ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14044 and ASTM PCR for:

Sheet and Hot-Melt Rubberized Asphalt Products

Water-Resistive & Air Barriers

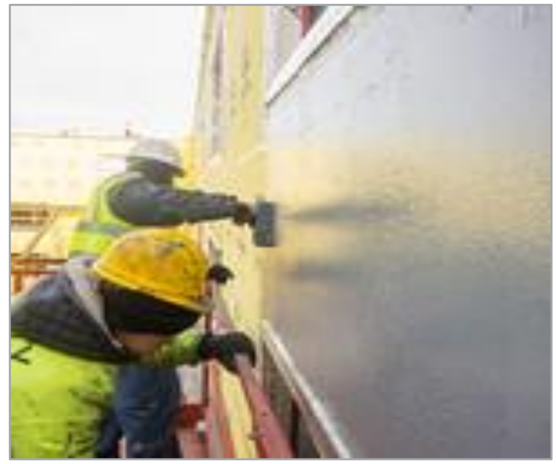
from Carlisle Coatings & Waterproofing Inc.

EPD DETAILS

Program Operator	NSF Certification, LLC 789 N Dixboro Road Ann Arbor, MI 48105, USA www.nsf.org Certified Environmental Product Declaration www.nsf.org
General Program instructions and Version Number	NSF Program Operator Rules, January 14, 2020
Manufacturer Name and Address	Carlisle Coatings & Waterproofing Inc. 900 Hensley Lane Wylie, Texas, USA 75098
Product Identification	Sheet and Hot-Melt Rubberized Asphalt Products: MiraDri 860/861, 711-70, 711-90, 705 AVB, 705 TWF, 705 FR-A, EZ Flash, Miradri 860-ULT, 705 XLT, 705 TWF XLT, 705 FR-A XLT, WIP 300HT, Metshield, 705 HT, VapAir Seal 725 TR, WIP 250, WIPGRIP and CCW 500.
Declared Product and Functional Unit	(1) m^2 of product following the ASTM Waster-Resistive & Air Barrier
Declaration Number	EPD10573
Reference PCR and Version Number	ASTM International: Water-Resistive and Air Barriers Valid: Sept. 2022 [1]. (UNCPC 54530 and/or CSI Master Format Designations 072500, 072600 and 072700)
Markets of applicability	North America
Date of Issue	June 30, 2021
Period of Validity	5 Years
EPD Type	Product Specific
EPD Scope	Cradle to Gate
Year of reported manufacturer primary data	2020
LCA Software and Version Number	Simapro v9.01
LCI database and version Number	Ecoinvent 3.6 [1] and Industry 2.0 [2]
LCIA Methodology and Version Number	TRACI 2.1 [2]
The PCR review conducted by;	Thomas P. Gloria, Industrial Ecology Consultants (chair), Graham Finch, RDH Building Science, Inc. & Paul H. Shipp, USG Corporation
This declaration was independently verified in accordance with ISO 14025:2006 [5]. ASTM International "Water-Resistive and Air Barriers), based on ISO 21930:2007 [6], serves as the core PCR. ☐INTERNAL ☒EXTERNAL	Tony Favilla, NSF International
This life cycle assessment was independently verified in accordance with ISO 14044 [7] and the reference PCR by:	Jack Geibig, Ecoform
This life cycle assessment was conducted in accordance with ISO 14044 [7] and the reference PCR by:	Intertek Health Sciences Inc. 2233 Argentia Road, Suite 201 Mississauga, Ontario, Canada L5N 2X7 www.intertek.com

GENERAL INFORMATION

Company Information



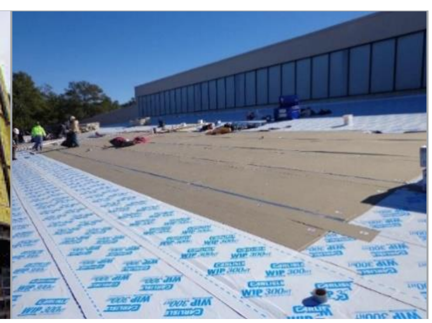
This cradle to gate environmental product declaration is for produced for Water-Resistive & Air Barriers products MiraDri 860/861, 711-70, 711-90, 705 AVB, 705 TWF, 705 FR-A, EZ Flash, Miradri 860-ULT, 705 XLT, 705 TWF XLT, 705 FR-A XLT, WIP 300HT, Metshield, 705 HT, VapAir Seal 725 TR, WIP 250, WIPGRIP, 500 from the location fully owned and operated by Carlisle Coatings & Waterproofing Inc. in USA, as follows:

For more than 45 years, CCW solutions have led the way in providing watertight, reliable waterproofing solutions to suit a variety of building sites. They provide time-tested and innovative solutions that incorporate the latest waterproofing technologies. Their complete waterproofing systems offer a single source warranty to streamline your next project from specification to delivery.

Further information regarding Carlisle Coatings & Waterproofing Inc. *can be accessed at:* https://www.carlisleccw.com

Product Information

Air barriers are essential for a high-performing building envelope. They dramatically improve building energy efficiency, indoor comfort, and longevity. CCW provides three types of water-resistive and air barrier products: self-adhered sheet, fluid-applied, and fluid-applied vapor-permeable. All have been evaluated by the Air Barrier Association of America (ABAA) and meet the most stringent energy codes including: 2012 & 2015 IECC; 2010 & 2013 ASHRAE 90.1; Massachusetts Energy Code 780 CMR; and the Canadian National Building Code.

MiraDri 860/861, 711-70, 711-90, 705 AVB, 705 TWF, 705 FR-A and EZ Flash, are self-adhering sheet membranes consisting of rubberized asphalt laminated to a polyolefin film. The combination of these two waterproofing materials provides a high-performance, extremely durable waterproofing barrier.

Miradri 860-ULT, 705 XLT, 705 TWF XLT and 705 FR-A XLT are self-adhering sheet membranes consisting of rubberized asphalt laminated to a polyolefin film. The combination of these two waterproofing materials provides a high-performance, extremely durable waterproofing barrier. These membranes are suitable for installations where the ambient temperature is between 15F and 60F.

WIP 300HT, Metshield and 705 HT Barritech NP-LT are high tensile strength rubberized asphalt self-adhering sheet membranes specifically designed to withstand temperatures up to 250F. They are ideal for use under metal including copper, zinc, and COR-TEN. The membranes resist cracking, drying and rotting, provides long-term waterproofing and low lifecycle cost.

VapAir Seal 725TR is a 40-mil composite consisting of 35 mils of self-adhering rubberized asphalt laminated to a 5-mil polypropylene film. A one-piece silicone poly release liner is applied to the SBS adhesive to prevent the material from bonding to itself. The factory-controlled thickness of the membrane ensures uniform barrier properties on the job. The woven polypropylene film increases strength and has a non-skid surface suitable for bonding of subsequent layers. VapAir Seal 725TR can be used on concrete, plywood, exterior gypsum, or other approved substrates in conjunction with Carlisle Syntec roofing systems. VapAir Seal 725TR must be covered with a roofing membrane within 120 days. T-joints must be sealed with an internal bead of Carlisle lap sealant.

WIP 250 is a self-adhering composite underlayment that consists of fiberglass-reinforced rubberized asphalt laminated to an impermeable film layer to provide dual-barrier moisture protection. Withstanding temperatures up to 250F, WIP 250 is ideal for use under metal and mechanically fastened tile roofs and provides unsurpassed protection from water penetration caused by wind-driven rain and ice dams.

WIPGRIP is a 55-mil flexible rubberized asphalt, fiberglass-reinforced membrane used as a shingle underlayment on critical roof areas such as eaves, ridges, valleys, dormers, and skylights. WIP GRIP underlayment protects roofing structures and interior spaces from water penetration caused by wind-driven rain and ice dams and may be used as a covering for the entire roof to prevent moisture or water entry.

CCW 500 is a hot applied waterproofing membrane is a single-component, rubberized asphalt compound that forms a tough, flexible, thick waterproofing membrane. It is comprised of 26% pre-consumer material and can contribute toward LEED credits in new construction. CCW-500 adheres tenaciously to virtually any sound vertical or horizontal surface to ensure water will not migrate beneath the membrane in the event of physical damage.

TABLE 1. PRODUCT CHARACTERISTICS AND PRODUCTION INFORMATION

Product	Product Density (kg/L)	Dry Product Thickness (m^2/L)	Dry Product Thickness (m^2/kg)
MiraDri 860/861	0.9798	0.7167	0.731
711-70		0.6771	0.691
711-90		0.5070	0.517
705 AVB		1.1150	1.138
705 TWF		1.1150	1.138
705 FR-A		1.1150	1.138
EZ Flash		2.6540	2.709
Miradri 860-ULT	0.9798	0.7167	0.731
705 XLT		1.115	1.137
705 TWF XLT		1.115	1.137
705 FR-A XLT		1.115	1.137
WIP 300HT	0.9865	1.224	1.240
Metshield		1.224	1.240
705 HT		1.224	1.240
VapAir Seal 725 TR	0.9851	1.062	1.078
WIP 250	1.146	1.117	0.974
WIPGRIP	1.277	1.104	0.864

TABLE 2. PRODUCT CHARACTERISTICS AND PRODUCTION INFORMATION FOR FLUID APPLIED PRODUCT

Product	Product Density (kg/L)	Dry Product Thickness (m^2/L)	Dry Product Thickness (m^2/kg)	Percent Solids (%)
500	1.328	0.3149	0.237	47.80

EPDs for fluid applied products shall note that environmental impact results will be proportional to dry product thickness if applied for a specific application to a thickness other than as specified in the EPD.

TABLE 3. TECHINCAL DATA FOR PRODUCTS

Product	Product Type and Performance	Physical Properties
MiraDri 860/861	Rubber Asphalt & Waterproofing Membrane	Colour: black on black film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.05 perms (ASTM E96)
711-70	Adhesive	Colour: Pale blue Odour: Latex Physical State: Liquid Evaporation Rate: 53 -55 % volatile VOC: 54 g/L Permeance: 0.05 perms (ASTM E96 B)
711-90	Rubber Asphalt & Waterproofing Membrane	Colour: black on black fabric Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.1 perms (ASTM E96 B)
705 AVB	Rubber Asphalt & Waterproofing Membrane	Colour: black on blue film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.08 & 0.1 perms (ASTM E96 A & B)
705 TWF	Rubber Asphalt & Waterproofing Membrane	Colour: black on blue film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F)
705 FR-A	Rubber Asphalt, Waterproofing & Air Barrier Membrane	Colour: black on silver film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.01 perms (ASTM E96 A & B)

EZ Flash	Waterproofing Membrane, Window and Door Flashing	Colour: black Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: >450 °F
Miradri 860-ULT	Waterproofing Membrane	Colour: black on black film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.05 perms (ASTM E96)
705 HT	Waterproofing and Air Barrier Membrane	Colour: black on black film Odour: Slight, petroleum Physical State: Solid Evaporation Rate: <0.01 Flash Point: 232°C (>450 °F) Permeance: 0.05 perms (ASTM E96)
CCW 500	Waterproofing Membrane	Colour: Black Odour: Asphalt Physical State: Solid Density:1.3 Flash Point: >450 °F Water Vapor Permeance: 13 ng/pa.s.m2 (ASTM E96 E)

TABLE 4. ADDITIONAL SYSTEM PERFORMANCE INFORMATION FOR ALL PRODUCTS

Product	ASTM
MiraDri 860/861	ASTM D 146, 412, 570, 903, & 1777 ASTM E 96 & 54
711-70	ASTM D 146 ASTM E 96
711-90	
705 AVB	ASTM E 2178-03, 96, 2357-11, 84-13a & AATCC Method 127
705 TWF	
705 FR-A	
EZ Flash	--
Miradri 860-ULT	--
705 XLT	--
705 TWF XLT	--
705 FR-A XLT	--
WIP 300HT	ASTM D 1970 (01, 08, 09, 11, 13)
Metshield	--
705 HT	--
VapAir Seal 725 TR	--
WIP 250	ASTM D 1970
WIPGRIP	ASTM D 1970

CCW 500	ASTM D 92, 41, 5329, 3746 ASTM E 96 & CGSB-3.50-M89

Some of the material ingredients used in the sheet and hot-melt rubberized asphalt products are identified as hazardous or toxic. The substances which are identified are crystalline silica, and calcium carbonate.

Product Application

CCW MiraDri 860/861 is a self-adhering sheet membrane consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to 4 mils (0.1 mm) of polyethylene to form a minimum 60-mil (1.5 mm) membrane. The combination of these two excellent waterproofing materials provides a high-performance, extremely durable waterproofing barrier. MiraDri 860/861 is suitable for installations where the ambient temperature is 40°F (4.4°C) or above. MiraDri 860-861 can be used for applications between 25°F (-3.9°C) and 40°F (4.4°C) if the product is stored in a heated area until use and the laps are treated with CCW contact adhesive.

CCW-711-70 & CCW-711-90 are a 70-mil-thick and 90-mil thick composition of a self-adhering rubberized asphalt membrane laminated to a strong, heat-resistant woven polypropylene mesh. A siliconized release liner prevents the material from sticking in the roll and is easily removed for installation. Factory-controlled thickness ensures uniform thickness on the job, while the inherent waterproofing properties of the rubberized asphalt membrane create an excellent water barrier that makes this product ideal for use in Department of Transportation projects that require waterproofing membranes. CCW-711-70 and CCW-711-90 Pre-Pave Sheet Membrane Waterproofing System will protect cracking in the asphalt overlay while preventing structural damage from water and de-icing salts.
CCW-705 is a 40-mil-thick self-adhering membrane consisting of a tough, cross-laminated, HDPE film fully coated with an aggressive, rubberized-asphalt adhesive. The product is packaged in rolls with a disposable silicone paper release liner that is removed during use. CCW-705 Strips are provided in convenient widths of 4", 6", 9" and 12". CCW-705 Strips are ideal for wall flashing applications such as window and door openings and joints, as well as detailing in CCW wall membrane air barrier systems.

CCW-705-TWF thru-wall flashing is a 40-mil self-adhering thru-wall flashing deigned to provide moisture protection in cavity wall construction.

EZ flash are manufactured with a self-adhering rubberized asphalt membrane laminated to a two-mil high density polyethylene film. It is cold applied system that offers firm adhesion and easy application and can be installed on any window or door. They can be installed on concrete, masonry, gypsum, steel, and wool substrates.
MiraDri 860-ULT, 705 XLT, 705 TWF XLT, 705 FR-A XLT are self-adhering sheet membranes consisting of rubberized asphalt laminated to a polyolefin film. The combination of these two waterproofing materials provides a high-performance, extremely durable waterproofing barrier. These membranes are suitable for installations where the ambient temperature is between 15 F and 60 F.

WIP 300HT, Metshield, and 705HT are high tensile strength rubberized asphalt self-adhering sheet membranes specifically designed to withstand temperatures up to 250F. They are ideal for use under metal including copper, zinc, and COR-TE. The membranes resist cracking, drying, and rotting, provides long-term waterproofing and low lifecycle cost.

CCW 705 FR-A & 725TR Air and Vapor Barrier/Temporary roof is a 40-mil composite consisting of 35 mils of self-adhering rubberized asphalt laminated to a 5-mil polypropylene film. A one-piece silicone poly release liner is applied to the SBS adhesive to prevent the material from bonding to itself. The factory-controlled thickness of the membrane ensures uniform barrier properties on the job. The woven polypropylene film increases strength and has a non-skid surface suitable for bonding of subsequent layers. 725TR can be used on concrete, plywood, exterior gypsum, or other approved substrates in conjunction with Carlisle Syntec roofing systems. 725TR must be covered with a roofing membrane within 120 days, T-joints must be sealed with an internal bead of Carlisle lap sealant.

WIP 250 is a self-adhering composite underlayment that consists of fiberglass-reinforced rubberized asphalt laminated to an impermeable film layer to provide dual-barrier moisture protection. Withstanding temperatures up to 250F, WIP 250 is ideal for use under metal and mechanically fastened tile roofs and provides unsurpassed protection from water penetration caused by wind-driven rain and ice dams. WIP GRIP is a 55-mil flexible rubberized asphalt, fiberglass-reinforced membrane used as a shingle underlayment on critical roof areas such as eaves, ridges, valleys, dormers, and skylights.

WIP GRIP underlayment protects roofing structures and interior spaces from water penetration caused by wind-driven rain and ice dams and may be used as a covering for the entire roof to prevent moisture or water entry.

CCW-500 hot applied waterproofing membrane is a single-component, rubberized asphalt compound that forms a tough, flexible, thick waterproofing membrane. It is comprised of 26% pre-consumer material and can contribute toward LEED credits in new construction. CCW-500 adheres tenaciously to virtually any sound vertical or horizontal surface to ensure water will not migrate beneath the membrane in the event of physical damage.

Study Application

This study was conducted to provide CCW with the cradle-to-gate environmental impacts associated with the MiraDri 860/861, 711-70, 711-90, 705 AVB, 705 TWF, 705 FR-A, EZ Flash, Miradri 860-ULT, 705 XLT, 705 TWF XLT, 705 FR-A XLT, WIP 300HT, Metshield, 705 HT, VapAir Seal 725 TR, WIP 250, WIPGRIP, 500 and to create the EPD for the products. The LCA study evaluates the environmental impacts at various stages of the lifecycle Sheet and Hot-Melt Rubberized Asphalt products. The results are intended to inform the creation of this EPD. This assessment is not intended to be used for comparative assertion. The intended audience of this study is both internal to CCW and external (Business-to-Business and Business-to-Consumer) to CCW *via* an EPD document.

Declaration of Methodological Framework

This EPD is considered a Cradle-to-Gate study. A summary of the life cycle stages included in this EPD is presented in Table 4. The Allocation and Cut-off rules applied to this study have been discussed in detail further in the report. The LCA Study followed an attributional approach and no known flows are deliberately excluded from this EPD.

Flow Diagram

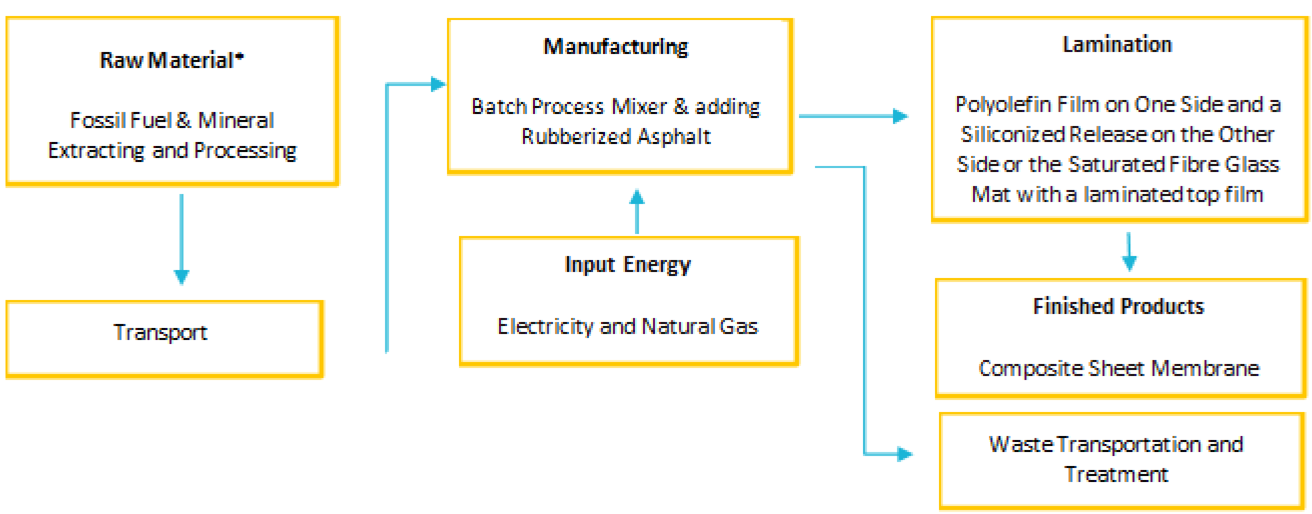


FIGURE 1. UNIT FLOW DIAGRAM FOR SHEET AND HOT-MELT RUBBERIZED ASPHALT PRODUCTS

Manufacturing Process

The sheet and Hot melt rubberised asphalt membrane products are manufactured at Terrell, Texas and Carlisle, Pennsylvania. The Manufacturing process starts when the raw materials are formulated and mixed in a batch process, adding rubberized asphalt. Then it is laminated to a polyolefin film on one side and a siliconized release liner is laminated to the other side. Depending on the product the lamination polyolefin film process is skipped, and a fibre glass mat is then dipped into a tank filled with rubberized asphalt until fully saturated and a top film is laminated it. The composite sheet membrane is packaged in a box for shipment.

