Environmental Product Declaration

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

WIGHT ALUMINIUM

# Commercial Aluminium Extrusion EPD

**EPD of multiple products, based on the average results of the product group. A full list of products covered by this EPD is presented within this document on page 4.**

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**www.wightaluminium.co.nz**

Environmental Product Declaration

## Commercial Aluminium Extrusion

# Programme-Related Information and Verification

| | | |
|---|---|---|
| **Declaration owner** | **Wight Aluminium Ltd**<br>24 Mill Road, Whanganui 4501,<br>New Zealand | www.wightaluminium.co.nz<br>info@wightaluminium.co.nz |
| **Geographical Scope** | New Zealand | |
| **Reference Year for Data** | 2023-01-01 to 2023-12-31 | |
| **EPD programme operator:** | **The International EPD® System**<br>EPD International AB,<br>Box 210 60, SE-100 31<br>Stockholm, Sweden | www.environdec.com<br>info@environdec.com |
| **Regional programme:** | **EPD Australasia Limited**<br>EPD Australasia Limited,<br>315a Hardy Street,<br>Nelson 7010, New Zealand | www.epd-australasia.com<br>info@epd-australasia.com |
| **Product Category Rules (PCR)** | | |
| CEN standard EN 15804 served as the core Product Category Rules (PCR) | | |
| **PCR:** | PCR 2019.14 Construction Products, version 1.3.4<br>(published on 2024-04-30, valid until 2025-06-20) | |
| **PCR review was conducted by:** | The Technical Committee of the International EPD® System.<br>See www.environdec.com for a list of members. | |
| **Review Chair:** | The most recent review chair: Claudia Peña, PINDA LCT SpA.<br>The review panel may be contacted via the Secretariat:<br>www.environdec.com/contact | |
| **Life cycle assessment (LCA)** | | |
| **LCA accountability:** | **thinkstep Ltd**<br>Barbara Nebel<br>Chanjief Chandrakumar<br>Haoran Lei<br>11 Rawhiti Road, Pukerua Bay,<br>Wellington 5026, New Zealand | www.thinkstep-anz.com<br>anz@thinkstep-anz.com |
| **Third-party verification** | Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:<br>☑ EPD verification by individual verifier | |
| **Third party verifier:** | Claudia A. Peña (Director of PINDA LCT SpA)<br>pinda.lct@gmail.com | |
| **Verifier approved by:** | EPD Australasia Limited | |
| **Procedure for follow-up of data during EPD validity involved third-party verifier** | ☐ Yes<br>☑ 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).

The EPD owner has the sole ownership, liability, and responsibility for the EPD. 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.

The results for EN15804+A1 compliant EPDs are not comparable with EN15804+A2 compliant studies as the methodologies are different. Results that are EN15804+A1 compliant are given in this document to assist comparability across EPDs.

WIGHT ALUMINIUM

## Wight Aluminium is a leading commercial façade provider in Aotearoa New Zealand. For over 50 years we've been delivering façade solutions that enhance New Zealand's built environment.

**This EPD is our commitment to being part of the solution for a lower embodied carbon built environment.**

We know that what we build now will influence New Zealand's carbon footprint for generations to come. In producing this EPD, we're providing high quality, comprehensive information to our project and industry partners, a strong foundation for informed decision making.

We provide full façade solutions – design, technical detailing, product manufacture and installation of curtain walls, window solutions and cladding - for commercial projects across New Zealand. Our two manufacturing facilities are located in Whanganui and Hamilton, with additional design and project management offices in Auckland and Wellington.

This EPD focuses on the aluminium extrusion used in our commercial suite products.

# Commercial Aluminium Extrusion

## Product Description

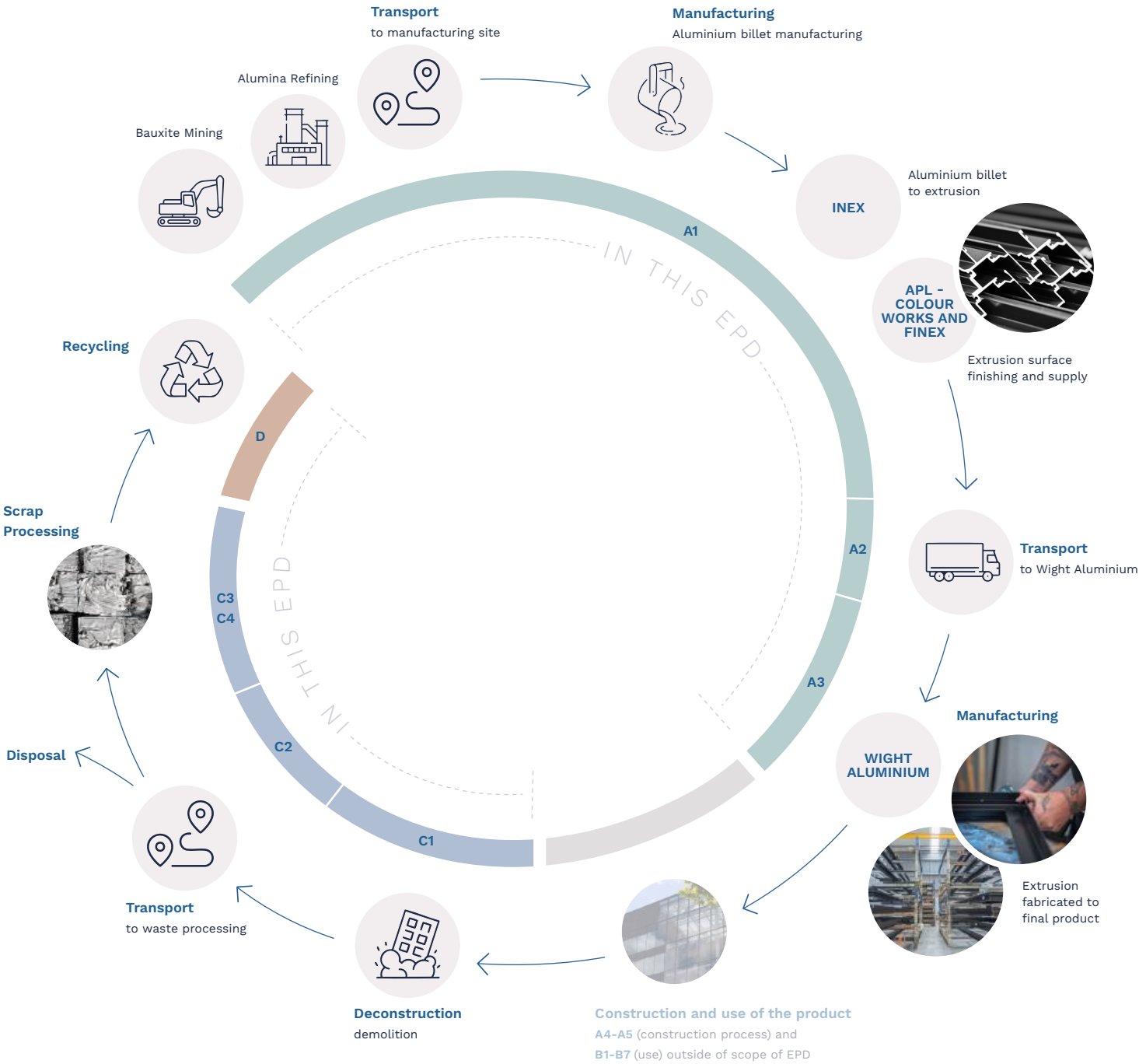
Wight Aluminium fabricates aluminium extrusion profiles into a range of products used in façade systems and building envelope solutions. This EPD focuses only on the aluminium extrusions that are used in façade systems designed for commercial project application.

