trans-
mu-
ta-
tion

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2: 2019/AC:2021

PostPrime Plastic® pellets from

Transmutation Pty Ltd (Australia)

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
Regional Programme:	EPD Australasia, www.epd-australasia.com
EPD registration number:	EPD-IES-0017436:002
Publication date:	2024-12-16
Revision date:	2025-02-20
Valid until:	2029-12-16

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

EPD®
THE INTERNATIONAL EPD® SYSTEM

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at https://epd-australasia.com/

Version History

Version

Version	2
Revision Date	20 February 2025 (valid until 16 December 2029)

Version differences

Version	Amendment summary
1	Original Version
2	Typo errors are corrected. There are no changes to the environmental results.

General EPD Information

Declaration Owner	Transmutation Pty Ltd 14 Flint Street, Robe SA 5276 T: +61 414730106 W: www.transmutation.com.au	
Geographical Scope	Australia	
Reference Year for Data	1 October 2023 - 30 September 2024	
EPD program operator:	EPD Australasia Limited epd-australasia.com info@epd-australasia.com EPD Australasia Limited 315a Hardy Street Nelson 7010, New Zealand	EPD International AB info@environdec.com EPD International AB Box 210 60, SE-100 31 Stockholm, Sweden
PRODUCT CATEGORY RULES (PCR)		
CEN standard EN 15804 served as the core Product Category Rules (PCR)		
Product Category Rules (PCR):	PCR 2019.14 Construction Products, version 1.3.4	
PCR review was conducted by:	The Technical Committee of the International EPD® System. See www.environdec.com for a list of members	
Review Chair:	Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact	
LIFE CYCLE ASSESSMENT (LCA)		
EPD Prepared by:	Sazal Kundu, Lilia Caballero Edge Environment Pty Limited Greenhouse, Level 3, 180 George Street, Sydney NSW 2000 W: www.edgeimpact.global E: info@edgeimpact.global	
THIRD-PARTY VERIFICATION		
Independent verification of the declaration and data, according to ISO 14025:2006	☒ EPD verification by individual verifier	
Third Party Verifier	Jane Anderson ConstructionLCA Market Rasen, Lincolnshire LN7 6NS, United Kingdom w: constructionlca.co.uk e: jane@constructionlca.co.uk	
Verifier approved by:	EPD Australasia Ltd	
Procedure for follow-up of data during EPD validity involved third-party verifier	☐ Yes ☒ No	

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product based on a consistent set of rules known as a PCR (Product Category Rules).

Transmutation has sole ownership, liability, and responsibility for this EPD. To the best of Transmutation's knowledge, the information provided in this document is accurate and reliable. However, no warranty, guarantee or representation is made as to its accuracy, reliability or completeness.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

About Transmutation

Transmutation Pty Ltd is a 100% Australian-owned company based in South Australia's Limestone Coast. Established in 2001, Transmutation initially specialized in providing transport and project management services to large logistics firms. However, in 2018, the company underwent a significant transformation by redirecting its focus to embrace a more environmentally conscious approach.

Transmutation has since evolved into a sustainable, recycling and manufacturing business that has specialized in accepting hard to recycle plastics and transforming them into commercial products.

Transmutation Recomposition manufactures products from fully recycled materials into high quality homeware, industrial and construction products.

Transmutation Resources excels in crafting high-quality resin pellets and has their own Trade Marked, PostPrime® Plastic polymer that is used in a wide variety of applications.

Transmutation Retail actively advocates for a circular economy, curating and selling items made from recycled materials while collaborating with like-minded artisans across Australia. The company aims to foster a sustainable retail outlet that not only produces goods from recycled materials but also educates customers on the principles of reduce, reuse, and recycle.

Our Commitment to Sustainability

At Transmutation, our commitment to sustainability drives us to innovate and find new ways to reduce waste and promote a circular economy. By partnering with Dulux, we have developed a groundbreaking solution that transforms powder waste into a valuable resource. This powder coating plastic waste in combination with agricultural plastic wastes are converted into PostPrime Plastic® pellet feedstock, a material that displaces virgin plastic in manufacturing processes.

Our first product utilizing this innovative material is the Bar Chair, a durable and eco-friendly solution for concrete reinforcing applications. The Transmutation Bar chair is Good Environmental Choice Australia (GECA) certified[1], ensuring it meets the highest environmental, social, and governance (ESG) standards. The Bar Chair not only reduces energy usage and carbon emissions but also contributes to a circular economy by being fully manufactured from pellets that are produced from plastic wastes.

[1] The certification followed the Good Environmental Choice Australia (GECA) standard: Recycled Products RP v1.0ii-2015.

Product Covered by this EPD

Product description:

Developed through a Patent Pending method, this innovative product marks a significant advancement in polymer technology. Crafted entirely from recycled materials and proudly Australian-made, ensures transparency and accountability throughout its lifecycle.