Period Under Review

The period of review is calendar year 2020.

Comparability & Benchmarking

This EPD should not be used for comparative assertions as the scope of the study is cradle-to-gate and does not include the use and end-of-life phase. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modelled.

LCA CALCULATION RULES

Declared Unit

The declared unit is defined as (1) m^2 of product following the ASTM International Waster-Resistive & Air Barrier PCR [1].

System Boundary

The LCA system boundary for all of the water-resistive and air barrier products includes cradle-to-gate life cycle stages. This boundary considers product stages such as: raw material extraction and processing, transport to the manufacturer, packaging, and manufacturing activities.

Construction, use, end-of-life, and the benefits and loads beyond the system boundary for reuse, recovery, and recycling potential, are not included in this study. The cradle-to-gate system boundary includes all unit processes contributing measurably to the category indicator results. As per the sensitivity analysis performed the system boundary does not need any refining and all the stages included in the initial system boundary stay the same.
Other Elements that are excluded from the system boundary are the manufacture, maintenance and decommissioning of capital equipment (e.g. buildings, machines, and vehicles), as well as the background infrastructure in both primary and secondary data. The deletion of these processes and inputs is permitted since it is not expected to significantly change the overall conclusions of the study. A description of each life cycle stage, in accordance with the PCR, is provided below

The study avoids the value choices such as normalization or grouping of indicator results and the LCA study is conducted with the best of the practitioner's knowledge.

TABLE 5. THE LIFE CYCLE STAGES INCLUDED IN THE SYSTEM BOUNDARY FOR ALL PRODUCTS

Upstream		Core	Downstream													Other
Product Stage			Construction Process Stage		Use Stage							End of Life Stage				Benefits and Loads Beyond
Raw Material Supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal	Future reuse, recycling, or energy recovery potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	**X**	**X**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

X = included in the study, ND = module not declared

A1-A3: Production Stage information modules

Extraction and Upstream Production (A1) includes the extraction of all raw materials, including the transport to the raw material processing site. Resource use and emissions associated with extraction of the raw materials and product component manufacturing is included. It also includes the generation of energy from the primary resources used during extraction and processing.

Transport to manufacturing facility (A2) includes the impacts associated with the transport of the processed raw materials to the manufacturing facility.

Manufacturing (A3) includes all the relevant manufacturing processes and flows, including the impacts from energy use and emissions at the facility. It also includes the transportation to landfill of all processing waste, including the empty back hauls. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are not included. This stage also includes the packaging of finished product.

Allocation

Based on the information provided by CCW a physical allocation by mass was applied. The primary data for resource use (electricity, natural gas, water, etc.) and waste are allocated on a mass basis as a fraction of total annual production (October 2019 to September 2020).

Additionally, ISO 14044 [7] addresses allocation procedures for reuse and recycling situations. Several allocation scenarios and procedures are addressed by the standard, including consideration of both closed-loop and open-loop recovery systems. For this LCA study there are no closed or open loop system.

Assumptions

The Ecoinvent 3.6 database is one of the most comprehensive and reliable resources for LCA data available globally. The inputs for manufacturing, packaging, and transporting the air & water barrier products w provided by CCW.

While raw material and sub-component data sets within the Ecoinvent 3.6 database typically include raw material extraction, transport, infrastructure, emissions, waste and energy use, they do not include any packaging and/or palletizing that is applied to sub-components in their transport to the finished product manufacturer.

- The dimensions of the pallets were provided by CCW. However, desktop research was required to determine the pallet weights, using the given dimensions.
- The Cardboard box dimension and weights were calculated using values determined through desktop research and images provided by CCW.
- All input information is assumed to be as accurate as possible at the time of the study (2019/2020).
- Inventory data for packaging, and ancillary materials were modelled with unit process data taken from Ecoinvent.

Cut-Off Rules

The following cut-off criteria was considered.

- The mass and energy flow that consist of less than 1% may be omitted from the inventory analysis and the total omitted mass or energy flows shall not exceed 5%.
- The cut-off criterium was not applied to any substance which are identified as hazardous or toxic and all such substances are included in the inventory.

A sensitivity analysis was performed to determine the environmental significance of this cut-off criteria, which showed no significant impact to the outcome of the study.

Data Quality

TABLE 6. DATA QUALITY ASSESSMENT

Requirement	Assessment
Time Related Coverage: age of data and the minimum length of time over which data should be collected	The material and energy inputs provided by CCW are from the manufacturer based on measured primary data in 2019-20 for their products. Data for the Life Cycle Inventory (LCI) was obtained primarily from Ecoinvent 3.6 datasets and in some cases from Industry 2.0 datasets, the most up-to-date version available at the time of the study. Many of the parameters included in the study, reference data from 2020 are used. Thus, it is considered high quality data.
Geographical Coverage: geographical area from which data for unit processes should be collected to satisfy the goal of the study	The Ecoinvent 3.6 database, typically base their research and measurement on specific producers, usually in Europe and adjust for global energy and transport considerations. The electricity grid selected for the production phase was specific to the USA, where the manufacturers are located. Thus, the data is considered high quality.
Technology Coverage: specific technology or technology mix	CCW provided the primary material and energy input data, based on their sales data and composition of the air and water barrier products and its transport packaging. CCW production and materials do not evolve quickly

Requirement	Assessment
	and thus analysis is based on current technologies for the product. Technology, materials, and processes used in the Ecoinvent 3.6 and Industry Data 2.0 are mostly current and typically reference data from 2020. Thus, it is considered medium quality.
Precision: measure of the variability of the data values for each data expressed	CCW provided the primary material and energy input data, based on sales data and composition and density. Given the simplicity of this data, it is anticipated that there are few opportunities for variability in data. Thus, the data is considered high quality Additionally, an uncertainty analysis was performed and reported in the uncertainty section of the report.
Completeness: percentage of flow that is measured or estimated	CCW provided the primary material and energy input data, based on sales data and composition. All materials reported in the data were included in the raw materials phase of the LCA. Energy data was provided by the manufacturer and was measured in a current year on for the product; thus, this is considered 100% measured. Background or secondary data provided by the Ecoinvent 3.6 database, are globally regarded as high quality and researched data. At the time of the study, version 3.6 is the most up-to-date dataset available in Ecoinvent. Thus, it is considered medium quality.
Representativeness: qualitative assessment of the degree to which the data set reflects the true population of interest	CCW provided the primary material and energy input data, based on sales data, material composition and measured energy consumption. Given CCW expertise and in-depth knowledge of their products, it is anticipated that primary data is representative of actual data. Thus, considered high quality.
Consistency: qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The same methodology was applied consistently to all the studies. Thus, considered high quality.
Reproducibility: qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Provided the practitioner has access to the same data sources described in the report, the results would be reproducible. It is considered high quality.
Data Sources: Description of data sources	CCW provided the primary material and energy input data, based on sales data, material composition and measured energy consumption. Thus, the data is considered high quality. Secondary data was derived from open sources, such as Ecoinvent 3.6, research and literature review.
Uncertainty: Description of known sources of potential uncertainty	Key uncertainty assumptions are stated in the report and evaluated by the pedigree matrix method.

Material Input

Raw material inputs are entered into the LCA model in kg per 1 m2 product. The bill of materials and material input information is shown for each product below. Primary data was provided by CCW for each product and its packaging. The sources of secondary LCI data is Ecoinvent v3.6 (2020). The tables below also summarize the data sources for materials and flows used in this LCA study.

TABLE 7. MATERIAL CONTRIBUTION USED TO MODEL MIRADRI 860/861

Flow	Contribution (%)
Miradri 860.861 Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 8. MATERIAL CONTRIBUTION USED TO MODEL 711-70

Flow	Contribution (%)
CCW 711-70 Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 9. MATERIAL CONTRIBUTION USED TO MODEL 711-90

Flow	Contribution (%)
CCW 711-90 Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 10. MATERIAL CONTRIBUTION USED TO MODEL 705 AVB

Flow	Contribution (%)
CCW 705 AVB Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 11. MATERIAL CONTRIBUTION USED TO MODEL 705 TWF

Flow	Contribution (%)
CCW 705 TWF – Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 12. MATERIAL CONTRIBUTION USED TO MODEL 705 FR-A

Flow	Contribution (%)
CCW 705 FR-A Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 13. MATERIAL CONTRIBUTION USED TO MODEL EZ FLASH

Flow	Contribution (%)
EZ Flash – Hot Melt	
Distillate	1-5%
Asphalt	0-80%
Asphalt, oxidized	0-80%

Flow	Contribution (%)
Distillate	0-80%
Petroleum Residues	0-80%
Fatty Acids	1-5%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	60%
Shrink Wrap	1%
Box	39%

TABLE 14. MATERIAL CONTRIBUTION USED TO MODEL MIRADRI 860- ULT

Flow	Contribution (%)
MiraDri 860- ULT Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 15. MATERIAL CONTRIBUTION USED TO MODEL CCW- 705 XLT

Flow	Contribution (%)
CCW – 705 XLT Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	

Flow	Contribution (%)
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 16. MATERIAL CONTRIBUTION USED TO MODEL CCW- 705 XLT TWF

Flow	Contribution (%)
CCW – 705 XLT TWF Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 17. MATERIAL CONTRIBUTION USED TO MODEL CCW 705 FR-A XLT

Flow	Contribution (%)
CCW 705 FR-A XLT Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 18. MATERIAL CONTRIBUTION USED TO MODEL WIP 300HT

Flow	Contribution (%)
WIP 300HT – Hot Melt	
Distillate	1-5%
Asphalt	0-80%
Asphalt, oxidized	0-80%
Distillate	0-80%
Petroleum Residues	0-80%
Fatty Acids	1-5%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 19. MATERIAL CONTRIBUTION USED TO MODEL METSHIELD

Flow	Contribution (%)
Metshield – Hot Melt	
Distillate	1-5%
Asphalt	0-80%
Asphalt, oxidized	0-80%
Distillate	0-80%
Petroleum Residues	0-80%
Fatty Acids	1-5%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 20. MATERIAL CONTRIBUTION USED TO MODEL 705 HT

Flow	Contribution (%)
CCW 705 HT – Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%

Flow	Contribution (%)
Petroleum Residues	0-75%
Fatty Acids	0-4%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 21. MATERIAL CONTRIBUTION USED TO MODEL VAPAIR SEAL 725 TR

Flow	Contribution (%)
VapAir Seal – Hot Melt	
Distillate	5-10%
Asphalt	0-75%
Asphalt, oxidized	0-75%
Distillate	0-75%
Petroleum Residues	0-75%
Fatty Acids	0.8%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	66%
Shrink Wrap	1%
Box	33%

TABLE 19. MATERIAL CONTRIBUTION USED TO MODEL WIP 250

Flow	Contribution (%)
WIP 250 – Hot Melt	
Asphalt	0-55%
Asphalt, oxidized	0-55%
Distillate	0-55%
Petroleum Residues	0-55%
Fatty Acids	10-30%
Limestone	10-30%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%

Flow	Contribution (%)
Shrink Wrap	1%
Box	38%

TABLE 22. MATERIAL CONTRIBUTION USED TO MODEL WIP GRIP

Flow	Contribution (%)
WIP GRIP – Hot Melt	
Asphalt	0-55%
Asphalt, oxidized	0-55%
Distillate	0-55%
Petroleum Residues	0-55%
Fatty Acids	5-10%
Limestone	15-40%
Asphalt Sheet Membrane	
Finished Membrane	100%
Packaging	
Pallet	61%
Shrink Wrap	1%
Box	38%

TABLE 23. MATERIAL CONTRIBUTION USED TO MODEL 500

Flow	Contribution (%)
500	
Distillate	5.86%
Paraffin Wax & Hydrocarbon Wax	2.27%
Limestone	40%
Zinc, bis(dibutylcarbamodithioato-S,S')-, (T-4)-	0.17%
Asphalt	0-16.14%
Asphalt, oxidized	0-16.14%
Distillate	0-16.14%
Petroleum Residues	0-16.14%%
Packaging	
Pallet	1%
Shrink Wrap	0%
Box	99%

ENVIRONMENTAL PERFORMANCE

Life Cycle Impact Assessment

The purpose of conducting an impact assessment is to determine the actual impacts from the material and energy inputs calculated in the LCI. This is accomplished through assigning the LCI mass and energy inputs into flows that are then classified by the environmental impact categories to which they contribute. To compare emissions from various pollutants on the same scale, the impact assessment methodology characterizes emissions from various substances to enable comparison in common equivalence units. The impact categories are based on TRACI 2.1 [2] as per the PCR [1]. Further details of each impact category are provided in Appendix B. Additionally, the PCR specifies that other measures are declared as per ISO 14044 representing Primary Energy Consumption and Material Resource Consumption [6]. All cradle-to-gate LCIA results are provided for modules A1-A3 in the results section below for all products.

The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. The LCIA indicators prescribed by the PCR do not represent all categories of potential environmental impacts, such as impacts to terrestrial ecosystem.

TABLE 24. LIST OF CRADLE-TO-GATE MODULE NUMBERS FOR REPORTING THE RESULTS

Module Number	Module Name
A1	Raw Material Supply
A2	Transport
A3	Manufacturing

LCIA Results: TRACI Method

TABLE 25. CRADLE-TO-GATE LCIA RESULT FOR MIRADRI 860/861 PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.06E+00	1.36E+00	6.01E-01	9.22E-02
Acidification	kg SO2 eq.	9.74E-03	6.88E-03	2.66E-03	2.09E-04
Eutrophication	kg N eq.	1.51E-03	1.09E-03	3.31E-04	9.19E-05
Smog	kg O3 eq.	1.56E-01	9.26E-02	6.11E-02	1.77E-03
Ozone Depletion	kgCFC-11 eq.	4.34E-07	2.92E-07	1.36E-07	6.37E-09
Non-Renewable Fossil	MJ (HHV)	5.06E+01	4.04E+01	9.30E+00	9.84E-01
Non-Renewable Nuclear	MJ (HHV)	1.78E+00	1.45E+00	1.28E-01	2.04E-01
Renewable	MJ (HHV)	2.12E-01	1.26E-01	1.51E-02	7.10E-02
Renewable (Biomass)	MJ (HHV)	6.50E+00	6.46E+00	3.52E-02	3.96E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.59E+00	3.57E+00	2.28E-02	2.82E-03
Net Fresh Water	L	1.81E+01	1.73E+01	7.70E-01	5.54E-02
Non-Hazardous Waste Generated	kg	6.13E-05	3.71E-05	2.39E-05	1.89E-07
Hazardous Waste Generated	kg	4.62E-01	1.14E-01	3.45E-01	3.32E-03

TABLE 26. CRADLE-TO-GATE LCIA RESULT FOR 711-70 PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.71E+00	1.95E+00	6.55E-01	1.10E-01
Acidification	kg SO2 eq.	1.24E-02	9.29E-03	2.90E-03	2.52E-04
Eutrophication	kg N eq.	1.78E-03	1.30E-03	3.61E-04	1.10E-04
Smog	kg O3 eq.	1.93E-01	1.24E-01	6.66E-02	2.07E-03
Ozone Depletion	kgCFC-11 eq.	4.84E-07	3.29E-07	1.48E-07	7.81E-09
Non-Renewable Fossil	MJ (HHV)	7.29E+01	6.16E+01	1.01E+01	1.20E+00
Non-Renewable Nuclear	MJ (HHV)	2.81E+00	2.42E+00	1.40E-01	2.51E-01
Renewable	MJ (HHV)	2.99E-01	1.95E-01	1.64E-02	8.74E-02
Renewable (Biomass)	MJ (HHV)	6.55E+00	6.51E+00	3.83E-02	4.87E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.61E+00	3.58E+00	2.49E-02	3.46E-03
Net Fresh Water	L	2.28E+01	2.18E+01	8.39E-01	6.85E-02
Non-Hazardous Waste Generated	kg	6.75E-05	4.13E-05	2.61E-05	2.24E-07
Hazardous Waste Generated	kg	5.20E-01	1.40E-01	3.76E-01	4.05E-03

TABLE 27. CRADLE-TO-GATE LCIA RESULT FOR 711-90 PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	3.19E+00	2.25E+00	8.44E-01	9.79E-02
Acidification	kg SO2 eq.	1.48E-02	1.09E-02	3.73E-03	2.23E-04
Eutrophication	kg N eq.	2.07E-03	1.51E-03	4.66E-04	9.80E-05
Smog	kg O3 eq.	2.33E-01	1.45E-01	8.59E-02	1.86E-03
Ozone Depletion	kgCFC-11 eq.	6.05E-07	4.07E-07	1.91E-07	6.84E-09
Non-Renewable Fossil	MJ (HHV)	8.76E+01	7.35E+01	1.31E+01	1.06E+00
Non-Renewable Nuclear	MJ (HHV)	3.07E+00	2.67E+00	1.80E-01	2.19E-01
Renewable	MJ (HHV)	3.07E-01	2.09E-01	2.12E-02	7.65E-02
Renewable (Biomass)	MJ (HHV)	6.62E+00	6.57E+00	4.94E-02	4.26E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.70E+00	3.67E+00	3.21E-02	3.03E-03
Net Fresh Water	L	2.55E+01	2.44E+01	1.08E+00	5.84E-02
Non-Hazardous Waste Generated	kg	8.07E-05	4.69E-05	3.36E-05	1.98E-07
Hazardous Waste Generated	kg	6.42E-01	1.54E-01	4.84E-01	3.56E-03

TABLE 28. CRADLE-TO-GATE LCIA RESULT FOR 705 AVB PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	1.56E+00	1.06E+00	4.07E-01	9.22E-02
Acidification	kg SO2 eq.	7.28E-03	5.27E-03	1.80E-03	2.09E-04
Eutrophication	kg N eq.	1.20E-03	8.79E-04	2.25E-04	9.19E-05
Smog	kg O3 eq.	1.15E-01	7.19E-02	4.14E-02	1.77E-03
Ozone Depletion	kgCFC-11 eq.	3.10E-07	2.12E-07	9.20E-08	6.37E-09
Non-Renewable Fossil	MJ (HHV)	3.56E+01	2.83E+01	6.30E+00	9.84E-01
Non-Renewable Nuclear	MJ (HHV)	1.49E+00	1.20E+00	8.69E-02	2.04E-01
Renewable	MJ (HHV)	1.94E-01	1.13E-01	1.02E-02	7.10E-02
Renewable (Biomass)	MJ (HHV)	6.62E+00	6.59E+00	2.38E-02	3.96E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.58E+00	3.56E+00	1.55E-02	2.82E-03
Net Fresh Water	L	1.53E+01	1.48E+01	5.22E-01	5.62E-02
Non-Hazardous Waste Generated	kg	4.80E-05	3.16E-05	1.62E-05	1.89E-07
Hazardous Waste Generated	kg	3.38E-01	1.01E-01	2.34E-01	3.32E-03