This is an EPD of multiple products, covering four products:

- Powder coated extruded aluminium profile fabricated at Wight Aluminium's Whanganui Factory
- Anodised extruded aluminium profile fabricated at Wight Aluminium's Whanganui Factory
- Powder coated extruded aluminium profile fabricated at Wight Aluminium's Hamilton Factory
- Anodised extruded aluminium profile fabricated at Wight Aluminium's Hamilton Factory

The EPD presents weighted average results based on sales volume for the 2023 calendar year (CY2023, 1 Jan to 31 Dec 2023).

## Product Life Cycle




### INEX, APL, COLOUR WORKS AND FINEX

Wight Aluminium sources aluminium extrusions from INEX Ltd, a leading aluminium extrusion manufacturer in New Zealand. INEX sources predominantly local aluminium billet with some international supply, and uses hydraulic extruders to produce it's extrusion.

The aluminium extrusions are surface finished – either powder coated or anodised – at APL's dedicated surface finishing facilities, Colour Works Ltd and FINEX Ltd, before distributed to Wight Aluminium's manufacturing sites. Both Colour Works Ltd and FINEX are located on the same site as INEX.

### WIGHT ALUMINIUM

In Wight Aluminium manufacturing, extrusions are cut to size and fabricated into curtain wall panels and/or commercial suite windows and doors, which can include fitting glass units and other window panels/door components (such as screws, rivets, gaskets/seals, and sealants), ready for installation to form a full window/door assembly, which is subsequently installed into commercial buildings.

This study focuses only on the extruded aluminium profiles used to fabricate windows and curtain wall panels for commercial applications.

## Declared Unit

The declared unit for the EPD is 1 kg of extruded aluminium profile, plus its packaging. The weight of the packaging is not included in the declared 1 kg of extruded aluminium profile.

**Table 1: Industry Classification**

| Product | Classification | Code | Category |
|---|---|---|---|
| Extruded aluminium profiles | UN CPC Ver.2 | 42120 | Doors, windows and their frames and thresholds for doors, of iron, steel or aluminium |
| | ANZSIC 2006 | 2223 | Architectural Aluminium Product Manufacturing |

**Table 2: Technical Specifications Applying to the Products in this EPD**

| Product group | Relevant standards |
|---|---|
| Extruded aluminium profiles | NZS 4211: Specification for performance of windows (incl. serviceability, deflection, operation of opening sashes, air infiltration, water penetration, ultimate strength, torsional strength of sashes) |
| | NZS 4284: Testing of Building Facades (incl. serviceability deflection, air infiltration, water penetration, ultimate strength, seismic, seal degradation) |
| | AS 3715:2002 Metal finishing—Thermoset powder coatings for architectural applications of aluminium and aluminium alloys |
| | SFA 3503-03:2005 Specification for Anodic Oxide Coatings on Wrought Aluminium for External Architectural Applications |

## Content Declaration

The content declaration for this EPD of multiple products is based on the average results of the product group.

**Table 3: Content Declaration of 1 kg of Wight Aluminium Extrusion (weighted average across powder coated and anodised)**

| Product components | Weight, kg | Post-consumer recycled material, weight-% of product | Biogenic material, weight-% of product | Biogenic material, kg C/kg of product |
|---|---|---|---|---|
| Aluminium extrusions | 0.940 (0.934-0.968) | 0* | 0 | 0 |
| Coating | 0.0602 (0.032-0.066) | 0 | 0 | 0 |
| **Total** | **1** | **0** | **0** | **0** |

* While aluminium billet produced at NZAS requires no scrap input, aluminium production in Middle East might use post-consumer scrap input. However, this information was not readily available – hence assumed zero.