PostPrime Plastic® is a high-quality plastic pellet that is made from agricultural and plastic wastes all sourced from Australia. The first product utilizing this innovative material is the Bar chair, and the Bar chairs products have undergone accreditation through the GECA which is an independent certification showing specifiers and purchasers that this material has reached the highest environmental standards. PostPrime Plastic® pellets eco-friendly solution for manufacturers seeking to incorporate recycled materials into their production processes.

Applications/Uses

PostPrime Plastic® pellets, made from recycled Polypropylene (PP), Polyethylene (PE), and Polyurethane are designed for a wide range of applications. Their durability, stability, and excellent flow characteristics make them ideal for various uses, particularly in environments exposed to sunlight and weather.

These pellets are well-suited for outdoor furniture, plastic lumber, and automotive parts, providing long-lasting strength and resistance to harsh conditions. They are also ideal for manufacturing packaging materials, consumer goods, and pipes, offering robust, corrosion-resistant solutions. Additionally, PostPrime Plastic® pellets are perfect for producing agricultural products, recycling bins, sporting goods, and various construction components, including the Transmutation Bar chair, where strength and longevity are essential.

Features and Benefits

- Recycled Origin: Made from waste products of the Dulux Powder Coating factory and agricultural plastic waste, highlighting a strong commitment to recycling and waste reduction.
- Eco-Friendly: Supports sustainable manufacturing practices by utilizing post-industrial and agricultural plastic waste.
- Environmental Impact: Reduces plastic waste by recycling materials that would otherwise contribute to landfill, supporting environmental sustainability.
- Versatility: Suitable for a wide range of applications, including outdoor furniture, automotive parts, packaging materials, and more, due to the two variants designed for different molding processes.
- Cost-Effective: Utilizing recycled materials can lower production costs compared to virgin plastics, providing economic benefits alongside environmental advantages.
- Quality and Performance: Maintains high standards of quality and performance, ensuring that products made from PostPrime Plastic® pellets are reliable and meet industry requirements.
- Support for Local Economy: The production process supports local businesses and economies in South Australia and Victoria from waste collection to processing and manufacturing.

Life Cycle Assessment Methodology

Database(s) and LCA software used:

The specific data used is based on direct utility bills or feedstock quantities from Transmutation's procurement records. The application of generic and specific data follows the EN 15804+A2 requirements and approach, which are entered into the SimaPro (v9.6) LCA software program and linked to the pre-existing data for the upstream feedstocks and services selected in order of preference from:

- For Australia, the Australian Life Cycle Inventory (AusLCI) v1.42 compiled by the Australian Life Cycle Assessment Society ((ALCAS), 2023). The AusLCI database at the time of this report was less than a year old, while the Australasian Unit Process **LCI** was 9 years old.
- Other authoritative sources (e.g., ecoinvent v3.10, (Wernet, et al., 2024)), where necessary adapted for relevance to Australian conditions (energy sources, transport distances and modes and so on, and documented to show how the data is adapted for national relevance). At the time of reporting, the ecoinvent v3.10 database was less than 1 year old.
- Other sources with sensitivity analysis reported to show the significance of this data for the results and conclusions drawn.

Allocation

In a process where more than one type of product is generated, it is necessary to allocate the environmental stressors (inputs and outputs) from the process to the different products (functional outputs) in order to get product-based inventory data instead of process-based data. An allocation problem also occurs for multi-input processes. In an allocation procedure, the sum of the allocated inputs and outputs to the products shall be equal to the unallocated inputs and outputs of the unit process.

The following stepwise allocation principles shall be applied for multi-input/output allocations:

- The initial allocation step includes dividing up the system sub-processes and collecting the input and output data related to these sub-processes.
- The first (preferably) allocation procedure step for each sub-process is to partition the inputs and outputs of the system into their different products in a way that reflects the underlying physical relationships between them.
- The second (worst case) allocation procedure step is needed when physical relationship alone cannot be established or used as the basis for allocation. In this case, the remaining environmental inputs and outputs from a sub-process must be allocated between the products in a way that reflects other relationships between them, such as the economic value of the products.

Cut-off rules and Exclusion of Small Amounts

It is common practice in LCA/LCI protocols to propose exclusion limits for inputs and outputs that fall below a threshold % of the total, but with the exception that where the input/output has a "significant" impact it should be included. According to the PCR 2019:14, Life cycle inventory data shall according to EN 15804 + A2 include a minimum of 95% of total inflows (mass and energy) per module. Data gaps in included stages in the downstream modules shall be reported in the EPD, including an evaluation of their significance. In accordance with the PCR 2019:14 Construction Products (v1.3.4), the following system boundaries are applied to manufacturing equipment and employees:

- The raw materials consumed in the case of Transmutation products are sourced agricultural plastic waste and powder coating wastes from Dulux Powder Coating factory and polluter's pay principle was applied in the LCA. In other words, the raw materials, transport and the sorting and crushing of agricultural plastic waste and the powder coating wastes from Dulux Powder Coating factory were excluded from the LCA.