TABLE 29. CRADLE-TO-GATE LCIA RESULT FOR 705 TWF PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	1.80E+00	1.27E+00	4.24E-01	9.79E-02
Acidification	kg SO2 eq.	8.27E-03	6.17E-03	1.87E-03	2.23E-04
Eutrophication	kg N eq.	1.37E-03	1.04E-03	2.34E-04	9.81E-05
Smog	kg O3 eq.	1.30E-01	8.51E-02	4.31E-02	1.87E-03
Ozone Depletion	kgCFC-11 eq.	3.36E-07	2.33E-07	9.58E-08	6.84E-09
Non-Renewable Fossil	MJ (HHV)	3.85E+01	3.09E+01	6.56E+00	1.06E+00
Non-Renewable Nuclear	MJ (HHV)	1.88E+00	1.57E+00	9.05E-02	2.19E-01
Renewable	MJ (HHV)	2.43E-01	1.56E-01	1.06E-02	7.65E-02
Renewable (Biomass)	MJ (HHV)	7.58E+00	7.55E+00	2.48E-02	4.26E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	4.12E+00	4.10E+00	1.61E-02	3.03E-03
Net Fresh Water	L	1.93E+01	1.87E+01	5.43E-01	5.91E-02
Non-Hazardous Waste Generated	kg	5.34E-05	3.64E-05	1.69E-05	1.98E-07
Hazardous Waste Generated	kg	3.89E-01	1.42E-01	2.43E-01	3.56E-03

TABLE 30. CRADLE-TO-GATE LCIA RESULT FOR 705 FR-A PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.16E+00	1.64E+00	4.33E-01	9.22E-02
Acidification	kg SO2 eq.	9.71E-03	7.58E-03	1.91E-03	2.09E-04
Eutrophication	kg N eq.	1.50E-03	1.17E-03	2.39E-04	9.19E-05
Smog	kg O3 eq.	1.50E-01	1.05E-01	4.40E-02	1.77E-03
Ozone Depletion	kgCFC-11 eq.	3.54E-07	2.49E-07	9.78E-08	6.37E-09
Non-Renewable Fossil	MJ (HHV)	4.27E+01	3.50E+01	6.69E+00	9.84E-01
Non-Renewable Nuclear	MJ (HHV)	2.45E+00	2.15E+00	9.24E-02	2.04E-01
Renewable	MJ (HHV)	3.02E-01	2.21E-01	1.09E-02	7.10E-02
Renewable (Biomass)	MJ (HHV)	5.69E+00	5.66E+00	2.53E-02	3.96E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.17E+00	3.15E+00	1.64E-02	2.82E-03
Net Fresh Water	L	2.33E+01	2.27E+01	5.55E-01	5.65E-02
Non-Hazardous Waste Generated	kg	8.24E-05	6.50E-05	1.72E-05	1.89E-07
Hazardous Waste Generated	kg	4.81E-01	2.30E-01	2.48E-01	3.32E-03

TABLE 31. CRADLE-TO-GATE LCIA RESULT FOR EZ FLASH PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	9.70E-01	6.92E-01	1.85E-01	9.22E-02
Acidification	kg SO2 eq.	4.46E-03	3.43E-03	8.19E-04	2.09E-04
Eutrophication	kg N eq.	7.52E-04	5.58E-04	1.02E-04	9.19E-05
Smog	kg O3 eq.	6.62E-02	4.56E-02	1.88E-02	1.77E-03
Ozone Depletion	kgCFC-11 eq.	1.55E-07	1.07E-07	4.19E-08	6.37E-09
Non-Renewable Fossil	MJ (HHV)	2.12E+01	1.74E+01	2.86E+00	9.84E-01
Non-Renewable Nuclear	MJ (HHV)	1.13E+00	8.85E-01	3.95E-02	2.04E-01
Renewable	MJ (HHV)	1.38E-01	6.27E-02	4.65E-03	7.10E-02
Renewable (Biomass)	MJ (HHV)	6.49E+00	6.47E+00	1.08E-02	3.96E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.28E+00	3.27E+00	7.03E-03	2.82E-03
Net Fresh Water	L	8.77E+00	8.47E+00	2.37E-01	5.56E-02
Non-Hazardous Waste Generated	kg	2.65E-04	2.57E-04	7.37E-06	1.89E-07
Hazardous Waste Generated	kg	1.70E-01	6.07E-02	1.06E-01	3.32E-03

TABLE 32. CRADLE-TO-GATE LCIA RESULT FOR MIRADRI 860-ULT PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.11E+00	1.37E+00	6.01E-01	1.41E-01
Acidification	kg SO2 eq.	9.87E-03	6.89E-03	2.66E-03	3.21E-04
Eutrophication	kg N eq.	1.57E-03	1.09E-03	3.31E-04	1.41E-04
Smog	kg O3 eq.	1.57E-01	9.29E-02	6.11E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	4.35E-07	2.90E-07	1.36E-07	9.79E-09
Non-Renewable Fossil	MJ (HHV)	5.09E+01	4.01E+01	9.30E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	1.89E+00	1.45E+00	1.28E-01	3.13E-01
Renewable	MJ (HHV)	2.52E-01	1.27E-01	1.51E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	6.91E+00	6.87E+00	3.52E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.77E+00	3.74E+00	2.28E-02	4.33E-03
Net Fresh Water	L	1.82E+01	1.73E+01	7.70E-01	8.41E-02
Non-Hazardous Waste Generated	kg	6.15E-05	3.73E-05	2.39E-05	2.88E-07
Hazardous Waste Generated	kg	4.67E-01	1.17E-01	3.45E-01	5.10E-03

TABLE 33. CRADLE-TO-GATE LCIA RESULT FOR 705 XLT PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	1.62E+00	1.07E+00	4.07E-01	1.41E-01
Acidification	kg SO2 eq.	7.46E-03	5.34E-03	1.80E-03	3.21E-04
Eutrophication	kg N eq.	1.27E-03	9.06E-04	2.25E-04	1.41E-04
Smog	kg O3 eq.	1.17E-01	7.29E-02	4.14E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	3.18E-07	2.16E-07	9.20E-08	9.79E-09
Non-Renewable Fossil	MJ (HHV)	3.60E+01	2.82E+01	6.30E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	1.60E+00	1.20E+00	8.69E-02	3.13E-01
Renewable	MJ (HHV)	2.34E-01	1.15E-01	1.02E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	7.39E+00	7.36E+00	2.38E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.95E+00	3.93E+00	1.55E-02	4.33E-03
Net Fresh Water	L	1.55E+01	1.49E+01	5.22E-01	8.41E-02
Non-Hazardous Waste Generated	kg	4.92E-05	3.27E-05	1.62E-05	2.88E-07
Hazardous Waste Generated	kg	3.45E-01	1.06E-01	2.33E-01	5.10E-03

TABLE 34. CRADLE-TO-GATE LCIA RESULT FOR 705 TWF PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	1.85E+00	1.28E+00	4.24E-01	1.41E-01
Acidification	kg SO2 eq.	8.43E-03	6.24E-03	1.87E-03	3.21E-04
Eutrophication	kg N eq.	1.44E-03	1.06E-03	2.34E-04	1.41E-04
Smog	kg O3 eq.	1.32E-01	8.61E-02	4.31E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	3.43E-07	2.38E-07	9.58E-08	9.79E-09
Non-Renewable Fossil	MJ (HHV)	3.89E+01	3.08E+01	6.56E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	1.98E+00	1.57E+00	9.05E-02	3.13E-01
Renewable	MJ (HHV)	2.78E-01	1.58E-01	1.06E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	8.35E+00	8.32E+00	2.48E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	4.49E+00	4.47E+00	1.61E-02	4.33E-03
Net Fresh Water	L	1.94E+01	1.88E+01	5.43E-01	8.41E-02
Non-Hazardous Waste Generated	kg	5.46E-05	3.74E-05	1.69E-05	2.88E-07
Hazardous Waste Generated	kg	3.95E-01	1.47E-01	2.43E-01	5.10E-03

TABLE 35. CRADLE-TO-GATE LCIA RESULT FOR 705 FR-A XLT PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.22E+00	1.65E+00	4.33E-01	1.41E-01
Acidification	kg SO2 eq.	9.88E-03	7.65E-03	1.91E-03	3.21E-04
Eutrophication	kg N eq.	1.58E-03	1.20E-03	2.39E-04	1.41E-04
Smog	kg O3 eq.	1.52E-01	1.06E-01	4.40E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	3.61E-07	2.54E-07	9.78E-08	9.79E-09
Non-Renewable Fossil	MJ (HHV)	4.31E+01	3.49E+01	6.69E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	2.56E+00	2.16E+00	9.23E-02	3.13E-01
Renewable	MJ (HHV)	3.43E-01	2.23E-01	1.09E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	6.46E+00	6.43E+00	2.53E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.54E+00	3.52E+00	1.64E-02	4.33E-03
Net Fresh Water	L	2.34E+01	2.28E+01	5.55E-01	8.41E-02
Non-Hazardous Waste Generated	kg	8.36E-05	6.61E-05	1.72E-05	2.88E-07
Hazardous Waste Generated	kg	4.88E-01	2.35E-01	2.48E-01	5.10E-03

TABLE 36. CRADLE-TO-GATE LCIA RESULT FOR WIP 300HT PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.67E+00	1.90E+00	6.32E-01	1.41E-01
Acidification	kg SO2 eq.	1.24E-02	9.28E-03	2.79E-03	3.21E-04
Eutrophication	kg N eq.	1.67E-03	1.18E-03	3.48E-04	1.41E-04
Smog	kg O3 eq.	1.87E-01	1.20E-01	6.42E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	3.64E-07	2.11E-07	1.43E-07	9.79E-09
Non-Renewable Fossil	MJ (HHV)	6.31E+01	5.19E+01	9.77E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	2.97E+00	2.52E+00	1.35E-01	3.13E-01
Renewable	MJ (HHV)	2.60E-01	1.35E-01	1.59E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	9.53E+00	9.49E+00	3.70E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	4.94E+00	4.91E+00	2.40E-02	4.33E-03
Net Fresh Water	L	2.05E+01	1.96E+01	8.09E-01	8.44E-02
Non-Hazardous Waste Generated	kg	9.48E-04	9.22E-04	2.51E-05	2.88E-07
Hazardous Waste Generated	kg	4.86E-01	1.19E-01	3.62E-01	5.10E-03

TABLE 37. CRADLE-TO-GATE LCIA RESULT FOR METSHIELD PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.67E+00	1.90E+00	6.32E-01	1.34E-01
Acidification	kg SO2 eq.	1.24E-02	9.28E-03	2.79E-03	3.09E-04
Eutrophication	kg N eq.	1.66E-03	1.18E-03	3.48E-04	1.35E-04
Smog	kg O3 eq.	1.87E-01	1.20E-01	6.42E-02	2.50E-03
Ozone Depletion	kgCFC-11 eq.	3.64E-07	2.11E-07	1.43E-07	9.78E-09
Non-Renewable Fossil	MJ (HHV)	6.31E+01	5.19E+01	9.77E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	2.97E+00	2.52E+00	1.35E-01	3.13E-01
Renewable	MJ (HHV)	2.60E-01	1.35E-01	1.59E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	9.53E+00	9.49E+00	3.70E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	4.94E+00	4.91E+00	2.40E-02	4.32E-03
Net Fresh Water	L	2.05E+01	1.96E+01	8.09E-01	8.51E-02
Non-Hazardous Waste Generated	kg	9.48E-04	9.22E-04	2.51E-05	2.85E-07
Hazardous Waste Generated	kg	4.86E-01	1.19E-01	3.62E-01	5.02E-03

TABLE 38. CRADLE-TO-GATE LCIA RESULT FOR 705 HT PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.67E+00	1.90E+00	6.32E-01	1.41E-01
Acidification	kg SO2 eq.	1.24E-02	9.28E-03	2.79E-03	3.21E-04
Eutrophication	kg N eq.	1.67E-03	1.18E-03	3.48E-04	1.41E-04
Smog	kg O3 eq.	1.87E-01	1.20E-01	6.42E-02	2.70E-03
Ozone Depletion	kgCFC-11 eq.	3.64E-07	2.11E-07	1.43E-07	9.79E-09
Non-Renewable Fossil	MJ (HHV)	6.31E+01	5.19E+01	9.77E+00	1.51E+00
Non-Renewable Nuclear	MJ (HHV)	2.97E+00	2.52E+00	1.35E-01	3.13E-01
Renewable	MJ (HHV)	2.60E-01	1.35E-01	1.59E-02	1.09E-01
Renewable (Biomass)	MJ (HHV)	9.53E+00	9.49E+00	3.70E-02	6.09E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	4.94E+00	4.91E+00	2.40E-02	4.33E-03
Net Fresh Water	L	2.05E+01	1.96E+01	8.09E-01	8.40E-02
Non-Hazardous Waste Generated	kg	9.48E-04	9.22E-04	2.51E-05	2.88E-07
Hazardous Waste Generated	kg	4.86E-01	1.19E-01	3.62E-01	5.10E-03

TABLE 39. CRADLE-TO-GATE LCIA RESULT FOR VAPAIR SEAL PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	1.58E+00	1.32E+00	1.45E-01	1.22E-01
Acidification	kg SO2 eq.	6.87E-03	5.95E-03	6.40E-04	2.81E-04
Eutrophication	kg N eq.	7.98E-04	5.95E-04	7.99E-05	1.23E-04
Smog	kg O3 eq.	8.95E-02	7.25E-02	1.47E-02	2.29E-03
Ozone Depletion	kgCFC-11 eq.	1.50E-07	1.08E-07	3.28E-08	8.81E-09
Non-Renewable Fossil	MJ (HHV)	4.07E+01	3.71E+01	2.24E+00	1.36E+00
Non-Renewable Nuclear	MJ (HHV)	2.00E+00	1.69E+00	3.09E-02	2.82E-01
Renewable	MJ (HHV)	1.58E-01	5.61E-02	3.64E-03	9.83E-02
Renewable (Biomass)	MJ (HHV)	3.70E+00	3.69E+00	8.48E-03	5.48E-03
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	1.74E+00	1.73E+00	5.50E-03	3.89E-03
Net Fresh Water	L	1.07E+01	1.04E+01	1.86E-01	7.55E-02
Non-Hazardous Waste Generated	kg	7.87E-04	7.81E-04	5.77E-06	2.59E-07
Hazardous Waste Generated	kg	1.51E-01	6.34E-02	8.31E-02	4.54E-03

TABLE 40. CRADLE-TO-GATE LCIA RESULT FOR WIP 250 PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.24E+00	1.88E+00	1.60E-01	2.03E-01
Acidification	kg SO2 eq.	9.07E-03	7.78E-03	7.06E-04	5.88E-04
Eutrophication	kg N eq.	1.40E-03	1.22E-03	8.81E-05	9.38E-05
Smog	kg O3 eq.	1.28E-01	1.06E-01	1.62E-02	5.67E-03
Ozone Depletion	kgCFC-11 eq.	1.90E-07	1.34E-07	3.61E-08	1.96E-08
Non-Renewable Fossil	MJ (HHV)	4.22E+01	3.74E+01	2.47E+00	2.36E+00
Non-Renewable Nuclear	MJ (HHV)	3.41E+00	2.41E+00	3.41E-02	9.65E-01
Renewable	MJ (HHV)	1.41E-01	1.12E-01	4.01E-03	2.53E-02
Renewable (Biomass)	MJ (HHV)	5.87E+00	5.84E+00	9.34E-03	1.74E-02
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.10E+00	3.08E+00	6.06E-03	1.27E-02
Net Fresh Water	L	2.34E+01	2.26E+01	2.05E-01	5.79E-01
Non-Hazardous Waste Generated	kg	5.61E-04	5.53E-04	6.36E-06	1.35E-06
Hazardous Waste Generated	kg	2.25E-01	1.27E-01	9.16E-02	6.80E-03

TABLE 41. CRADLE-TO-GATE LCIA RESULT FOR WIP GRIP PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	2.73E+00	2.30E+00	1.31E-01	2.92E-01
Acidification	kg SO2 eq.	1.05E-02	9.04E-03	5.80E-04	8.43E-04
Eutrophication	kg N eq.	1.62E-03	1.41E-03	7.24E-05	1.35E-04
Smog	kg O3 eq.	1.49E-01	1.27E-01	1.33E-02	8.13E-03
Ozone Depletion	kgCFC-11 eq.	2.12E-07	1.54E-07	2.97E-08	2.81E-08
Non-Renewable Fossil	MJ (HHV)	4.57E+01	4.03E+01	2.03E+00	3.36E+00
Non-Renewable Nuclear	MJ (HHV)	4.21E+00	2.80E+00	2.80E-02	1.38E+00
Renewable	MJ (HHV)	1.81E-01	1.42E-01	3.29E-03	3.63E-02
Renewable (Biomass)	MJ (HHV)	6.46E+00	6.42E+00	7.68E-03	2.50E-02
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	3.32E+00	3.29E+00	4.98E-03	1.82E-02
Net Fresh Water	L	2.68E+01	2.59E+01	1.68E-01	8.28E-01
Non-Hazardous Waste Generated	kg	6.25E-04	6.18E-04	5.22E-06	1.91E-06
Hazardous Waste Generated	kg	2.44E-01	1.59E-01	7.53E-02	9.76E-03

TABLE 42. CRADLE-TO-GATE LCIA RESULT FOR CCW 500 PER DECLARED UNIT

Impact Category	Unit	Total	A1	A2	A3
Global Warming	kg CO2 eq.	5.81E+00	4.79E+00	8.60E-01	1.60E-01
Acidification	kg SO2 eq.	2.15E-02	1.73E-02	3.80E-03	4.61E-04
Eutrophication	kg N eq.	2.83E-03	2.29E-03	4.74E-04	7.47E-05
Smog	kg O3 eq.	3.99E-01	3.07E-01	8.74E-02	4.46E-03
Ozone Depletion	kgCFC-11 eq.	6.12E-07	4.02E-07	1.94E-07	1.53E-08
Non-Renewable Fossil	MJ (HHV)	9.96E+01	8.45E+01	1.33E+01	1.83E+00
Non-Renewable Nuclear	MJ (HHV)	4.50E+00	3.56E+00	1.83E-01	7.55E-01
Renewable	MJ (HHV)	3.82E-01	3.41E-01	2.16E-02	1.98E-02
Renewable (Biomass)	MJ (HHV)	1.55E+01	1.54E+01	5.03E-02	1.36E-02
Non-Renewable Material Resources	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Renewable Material Resources	kg	1.06E+01	1.06E+01	3.26E-02	9.92E-03
Net Fresh Water	L	4.29E+01	4.13E+01	1.10E+00	4.53E-01
Non-Hazardous Waste Generated	kg	8.55E-05	5.03E-05	3.42E-05	1.03E-06
Hazardous Waste Generated	kg	8.44E-01	3.46E-01	4.93E-01	5.33E-03

Sensitivity

The sensitivity analysis included the following four scenarios and the tables below show the results and the percent change from the baseline model.

- **Scenario 1:** Use of ReCiPe midpoint method instead of TRACI midpoint method.
- **Scenario 2:** Change in material weight by 5%.
- **Scenario 3:** Change in assembly energy by 5%.
- **Scenario 4:** Change in eGrid.
- **Scenario 5:** Change in natural gas usage at the manufacturing facility and the transport of raw material by truck varied by 10% to account for the unavailability of US datasets.

MiraDri 860/861

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation.