**Table 4: Content Declaration of 1 kg of Wight Aluminium Extrusion (powder coated)**

| Product components | Weight, kg | Post-consumer recycled material, weight-% | Biogenic material, weight-% and kg C/kg |
|---|---|---|---|
| Aluminium extrusions | 0.934 | 0* | 0 resp. 0 |
| Coating | 0.066 | 0 | 0 resp. 0 |
| *Powder coat paint* | 0.052 | 0 | 0 resp. 0 |
| *Gardacid* | 0.00434 | 0 | 0 resp. 0 |
| *Gardobond* | 0.00334 | 0 | 0 resp. 0 |
| *Metal etch* | 0.00214 | 0 | 0 resp. 0 |
| *Oxsilan* | 1.65E-04 | 0 | 0 resp. 0 |
| *Oxsilan additive* | 8.12E-05 | 0 | 0 resp. 0 |
| *Oxsilan AL* | 1.30E-04 | 0 | 0 resp. 0 |
| *Phosystem* | 6.82E-06 | 0 | 0 resp. 0 |
| *Caustic soda (50%)* | 0.00299 | 0 | 0 resp. 0 |
| *Dispozaid flocculant* | 1.34E-07 | 0 | 0 resp. 0 |
| *Hydrochloric acid (33%)* | 0.001 | 0 | 0 resp. 0 |
| *Gardacid* | 0.00434 | 0 | 0 resp. 0 |
| **Total** | **1** | **0** | **0 resp. 0** |

* While aluminium billet produced at NZAS requires no scrap input, aluminium production in Middle East might use post-consumer scrap input. However, this information was not readily available – hence assumed zero.

**Table 5: Content Declaration of 1 kg of Wight Aluminium Extrusion (anodised)**

| Product components | Weight, kg | Post-consumer recycled material, weight-% | Biogenic material, weight-% and kg C/kg declared unit |
|---|---|---|---|
| Aluminium extrusion | 0.968 | 0* | 0 resp. 0 |
| Coating | 0.032 | 0 | 0 resp. 0 |
| *Stannous sulphate powder* | 0.00505 | 0 | 0 resp. 0 |
| *Gardocolor* | 0.00289 | 0 | 0 resp. 0 |
| *Gardoseal* | 0.0190 | 0 | 0 resp. 0 |
| *Superseal* | 0.00551 | 0 | 0 resp. 0 |
| **Total** | **1** | **0** | **0 resp. 0** |

* While aluminium billet produced at NZAS requires no scrap input, aluminium production in Middle East might use post-consumer scrap input. However, this information was not readily available – hence assumed zero.

**Table 6: Composition of Packaging per 1 kg of Wight Aluminium Extrusion (powder coated/anodised)**

| Packaging materials | Weight, kg | Weight-% (versus the product) | Weight biogenic carbon, kg C/declared unit |
|---|---|---|---|
| Timber pallet | 0.0172 | 1.72 | 0.00791 |
| Cardboard | 0.00405 | 0.405 | 0.00186 |
| Polyethylene (PE) film and bag | 0.00321 | 0.321 | 0 |
| Polystyrene (PS) foam | 9.50E-05 | 0.00950 | 0 |
| Polyethylene terephthalate (PET) strapping | 4.97E-04 | 0.0497 | 0 |
| **Total** | **0.0250** | **2.50** | **0.00977** |

**Dangerous substances from the candidate list of SVHC for Authorisation**

The products declared within this EPD

- Do not release dangerous substances to soil and water
- Do not contain hazardous substances requiring labelling
- Do not contain materials identified in the European Chemicals Agency's Candidate List of Substances of Very High Concern in the products at a concentration greater than 0.1% (ECHA, 2022)

## System Boundaries

As shown in the table below, this EPD is of the type 'cradle to gate with Modules C1-C4 and Module D (A1-A3 + C + D)' (type a). Other life cycle stages (Modules A4-A5, B1-B7) are dependent on particular scenarios and best modelled at the building level.

**Table 7: Modules Included in the Scope of the EPD**

| | Product stage | | | Construction process stage | | Use stage | | | | | | | End-of-life stage | | | | Recovery stage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Raw material supply | Transport | Manufacturing | Transport | Construction Installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction / demolition | Transport | Waste processing | Disposal | Future reuse, recycling or energy recovery potential |
| Module | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| Modules declared | X | X | X | ND | ND | ND | ND | ND | ND | ND | ND | ND | X | X | X | X | X |
| Geography | GLO | GLO | NZ | - | - | - | - | - | - | - | - | - | NZ | NZ | NZ | NZ | NZ |
| Share of specific data | 69%* | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation: products | 10.7% | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation: sites | <10% | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

X = included in the EPD; ND = Module not declared (such a declaration shall not be regarded as an indicator result of zero)

* This includes upstream INEX extrusion operations, aluminium extrusion transport between INEX and Wight Aluminium, fabrication processes and product packaging. Share of specific data is calculated based on the GWP-GHG results.

The processes below are included in the product system to be studied. For modules beyond A3, the scenarios included are currently in use and are representative for one of the most probable alternatives.

## Product Stage (Modules A1-A3)

The production stage covers the extraction and processing of raw materials, transport to manufacturing sites and manufacturing processes of extruded aluminium profiles. Packaging of extruded aluminium profiles is also included.

- Aluminium billet production. INEX sources aluminium billet from both local and overseas suppliers.
- Aluminium billets are transported to the INEX manufacturing facility in Hamilton (New Zealand).
- Extrusion press operation. Aluminium billets are cut into smaller lengths and heated via electric induction oven. Billets are then loaded into a chamber and pushed at force through extrusion press (hydraulic extruders) to form aluminium extrusion profiles.
- Surface finishing. INEX aluminium extrusion profiles undergo a surface finishing process, which can be either powder coating or anodising. Powder coating and anodising are undertaken at Colour Works Ltd and FINEX Ltd, respectively. Both facilities are part of Profile Group and located on the same site as INEX.
- 100% of INEX and APL's electricity consumption is covered via New Zealand Energy Certificate System.
- Packaging of INEX and APL aluminium extrusion profiles.
- Transport of INEX aluminium extrusions to Wight Aluminium manufacturing sites in Whanganui and Hamilton.

**Wight Aluminium's manufacturing process**

- Cutting of INEX aluminium extrusion profiles to desired length and 'fabricating curtain wall panels, window and door frames according to the requirements of clients.
- 100% of Wight Aluminium's electricity consumption is covered via New Zealand Energy Certificate System.
- Packaging of Wight Aluminium extruded aluminium profiles. Note that Wight Aluminium reuses the packaging materials that come with INEX aluminium extrusions and only sources virgin packaging materials if required.