- Environmental impact from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not accounted for. Capital equipment and buildings typically account for less than a few percent of nearly all life cycle inventories and this is usually smaller than the error in the inventory data itself. For this project, it is assumed that capital equipment makes a negligible contribution to the impacts as per Frischknecht et al. (Frischknecht, 2007) with no further investigation.
- Personnel-related impacts, such as transportation to and from work, are also not accounted for. The impacts of employees are also excluded from inventory impacts on the basis that if they were not employed for this production or service function, they would be employed for another. It is very hard to decide what proportion of the impacts from their whole lives should count towards their employment. For this project, the impacts of employees are excluded.
- The transport of the excavator, bobcat, grater, and roller are excluded.

Data Quality and Validation

The primary data used for the study (core module) is based on direct utility bills or feedstock quantities from the Transmutation's procurement records. Primary data was carefully reviewed in order to ensure completeness, accuracy and representativeness of the data supplied. Contribution analysis was used to focus on the key pieces of data contributing to the environmental impact categories. The data was benchmarked against relevant benchmark data in ecoinvent. Overall, the data was deemed to be of high quality for the core module. The data quality ranking is as follows: geographical representativeness – very good; technical representativeness – very good and time representativeness – very good.

Assumptions, Choices, and Limitations

Table 1: Key assumptions, choices and limitation for this EPD

Assumption or limitation	Impact on LCA results	Discussion
Raw material data for panel production.	Minor	The Transmutation team provided the composition of the products and other manufacturing inputs. No proxy data was used. Energy and utility used as well as waste generated during the production of products were allocated to the different products using mass allocation method.
Exclusion of employees, capital good and infrastructure	Minor	Personnel-related impacts, such as transportation to and from work, are also not accounted for in the LCI. The impacts of employees are also excluded from inventory impacts on the basis that if they were not employed for this production or service function, they would be employed for another. It is very hard to decide what proportion of the impacts from their whole lives should count towards their employment. For this project, the impacts of employees are excluded.
Products distribution	Minor	Information obtained from Transmutation Team. The Transmutation team gave the destinations and associated average distance for each type of product.

Compliance with Standards

The methodology and report format has been modified to comply with:

- ISO 14040:2006 and ISO14044:2006+A1:2018 which describe the principles, framework, requirements and provides guidelines for life cycle assessment (LCA).
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations -- Principles and procedures, which establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations.
- EN 15804:2012+A1:2013; Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
- EN 15804:2012+A2:2019; Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
- Product Category Rules (PCR) 2019:14, v1.3.4 – Construction products – Hereafter referred to as PCR 2019:14.
- General Programme Instructions (GPI) for the International EPD System v5.0 – containing instructions regarding methodology and the content that must be included in EPDs registered under the International EPD System.
- Instructions of EPD Australasia V4.2 – a regional annex to the general programme instructions of the International EPD System.

LCA Information

Declared unit: 1 kg of PostPrime Plastic® pellets, manufactured in Hamilton, Victoria, Australia

The UN CPC code for the PostPrime Plastic® pellets is 89420: Non-metal waste and scrap recovery (recycling) services 39290 Other non-metal waste or scrap, on a fee or contract basis, and its ANZSIC Business industry code is 29220 (Recycling of other non-metal waste and scrap).

Time representativeness: The LCA study was conducted on the September 2023 to September 2024 production data.

System Boundaries

The scope of the LCA was cradle to gate with modules A1-A3, and module A4, in alignment with EN 15804, Section 5.2, which allows the omission of modules C1-C4 and D for certain construction materials. This is justified because:

- Integrated Use: The pellets are fully integrated within the bar chair product during manufacturing and are inseparable from it, making them effectively a non-standalone product at the installation stage.
- Irreversibility at End of Life: The pellets undergo transformations within the bar chair, becoming indistinguishable from other materials at end of life.
- No Biogenic Carbon: The pellets do not contain biogenic carbon, which simplifies their LCA requirements.

The geographical scope of this EPD is Australia.

This EPD has been produced in conformance with the requirements of PCR2019:14, General Program Instructions (GPI) and EN 15804.

Table 2: Life Cycle of building products: stages and modules included in this EPD

Product stage				Construction process stage		Use stage							End of life stage					Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal		Reuse-Recovery- Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Modules declared	x	x	x	x	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND
Geography	AU	AU	AU	AU	-	-	-	-	-	-	-	-	-	-	-	-		-
Specific data used	30%			-	-	-	-	-	-	-	-	-	-	-	-	-		-
Variation of products	N/A			-	-	-	-	-	-	-	-	-	-	-	-	-		-
Variation – sites	Not applicable			-	-	-	-	-	-	-	-	-	-	-	-	-		-

ND = not declared (such a declaration shall not be regarded as an indicator of zero result).

All processes related to the use stage, and end of life of PostPrime Plastic® pellets and module D are outside the scope of this EPD as the PostPrime Plastic® pellets will be used as the main component in manufacturing for other products (i.e., Transmutation concrete bar chairs) and its cannot be physically separated from other products at end of life.