All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 43. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – MIRADRI 860/861

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.14E+00	1.43E+00	6.07E-01	1.01E-01
Stratospheric ozone depletion	kg CFC11 eq	1.06E-06	7.44E-07	2.81E-07	3.15E-08
Ionizing radiation	kBq Co-60 eq	1.63E-02	1.09E-02	4.42E-03	9.27E-04
Ozone formation, Human health	kg NOx eq	6.67E-03	4.05E-03	2.54E-03	7.27E-05
Fine particulate matter formation	kg PM2.5 eq	3.75E-03	2.62E-03	7.51E-04	3.76E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	7.12E-03	4.45E-03	2.59E-03	7.47E-05
Terrestrial acidification	kg SO2 eq	7.48E-03	5.52E-03	1.79E-03	1.72E-04
Freshwater eutrophication	kg P eq	7.02E-05	5.29E-05	6.43E-06	1.09E-05
Marine eutrophication	kg N eq	4.28E-05	3.43E-05	1.36E-06	7.10E-06
Terrestrial ecotoxicity	kg 1,4-DCB	1.17E+01	3.09E+00	8.59E+00	5.43E-02
Freshwater ecotoxicity	kg 1,4-DCB	2.97E-03	1.46E-03	1.39E-03	1.10E-04
Marine ecotoxicity	kg 1,4-DCB	1.03E-02	3.67E-03	6.51E-03	1.52E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.53E-02	1.07E-02	3.91E-03	7.02E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	4.45E-01	2.62E-01	1.70E-01	1.29E-02
Land use	m2a crop eq	2.33E-01	2.12E-01	2.07E-02	3.14E-04
Mineral resource scarcity	kg Cu eq	8.89E-03	5.96E-03	2.87E-03	5.99E-05
Fossil resource scarcity	kg oil eq	1.11E+00	8.81E-01	2.03E-01	2.17E-02
Water consumption	m3	2.22E-02	2.08E-02	1.06E-03	3.33E-04

Scenarios 2, 3, 4 and 5

CCW's MiraDri 860/861 product was tested by increasing and decreasing the overall weight of the product (*i.e.*, bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 9% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 44. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – MIRADRI 860/861

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-3%	0%	0%	0%	0%
Acidification (kg SO2 eq)	4%	-4%	0%	0%	0%	0%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	0%
Smog (kg O3 eq)	3%	-3%	0%	0%	0%	1%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	0%	0%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	0%
Non-Renewable Nuclear (MJ)	4%	-4%	1%	0%	9%	0%
Renewable (MJ)	3%	-3%	3%	-1%	-18%	0%
Renewable (Biomass) (MJ)	6%	-4%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-4%	0%	0%	0%	0%
Net Fresh Water (L)	5%	-5%	0%	0%	2%	0%

Hazardous Waste Generated (kg)	3%	-3%	0%	0%	0%	1%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	1%

CCW 711-70

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 45. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – BARRITECH NP

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.83E+00	2.05E+00	6.61E-01	1.18E-01
Stratospheric ozone depletion	kg CFC11 eq	1.25E-06	9.05E-07	3.07E-07	3.77E-08
Ionizing radiation	kBq Co-60 eq	1.97E-02	1.38E-02	4.81E-03	1.14E-03
Ozone formation, Human health	kg NOx eq	8.31E-03	5.46E-03	2.77E-03	8.54E-05
Fine particulate matter formation	kg PM2.5 eq	4.63E-03	3.35E-03	8.18E-04	4.60E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	8.87E-03	5.95E-03	2.83E-03	8.78E-05
Terrestrial acidification	kg SO2 eq	9.58E-03	7.42E-03	1.95E-03	2.09E-04
Freshwater eutrophication	kg P eq	8.93E-05	6.89E-05	7.01E-06	1.33E-05
Marine eutrophication	kg N eq	4.17E-05	3.30E-05	1.48E-06	7.21E-06
Terrestrial ecotoxicity	kg 1,4-DCB	1.34E+01	3.97E+00	9.36E+00	6.43E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.32E-03	1.68E-03	1.52E-03	1.22E-04
Marine ecotoxicity	kg 1,4-DCB	1.18E-02	4.49E-03	7.10E-03	1.71E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.90E-02	1.39E-02	4.26E-03	8.17E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	5.46E-01	3.46E-01	1.85E-01	1.53E-02
Land use	m2a crop eq	2.36E-01	2.13E-01	2.26E-02	3.77E-04
Mineral resource scarcity	kg Cu eq	1.09E-02	7.65E-03	3.13E-03	7.32E-05
Fossil resource scarcity	kg oil eq	1.59E+00	1.35E+00	2.21E-01	2.66E-02
Water consumption	m3	2.75E-02	2.60E-02	1.16E-03	4.04E-04

Scenarios 2, 3, 4 and 5

CCW's 711-70 product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 7% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 46. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 711-70

	Scenario 2	Scenario 3	Scenario 4	Scenario 5

Impact category	Increase	Decrease	Increase	± Change	Change	± Change
Global Warming (kg CO2 eq)	4%	-3%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-3%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	4%	-3%	0%	0%	0%	3%
Ozone Depletion (kg CFC-11 eq)	4%	-3%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	5%	-4%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	5%	-3%	1%	-1%	7%	0%
Renewable (MJ)	4%	-2%	0%	-1%	-16%	1%
Renewable (Biomass) (MJ)	6%	-3%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-3%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-4%	0%	0%	1%	0%
Hazardous Waste Generated (kg)	4%	-2%	0%	0%	0%	4%
Non-Hazardous Waste Generated (kg)	2%	-1%	0%	0%	0%	7%

CCW 711-90

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 47. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – CCW 711-90

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	3.32E+00	2.37E+00	8.52E-01	1.06E-01
Stratospheric ozone depletion	kg CFC11 eq	1.43E-06	1.00E-06	3.95E-07	3.35E-08
Ionizing radiation	kBq Co-60 eq	2.35E-02	1.63E-02	6.20E-03	9.98E-04
Ozone formation, Human health	kg NOx eq	1.00E-02	6.38E-03	3.57E-03	7.67E-05
Fine particulate matter formation	kg PM2.5 eq	5.34E-03	3.88E-03	1.05E-03	4.04E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	1.07E-02	7.01E-03	3.64E-03	7.89E-05
Terrestrial acidification	kg SO2 eq	1.14E-02	8.72E-03	2.51E-03	1.84E-04
Freshwater eutrophication	kg P eq	9.79E-05	7.72E-05	9.03E-06	1.17E-05
Marine eutrophication	kg N eq	4.21E-05	3.30E-05	1.91E-06	7.13E-06
Terrestrial ecotoxicity	kg 1,4-DCB	1.66E+01	4.51E+00	1.21E+01	5.76E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.94E-03	1.87E-03	1.96E-03	1.14E-04
Marine ecotoxicity	kg 1,4-DCB	1.45E-02	5.17E-03	9.15E-03	1.58E-04
Human carcinogenic toxicity	kg 1,4-DCB	2.14E-02	1.52E-02	5.49E-03	7.40E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	6.37E-01	3.84E-01	2.39E-01	1.37E-02
Land use	m2a crop eq	2.53E-01	2.24E-01	2.91E-02	3.34E-04
Mineral resource scarcity	kg Cu eq	1.31E-02	8.97E-03	4.04E-03	6.41E-05
Fossil resource scarcity	kg oil eq	1.91E+00	1.60E+00	2.85E-01	2.33E-02
Water consumption	m3	3.11E-02	2.93E-02	1.49E-03	3.48E-04

Scenarios 2, 3, 4 and 5

CCW's 711-90 product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 6% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 48. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 711-90

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	4%	-3%	0%	0%	0%	3%
Acidification (kg SO2 eq)	4%	-3%	0%	0%	0%	3%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-1%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	0%	4%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	5%	-4%	1%	-1%	6%	1%
Renewable (MJ)	4%	-3%	0%	-1%	-13%	1%
Renewable (Biomass) (MJ)	5%	-4%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	5%	-4%	0%	0%	0%	0%
Net Fresh Water (L)	5%	-4%	0%	0%	1%	0%
Hazardous Waste Generated (kg)	3%	-3%	0%	0%	0%	4%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	8%

CCW 705 AVB

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 49. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –CCW 705 AVB

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.62E+00	1.11E+00	4.11E-01	1.01E-01
Stratospheric ozone depletion	kg CFC11 eq	8.86E-07	6.64E-07	1.91E-07	3.15E-08
Ionizing radiation	kBq Co-60 eq	1.23E-02	8.42E-03	2.99E-03	9.27E-04
Ozone formation, Human health	kg NOx eq	4.92E-03	3.12E-03	1.72E-03	7.27E-05
Fine particulate matter formation	kg PM2.5 eq	2.98E-03	2.09E-03	5.09E-04	3.76E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.22E-03	3.39E-03	1.76E-03	7.47E-05
Terrestrial acidification	kg SO2 eq	5.58E-03	4.20E-03	1.21E-03	1.72E-04
Freshwater eutrophication	kg P eq	5.99E-05	4.47E-05	4.35E-06	1.09E-05
Marine eutrophication	kg N eq	4.25E-05	3.44E-05	9.19E-07	7.10E-06
Terrestrial ecotoxicity	kg 1,4-DCB	8.42E+00	2.55E+00	5.82E+00	5.43E-02
Freshwater ecotoxicity	kg 1,4-DCB	2.33E-03	1.28E-03	9.44E-04	1.10E-04
Marine ecotoxicity	kg 1,4-DCB	7.55E-03	2.99E-03	4.41E-03	1.52E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.32E-02	9.82E-03	2.65E-03	7.02E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	3.52E-01	2.24E-01	1.15E-01	1.29E-02
Land use	m2a crop eq	2.21E-01	2.07E-01	1.40E-02	3.14E-04
Mineral resource scarcity	kg Cu eq	6.70E-03	4.69E-03	1.95E-03	5.99E-05
Fossil resource scarcity	kg oil eq	7.77E-01	6.18E-01	1.37E-01	2.17E-02
Water consumption	m3	1.86E-02	1.75E-02	7.20E-04	3.34E-04

Scenarios 2, 3, 4 and 5

CCW's 705 AVB product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 11% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 50. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 AVB

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-3%	0%	0%	0%	3%
Acidification (kg SO2 eq)	4%	-3%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	1%	4%
Ozone Depletion (kg CFC-11 eq)	4%	-3%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	4%	-4%	1%	-1%	11%	1%
Renewable (MJ)	3%	-3%	0%	-1%	-20%	1%
Renewable (Biomass) (MJ)	5%	-3%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%

Renewable Material Resources (kg)	5%	-3%	0%	0%	0%	0%
Net Fresh Water (L)	5%	-4%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	4%	-3%	0%	0%	0%	3%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	7%

CCW 705 TWF

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 51. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –CCW 705 TWF

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.87E+00	1.34E+00	4.28E-01	1.06E-01
Stratospheric ozone depletion	kg CFC11 eq	1.01E-06	7.74E-07	1.98E-07	3.35E-08
Ionizing radiation	kBq Co-60 eq	1.45E-02	1.04E-02	3.11E-03	9.98E-04
Ozone formation, Human health	kg NOx eq	5.54E-03	3.67E-03	1.79E-03	7.68E-05
Fine particulate matter formation	kg PM2.5 eq	3.49E-03	2.55E-03	5.29E-04	4.04E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.86E-03	3.95E-03	1.83E-03	7.90E-05
Terrestrial acidification	kg SO2 eq	6.32E-03	4.88E-03	1.26E-03	1.84E-04
Freshwater eutrophication	kg P eq	7.24E-05	5.62E-05	4.53E-06	1.17E-05
Marine eutrophication	kg N eq	5.43E-05	4.62E-05	9.56E-07	7.14E-06
Terrestrial ecotoxicity	kg 1,4-DCB	9.51E+00	3.39E+00	6.06E+00	5.76E-02
Freshwater ecotoxicity	kg 1,4-DCB	2.68E-03	1.59E-03	9.82E-04	1.14E-04
Marine ecotoxicity	kg 1,4-DCB	8.52E-03	3.77E-03	4.59E-03	1.58E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.56E-02	1.21E-02	2.75E-03	7.40E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	4.11E-01	2.78E-01	1.20E-01	1.37E-02
Land use	m2a crop eq	2.54E-01	2.39E-01	1.46E-02	3.35E-04
Mineral resource scarcity	kg Cu eq	7.50E-03	5.41E-03	2.03E-03	6.43E-05
Fossil resource scarcity	kg oil eq	8.41E-01	6.75E-01	1.43E-01	2.33E-02
Water consumption	m3	2.29E-02	2.18E-02	7.49E-04	3.56E-04

Scenarios 2, 3, 4 and 5

CCW's 705 TWF product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 10% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 52. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 TWF

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-4%	0%	0%	0%	2%
Acidification (kg SO2 eq)	3%	-4%	0%	0%	0%	2%
Eutrophication (kg N eq)	3%	-4%	0%	0%	-2%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	4%	-4%	1%	-1%	10%	0%
Renewable (MJ)	3%	-3%	0%	-1%	-17%	0%
Renewable (Biomass) (MJ)	3%	-5%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	3%	-5%	0%	0%	0%	0%
Net Fresh Water (L)	4%	-5%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	3%	-4%	0%	0%	0%	3%
Non-Hazardous Waste Generated (kg)	2%	-2%	0%	0%	0%	6%

CCW 705 FR-A

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 53. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –CCW 705 FR-A

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.27E+00	1.73E+00	4.37E-01	1.01E-01
Stratospheric ozone depletion	kg CFC11 eq	1.09E-06	8.53E-07	2.03E-07	3.15E-08
Ionizing radiation	kBq Co-60 eq	1.77E-02	1.36E-02	3.18E-03	9.27E-04
Ozone formation, Human health	kg NOx eq	6.38E-03	4.48E-03	1.83E-03	7.27E-05
Fine particulate matter formation	kg PM2.5 eq	4.16E-03	3.25E-03	5.41E-04	3.76E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	6.71E-03	4.77E-03	1.87E-03	7.47E-05
Terrestrial acidification	kg SO2 eq	7.40E-03	5.94E-03	1.29E-03	1.72E-04
Freshwater eutrophication	kg P eq	8.70E-05	7.15E-05	4.63E-06	1.09E-05
Marine eutrophication	kg N eq	6.71E-05	5.91E-05	9.76E-07	7.09E-06
Terrestrial ecotoxicity	kg 1,4-DCB	1.13E+01	5.03E+00	6.18E+00	5.43E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.14E-03	2.03E-03	1.00E-03	1.10E-04
Marine ecotoxicity	kg 1,4-DCB	1.01E-02	5.29E-03	4.69E-03	1.52E-04
Human carcinogenic toxicity	kg 1,4-DCB	2.34E-02	1.99E-02	2.81E-03	7.02E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	4.98E-01	3.63E-01	1.22E-01	1.29E-02
Land use	m2a crop eq	2.25E-01	2.09E-01	1.49E-02	3.14E-04
Mineral resource scarcity	kg Cu eq	1.19E-02	9.74E-03	2.07E-03	5.99E-05
Fossil resource scarcity	kg oil eq	9.32E-01	7.65E-01	1.46E-01	2.17E-02
Water consumption	m3	2.70E-02	2.59E-02	7.65E-04	3.34E-04

Scenarios 2, 3, 4 and 5

CCW's 705 FR-A product was tested by increasing and decreasing the overall weight of the product (*i.e.*, bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 7% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 54. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 FR-A

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	4%	-3%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-3%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	4%	-3%	0%	0%	0%	3%
Ozone Depletion (kg CFC-11 eq)	4%	-3%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	5%	-4%	1%	-1%	7%	0%
Renewable (MJ)	4%	-3%	0%	-1%	-13%	0%
Renewable (Biomass) (MJ)	6%	-2%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%

Renewable Material Resources (kg)	6%	-2%	0%	0%	1%	0%
Net Fresh Water (L)	5%	-4%	0%	0%	1%	0%
Hazardous Waste Generated (kg)	4%	-3%	0%	0%	0%	2%
Non-Hazardous Waste Generated (kg)	2%	-2%	0%	0%	0%	5%

EZ Flash

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 55. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –EZ FLASH

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.01E+00	7.24E-01	1.87E-01	1.01E-01
Stratospheric ozone depletion	kg CFC11 eq	6.74E-07	5.56E-07	8.67E-08	3.15E-08
Ionizing radiation	kBq Co-60 eq	6.37E-03	4.08E-03	1.36E-03	9.27E-04
Ozone formation, Human health	kg NOx eq	2.81E-03	1.95E-03	7.84E-04	7.27E-05
Fine particulate matter formation	kg PM2.5 eq	1.89E-03	1.28E-03	2.31E-04	3.76E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	2.95E-03	2.08E-03	7.99E-04	7.47E-05
Terrestrial acidification	kg SO2 eq	3.47E-03	2.75E-03	5.51E-04	1.72E-04
Freshwater eutrophication	kg P eq	4.34E-05	3.05E-05	1.98E-06	1.09E-05
Marine eutrophication	kg N eq	3.49E-05	2.73E-05	4.18E-07	7.10E-06
Terrestrial ecotoxicity	kg 1,4-DCB	3.99E+00	1.29E+00	2.65E+00	5.43E-02
Freshwater ecotoxicity	kg 1,4-DCB	1.42E-03	8.84E-04	4.29E-04	1.10E-04
Marine ecotoxicity	kg 1,4-DCB	3.87E-03	1.71E-03	2.01E-03	1.52E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.05E-02	8.56E-03	1.20E-03	7.02E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	2.03E-01	1.37E-01	5.24E-02	1.29E-02
Land use	m2a crop eq	1.98E-01	1.91E-01	6.38E-03	3.14E-04
Mineral resource scarcity	kg Cu eq	3.98E-03	3.03E-03	8.86E-04	5.99E-05
Fossil resource scarcity	kg oil eq	4.57E-01	3.73E-01	6.25E-02	2.17E-02
Water consumption	m3	2.14E-02	2.07E-02	3.27E-04	3.33E-04

Scenarios 2, 3, 4 and 5

CCW's EZ Flash product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 15% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 56. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – EZ FLASH

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-3%	0%	0%	0%	2%
Acidification (kg SO2 eq)	3%	-4%	0%	0%	1%	2%
Eutrophication (kg N eq)	4%	-2%	0%	0%	-3%	1%
Smog (kg O3 eq)	3%	-3%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	4%	-2%	0%	0%	1%	3%
Non-Renewable Fossil (MJ)	3%	-5%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	3%	-5%	1%	-1%	15%	0%
Renewable (MJ)	3%	-1%	0%	-1%	-27%	0%
Renewable (Biomass) (MJ)	4%	-2%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	5%	-2%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-3%	0%	0%	3%	0%
Hazardous Waste Generated (kg)	-2%	-11%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	6%

Miradri 860-ULT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 57. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – MIRADRI 860-ULT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.20E+00	1.44E+00	6.07E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	1.12E-06	7.87E-07	2.81E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.67E-02	1.09E-02	4.42E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	6.72E-03	4.06E-03	2.54E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	3.96E-03	2.63E-03	7.51E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	7.17E-03	4.46E-03	2.59E-03	1.14E-04
Terrestrial acidification	kg SO2 eq	7.58E-03	5.53E-03	1.79E-03	2.63E-04
Freshwater eutrophication	kg P eq	7.66E-05	5.35E-05	6.43E-06	1.68E-05
Marine eutrophication	kg N eq	4.79E-05	3.59E-05	1.36E-06	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	1.18E+01	3.11E+00	8.59E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.06E-03	1.50E-03	1.39E-03	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	1.05E-02	3.72E-03	6.51E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.65E-02	1.16E-02	3.91E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	4.55E-01	2.65E-01	1.70E-01	1.97E-02
Land use	m2a crop eq	2.45E-01	2.23E-01	2.07E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	9.09E-03	6.13E-03	2.87E-03	9.19E-05
Fossil resource scarcity	kg oil eq	1.11E+00	8.75E-01	2.03E-01	3.33E-02
Water consumption	m3	2.25E-02	2.09E-02	1.06E-03	5.03E-04