Modules A1-A3 include the generation and transmission of electricity generation of thermal energy from natural gas and liquid petroleum gas, supply of water, and solid waste and wastewater management.

Profile Group is the parent company to INEX, Colour Works and FINEX. 100% of Profile Group's and Wight Aluminium's electricity consumption is covered via New Zealand Energy Certificate System (NZECS). These NZECS certificates were generated by Kawatiri Energy - one of New Zealand's newest hydroelectricity projects which generates hydropower from the Lake Rochfort Scheme near Westport (APL Window Solutions, 2024).

## End-of-life Stage (Modules C1-C4)

When a building reaches its end-of-life it will be demolished and the demolition waste transported to a processing facility. The waste processing includes the separation of aluminium waste from other building materials and shredding activities. Material that cannot be recycled will be disposed. The end-of-life stage (Modules C1-C4) is modelled using a scenario reflecting end-of-life recycling/ landfilling rates for metal products in the construction sector, according to BRANZ (2024).

**The end-of-life stage (Modules C1-C4) covers the following:**

Module C1 (deconstruction/demolition) includes demolition of the whole building including aluminium extrusion profiles (in windows/doors) using mass allocation, based on a 100-kW construction excavator.

Module C2 (transport to end-of-life) includes transport of waste aluminium extrusions to waste management facilities, following building demolition.

Module C3 (waste processing) includes the processing of waste aluminium extrusions for reuse or recycling.

Module C4 (disposal) includes aluminium extrusions end-of-life which is a combination of landfill and recycling.

**Table 8: End-of-life Scenarios for Products Considered in this EPD**

| Process | Unit (expressed per declared unit of extruded aluminium profile) |
|---|---|
| Excavator | 1 kg collected separately |
| Recovery system specified by type | 0% for re-use |
| | 85% of metals for recycling (BRANZ, 2024) |
| | 0% for energy recovery |
| Disposal specified by type | 15% of metals modelled as ferrous metals in landfill (BRANZ, 2024) |
| Assumptions for scenario development | C1 - demolishing with an Excavator (100kW); fuel consumption is calculated at 0.172 kg diesel input per tonne of material<br>C2 - 50 km of transport by truck with a utilisation rate of 50%<br>C3 – waste processing for recycling<br>C4 – 15% of aluminium is landfilled |

The European Union Guidance on PEF identifies an R2 value of 95% for aluminium products in EU (European Commission, 2020). In this study, we have used 85% which correctly reflects the New Zealand context (BRANZ, 2024). A recycling yield (Y) of 95% is used.

## Recovery and Recycling Potential (Module D)

Benefits and loads beyond system boundary (Module D) include recovered aluminium scraps that are fed into a second life cycle. This Module is modelled considering the avoided virgin aluminium production in New Zealand.