System Diagram:

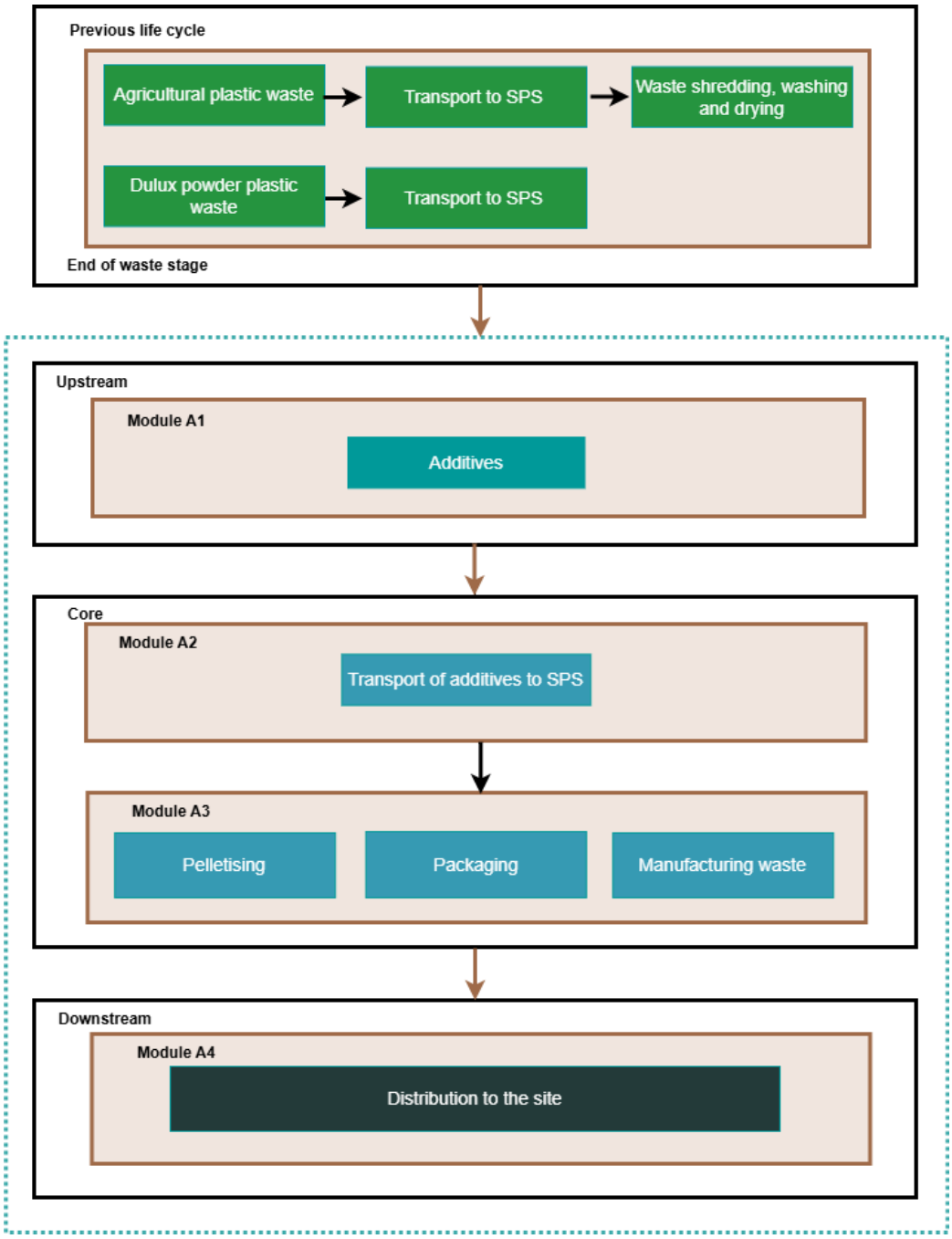

Figure 1 I System diagram of Transmutation Concrete Bar chair.

Upstream processes

The upstream processes include those involved in Module A1 – Raw material supply. In this case the obtention of the agricultural plastic waste and the powder coating wastes from Dulux Powder Coating factory, fall within the PPP, thus these data were not used in the LCA.

Core Processes

The core processes include those involved in Module A2 and Module A3, including:

- External transportation of materials to the core processes and internal transport. The transport of the agricultural plastic and the powder coating wastes from Dulux Powder Coating factory in Dandenong to SPS in Hamilton is not considered in the LCA as it falls within the PPP.
- Manufacturing of Transmutation Pellets.
- Packaging materials.

Downstream Processes

The downstream processes include those involved in Module A4 to C4, including:

- Transportation from the production gate to the Transmutation factory or to different manufacturing sites.

Criteria for Polluter's Pay Principle

According to PCR 1.3.4, products originating from waste materials need to meet four criteria in order to apply polluters-pay principle. Transmutations PostPrime Plastic® pellets are found to match again each criterion below:

Criterion 1: the recovered material or product (including, e.g., energy ware such as fuel, electricity and heat) is commonly used for specific purposes.

Due to their durability, stability, and excellent flow characteristics, PostPrime Plastic® pellets are ideal for a wide range of applications, particularly in environments exposed to sunlight and weather. These pellets are commonly used as raw materials in the construction industry, notably in the manufacturing of Transmutation Bar chairs, which provide sustainable and durable solutions for concrete reinforcement projects. Other applications include the production of outdoor furniture, plastic lumber, automotive parts, packaging materials, consumer goods, pipes, agricultural products, recycling bins, sporting goods, and various construction components.