Scenarios 2, 3, 4 and 5

CCW's Miradri 860-ULT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 13%. The results also show that the non-renewable nuclear impact for each product increased by 15% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 58. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – MIRADRI 860-ULT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	5%	-2%	0%	0%	0%	3%
Acidification (kg SO2 eq)	5%	-2%	0%	0%	0%	3%
Eutrophication (kg N eq)	5%	-2%	0%	0%	-2%	2%
Smog (kg O3 eq)	4%	-2%	0%	0%	1%	4%
Ozone Depletion (kg CFC-11 eq)	4%	-2%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	6%	-2%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	5%	-2%	1%	-1%	13%	1%
Renewable (MJ)	3%	-2%	0%	-1%	-23%	1%
Renewable (Biomass) (MJ)	6%	-3%	0%	0%	1%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-3%	0%	0%	1%	0%

Net Fresh Water (L)	7%	-3%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	4%	-2%	0%	0%	0%	4%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	7%

CCW 705 XLT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 59. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – CCW 705 XLT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.69E+00	1.12E+00	4.11E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	9.77E-07	7.38E-07	1.91E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.30E-02	8.61E-03	2.99E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	4.99E-03	3.16E-03	1.72E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	3.21E-03	2.12E-03	5.09E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.30E-03	3.42E-03	1.76E-03	1.14E-04
Terrestrial acidification	kg SO2 eq	5.72E-03	4.25E-03	1.21E-03	2.63E-04
Freshwater eutrophication	kg P eq	6.69E-05	4.58E-05	4.35E-06	1.68E-05
Marine eutrophication	kg N eq	4.91E-05	3.75E-05	9.19E-07	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	8.50E+00	2.60E+00	5.82E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	2.47E-03	1.36E-03	9.44E-04	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	7.75E-03	3.11E-03	4.41E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.49E-02	1.12E-02	2.65E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	3.65E-01	2.30E-01	1.15E-01	1.97E-02
Land use	m2a crop eq	2.47E-01	2.32E-01	1.40E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	7.00E-03	4.96E-03	1.95E-03	9.19E-05
Fossil resource scarcity	kg oil eq	7.87E-01	6.16E-01	1.37E-01	3.33E-02
Water consumption	m3	1.90E-02	1.78E-02	7.20E-04	5.03E-04

Scenarios 2, 3, 4 and 5

CCW's 705 XLT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 16% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 60. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 XLT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	5%	-1%	0%	0%	0%	3%
Acidification (kg SO2 eq)	5%	-2%	0%	0%	1%	2%
Eutrophication (kg N eq)	4%	-2%	0%	0%	-3%	2%
Smog (kg O3 eq)	4%	-2%	0%	0%	1%	4%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	6%	-1%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	6%	-2%	1%	-1%	16%	1%
Renewable (MJ)	3%	-2%	0%	-1%	-25%	0%
Renewable (Biomass) (MJ)	4%	-4%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	4%	-4%	0%	0%	1%	0%
Net Fresh Water (L)	7%	-2%	0%	0%	3%	0%
Hazardous Waste Generated (kg)	3%	-3%	0%	0%	0%	3%
Non-Hazardous Waste Generated (kg)	2%	-1%	0%	0%	0%	7%

CCW 705 TWF XLT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 61. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –CCW 705 TWF XLT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.93E+00	1.35E+00	4.28E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	1.10E-06	8.49E-07	1.98E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.51E-02	1.06E-02	3.11E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	5.61E-03	3.71E-03	1.79E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	3.69E-03	2.58E-03	5.29E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.93E-03	3.98E-03	1.83E-03	1.14E-04
Terrestrial acidification	kg SO2 eq	6.45E-03	4.93E-03	1.26E-03	2.63E-04
Freshwater eutrophication	kg P eq	7.86E-05	5.73E-05	4.53E-06	1.68E-05
Marine eutrophication	kg N eq	6.09E-05	4.93E-05	9.56E-07	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	9.58E+00	3.44E+00	6.06E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	2.82E-03	1.67E-03	9.82E-04	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	8.72E-03	3.90E-03	4.59E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.73E-02	1.35E-02	2.75E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	4.23E-01	2.83E-01	1.20E-01	1.97E-02
Land use	m2a crop eq	2.80E-01	2.65E-01	1.46E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	7.79E-03	5.67E-03	2.03E-03	9.19E-05
Fossil resource scarcity	kg oil eq	8.49E-01	6.72E-01	1.43E-01	3.33E-02
Water consumption	m3	2.33E-02	2.20E-02	7.49E-04	5.03E-04

Scenarios 2, 3, 4 and 5

CCW's 705 TWF XLT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 16% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

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TABLE 62. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 TWF XLT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	5%	-2%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-3%	0%	0%	1%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-3%	2%
Smog (kg O3 eq)	4%	-2%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	6%	-2%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	5%	-3%	1%	-1%	16%	0%
Renewable (MJ)	3%	-3%	0%	-1%	-25%	0%
Renewable (Biomass) (MJ)	2%	-6%	0%	0%	0%	0%

Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	2%	-6%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-4%	0%	0%	3%	0%
Hazardous Waste Generated (kg)	2%	-4%	0%	0%	0%	3%
Non-Hazardous Waste Generated (kg)	2%	-2%	0%	0%	0%	6%

CCW 70 FR-A XLT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 63. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD –CCW 70 FR-A XLT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO_2 eq	2.33E+00	1.74E+00	4.37E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	1.18E-06	9.27E-07	2.03E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.84E-02	1.38E-02	3.18E-03	1.43E-03
Ozone formation, Human health	kg NO_x eq	6.46E-03	4.51E-03	1.83E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	4.39E-03	3.28E-03	5.40E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NO_x eq	6.79E-03	4.80E-03	1.87E-03	1.14E-04
Terrestrial acidification	kg SO_2 eq	7.54E-03	5.99E-03	1.29E-03	2.63E-04
Freshwater eutrophication	kg P eq	9.40E-05	7.26E-05	4.63E-06	1.68E-05
Marine eutrophication	kg N eq	7.38E-05	6.21E-05	9.76E-07	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	1.13E+01	5.08E+00	6.18E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.28E-03	2.11E-03	1.00E-03	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	1.03E-02	5.41E-03	4.69E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	2.51E-02	2.12E-02	2.81E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	5.11E-01	3.68E-01	1.22E-01	1.97E-02
Land use	m2a crop eq	2.50E-01	2.35E-01	1.49E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	1.22E-02	1.00E-02	2.07E-03	9.19E-05
Fossil resource scarcity	kg oil eq	9.42E-01	7.62E-01	1.46E-01	3.33E-02
Water consumption	m3	2.74E-02	2.61E-02	7.65E-04	5.03E-04

Scenarios 2, 3, 4 and 5

CCW's 70 FR-A XLT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 10% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 64. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 70 FR-A XLT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	5%	-3%	0%	0%	0%	2%
Acidification (kg SO2 eq)	5%	-3%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	4%	-2%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	5%	-3%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	5%	-3%	1%	-1%	10%	0%
Renewable (MJ)	4%	-3%	0%	-1%	-17%	0%
Renewable (Biomass) (MJ)	4%	-2%	0%	0%	1%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	4%	-3%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-3%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	4%	-4%	0%	0%	0%	2%
Non-Hazardous Waste Generated (kg)	3%	-2%	0%	0%	0%	5%

WIP 300HT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 65. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – WIP 300HT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.79E+00	1.99E+00	6.37E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	1.12E-06	7.74E-07	2.96E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.40E-02	7.97E-03	4.64E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	7.96E-03	5.17E-03	2.67E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	4.63E-03	3.26E-03	7.89E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	8.44E-03	5.60E-03	2.72E-03	1.14E-04
Terrestrial acidification	kg SO2 eq	9.67E-03	7.53E-03	1.88E-03	2.63E-04
Freshwater eutrophication	kg P eq	9.59E-05	7.24E-05	6.75E-06	1.68E-05
Marine eutrophication	kg N eq	5.24E-05	4.04E-05	1.42E-06	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	1.21E+01	2.97E+00	9.03E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.14E-03	1.51E-03	1.46E-03	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	1.05E-02	3.38E-03	6.84E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.67E-02	1.15E-02	4.10E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	4.91E-01	2.92E-01	1.79E-01	1.97E-02
Land use	m2a crop eq	2.98E-01	2.76E-01	2.17E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	9.59E-03	6.47E-03	3.02E-03	9.19E-05
Fossil resource scarcity	kg oil eq	1.36E+00	1.11E+00	2.13E-01	3.33E-02
Water consumption	m3	6.47E-02	6.31E-02	1.12E-03	5.04E-04

Scenarios 2, 3, 4 and 5

CCW's WIP 300HT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 9% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 66. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – WIP 300HT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-4%	0%	0%	3%	2%
Acidification (kg SO2 eq)	4%	-4%	0%	0%	4%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	4%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	3%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	3%	4%
Non-Renewable Fossil (MJ)	4%	-5%	0%	0%	4%	2%
Non-Renewable Nuclear (MJ)	4%	-5%	1%	-1%	4%	0%
Renewable (MJ)	3%	-2%	0%	-1%	3%	1%
Renewable (Biomass) (MJ)	6%	-3%	0%	0%	6%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-3%	0%	0%	6%	0%

Net Fresh Water (L)	6%	-4%	0%	0%	6%	0%
Hazardous Waste Generated (kg)	3%	-7%	0%	0%	3%	0%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	1%	7%

Metshield

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 67. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – METSHIELD

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.77E+00	1.99E+00	6.37E-01	1.43E-01
Stratospheric ozone depletion	kg CFC11 eq	1.12E-06	7.74E-07	2.96E-07	4.61E-08
Ionizing radiation	kBq Co-60 eq	1.40E-02	7.97E-03	4.64E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	7.95E-03	5.17E-03	2.67E-03	1.03E-04
Fine particulate matter formation	kg PM2.5 eq	4.62E-03	3.26E-03	7.89E-04	5.73E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	8.43E-03	5.60E-03	2.72E-03	1.06E-04
Terrestrial acidification	kg SO2 eq	9.67E-03	7.53E-03	1.88E-03	2.60E-04
Freshwater eutrophication	kg P eq	9.57E-05	7.24E-05	6.75E-06	1.65E-05
Marine eutrophication	kg N eq	4.92E-05	4.04E-05	1.42E-06	7.39E-06
Terrestrial ecotoxicity	kg 1,4-DCB	1.21E+01	2.97E+00	9.03E+00	7.78E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.11E-03	1.51E-03	1.46E-03	1.38E-04
Marine ecotoxicity	kg 1,4-DCB	1.04E-02	3.38E-03	6.84E-03	1.97E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.66E-02	1.15E-02	4.10E-03	9.71E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	4.89E-01	2.92E-01	1.79E-01	1.85E-02
Land use	m2a crop eq	2.98E-01	2.76E-01	2.17E-02	4.61E-04
Mineral resource scarcity	kg Cu eq	9.59E-03	6.47E-03	3.02E-03	9.15E-05
Fossil resource scarcity	kg oil eq	1.36E+00	1.11E+00	2.13E-01	3.33E-02
Water consumption	m3	6.47E-02	6.31E-02	1.12E-03	5.04E-04

Scenarios 2, 3, 4 and 5

CCW's Metshield product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 9% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 68. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – METSHIELD

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-4%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-4%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	0%	4%
Non-Renewable Fossil (MJ)	4%	-5%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	4%	-5%	1%	-1%	9%	0%
Renewable (MJ)	3%	-2%	0%	-1%	-22%	1%
Renewable (Biomass) (MJ)	6%	-3%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-3%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-4%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	3%	-7%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	7%

CCW 705 HT

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 69. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – CCW 705 HT

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.79E+00	1.99E+00	6.37E-01	1.54E-01
Stratospheric ozone depletion	kg CFC11 eq	1.12E-06	7.74E-07	2.96E-07	4.83E-08
Ionizing radiation	kBq Co-60 eq	1.40E-02	7.97E-03	4.64E-03	1.43E-03
Ozone formation, Human health	kg NOx eq	7.96E-03	5.17E-03	2.67E-03	1.11E-04
Fine particulate matter formation	kg PM2.5 eq	4.63E-03	3.26E-03	7.89E-04	5.79E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	8.44E-03	5.60E-03	2.72E-03	1.14E-04
Terrestrial acidification	kg SO2 eq	9.67E-03	7.53E-03	1.88E-03	2.63E-04
Freshwater eutrophication	kg P eq	9.59E-05	7.24E-05	6.75E-06	1.68E-05
Marine eutrophication	kg N eq	5.24E-05	4.04E-05	1.42E-06	1.07E-05
Terrestrial ecotoxicity	kg 1,4-DCB	1.21E+01	2.97E+00	9.03E+00	8.31E-02
Freshwater ecotoxicity	kg 1,4-DCB	3.14E-03	1.51E-03	1.46E-03	1.67E-04
Marine ecotoxicity	kg 1,4-DCB	1.05E-02	3.38E-03	6.84E-03	2.31E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.67E-02	1.15E-02	4.10E-03	1.07E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	4.91E-01	2.92E-01	1.79E-01	1.97E-02
Land use	m2a crop eq	2.98E-01	2.76E-01	2.17E-02	4.81E-04
Mineral resource scarcity	kg Cu eq	9.59E-03	6.47E-03	3.02E-03	9.19E-05

Fossil resource scarcity	kg oil eq	1.36E+00	1.11E+00	2.13E-01	3.33E-02
Water consumption	m3	6.47E-02	6.31E-02	1.12E-03	5.03E-04

Scenarios 2, 3, 4 and 5

CCW's 705 HT product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 9% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 70. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 705 HT

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-4%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-4%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-3%	0%	0%	-2%	2%
Smog (kg O3 eq)	3%	-3%	0%	0%	1%	3%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	0%	4%
Non-Renewable Fossil (MJ)	4%	-5%	0%	0%	0%	2%
Non-Renewable Nuclear (MJ)	4%	-5%	1%	-1%	9%	0%
Renewable (MJ)	3%	-2%	0%	-1%	-22%	1%
Renewable (Biomass) (MJ)	6%	-3%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	6%	-3%	0%	0%	1%	0%
Net Fresh Water (L)	6%	-4%	0%	0%	2%	0%
Hazardous Waste Generated (kg)	3%	-7%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	1%	-1%	0%	0%	0%	7%

VapAir Seal 725 TR

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 71. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – VAPAIR SEAL 725 TR

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	1.67E+00	1.39E+00	1.46E-01	1.31E-01
Stratospheric ozone depletion	kg CFC11 eq	5.03E-07	3.93E-07	6.78E-08	4.19E-08
Ionizing radiation	kBq Co-60 eq	6.24E-03	3.89E-03	1.06E-03	1.28E-03
Ozone formation, Human health	kg NOx eq	3.83E-03	3.13E-03	6.13E-04	9.44E-05
Fine particulate matter formation	kg PM2.5 eq	2.58E-03	1.88E-03	1.81E-04	5.17E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	4.08E-03	3.35E-03	6.25E-04	9.71E-05
Terrestrial acidification	kg SO2 eq	5.56E-03	4.89E-03	4.31E-04	2.35E-04
Freshwater eutrophication	kg P eq	5.47E-05	3.83E-05	1.55E-06	1.49E-05
Marine eutrophication	kg N eq	2.81E-05	2.04E-05	3.27E-07	7.32E-06
Terrestrial ecotoxicity	kg 1,4-DCB	3.54E+00	1.40E+00	2.07E+00	7.11E-02
Freshwater ecotoxicity	kg 1,4-DCB	1.31E-03	8.45E-04	3.36E-04	1.30E-04
Marine ecotoxicity	kg 1,4-DCB	3.62E-03	1.87E-03	1.57E-03	1.85E-04
Human carcinogenic toxicity	kg 1,4-DCB	9.45E-03	7.61E-03	9.42E-04	8.94E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	1.84E-01	1.26E-01	4.10E-02	1.69E-02
Land use	m2a crop eq	1.10E-01	1.04E-01	4.99E-03	4.19E-04
Mineral resource scarcity	kg Cu eq	4.45E-03	3.67E-03	6.93E-04	8.26E-05
Fossil resource scarcity	kg oil eq	8.69E-01	7.90E-01	4.89E-02	3.00E-02
Water consumption	m3	4.75E-02	4.68E-02	2.56E-04	4.56E-04

Scenarios 2, 3, 4 and 5

CCW's VapAir Seal 725 TR product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product increased by 11% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 72. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – VAPAIR SEAL 725 TR

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	5%	-3%	0%	0%	0%	1%
Acidification (kg SO2 eq)	5%	-3%	0%	0%	1%	1%
Eutrophication (kg N eq)	5%	-2%	0%	0%	-4%	1%
Smog (kg O3 eq)	5%	-3%	0%	0%	1%	2%
Ozone Depletion (kg CFC-11 eq)	4%	-3%	0%	0%	1%	2%
Non-Renewable Fossil (MJ)	5%	-4%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	6%	-3%	1%	-1%	11%	0%
Renewable (MJ)	3%	-1%	0%	-1%	-33%	0%
Renewable (Biomass) (MJ)	7%	-1%	0%	0%	1%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	8%	0%	0%	0%	1%	0%

Net Fresh Water (L)	6%	-3%	0%	0%	4%	0%
Hazardous Waste Generated (kg)	7%	-3%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	3%	-1%	0%	0%	0%	6%

WIP 250

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 73. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – WIP 250

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.34E+00	1.97E+00	1.61E-01	2.15E-01
Stratospheric ozone depletion	kg CFC11 eq	1.20E-06	1.04E-06	7.48E-08	8.26E-08
Ionizing radiation	kBq Co-60 eq	1.18E-02	6.19E-03	1.17E-03	4.43E-03
Ozone formation, Human health	kg NOx eq	5.05E-03	4.14E-03	6.76E-04	2.36E-04
Fine particulate matter formation	kg PM2.5 eq	3.13E-03	2.65E-03	1.99E-04	2.83E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.31E-03	4.38E-03	6.89E-04	2.42E-04
Terrestrial acidification	kg SO2 eq	7.28E-03	6.33E-03	4.75E-04	4.73E-04
Freshwater eutrophication	kg P eq	6.34E-05	5.18E-05	1.71E-06	9.92E-06
Marine eutrophication	kg N eq	1.44E-04	1.37E-04	3.60E-07	7.25E-06
Terrestrial ecotoxicity	kg 1,4-DCB	5.78E+00	3.40E+00	2.28E+00	9.99E-02
Freshwater ecotoxicity	kg 1,4-DCB	1.97E-03	1.47E-03	3.70E-04	1.32E-04
Marine ecotoxicity	kg 1,4-DCB	5.40E-03	3.46E-03	1.73E-03	2.06E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.46E-02	1.27E-02	1.04E-03	8.54E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	2.99E-01	2.36E-01	4.52E-02	1.82E-02
Land use	m2a crop eq	2.09E-01	2.02E-01	5.50E-03	1.56E-03
Mineral resource scarcity	kg Cu eq	6.08E-03	5.17E-03	7.64E-04	1.49E-04
Fossil resource scarcity	kg oil eq	9.08E-01	8.02E-01	5.39E-02	5.15E-02
Water consumption	m3	5.02E-02	4.92E-02	2.82E-04	7.58E-04

Scenarios 2, 3, 4 and 5

CCW's WIP 250 product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product decreased by 9% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 74. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – WIP 250