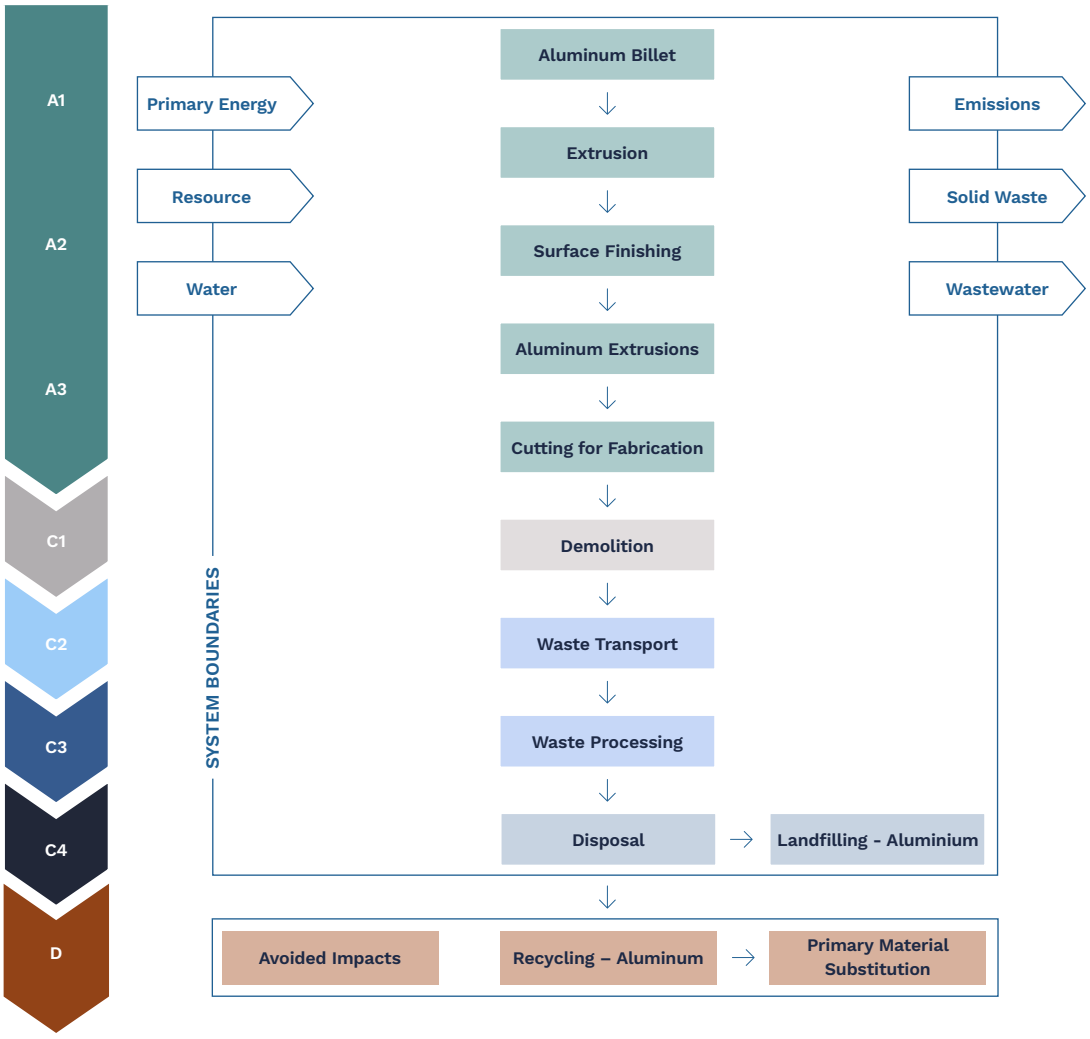



**Figure 2: High-level Processes for Wight Aluminium Products (A1-A3, C1-C4 and D)**

# Life Cycle Inventory (LCI) Data and Assumptions

Primary data was used for all manufacturing operations up to the factory gate, including upstream data for aluminium extrusion, surface finishing, transport of surface finished extrusions to manufacturing sites and fabrication processes, for CY2023.

**Background data was used for input materials sourced from other suppliers such as packaging materials.**

Overseeing and managing the data collection for Wight Aluminium was Kate Bellis – Brand and Communication Manager.

## Upstream Data

**Aluminium extrusions**

INEX produces aluminium extrusion profiles using aluminium billets sourced from New Zealand and overseas suppliers.

**Surface finishing**

INEX aluminium extrusion profiles undergo a surface finishing process, which can be either powder coating or anodising. Powder coating and anodising are undertaken at Colour Works Ltd and FINEX Ltd, respectively.

## LCA Software and Database

The underlying LCA model was developed according to the ISO standards for LCA (ISO, 2006a, 2006b), using the Life Cycle for Experts (LCA FE) (formerly known as GaBi Software) for life cycle engineering (version 10.9.0.31), developed by Sphera Solutions, Inc.

Data for all energy inputs, transport processes and raw materials are from the Managed LCA Content (MLC) Database 2024.2 (Sphera, 2024). The reference year for the data ranges from 2015 to 2023 and therefore, all datasets are within the 10-year limit allowable for generic data under EN 15804 and the PCR.

## Electricity

100% of Profile Group's and Wight Aluminium's electricity consumption is covered via New Zealand Energy Certificate System (NZECS). These NZECS certificates were generated by Kawatiri Energy - one of New Zealand's newest hydroelectricity projects which generates hydropower from the Lake Rochfort Scheme near Westport (APL Window Solutions, 2024). Wight Aluminium has committed to source NZECS Certificates for the next six months and beyond.

The emission factor for the New Zealand hydroelectricity (including transmission and distribution losses) for the GWP-GHG indicator is 0.00769 kg $CO_2$-eq./kWh (based on EF3.1).

Location-based grid mix emission factors (using the published grid mix) are used for other electricity consumption including Modules C1-C4 and D.

## Recycling and Recycled Inputs

Benefits from recycling the recovered aluminium in Module C4 are considered in Module D; for aluminium, a recycling rate of 85% is considered and 15% is landfilled (BRANZ, 2024).

Aluminium credits are modelled as avoided burdens of virgin aluminium produced in New Zealand, considering recycling efficiency. This leads to recycling credits being lower than the impact of virgin production.

## Transport

Primary transport data was used for transport of production inputs (A2). Any wastes from the production process (A3) are assumed to be transported over a 50 km distance to a treatment or disposal site. Transport modes:

Truck (diesel), Euro 0 - 6 mix, 34 - 40 t gross weight / 27 t payload capacity.

Container ship (heavy fuel oil), 5 000 to 200 000 dwt payload capacity, ocean going.

## Explanation of Average Products & Variation

This is an EPD of multiple products (four products in total): powder coated and anodised extruded aluminium profiles manufactured at two sites. The results were calculated for individual products and weighted based on the sales volume for CY2023. The variation for the GWP-GHG indicator results is 10.7% across Modules A1-A3.

## Cut-off Criteria

thinkstep-anz consistently excludes environmental impacts from infrastructure, construction, production equipment, and tools that are not directly consumed in the foreground production process, ('capital goods') regardless of potential significance.

Infrastructure/capital goods are excluded from all MLC datasets. An important exception is the inclusion of capital goods for electricity generation, where the capital goods are very important for modelling of changes towards more renewable generation. Capital goods related to electricity generation are included in all MLC electricity datasets.

Note: The system boundaries on manufacturing of equipment and for employees are not regarded as limiting the scope of the inventory or as an incomplete inventory (i.e. a cut-off).

Cut-off criteria were applied to the following:

- Cut-off was applied to the volatile organic compounds (VOCs) released to air during the powder coating process, due to data unavailability.
- Cut-off was applied to the packaging materials given most of them are reused or sent for recycling.

The effects of the exclusions are minimal (meeting the <1% flow exclusion criteria), given the impacts of Wight Aluminium products are largely driven by upstream aluminium billet production.

## Allocation

**Allocation of co-products**

Following the requirements of PCR 2019:14 v1.3.4 section 4.5.1 (EPD International, 2024), co-product allocation was applied for manufacturing processes that involve aluminium and scraps, which have economic values. In this study, aluminium extrusion and aluminium scrap are treated as product and co-product, respectively.

- Aluminium scrap is generated during aluminium profile extrusion (at INEX) and fabrication (Module A3). The aluminium scrap is subsequently sold to a recycler, which has an economic value compared to the main product.
- Economic data supplied by INEX for the 2023/24 financial year was used.
- Site overheads (e.g. water, wastewater, fuels, electricity, and waste) are allocated based on the economic values of the product and scrap.
- Packaging materials are allocated by mass across the total output of packaged extruded aluminium profiles.

**Allocation of waste**

The allocation of waste follows the "polluter-pays" principle, as outlined in PCR 2019:14 v1.3.4 section 4.5.2 (EPD International, 2024).

Packaging waste materials that are sent for landfill reaches their end-of-waste state once they reach the landfill. The transport to the landfill is accounted for.