Criterion 2: a market or demand, identified for example by a positive economic value, exists for such a recovered material or product.

From October 2023 to September 2024, Transmutation sold 9.3 tonnes of PostPrime Plastic® pellets.

Criterion 3: the recovered material or product fulfils the technical requirements for the specific purposes for which it is used and meets the existing legislation and standards applicable to its use.

Transmutation PostPrime Plastic® pellets meet the technical specifications set by ASTM standards.

Criterion 4: the use of the recovered material or product will not lead to overall adverse environmental or human health impacts, which shall be understood as content of hazardous substances below limit values in applicable legislation.

PostPrime Plastic® pellets mitigate environmental impacts, reducing plastic waste replacing their virgin counterparts and are not expected to lead to overall adverse environmental or human health impacts.

Manufacturing of Transmutations PostPrime Plastic® pellets

The process to the manufacture of PostPrime Plastic® begins with the sourcing agricultural plastic waste and powder plastic wastes. Transmutation brings both agricultural plastic waste and plastic powder wastes in Transmutation's Sustainable Plastic Solutions (SPS) in Hamilton, VIC 3300. In SPS, agricultural waste is shredded, washed and dried. After these processes, the end-of-waste state of both agricultural plastic waste and Dulux powder coating wastes are achieved as they become usable materials.

At SPS, both sources of plastics are combined with additives to produce our PostPrime Plastic® pellets using an extruder machine.

Content Information

Product Stage (Modules A1 – A3)

In general, modules A1 through A3 consider the sourcing of raw materials, any movement of materials onsite and the production stage, of a product. However, this differs when polluter's pay principle applies (PPP). In the case of PPP, impacts associated with the wastes reaching to end-of-waste state are part of PPP and excluded.

The raw materials consumed in the case of Transmutation PostPrime Plastic® pellets are sourced from agricultural plastic waste and the powder coating wastes from Dulux Powder Coating factory, and PPP was applied in the LCA. Accordingly, the environmental upstream impact for agricultural plastic waste and the powder coating wastes from Dulux Powder Coating factory, was set to zero according to PCR 1.3.4 for construction products. In addition, the transport of these raw materials as well as their sorting, crushing and screening of plastic wastes were excluded from the LCA as detailed in Table 3.

Table 3 – Production stage inclusions and exclusions in the LCA for PostPrime Plastic® pellets.

Items accounted in the LCA	Items excluded according to polluter's pay principle (PPP)
Additives (Polyolefin Copolymer)	Agricultural plastic waste (Polypropylene)
Transport of additives (truck and ship)	Plastic wastes from Dulux factory (Polyethylene + Polyurethane)
Electricity used for the manufacturing of new products	Transport of agricultural plastic waste to SPS site
Packaging (bulka bags and timber pallets)	Energy and water to shred, wash and dry of agricultural plastic waste
Manufacturing waste to recycle (carboard)	

At SPS, the materials are processed and compounded into pellets, following a specific composition:

- 72% agricultural plastic waste
- 20% powder coating wastes from Dulux Powder Coating
- 8% additives

The agricultural plastic waste and the plastic waste from Dulux Powder Coating factory, are received by Transmutation without any packaging.

Inventory for manufacturing energy, utility and waste is given below.

Transport of Raw materials (A2)

PostPrime Plastic® starts as the waste product from agricultural plastic waste from Victorian farmlands and Grainco facilities in Melbourne, VIC., and the powder coating wastes from Dulux Powder Coating factory in Dandenong South VIC. The waste is then transported to SPS in Hamilton VIC 3300. At this location agricultural plastic waste is processed and compounded into pellets. The transport of agricultural plastic waste, as well as powder coating waste, has not been accounted for in the LCA, as the polluter pays principle has been applied.

Transport for the additives has been accounted for in the LCA as they are of virgin origin.

Manufacturing process (A3)

The Dulux waste powder is fed into a hopper of a batching and mixing machine and combined with the agricultural plastic waste as per the Patent Pending method. The plastic waste is loaded into the main hopper of the Coperion Extruder machine. It is fed into the barrel and heated to its melting temperature (around 190 degrees).

As the melted agricultural plastic resin is moving through the barrel the powder is fed into the mix at a set ratio and the resulting extruded plastic is the PostPrime Plastic®. The extruded line of plastic is then passed through a water bath and cooled. The hardened plastic is then cut into 3mm pellet lengths and bagged.

Energy Mix

The electricity consumption model was sourced from AusLCI database for grid electricity of Victoria consisting of natural gas (43.8%), coal (40.5%), wind power (8%), heat pump (3.1%), hydro (2.8%), photovoltaic (0.7%), biogas (0.7%), bagasse (0.4%), and oil (0.1%) with a GWP-GHG impact of 0.92 kg CO_2 eq/kWh.