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	3%	-5%	0%	0%	-1%	1%
Acidification (kg SO2 eq)	3%	-5%	0%	0%	-1%	1%
Eutrophication (kg N eq)	3%	-5%	0%	0%	1%	1%
Smog (kg O3 eq)	3%	-5%	0%	0%	0%	1%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	-1%	2%
Non-Renewable Fossil (MJ)	3%	-5%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	2%	-5%	1%	-1%	-9%	0%
Renewable (MJ)	3%	-5%	0%	-1%	24%	0%
Renewable (Biomass) (MJ)	3%	-4%	0%	0%	1%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	3%	-5%	0%	0%	1%	0%
Net Fresh Water (L)	3%	-6%	0%	0%	0%	0%
Hazardous Waste Generated (kg)	2%	-8%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	2%	-3%	0%	0%	0%	4%

WIP GRIP

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 75. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – WIP GRIP

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	2.86E+00	2.42E+00	1.32E-01	3.09E-01
Stratospheric ozone depletion	kg CFC11 eq	1.43E-06	1.25E-06	6.14E-08	1.18E-07
Ionizing radiation	kBq Co-60 eq	1.49E-02	7.54E-03	9.64E-04	6.36E-03
Ozone formation, Human health	kg NOx eq	5.59E-03	4.69E-03	5.55E-04	3.39E-04
Fine particulate matter formation	kg PM2.5 eq	3.70E-03	3.13E-03	1.64E-04	4.07E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	5.81E-03	4.90E-03	5.66E-04	3.48E-04
Terrestrial acidification	kg SO2 eq	8.43E-03	7.36E-03	3.90E-04	6.79E-04
Freshwater eutrophication	kg P eq	7.68E-05	6.11E-05	1.40E-06	1.43E-05
Marine eutrophication	kg N eq	1.74E-04	1.63E-04	2.96E-07	1.08E-05
Terrestrial ecotoxicity	kg 1,4-DCB	6.89E+00	4.87E+00	1.88E+00	1.44E-01
Freshwater ecotoxicity	kg 1,4-DCB	2.34E-03	1.85E-03	3.04E-04	1.92E-04
Marine ecotoxicity	kg 1,4-DCB	6.23E-03	4.51E-03	1.42E-03	2.99E-04
Human carcinogenic toxicity	kg 1,4-DCB	1.81E-02	1.60E-02	8.53E-04	1.24E-03
Human non-carcinogenic toxicity	kg 1,4-DCB	3.72E-01	3.08E-01	3.72E-02	2.62E-02
Land use	m2a crop eq	2.19E-01	2.12E-01	4.52E-03	2.23E-03
Mineral resource scarcity	kg Cu eq	7.09E-03	6.25E-03	6.28E-04	2.13E-04
Fossil resource scarcity	kg oil eq	9.83E-01	8.66E-01	4.43E-02	7.35E-02
Water consumption	m3	5.69E-02	5.56E-02	2.32E-04	1.08E-03

Scenarios 2, 3, 4 and 5

CCW's WIP GRIP product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product decreased by 11% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 76. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – WIP GRIP

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	2%	-6%	0%	0%	-1%	1%
Acidification (kg SO2 eq)	3%	-6%	0%	0%	-2%	1%
Eutrophication (kg N eq)	2%	-7%	0%	0%	2%	0%
Smog (kg O3 eq)	3%	-6%	0%	0%	-1%	1%
Ozone Depletion (kg CFC-11 eq)	3%	-4%	0%	0%	-2%	2%
Non-Renewable Fossil (MJ)	3%	-6%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	2%	-5%	1%	-1%	-11%	0%
Renewable (MJ)	2%	-5%	0%	-1%	26%	0%
Renewable (Biomass) (MJ)	1%	-6%	0%	0%	1%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	1%	-6%	0%	0%	1%	0%

Net Fresh Water (L)	1%	-8%	0%	0%	0%	0%
Hazardous Waste Generated (kg)	4%	-6%	0%	0%	0%	0%
Non-Hazardous Waste Generated (kg)	2%	-4%	0%	0%	0%	3%

CCW 500

Scenario 1

The sensitivity analysis scenario was modelled by running the LCA model using the ReCiPe Midpoint (H) method [13] rather than the TRACI midpoint method. When the TRACI midpoint method was used to model the LCA, it was observed that the raw materials had the highest environmental impact in all products followed by upstream transportation. All the observations made while using the ReCiPe midpoint method are the same as when the TRACI method was used for calculation of the environmental impacts.

TABLE 77. CRADLE-TO-GATE LCIA RESULTS WITH RECIPE METHOD – CCW 500

Impact category	Unit	Total	A1	AA	A3
Global warming	kg CO2 eq	6.07E+00	5.04E+00	8.68E-01	1.70E-01
Stratospheric ozone depletion	kg CFC11 eq	1.78E-06	1.31E-06	4.02E-07	6.48E-08
Ionizing radiation	kBq Co-60 eq	2.88E-02	1.90E-02	6.32E-03	3.47E-03
Ozone formation, Human health	kg NOx eq	1.39E-02	1.01E-02	3.64E-03	1.86E-04
Fine particulate matter formation	kg PM2.5 eq	7.90E-03	6.60E-03	1.07E-03	2.23E-04
Ozone formation, Terrestrial ecosystems	kg NOx eq	1.48E-02	1.09E-02	3.71E-03	1.91E-04
Terrestrial acidification	kg SO2 eq	1.67E-02	1.38E-02	2.56E-03	3.70E-04
Freshwater eutrophication	kg P eq	1.51E-04	1.34E-04	9.20E-06	7.82E-06
Marine eutrophication	kg N eq	7.58E-05	6.74E-05	1.94E-06	6.47E-06
Terrestrial ecotoxicity	kg 1,4-DCB	3.06E+01	1.82E+01	1.23E+01	7.92E-02
Freshwater ecotoxicity	kg 1,4-DCB	5.49E-03	3.39E-03	1.99E-03	1.10E-04
Marine ecotoxicity	kg 1,4-DCB	2.19E-02	1.25E-02	9.31E-03	1.69E-04
Human carcinogenic toxicity	kg 1,4-DCB	3.65E-02	3.02E-02	5.59E-03	6.92E-04
Human non-carcinogenic toxicity	kg 1,4-DCB	1.18E+00	9.21E-01	2.43E-01	1.45E-02
Land use	m2a crop eq	8.55E-01	8.24E-01	2.96E-02	1.22E-03
Mineral resource scarcity	kg Cu eq	1.99E-02	1.57E-02	4.11E-03	1.16E-04
Fossil resource scarcity	kg oil eq	2.18E+00	1.85E+00	2.90E-01	4.00E-02
Water consumption	m3	5.17E-02	4.95E-02	1.52E-03	5.92E-04

Scenarios 2, 3, 4 and 5

CCW's 500 product was tested by increasing and decreasing the overall weight of the product (i.e., bill of materials) by 5%, increasing and decreasing the energy consumption by 5%, and replacing the energy dataset used in the LCA to reflect a national (US only) eGrid. The results show the greatest change to environmental impacts occurred when the bill of materials was increased and decreased by 5%. The results also show that the non-renewable nuclear impact for each product decreased by 5% when a national (US only) average electrical grid was used. Additionally, when the datasets for natural gas and truck transport were varied by 10% to see the environmental impacts associated with not using the US based datasets, we see a small change in all the environmental impacts categories.

TABLE 78. PERCENTAGE CHANGE BILL OF MATERIALS, ASSEMBLY ENERGY, AND ENERGY DATASET – 500

	Scenario 2		Scenario 3		Scenario 4	Scenario 5
Impact category	**Increase**	**Decrease**	**Increase**	**± Change**	**Change**	**± Change**
Global Warming (kg CO2 eq)	4%	-4%	0%	0%	0%	2%
Acidification (kg SO2 eq)	4%	-4%	0%	0%	0%	2%
Eutrophication (kg N eq)	4%	-4%	0%	0%	1%	2%
Smog (kg O3 eq)	4%	-4%	0%	0%	0%	2%
Ozone Depletion (kg CFC-11 eq)	3%	-3%	0%	0%	0%	3%
Non-Renewable Fossil (MJ)	4%	-4%	0%	0%	0%	1%
Non-Renewable Nuclear (MJ)	4%	-4%	1%	-1%	-5%	0%
Renewable (MJ)	4%	-4%	0%	-1%	7%	1%
Renewable (Biomass) (MJ)	5%	-5%	0%	0%	0%	0%
Non-Renewable Material Resources (kg)	0%	0%	0%	0%	0%	0%
Renewable Material Resources (kg)	5%	-5%	0%	0%	0%	0%
Net Fresh Water (L)	5%	-5%	0%	0%	0%	0%
Hazardous Waste Generated (kg)	3%	-3%	0%	0%	0%	4%
Non-Hazardous Waste Generated (kg)	2%	-2%	0%	0%	0%	6%

INTERPRETATION

The primary goals of the comprehensive LCA for each Sheet and Hot-Melt Rubberized Asphalt products were developed at the beginning of the project with CCW and are outlined in the Introduction of this report. The Interpretation section serves as a discussion of the results and their relationship to the initial goals of the study.

MiraDri 860/861

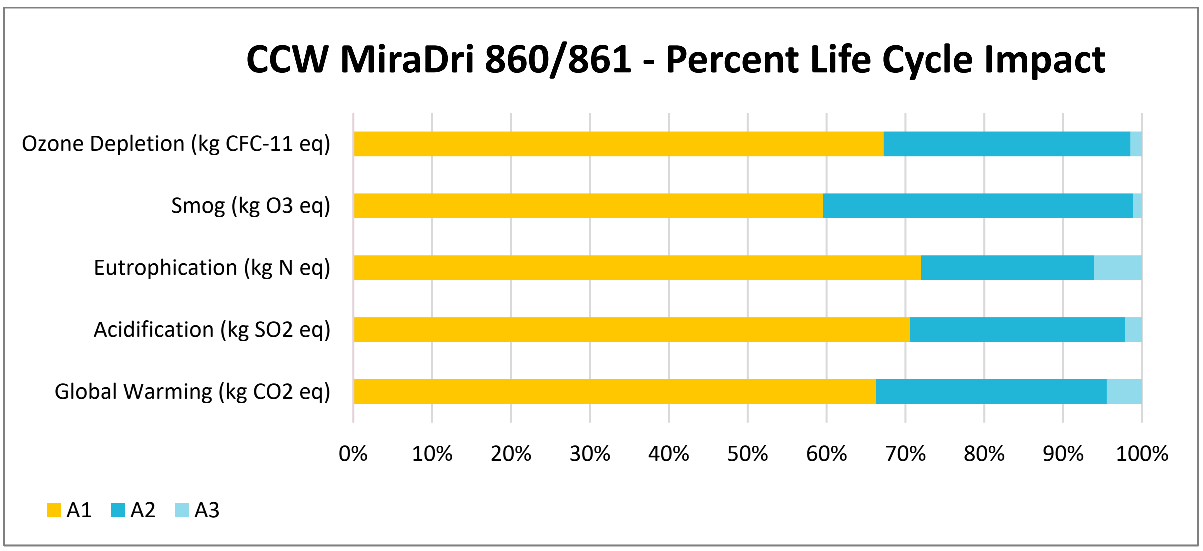

FIGURE 2. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – MIRADRI 860/861

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.05 kgCO_2eq. for MiraDri 860/861as per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 29%, 14% and 13% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 31% towards ozone depletion, followed by asphalt which contributes 17%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 39%, Naphtha and asphalt contributes 26% and 17% respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 711-70

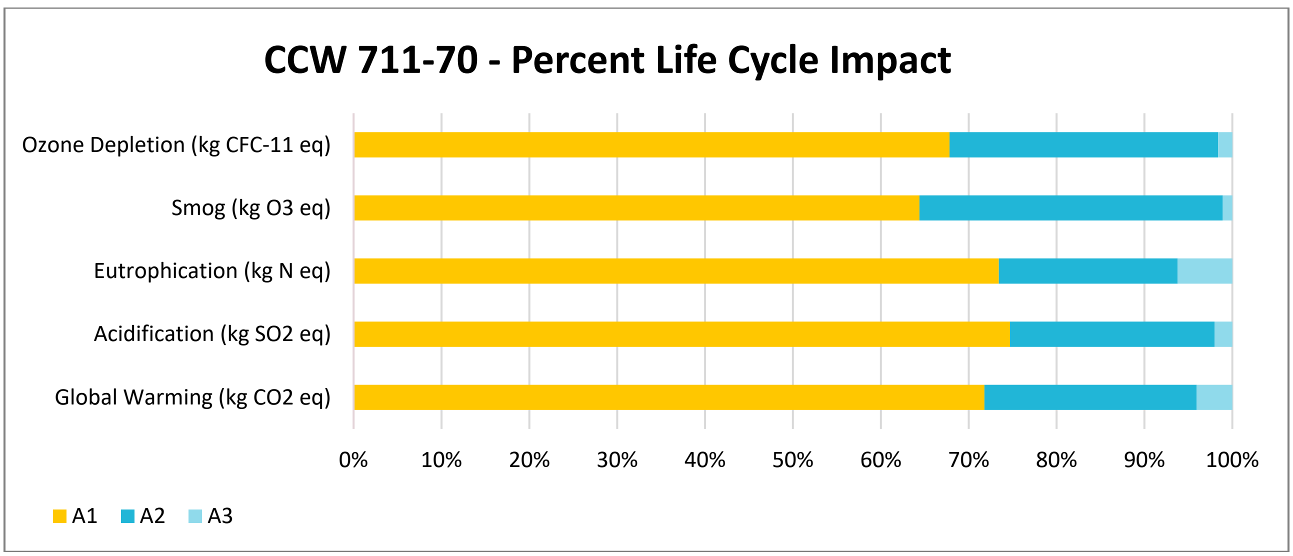

FIGURE 3. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 711-70

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here:

- The results of the cradle-to-gate LCA showed global warming impacts of 2.71 kg CO_2eq. for CCW 711-70 as per the declared unit.
- The highest contributors of global warming potential are upstream transport, non-woven polypropylene and the asphalt at 24%, 24% and 10% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the non-woven PP and asphalt contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation, non-woven PP and asphalt, the reasons are similar to those mentioned for GWP.

- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from non-woven PP, release paper, asphalt, Naphtha, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 31% towards ozone depletion, followed by asphalt which contributes 16%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 35%, non-woven PP and asphalt contributes 18% and 10% respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 711-90

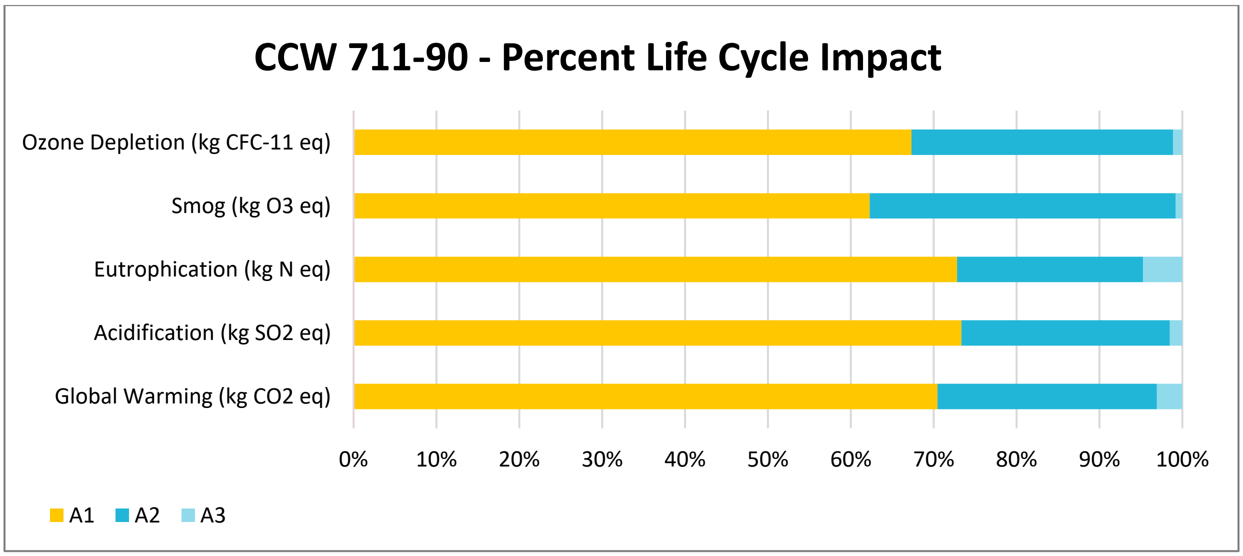

FIGURE 4. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 711-90

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 3.18 kgCO_2eq. for CCW 711-90as per the declared unit.
- The highest contributors of global warming potential are upstream transport, non-woven polypropylene and the asphalt at 26%, 21% and 12% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the non-woven PP and asphalt contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation, non-woven PP and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from non-woven PP, release paper, asphalt, Naphtha, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 32% towards ozone depletion, followed by asphalt which contributes 17%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.

