCA ( <a href="https://aclca.org/lcaccp-certification/">https://aclca.org/lcaccp-certification/</a> ) or by an ILFI-approved LCA practitioner or consultancy?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, ACLCA Certified Practitioner	9/9/2020
1.5	Has either been performed by an LCA Certified Practitioner certified by ACLCA ( <a href="https://aclca.org/lcaccp-certification/">https://aclca.org/lcaccp-certification/</a> ) or by an ILFI-approved LCA practitioner or consultancy?	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Hotspots identified. 5.3,5.4,5.5	9/9/2020
1.6	The LCA should clearly demonstrate the product's contributions to, at minimum, fossil-based energy, water, and greenhouse gas (GHG) emissions	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	LCA valid for 3 years.	9/9/2020
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.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Any updates in the LCA will be communicated to the reviewer and verified before applying for recertification.	9/9/2020

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.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.5	9/9/2020
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.	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.5	9/9/2020
3 I06-6 Energy Hotspot Identification					
3.1	A table of process contributions to cradle-to-gate life cycle energy consumption, listing at least the top 5 processes ranked in terms of energy consumption.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.3	9/9/2020
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.	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.3	9/9/2020
4 I14-4 Carbon Hotspot Identification					
4.1	A table of process contributions to cradle-to-gate life cycle carbon consumption, listing at least the top 5 processes ranked in terms of GHG emissions.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.4	9/9/2020
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.	<input type="checkbox"/> Requirement <input checked="" type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Section 5.4	9/9/2020

## COMPLIANCE TO LEED V4.1 LCA-BASED REQUIREMENTS

	Element	Applicability	Conformance Status	Review Comments <small>(Reviewer Comments in Black. LCA Practitioner Comments in Red)</small>	Approval Date
<b>1</b>	<b>BPDO - Environmental Product Declaration – Public Life Cycle Assessment Option (1 pt.)</b>				
1.1	Publicly Available	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	<a href="https://www.humanscale.com/resources/designer-toolkit/green-design.cfm">https://www.humanscale.com/resources/designer-toolkit/green-design.cfm</a>	9/9/2020
1.2	Critically Reviewed	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes.	9/9/2020
1.3	ISO14044 Compliant	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Critical review confirmed conformance.	9/21/2020
1.4	At Least Cradle to Gate in Scope	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, cradle to grave in scope.	9/9/2020
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.	<input checked="" type="checkbox"/> Requirement <input type="checkbox"/> Recommendation	<input checked="" type="checkbox"/> Conformance <input type="checkbox"/> Non-Conformance	Yes, pages 2 and 3 of the document.	9/9/2020

# 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_MArms_.zolca							
1	M10	Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
2		M10 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
3		M10 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
4		M10 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
5		M10 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
6		M10 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
7		M10 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
8		M10 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
9		M10 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
10		M10 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
11		M10 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
12		M10 EOL Trspt	Confirmed	Confirmed	Confirmed	Confirmed	
13		M10 EOL Disposal	Confirmed	Confirmed	Confirmed	Confirmed	
14	M2.1	M2.1 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
15		M2.1 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
16		M2.1 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
17		M2.1 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
18		M2.1 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
19		M2.1 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	

20		M2.1 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
21		M2.1 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
22		M2.1 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
23		M2.1 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
24		M2.1 EOL Trspt	Confirmed	Confirmed	Confirmed	Confirmed	
25		M2.1 EOL Disposal	Confirmed	Confirmed	Confirmed	Confirmed	
26	M8.1	M8.1 Cradle to Gate (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
27		M8.1 Cradle to Gate (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
28		M8.1 Cradle to Grave (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
29		M8.1 Cradle to Grave (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
30		M8.1 MatExtract (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
31		M8.1 MatTrans (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
32		M8.1 Trspt to Cust (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
34		M8.1 Trspt to Cust (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
35		M8.1 Trspt to HS (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	
36		M8.1 Trspt to HS (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
37		M8.1 EOL Trspt	Confirmed	Confirmed	Confirmed	Confirmed	
38		M8.1 EOL Disposal	Confirmed	Confirmed	Confirmed	Confirmed	
39		M8.1 GLO Electricity Pisc	Confirmed	Confirmed	Confirmed	Confirmed	WAP (9/17/2020): What is this process used for? HS (9/21/2020): This is used in Sensitivity Analysis for the electricity flow used WAP (9/21/2020): Accepted

40	All monitor arm models	Assembly (Dub)	Confirmed	Confirmed	Confirmed	Confirmed	WAP (9/17/2020): I see that the model 2017 data for assembly, but the report says 2019. Please elaborate on the difference. HS (9/21/2020): Mistake – used 2017 data accidentally which ends up being a very minor detriment to the impact categories. 2017 was a more consumptive year than 2019 WAP (9/21/2020): Reviewed and Accepted
41	All monitor arm models	Assembly (Pisc)	Confirmed	Confirmed	Confirmed	Confirmed	
42	All monitor arm models	Monitor Arm Maintenance	Confirmed	Confirmed	Confirmed	Confirmed	
43	All monitor arm models	Disinfecting Wipes (85 ct)	Confirmed	Confirmed	Confirmed	Confirmed	
44	All monitor arm models	Market for Pre-consumer plastic granulate	Confirmed	Confirmed	Confirmed	Confirmed	WAP (9/17/2020): What is this process used for? HS (9/21/2020): This is not used in the model. This was a separate analysis unrelated to this study WAP (9/21/2020): Reviewed and Accepted
45	All monitor arm models	Market for aluminum, cast alloy HS ratio	Confirmed	Confirmed	Confirmed	Confirmed	WAP (9/17/2020): What is this process used for? HS (9/21/2020): Used for aluminum with primary data for recycled content WAP (9/21/2020): Reviewed and Accepted