## End-of-life Allocation

End-of-life allocation generally follows the requirements of ISO 14044, section 4.3.4.3.

Material recycling (avoided burden approach): Open scrap inputs from the production stage are subtracted from scrap to be recycled at end-of-life to give the net scrap output from the product life cycle. This remaining net scrap is sent to material recycling. Credits are assigned at Module D based on the potential benefit of recovering the secondary material in substitution for primary material production. If net scrap is negative (e.g. the production stage scrap inputs are higher than the scrap available for recycling at end-of-life), Module D will assign a burden. The Module D impacts are modelled using industry average inventories.

Landfilling (avoided burden approach): In cases where materials are sent to landfills, they are linked to an inventory that accounts for waste composition, regional leachate rates, landfill gas capture as well as utilisation rates (flaring vs. power production).

## Assumptions

**Few assumptions were made during the LCI collection and modelling process are as follows:**

- Cut-off criteria, as per the PCR 2019:14 version 1.3.4 (EPD International, 2024), are reasonable in the context of the overall impacts of Wight Aluminium extruded aluminium profiles.
- Where specific life cycle inventory data were unavailable, proxy data were used, giving preference to regional data.
- Use of any required secondary data from outside New Zealand is sufficiently representative of the impacts of the material. Where the geography is expected to have an impact on the results, this is indicated as a geographical proxy.
- Average utility impact is based on the utility data and total production for CY2023.

## Sensitivity Analysis

A sensitivity analysis was undertaken to understand the effect of price change for both aluminium extrusion and scrap produced at INEX. A ±20% price change in aluminium extrusion and scrap showed little effects on the overall impacts of the aluminium extrusion produced at INEX (up to 2.17%). However, it is essential to monitor these effects continuously.

## Data Quality Assessment

Primary data for aluminium extrusion, surface finishing, transport to fabrication sites and fabrication was sourced for CY2023.

This study utilises the system for “Data quality level and criteria of the UN Environment Global Guidance on LCA database development” (CEN, 2019).

**Table 9: Data Quality Assessment**

| Material/Life cycle stage | Collected foreground data | Data Source and Year | Representativeness | | |
|---|---|---|---|---|---|
| | | | Geographical | Technological | Time |
| Al Extrusions (A1-A3) | Raw materials and suppliers, land use, manufacturing processes, energy and water use, production volumes, transport modes and distances | Supplied by INEX, for CY2023 | Very Good | Very Good | Very Good |
| Powder Coating (A1-A3) | Raw materials and suppliers, land use, manufacturing processes, energy and water use, production volumes, transport modes and distances | Supplied by Colour Works, for CY2023 | Very Good | Very Good | Very Good |
| Anodising (A1-A3) | Raw materials and suppliers, land use, manufacturing processes, energy and water use, production volumes, transport modes and distances | Supplied by FINEX, for CY2023 | Very Good | Very Good | Very Good |
| Fabrication (A1-A3) | Raw materials and suppliers, land use, manufacturing processes, energy and water use, production volumes, transport modes and distances | Supplied by Wight Aluminium, for CY2023 | Very Good | Very Good | Very Good |
| Module C1 | Inputs for deconstruction & demolition | Assumptions for deconstruction energy | Fair | Good | Fair |
| Module C2 | Transport modes and distances to end-of-life destinations | General assumption | Fair | Fair | Fair |
| Module C3 | Inputs for waste processing including aluminium recovery rate | (BRANZ, 2024) | Good | Fair | Fair |
| Module C4 | End-of-life destinations | (BRANZ, 2024) | Fair | Fair | Fair |
| Module D | Inputs for aluminium scrap recycling | Assumptions for recycling and credits | Good | Fair | Fair |

## Assessment Indicators

**The results tables describe the different environmental indicators for each product per declared unit, for each declared module. The EN 15804 reference package based on EF 3.1 is used.**

Table 10 contains the core environmental impact indicators in accordance with EN 15804:2012+A2:2019, describing the potential environmental impacts of the product.

Table 11 shows the life cycle inventory indicators for resource use.

Table 12 displays the life cycle inventory indicators for waste and other outputs.

Table 13 provides additional environmental impact indicators in accordance with EN 15804:2012+A2:2019.

Table 14 displays biogenic carbon content indicators.

Table 15 contains results for environmental impact indicators in accordance with EN 15804:2012+A1:2013 to aid backward comparability. Results using the indicators and characterisation factors of EN15804+A1 are included to aid comparison and backwards compatibility with rating tools. While the indicators and characterisation methods are from EN 15804:2012+A1:2013, other LCA rules for the study (such as system boundaries and allocation) are according to EN 15804:2012+A2:2019; i.e., this study does not claim that the results of the "+A1 indicators" are compliant with EN 15804:2012+A1:2013.

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.

The use of primary energy is separated into energy used as raw material and energy used as energy carrier as per option C in Annex 3 in the PCR (EPD International, 2024)

Energy indicators (MJ) are always given as net calorific value.

**Table 10: EN15804+A2 Core Environmental Impact Indicators**

| Impact category | Indicator | Unit |
|---|---|---|
| Climate change – total | GWP-total | kg $CO_2$-eq. |
| Climate change – fossil | GWP-fossil | kg $CO_2$-eq. |
| Climate change – biogenic | GWP-biogenic | kg $CO_2$-eq. |
| Climate change – land use and land use change | GWP-luluc | kg $CO_2$-eq. |
| Ozone depletion | ODP | kg CFC11-eq. |
| Acidification | AP | Mole of $H^+$ eq. |
| Eutrophication aquatic freshwater | EP-freshwater | kg P eq. |
| Eutrophication aquatic marine | EP-marine | kg N eq. |
| Eutrophication terrestrial | EP-terrestrial | Mole of N eq. |
| Photochemical ozone formation | POCP | kg NMVOC eq. |
| Depletion of abiotic resources – minerals and metals[1] | ADP-m&m | kg Sb-eq. |
| Depletion of abiotic resources – fossil fuels[1] | ADP-fossil | MJ |
| Water use[1] | WDP | $m^3$ world equiv. |