- Upstream transport contributes 37%, non-woven PP and asphalt contributes 15% and 11% respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 AVB

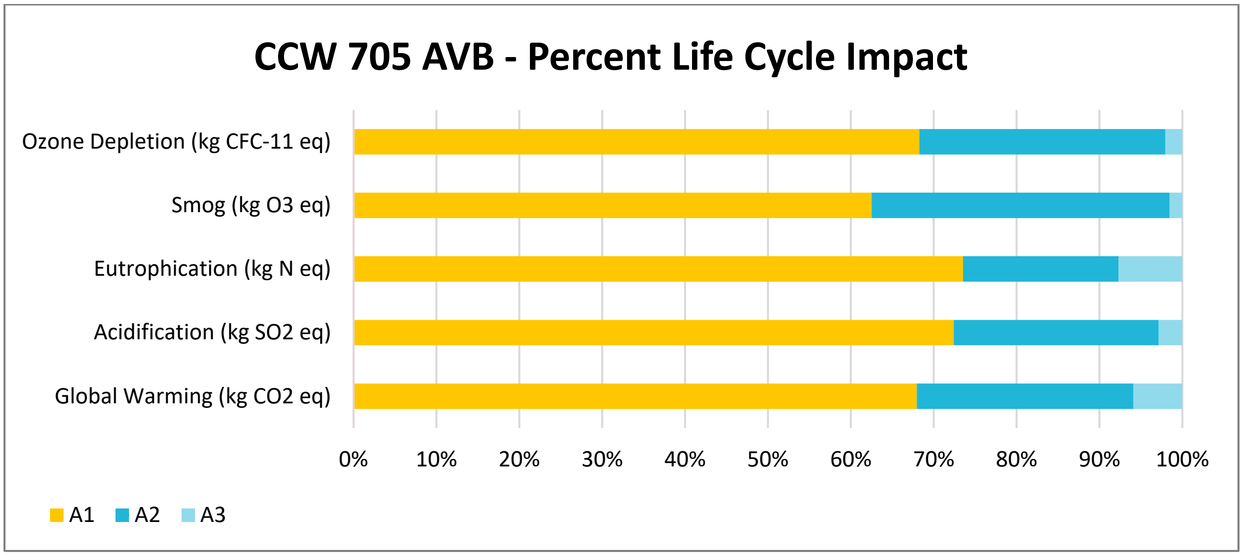

FIGURE 5. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 711-90

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 1.55 $kgCO_2eq$. for CCW 705 AVB per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 26%, 19% and 11% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 30% towards ozone depletion, followed by asphalt which contributes 15%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 36%, Naphtha and asphalt contributes 24% and 15% respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 TWF

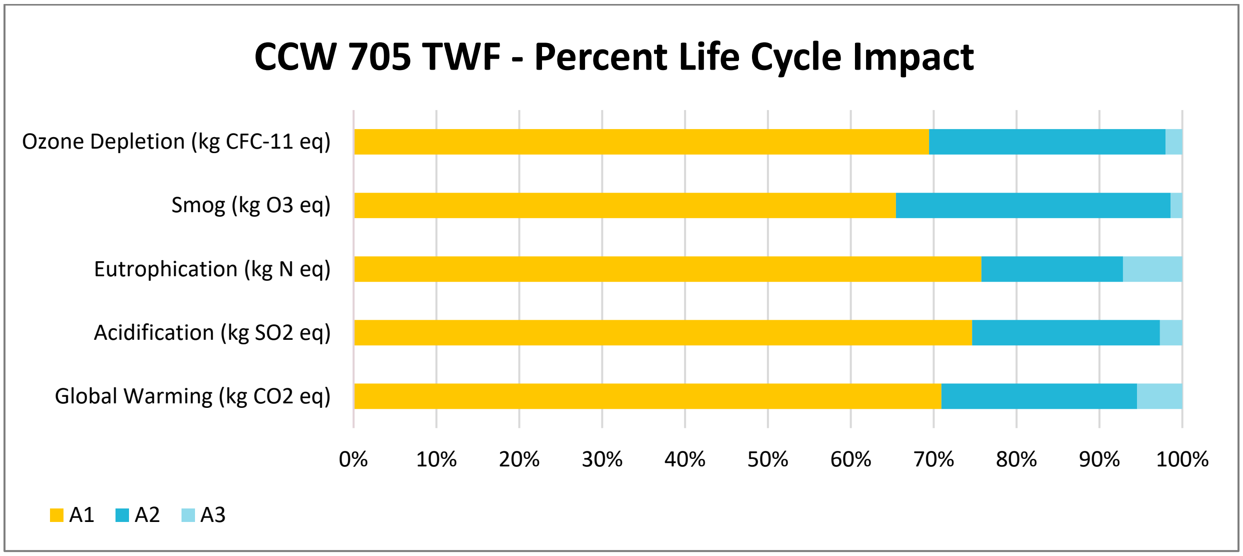

FIGURE 6. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705 TWF

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 1.80 kgCO_2eq. for CCW 705 TWF per the declared unit.
- The highest contributors of global warming potential are upstream transport, HDPE substrate, release paper and the asphalt at 24%, 17%,19% and 9% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation, HDPE substrate, release paper and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, HDPE substrate, Naphtha, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 29% towards ozone depletion, followed by asphalt which contributes 14%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 33%, HDPE substrate and asphalt contributes 14% and 9% respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 FR-A

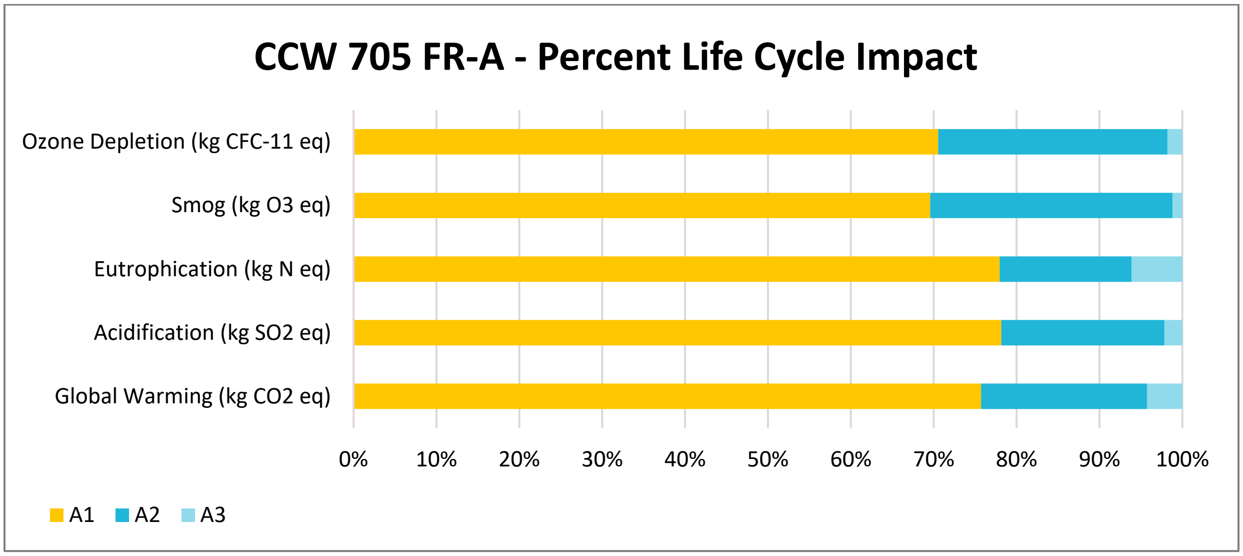

FIGURE 7. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705 FR-A

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.16 kgCO_2eq. for CCW 705 FR-A per the declared unit.
- The highest contributors of global warming potential are aluminium foiled HDPE, upstream transport, and the asphalt at 38%, 20% and 8% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the aluminium foiled HDPE contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by aluminium foiled substrate, upstream transportation, and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by aluminium foiled HDPE, upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 28% towards ozone depletion, followed by Naphtha which contributes 21%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- The aluminium foiled HDPE contributes 32%, the upstream transport contributes 29%, and asphalt contributes 8% towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

EZ Flash

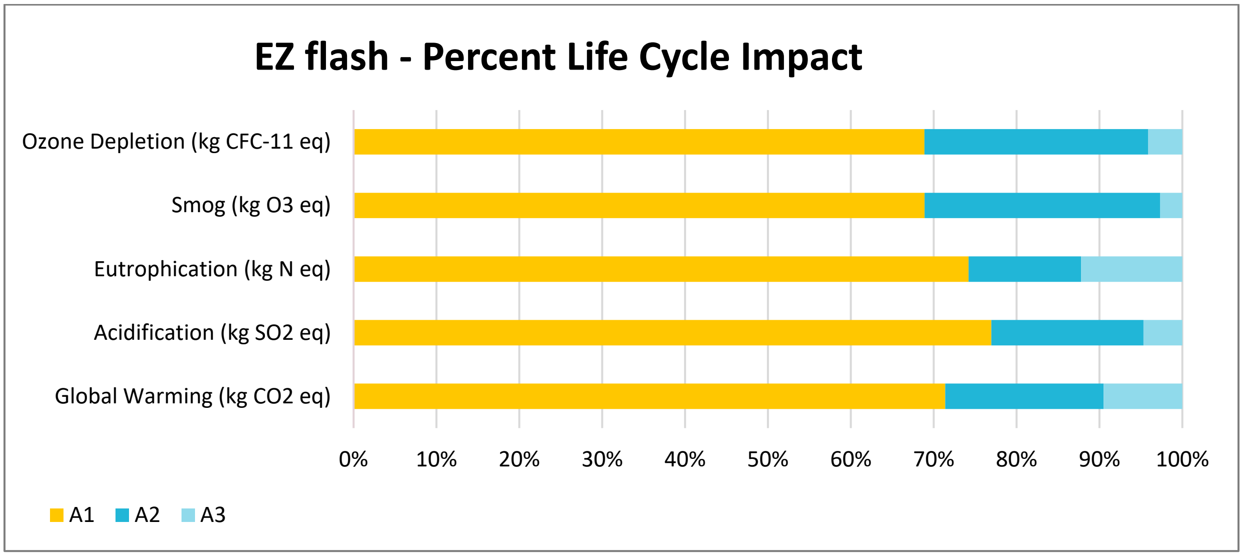

FIGURE 8. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – EZ FLASH

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 0.97 kgCO_2eq. for EZ Flash per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 19%, 23% and 7% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 27% towards ozone depletion, followed by asphalt which contributes 13%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 28%, release paper and asphalt contribute 24% and 7%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

MiraDri 860 ULT

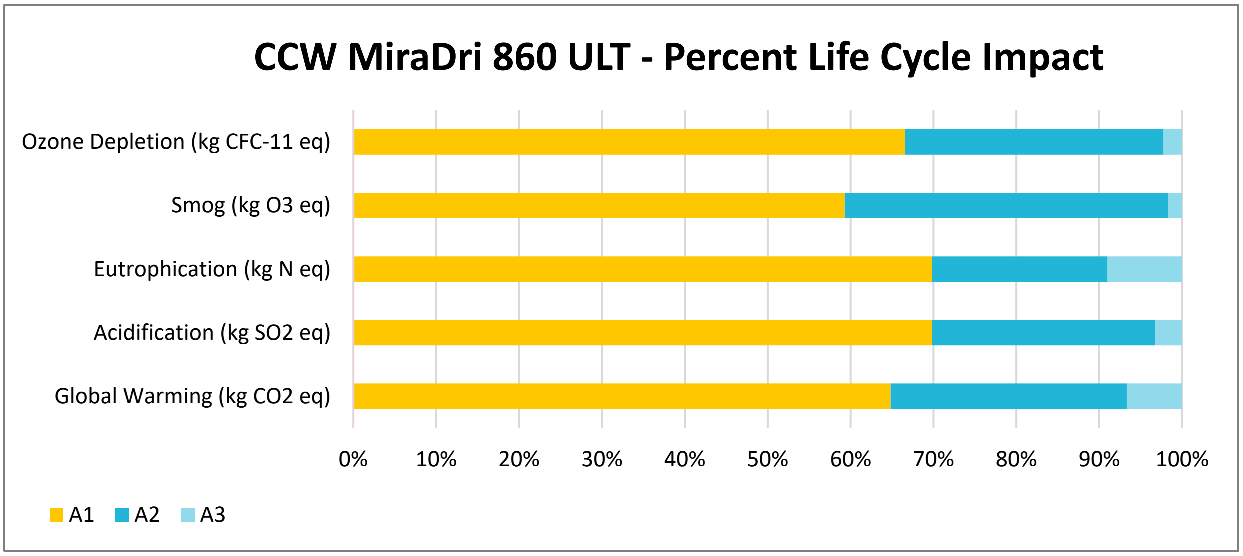

FIGURE 9. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – MIRADRI 860 ULT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.11 kgCO_2eq. for MiraDri 860 ULT per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 28%, 14% and 12% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 31% towards ozone depletion, followed by asphalt which contributes 17%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 39%, release paper and asphalt contribute 14% and 12%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 XLT

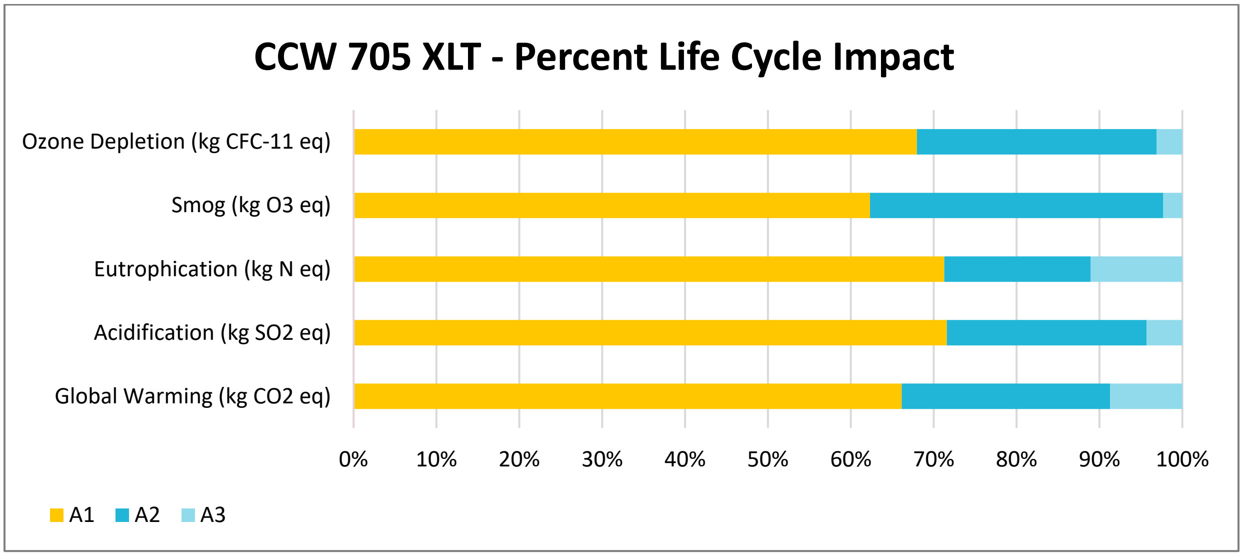

FIGURE 10. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705 XLT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 1.62 kgCO_2eq. for CCW 705 XLT per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 25%, 18% and 10% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 29% towards ozone depletion, followed by asphalt which contributes 10%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 35%, release paper and asphalt contribute 18% and 10%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 TWF XLT

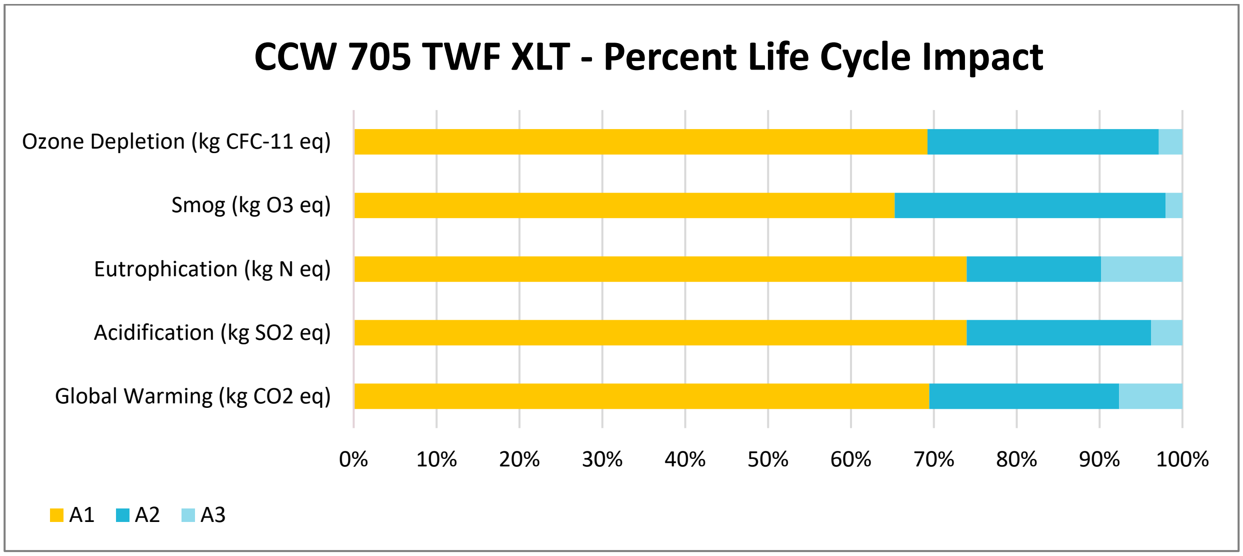

FIGURE 11. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705 TWF XLT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 1.85 kgCO_2eq. for CCW 705 TWF XLT per the declared unit.
- The highest contributors of global warming potential are upstream transport, HDPE substrate, release paper and the asphalt at 23%, 16%, 19% and 9% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation, HDPE substrate and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, HDPE substrate, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 28% towards ozone depletion, followed by Naphtha which contributes 22%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 33%, release paper, HDPE substrate and asphalt contributes 19%, 13% and 9%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705 FR-A XLT

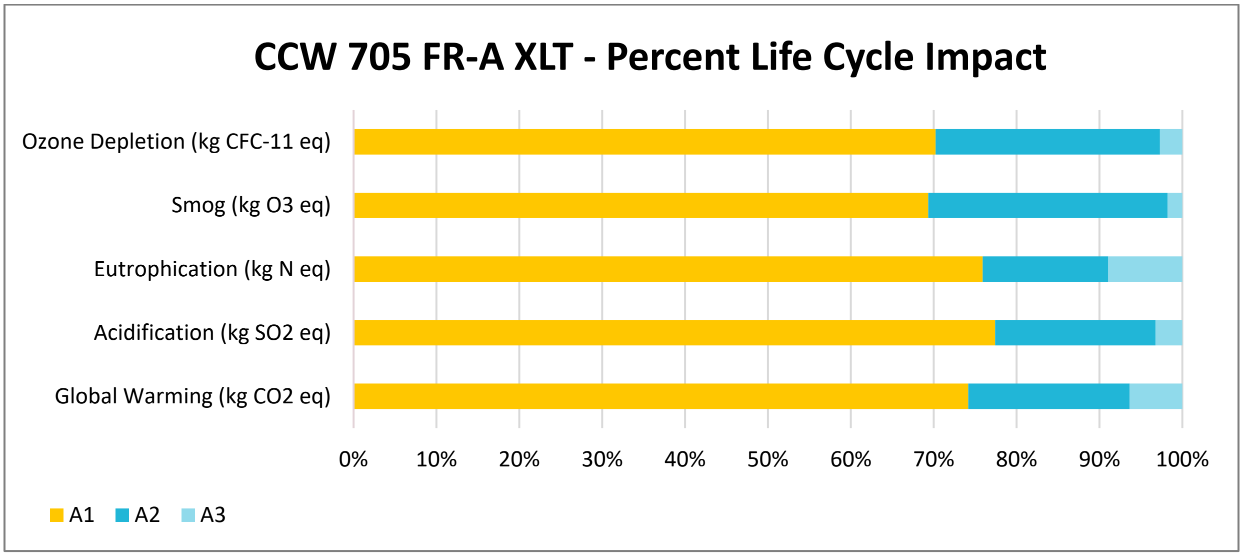

FIGURE 12. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705 FR-A XLT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.22 kgCO_2eq. for CCW 705 FR-A XLT per the declared unit.
- The highest contributors of global warming potential are aluminium foiled HDPE, upstream transport, release paper and the asphalt at 37%, 19%, 9% and 7% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by aluminium foiled HDPE, upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by aluminium foiled substrate, with other considerable portions coming from upstream transportation, release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 27% towards ozone depletion, followed by asphalt which contributes 13%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- The aluminium foiled substrate contributes 31%, upstream transport and asphalt contributes 29% and 8%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

WIP 300HT

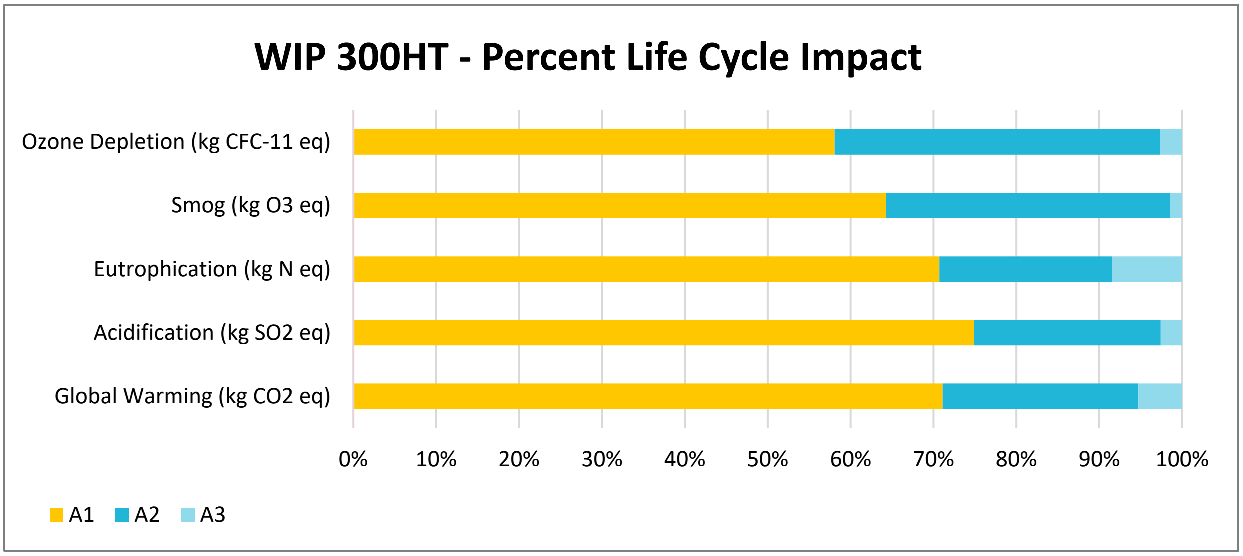

FIGURE 13. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – WIP 300HT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.67 kgCO_2eq. for WIP 300HT per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 24%, 17% and 10% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 39% towards ozone depletion, followed by asphalt which contributes 20%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 34%, release and asphalt contribute 17% and 10%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