Packaging materials and waste

Certain wastes are generated during manufacture, these include packaging waste. Based on the type of waste, they are routed to municipal landfill, or municipal recycling. Timber pallets and bulka bags are assumed to be reused between SPS and Transmutation manufacturing site up to 10 times before being discarded. At this point, pallets are disposed of, while on assumption 80 % of bulka bags are sent back to the Hamilton plant where they get recycled.

All materials destined for the landfill do not have a specific use at end of life. All materials destined for recycling can be used for a specific purpose, there is a market for it, and all national and local laws and regulations are fulfilled.

Table 4: Content declaration for 1kg of PostPrime Plastic® pellets.

Product components	Weight, kg	Post-consumer recycled material (%)	Biogenic material, weight-% of product	Biogenic material, kg C/product or declared unit
Agricultural plastic waste (polypropylene)	0.72	100	0	0
Plastic powder wastes (polyethylene + polyurethane)[2]	0.20	0	0	0
Additives (Polyolefin Copolymer)	0.08	0	0	0

The A1-A3 results includes the “balancing-out reporting” of the biogenic CO_2 of packaging released in moulding phase of the pellets (module A5).

[2] The plastic powder waste is sourced from Dulux as a pre-consumer material.

Table 5: Content declaration of packaging for 1kg of PostPrime Plastic® pellets.

Packaging components	Weight, kg	Post-consumer recycled material (%)	Biogenic material, weight-% of product	Biogenic material, kg C/product or declared unit
Timber pallets	2.40E-03	0	0.24%	1.00E-03
Bulka bags	2.35E-04	100	0	0

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2

Additional information on release of dangerous substances to indoor air, soil and water

The products are highly inert and are used predominantly in outdoor applications. They do not release any dangerous substances to indoor air, soil, or water.

None of the products contain one or more substances that are listed in the "Candidate List of Substances of Very High Concern for authorisation". Based on available information and safety data sheet, PostPrime Plastic® products are not classified as Hazardous according to Safe Work Australia criteria.

Distribution Stage (Module A4)

PostPrime Plastic® pellets are distributed across within Australia is by road. The transport distances from manufacturing gate to customers' location were calculated based on primary data from percentage of total products shipped to customers.

Table 6 I Distribution distances

Product Name	Vehicle Type	Yearly mass (tonne)	Weighted Average Road Distance (km)
PostPrime Plastic® pellets	Truck	9.3	279

Environmental Impact Indicators

The potential environmental impacts, use of resources and waste categories included in this EPD were calculated using the SimaPro v9.6 tool and are listed in Table 7. The characterisation factors applied to the calculation of potential environmental impacts (Table 7) are based on version 3.1 of the reference package for CFs used in the Product Environmental Footprint (PEF) framework (EF 3.1).

All tables from this point will contain abbreviations only. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Table 7: Life Cycle Impact, Resource and Waste Assessment Categories, Measurements and Methods in accordance with EN15804+A2

Impact Category	Abbreviation	Measurement Unit	Assessment Method and Implementation
Potential Environmental Impacts			
Total global warming potential	GWP - Total	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Global warming potential (fossil)	GWP - Fossil	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Global warming potential (biogenic)	GWP - Biogenic	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Land use/ land transformation	GWP - Luluc	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021
Ozone depletion potential	ODP	kg CFC 11 equivalents	Steady-state ODPs, WMO 2014
Acidification potential	AP	mol H^+ eq.	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication – aquatic freshwater	EP - freshwater	kg P equivalent	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication – aquatic marine	EP - marine	kg N equivalent	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication – terrestrial	EP – terrestrial	mol N equivalent	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone creation potential	POCP	kg NMVOC equivalents	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe
Abiotic depletion potential (elements)*	ADPE	kg Sb equivalents	CML 2002 (v4.8)
Abiotic depletion potential (fossil fuels)*	ADPF	MJ net calorific value	CML 2002 (v4.8)
Water Depletion Potential*	WDP	m^3 equivalent deprived	Available Water Remaining (AWARE) Boulay et al., 2016 (includes Australia flows calculated using 36 Australian catchments)
**Disclaimer – The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.*			
Resource use			
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value	Manual for direct inputs[3]
Use of renewable primary energy resources used as raw materials	PERM	MJ, net calorific value	Manual for direct inputs[4]
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value	ecoinvent version 3.10 and expanded by PRé Consultants[5]

3 PERE = PERT - PERM
4 Calculated based on the lower heating value of renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to-calculate-EN-15804-A2-indicators-in-desktop-SimaPro
5 Calculated as sum of renewables, biomass; renewable, wind, solar and geothermal, and renewable, water.

Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value	Manual for direct inputs[6]
Use of non- renewable primary energy resources used as raw materials	PENRM	MJ, net calorific value	Manual for direct inputs[7]
Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value	ecoinvent version 3.10 and expanded by PRé Consultants[8]
Use of secondary material	SM	kg	Manual for direct inputs
Use of renewable secondary fuels	RSF	MJ, net calorific value	Manual for direct inputs
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value	Manual for direct inputs
Use of net fresh water	FW	m^3	ReCiPe 2016
Waste categories			
Hazardous waste disposed	HWD	kg	EDIP 2003 (v1.05)
Non-hazardous waste disposed	NHWD	kg	EDIP 2003 (v1.05) [9]
Radioactive waste disposed/stored	RWD	kg	EDIP 2003 (v1.05)
Output flow categories			
Components for re-use	CRU	kg	Manual for direct inputs
Material for recycling	MFR	kg	Manual for direct inputs
Materials for energy recovery	MERE	kg	Manual for direct inputs
Exported energy - electricity	EE - e	MJ per energy carrier	Manual for direct inputs
Exported energy – thermal	EE – t	MJ per energy carrier	Manual for direct inputs
Additional environmental impact indicators			
Global warming potential, excluding biogenic uptake, emissions and storage	GWP-GHG	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2021[10]
Global warming potential, aligned with the IPCC 2013 Fifth Assessment Report	GWP-GHG (AR5)	kg CO_2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 5th Assessment Report
Particulate matter	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising radiation - human health**	Potential Human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	Human Health Effect model

6 PENRE = PENRT - PENRM
7 Calculated based on the lower heating value (LHV) of non-renewable raw materials. LHV is taken from https://phyllis.nl/, as recommended by SimaPro in compliance with EN15804+A2: https://support.simapro.com/s/article/How-to-calculate-EN-15804-A2-indicators-in-desktop-SimaPro
8 Calculated as sum of non-renewables, fossil and non-renewable, nuclear.
9 Calculated as sum of Bulk waste and Slags/ash.
10 This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Eco-toxicity (freshwater)*	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	CTUe	USEtox
Human toxicity potential - cancer effects*	Potential Comparative Toxic Unit for humans (HTP-c)	CTUh	USEtox
Human toxicity potential - non cancer effects*	Potential Comparative Toxic Unit for humans (HTP-nc)	CTUh	USEtox
Soil quality*	Potential soil quality index (SQP)	dimensionless	Soil quality index (LANCA®)
Potential Environmental Impacts – Indicators According to EN 15804+A1			
Global warming (GWP100a)	GWP	kg CO_2 equivalents	CML (v4.02) based on IPCC AR4
Ozone layer depletion	ODP	kg CFC-11 equivalents	CML (v4.02) based on WMO 1999
Acidification	AP	kg SO_2 equivalents	CML (v4.02)
Eutrophication	EP	kg PO_4^{3-} equivalents	CML (v4.02)
Photochemical oxidation	POCP	kg C_2H_4 equivalents	CML (v4.02)
Abiotic depletion	ADPE	kg Sb equivalents	CML (v4.02)
Abiotic depletion (fossil fuels)	ADPF	MJ, net calorific value	CML (v4.02)
Environmental impact indicators in accordance with Green Star v1.3			
Human toxicity cancer	HTP-c	CTUh	USEtox – cancer effect
Human toxicity noncancer	HTP-nc	CTUh	USEtox – noncancer effect
Land use	LU	kg C deficit-eq.	Soil Organic Matter method
Resource depletion - water	RDW	m^3	Water Stress Indicator
Ionising radiation	IR	kBq U-235-eq.	Human Health Effect model
Particulate matter	PM	kg PM2.5-eq.	RiskPoll

**Disclaimer – The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.*

***Disclaimer – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*

Environmental Performance

The interpretation of results is presented in the following sections. Note that the use of results of modules A1-A3 or A1-A5, without considering the results of module C may mislead the communication and decision-making. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Table 8 | Environmental impacts per kg of Pellets (results are in accordance with EN15804+A2:2019)

Indicator	Unit	A1-A3	A4
GWP-total	kg CO_2 eq.	3.47E-01	1.72E-01
GWP-fossil	kg CO_2 eq.	3.46E-01	1.72E-01
GWP-biogenic	kg CO_2 eq.	7.00E-04	7.74E-06
GWP-luluc	kg CO_2 eq.	4.89E-05	5.04E-06
ODP	kg CFC 11 eq.	1.72E-09	2.31E-09
AP	mol H^+ eq.	1.49E-03	4.68E-04
EP - F	kg P eq.	5.15E-06	3.51E-06
EP - M	kg N eq.	2.76E-04	1.71E-04
EP - T	mol N eq.	2.86E-03	1.87E-03
POCP	kg NMVOC eq.	1.08E-03	6.98E-04
ADP	kg Sb eq.	1.08E-06	1.02E-08
ADPF	MJ	4.42E+01	2.30E+00
WDP	m^3 eq. deprived	4.82E+00	2.14E-03
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption;		

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Table 8 | Resource use per kg of Pellets (results are in accordance with EN15804+A2:2019)

Indicator	Unit	A1-A3	A4
PERE	MJ	1.66E-01	3.75E-03
PERM	MJ	0.00E+00	0.00E+00
PERT	MJ	1.66E-01	3.75E-03
PENRE	MJ	2.19E+00	2.30E+00
PENRM	MJ	4.20E+01	0.00E+00
PENRT	MJ	4.42E+01	2.30E+00
SM	kg	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00
FW	m^3	1.19E-02	7.74E-05
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water		