### Table 11: Life Cycle Inventory Indicators on Use of Resources

| Parameter | Indicator | Unit |
|---|---|---|
| Use of renewable primary energy excluding renewable primary energy resources used as raw materials | PERE | MJ |
| Use of renewable primary energy resources used as raw materials | PERM | MJ |
| Total use of renewable primary energy resources | PERT | MJ |
| Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | PENRE | MJ |
| Use of non-renewable primary energy resources used as raw materials | PENRM | MJ |
| Total use of non-renewable primary energy resources | PENRT | MJ |
| Use of secondary material | SM | kg |
| Use of renewable secondary fuels | RSF | MJ |
| Use of non-renewable secondary fuels | NRSF | MJ |
| Net use of fresh water | FW | $m^3$ |

### Table 12: Life Cycle Inventory Indicators on Waste Categories and Output Flows

| Parameter | Indicator | Unit |
|---|---|---|
| Hazardous waste disposed | HWD | kg |
| Non-hazardous waste disposed | NHWD | kg |
| Radioactive waste disposed | RWD | kg |
| Components for reuse | CRU | kg |
| Materials for energy recovery | MER | kg |
| Materials for recycling | MFR | kg |
| Exported electrical energy | EEE | MJ |
| Exported thermal energy | EET | MJ |

### Table 13: EN15804+A2 Additional Environmental Impact Indicators

| Impact Category | Indicator | Unit |
|---|---|---|
| Climate Change[2] | GWP-GHG | kg $CO_2$-eq. |
| Climate Change[3] | GWP-GHG (IPCC AR5) | kg $CO_2$-eq. |
| Particulate Matter emissions | PM | Disease incidences |
| Ionising Radiation – human health[4] | IRP | kBq U235 eq. |
| Eco-toxicity (freshwater)[1] | ETP-fw | CTUe |
| Human Toxicity, cancer[1] | HTP-c | CTUh |
| Human Toxicity, non-cancer[1] | HTP-nc | CTUh |
| Land use related impacts / soil quality[1] | SQP | Dimensionless |

**Table 14: Biogenic Carbon Content Indicators**

| Parameter | Indicator | Unit |
|---|---|---|
| Biogenic carbon content - product | BCC-prod | kg C |
| Biogenic carbon content - packaging | BCC-pack | kg C |

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

**Table 15: EN15804+A1 Environmental Impact Indicators**

| Impact Category | Indicator | Unit |
|---|---|---|
| Global warming potential | GWP (EN15804+A1) | kg $CO_2$-eq. |
| Ozone depletion potential | ODP (EN15804+A1) | kg CFC11-eq. |
| Acidification potential | AP (EN15804+A1) | kg $SO_2$-eq. |
| Eutrophication potential | EP (EN15804+A1) | kg $PO_4^{3-}$-eq. |
| Photochemical ozone creation potential | POCP (EN15804+A1) | kg $C_2H_4$-eq. |
| Abiotic depletion potential for non-fossil resources | ADPE (EN15804+A1) | kg Sb-eq. |
| Abiotic depletion potential for fossil resources | ADPF (EN15804+A1) | MJ |

## Disclaimers

[1]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

[2]This indicator is identical to GWP-total except that the characterisation factor for biogenic $CO_2$ is set to zero. It has been included in the EPD following the PCR.

[3]GWP-GHG (IPCC AR5) is an additional GWP100 indicator that is aligned with the Intergovernmental Panel on Climate Change (IPCC) 2013 Fifth Assessment Report (AR5) (IPCC 2013), national greenhouse gas reporting frameworks in Australia and New Zealand and previous versions of the Construction Products PCR (PCR2019:14v1.11). It excludes biogenic carbon and indirect radiative forcing.

[4]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 some construction materials is also not measured by this indicator.

# Environmental Performance

The following tables show the results for one declared unit of extruded aluminium profiles.

**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 16: EN15804+A2 Core Environmental Impact Indicators**

| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D | A-C Variation |
|---|---|---|---|---|---|---|---|---|
| GWP-total | kg $CO_2$-eq. | 9.48E+00 | 6.76E-04 | 4.60E-03 | 2.80E-03 | 2.27E-03 | -4.35E+00 | 10.9% |
| GWP-fossil | kg $CO_2$-eq. | 9.46E+00 | 6.70E-04 | 4.59E-03 | 2.73E-03 | 2.24E-03 | -4.35E+00 | 10.5% |
| GWP-biogenic | kg $CO_2$-eq. | 1.66E-02 | 5.50E-06 | 6.15E-07 | 2.04E-05 | 7.14E-06 | 0.00E+00 | 238% |
| GWP-luluc | kg $CO_2$-eq. | 1.41E-03 | 1.75E-08 | 1.21E-07 | 4.10E-05 | 1.35E-05 | -2.72E-04 | 6.13% |
| ODP | kg $CFC_{11}$-eq. | 8.78E-12 | 6.68E-17 | 4.60E-16 | 8.46E-15 | 6.06E-15 | -5.28E-12 | 7.11% |
| AP | Mole of H+ eq. | 5.25E-02 | 3.49E-06 | 1.17E-05 | 1.32E-05 | 1.59E-05 | -2.97E-02 | 4.65% |
| EP-freshwater | kg P eq. | 1.21E-05 | 1.03E-10 | 7.06E-10 | 7.65E-09 | 5.10E-09 | -1.05E-06 | 298% |
| EP-marine | kg N eq. | 8.80E-03 | 1.70E-06 | 5.18E-06 | 6.13E-06 | 4.10E-06 | -2.87E-03 | 12.8% |
| EP-terrestrial | Mole of N eq. | 9.59E-02 | 1.86E-05 | 5.69E-05 | 6.79E-05 | 4.52E-05 | -3.15E-02 | 11.4% |
| POCP | kg NMVOC eq. | 2.65E-02 | 4.79E-06 | 1.24E-05 | 1.69E-05 | 1.26E-05 | -9.45E-03 | 9.76% |
| ADP-m&m | kg Sb-eq. | 7.00E-07 | 8.79E-12 | 6.05E-11 | 3.01E-09 | 1.45E-10 | -3.91E-07 | 25.1% |
| ADP-fossil | MJ | 1.10E+02 | 8.82E-03 | 6.07E-02 | 4.92E-02 | 2.96E-02 | -3.91E+01 | 14.61% |
| WDP | $m^3$ world equiv. | 2.78E+00 | 2.51E-06 | 1.73E-05 | 4.57E-04 | 2.57E-04 | -1.64E+00 | 29.6% |