Metshield

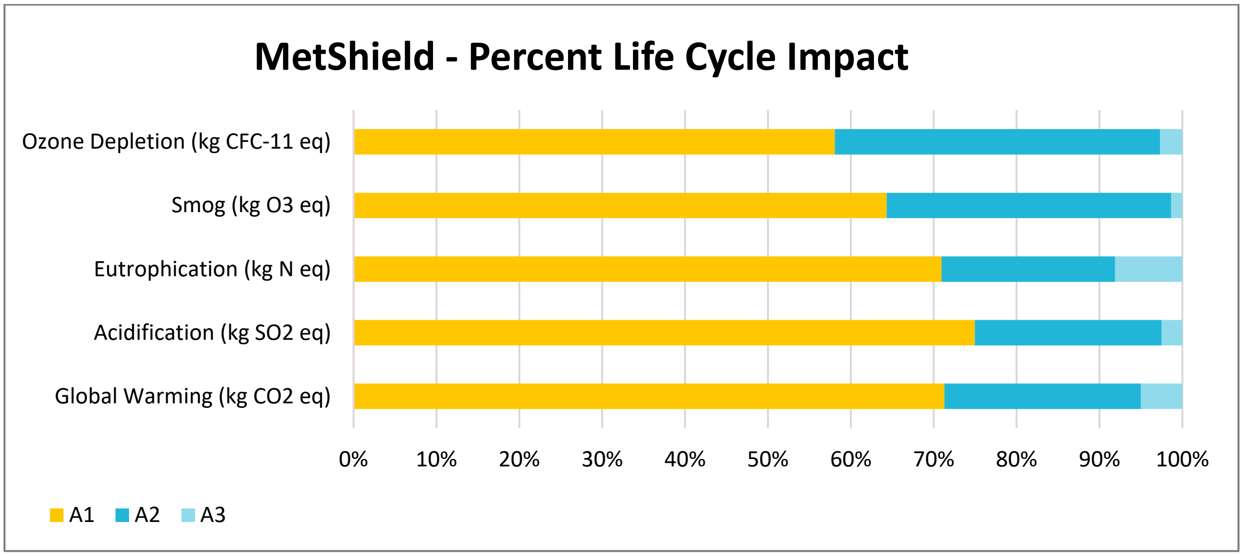

FIGURE 14. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – METSHIELD

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.67 kgCO_2eq. for Metshield per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 24%, 17% and 10% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 39% towards ozone depletion, followed by asphalt which contributes 20%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 34% and asphalt contributes 10%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 705HT

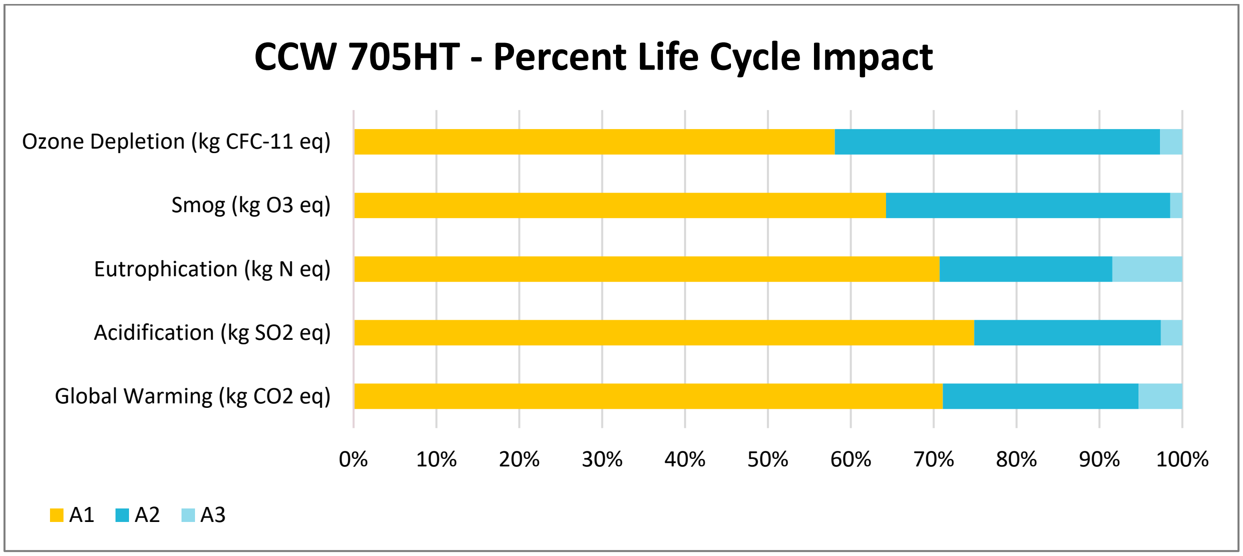

FIGURE 15. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 705HT

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.67 kgCO_2eq. for CCW 705HT per the declared unit.
- The highest contributors of global warming potential are upstream transport, release paper and the asphalt at 24% , 17% and 10% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the paper release which is mainly a layer of paper over silicone contributes towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by upstream transportation and asphalt, the reasons are similar to those mentioned for GWP. Release paper is also a significant portion in acidification.
- Eutrophication potential is largely driven again by upstream transportation, with other considerable portions coming from release paper, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 39% towards ozone depletion, followed by asphalt which contributes 20%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 34%, and asphalt contributes 10%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

VapAir Seal 725TR

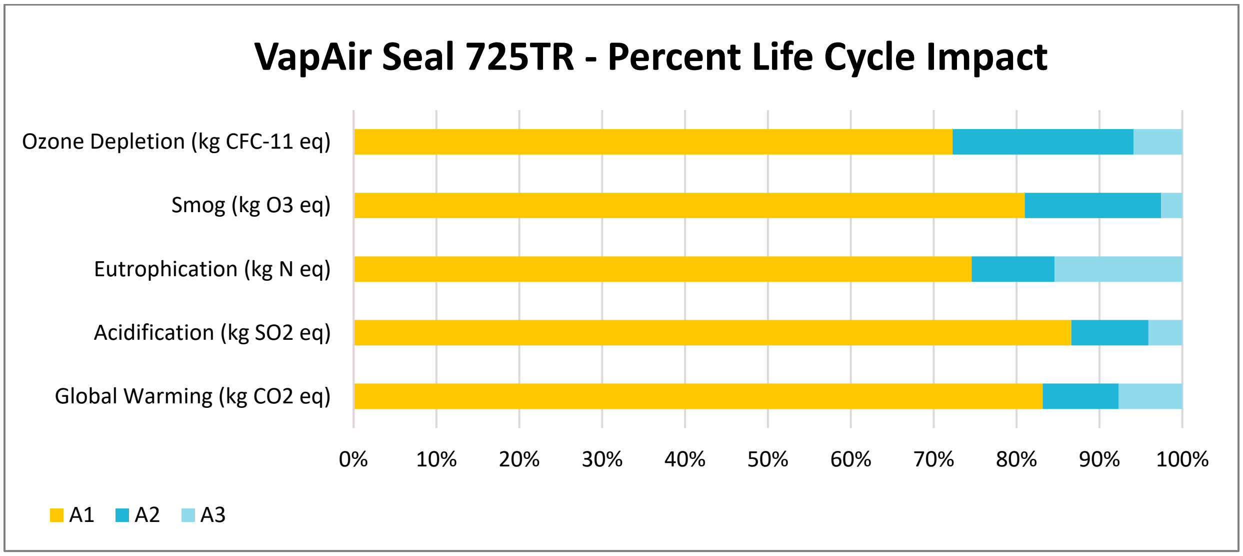

FIGURE 16. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – VAPAIR SEAL 725TR

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 1.58 kgCO_2eq. for VapAir Seal 725TR per the declared unit.
- The highest contributors of global warming potential are OPP substrate, upstream transportation, and the asphalt at 26%, 9% and 12% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP.
- Similar to global warming potential, acidification potential was greatly influenced by OPP substrate and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven by asphalt, with other considerable portions coming from release paper, upstream transportation, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Asphalt contributes 35% towards ozone depletion, followed by upstream transport which contributes 22%. The fossil fuel extraction, processing, and the diesel fuel used in truck are the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 16%, release paper and asphalt contribute 10% and 15%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

WIP 250

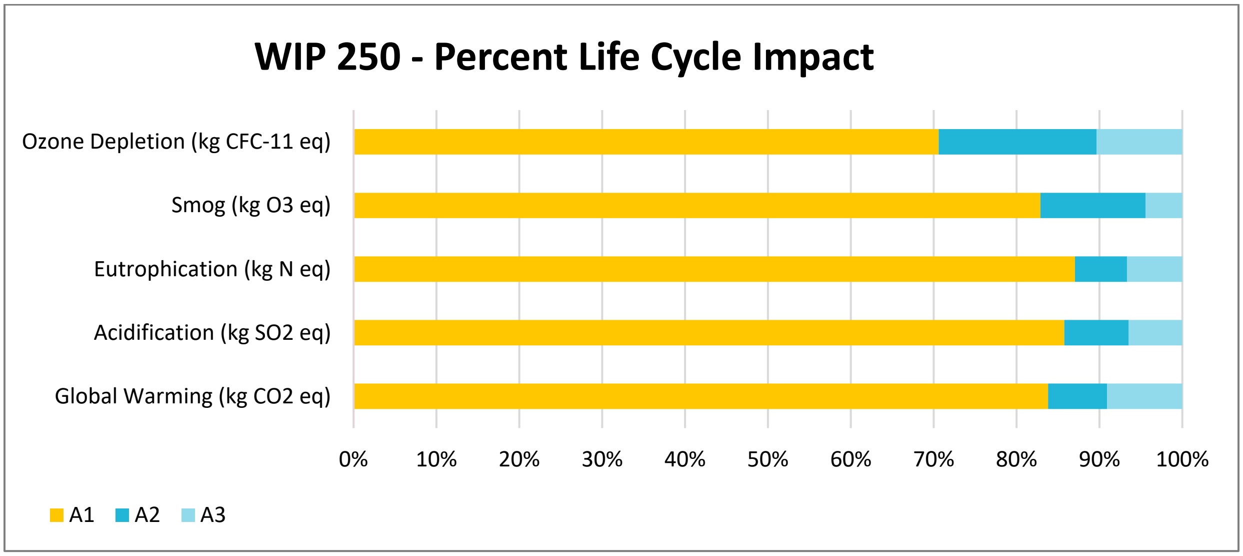

FIGURE 17. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – WIP 250

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.24 kgCO_2eq. for WIP 250 per the declared unit.
- The highest contributors of global warming potential are the glass fibre used in the membrane, calcium carbonate, upstream transport, release paper and the asphalt at 24%, 16% and 7%, each respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the glass fibre are the main contributor towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by the glass fibre and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by the glass fibre, with other considerable portions coming from calcium carbonate, asphalt, transport, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 19% towards ozone depletion, followed by asphalt which contributes 24%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Upstream transport contributes 13%, glass fibre and the calcium carbonate contributes 17%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

WIP GRIP

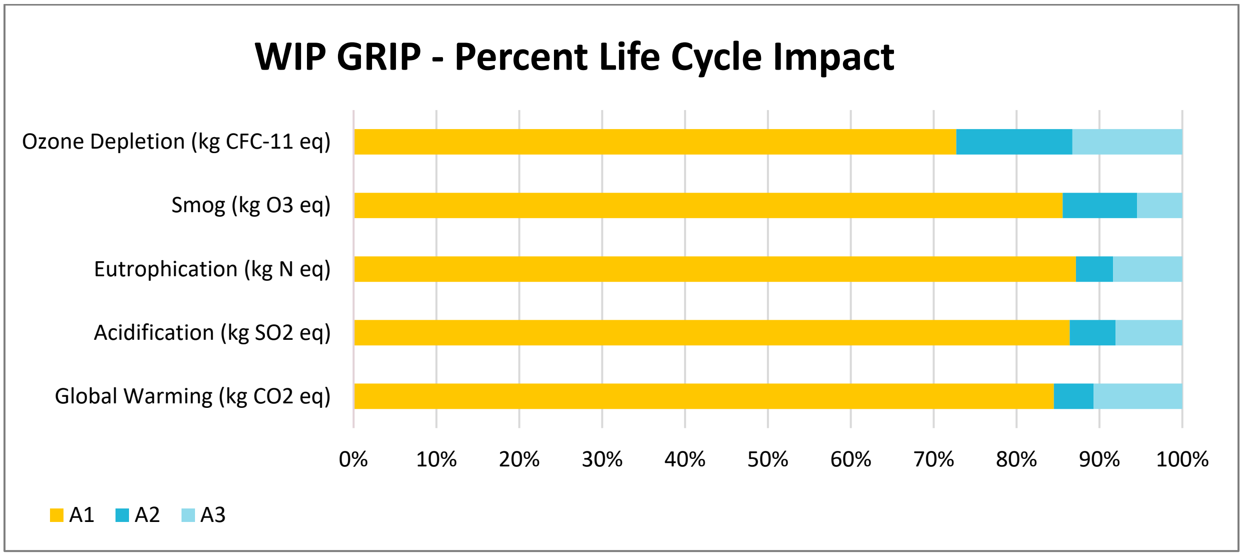

FIGURE 18. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – WIP GRIP

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 2.73 kgCO_2eq. for WIP GRIP per the declared unit.
- The highest contributors of global warming potential are the glass fibre used in the membrane, calcium carbonate, upstream transport, release paper and the asphalt at 23%, 24% and 5%, each respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the glass fibre are the main contributor towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by the glass fibre and asphalt, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by the glass fibre, with other considerable portions coming from calcium carbonate, asphalt, transport, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Calcium carbonate contributes 20% towards ozone depletion, followed by asphalt which contributes 20%. The raw material extraction and processing of raw material are one of the main contributors towards Ozone depletion.
- The calcium carbonate contributes 27% followed by upstream transport at 9% towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

CCW 500

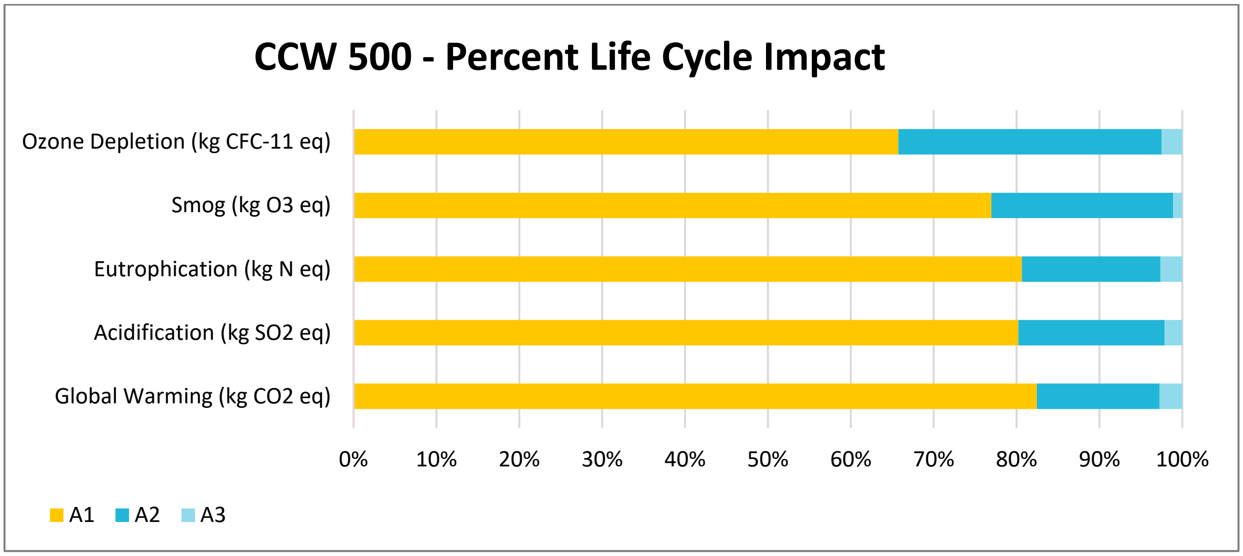

FIGURE 19. CRADLE-TO-GATE LCA PERCENTAGE CONTRIBUTION TO ENVIRONMENTAL IMPACTS – CCW 500

The cradle-to-gate LCA showed several intriguing results for interpretation as part of the study. While these are discussed in the Life Cycle Impact Assessment and Sensitivity sections of the report, they are further summarized here.

- The results of the cradle-to-gate LCA showed global warming impacts of 5.80 kgCO_2eq. for CCW 500 per the declared unit.
- The highest contributors of global warming potential are calcium carbonate, and upstream transport at 49%, and 15% respectively, the transportation is majorly by truck and burning of fuel (diesel) contributes to GWP, the extraction of minerals and the fossil fuel burned in production of the calcium carbonate are the main contributor towards the GWP.
- Similar to global warming potential, acidification potential was greatly influenced by the calcium carbonate and upstream transport, the reasons are similar to those mentioned for GWP.
- Eutrophication potential is largely driven again by the calcium carbonate, with other considerable portions coming from upstream transport, asphalt, and electricity. Processing of raw materials, transportation and generation of heat and electricity can lead to release of agents that cause eutrophication in the water supply.
- Upstream transport contributes 32% towards ozone depletion, followed by calcium carbonate which contributes 29%. Diesel fuel used in truck is the major contributor contributing towards Ozone Depletion.
- Calcium Carbonate contributes 43%, and the upstream transportation contributes 22%, respectively towards smog formation potential, the fossil fuel burned during extraction and transportation by truck, is the major reason for Smog contribution.

Limitations of Study

The study limitations are as follows.

- Due to the inherent limitations of LCA methodology, this study should not be used as the sole source of environmental data on the materials and processes modelled. This LCA has been performed according to best practices in modelling and allocation.
- Resource use at the CCW facility were allocated to each product based on the mass of the product as a fraction of the total facility production (i.e., mass-based allocation).

- The Datasets used for representing the natural gas usage at the manufacturing facilities and the transport of raw materials by truck within US are modelled in the study using global datasets. In the older ecoinvent version they were available as part of the US LCI database, which due to errors during software update did not get transferred into the new ecoinvent 3.6 version. A sensitivity scenario was modelled to account for this data gap where the truck transport and the natural gas inputs were varied by 10%. Scenario 5 represents these changes, and the results shows a very small percentage change to overall environmental impacts.

ADDITIONAL INFORMATION

- Environment and Health during Installation or Use: No environmental or health impacts are expected from the Sheet and Hot-Melt Rubberized Asphalt Products during its installation or use.
- Extraordinary Effects: No environmental or health impacts are expected due to extraordinary effects including fire and/or water damage and product destruction.

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