Table 9 | Waste generated per kg of Pellets (results are in accordance with EN15804+A2:2019)

Indicator	Unit	A1-A3	A4
Hazardous waste disposed	kg	6.98E-06	1.58E-05
Non-hazardous waste disposed	kg	1.23E-03	9.86E-05
Radioactive waste disposed/stored	kg	5.55E-08	8.28E-08

Table 10 | Output flows per kg of Pellets (results are in accordance with EN15804+A2:2019)

Indicator	Unit	A1-A3	A4
Components for reuse	kg	2.35E-04	0.00E+00
Materials for recycling	kg	2.22E-03	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00
Exported energy - electricity	MJ	0.00E+00	0.00E+00
Exported energy - thermal	MJ	0.00E+00	0.00E+00

Table 11 | Additional environmental impacts per kg of Pellets (results are in accordance with EN15804+A2:2019

Indicator	Unit	A1-A3	A4
GWP-GHG	kg CO_2 eq	3.47E-01	1.72E-01
GWP-GHG (IPCC AR5)	kg CO_2 eq	3.48E-01	1.73E-01
Particulate matter	disease incidence	1.63E-08	1.15E-08
Ionising radiation - human health**	kBq U-235 eq	9.18E-03	3.50E-04
Ecotoxicity – freshwater*	CTUe	2.10E+00	1.52E-01
Human toxicity potential - cancer effects*	CTUh	9.97E-11	1.45E-11
Human toxicity potential - non cancer effects*	CTUh	1.32E-09	1.14E-09
Soil quality*	Pt	7.48E-01	9.41E-03
Acronyms	GWP-GHG = Global warming potential, excluding biogenic uptake, emissions and storage		

**Disclaimer – The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.*

***Disclaimer – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*

Table 12 | Environmental impacts per kg of Pellets (results are in accordance with EN15804+A1:2013)

Indicator	Unit	A1-A3	A4
Global warming potential (GWP100)	kg CO_2 eq	3.47E-01	1.72E-01
Ozone layer depletion	kg CFC-11 eq	1.75E-09	1.83E-09
Acidification potential	kg SO_2 eq	7.33E-04	3.50E-04
Eutrophication potential	kg PO_4^{3-} eq	1.04E-04	7.05E-05
Photochemical oxidation	kg C_2H_4 eq	5.35E-05	2.07E-05
Abiotic depletion potential for non-fossil resources	kg Sb eq	1.08E-06	1.02E-08
Abiotic depletion potential for fossil resources	MJ	1.47E+00	8.67E-02

Table 13 | Environmental impacts per kg of Pellets (results are in accordance with Green Star v1.3)

Indicator	Unit	A1-A3	A4
Human Toxicity cancer	CTUh	1.74E-11	6.60E-12
Human Toxicity non-cancer	CTUh	2.08E-12	1.49E-13
Land use	kg C deficit eq.	4.44E-02	4.66E-03
Ionising radiation	kBq U235 eq	9.18E-03	3.51E-04
Particulate Matter	kg PM2,5-Equiv.	1.61E-04	1.06E-04
Resource depletion - water	m^3	1.57E-01	1.12E-04

Interpretation of Results

The following insights were observed from the LCA results for PostPrime Plastic® pellets:

- The GWP-Total emission from the product stage (A1-A3) is 67% of total lifecycle emissions (modules A1-A4).
- Following the Polluter Pays Principle (PPP), no impact was accounted for the raw materials (agricultural plastic waste and the plastic wastes from Dulux Powder Coating factory), and their transport to SPS in Hamilton. Nevertheless, the largest impact in the product stage (A1-A3) is from the Additives (Polyolefin Copolymer), the accounting 47% of product stage emissions.
- The downstream (module A4) accounts 33% of total lifecycle emissions.
- Across all modules, 98% of the waste disposed is non-hazardous (NHWD).

References

ALCAS, A. L. (2023). Australian Life Cycle Inventory (AusLCI) – v1.42; www.auslci.com.au

BlueScope. (2010). Sustainability – Recycling. Technical Bulletin.

EN 15804:2012+A1:2013. (2013). Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Brussels: European Committee for.

EN 15804:2012+A2:2019. (2019). Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Brussels: European Committee for.

EPD International (2024). General Programme Instructions for the International EPD System, version 5.0, dated 2021-03-29. www.environdec.com.

EPD International. (2024). PCR 2019:14, version 1.3.4 Construction Products. www.environdec.com.

ISO. (2006). ISO 14025:2006 - Environmental labels and declarations - Type III environmental declarations - Principles and procedures. Geneva: International Organization for Standardization (ISO).

ISO. (2006). ISO 14040:2006. Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO. (2006). ISO 14044:2006. Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

The ecoinvent database version 3.10; https://ecoinvent.org/ecoinvent-v3-10/

One Click. (2023). Biogenic Carbon. https://oneclicklca.zendesk.com/hc/en-us/articles/360015036640-Biogenic-Carbon.