**Table 17: Use of Resources**

| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| PERE | MJ | 8.26E+01 | 3.81E-05 | 2.62E-04 | 6.88E-03 | 5.17E-03 | -5.60E+01 |
| PERM | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PERT | MJ | 8.26E+01 | 3.81E-05 | 2.62E-04 | 6.88E-03 | 5.17E-03 | -5.60E+01 |
| PENRE | MJ | 1.10E+02 | 8.82E-03 | 6.07E-02 | 4.92E-02 | 2.96E-02 | -3.91E+01 |
| PENRM | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PENRT | MJ | 1.10E+02 | 8.82E-03 | 6.07E-02 | 4.92E-02 | 2.96E-02 | -3.91E+01 |
| SM | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FWT | $m^3$ | 2.93E-01 | 5.11E-08 | 3.51E-07 | 1.43E-05 | 7.85E-06 | -1.79E-01 |

Since Module C is included in the EPD, the use of Module A1-A3 results without considering the results of Module C is discouraged.

### Table 18: Waste Production and Output Flows

| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| HWD | kg | 4.20E-07 | 1.42E-13 | 9.77E-13 | 1.04E-11 | 7.38E-12 | 1.02E-08 |
| NHWD | kg | 4.59E+00 | 2.16E-07 | 1.49E-06 | 1.47E-05 | 1.50E-01 | -2.83E+00 |
| RWD | kg | 6.08E-04 | 1.72E-09 | 1.18E-08 | 3.85E-07 | 3.12E-07 | -1.44E-04 |
| CRU | kg | 1.49E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER | kg | 3.04E-01 | 0.00E+00 | 0.00E+00 | 8.50E-01 | 0.00E+00 | 0.00E+00 |
| MFR | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EEE | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EET | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

### Table 19: EN15804+A2 Additional Environmental Impact Indicators

| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| GWP-GHG | kg $CO_2$-eq. | 9.48E+00 | 6.71E-04 | 4.60E-03 | 2.80E-03 | 2.27E-03 | -4.35E+00 |
| GWP-GHG (IPCC AR5) | kg $CO_2$-eq. | 9.39E+00 | 6.71E-04 | 4.60E-03 | 2.75E-03 | 2.25E-03 | -4.28E+00 |
| PM | Disease incidences | 7.04E-07 | 4.42E-11 | 1.18E-10 | 2.60E-10 | 2.00E-10 | -3.96E-07 |
| IRP | kBq U235 eq. | 9.53E-02 | 1.85E-07 | 1.27E-06 | 4.06E-05 | 3.61E-05 | -2.35E-02 |
| ETP-fw | CTUe | 3.48E+01 | 3.94E-03 | 2.71E-02 | 3.81E-02 | 2.26E-02 | -1.84E+01 |
| HTP-c | CTUh | 3.34E-09 | 6.47E-14 | 4.46E-13 | 8.26E-13 | 4.03E-13 | -1.86E-09 |
| HTP-nc | CTUh | 6.33E-08 | 1.43E-12 | 9.77E-12 | 2.90E-11 | 1.56E-11 | -3.93E-08 |
| SQP | Dimension-less | 1.43E+01 | 1.80E-05 | 1.24E-04 | 2.11E-02 | 8.15E-03 | -9.73E-01 |

### Table 20: Biogenic Carbon Content

| Indicator | Unit | A1-A3 |
|---|---|---|
| BCC-prod | kg C | 0.00E+00 |
| BCC-pack | kg C | 1.11E-02 |

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

Since Module C is included in the EPD, the use of Module A1-A3 results without considering the results of Module C is discouraged.

**Table 21: EN15804+A1 Environmental Impact Indicators**

| Indicator | Unit | A1-A3 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|
| GWP (EN15804+A1) | kg $CO_2$-eq. | 9.39E+00 | 6.69E-04 | 4.55E-03 | 2.70E-03 | 2.22E-03 | -4.32E+00 |
| ODP (EN15804+A1) | kg CFC11-eq. | 1.04E-11 | 7.87E-17 | 5.42E-16 | 9.96E-15 | 7.14E-15 | -6.22E-12 |
| AP (EN15804+A1) | kg $SO_2$-eq. | 4.41E-02 | 2.42E-06 | 8.26E-06 | 9.22E-06 | 1.27E-05 | -2.58E-02 |
| EP (EN15804+A1) | kg P eq. | 3.05E-03 | 5.70E-07 | 1.75E-06 | 2.16E-06 | 1.44E-06 | -9.76E-04 |
| POCP (EN15804+A1) | kg $C_2H_4$-eq. | 2.70E-03 | 2.52E-07 | -1.13E-06 | 1.23E-06 | 1.05E-06 | -1.34E-03 |
| ADPE (EN15804+A1) | kg Sb-eq. | 7.04E-07 | 8.80E-12 | 6.06E-11 | 3.01E-09 | 1.47E-10 | -3.91E-07 |
| ADPF (EN15804+A1) | MJ | 1.08E+02 | 8.76E-03 | 6.03E-02 | 4.75E-02 | 2.84E-02 | -3.84E+01 |

## Variability of Results

Across the four products considered in this EPD, the variation for the GWP-GHG indicator results for Modules A1-A3 was 10.7% which is driven by the type of surface finishing. The variation across the sites for Modules A1-A3 is <10% for the GWP-GHG indicator.

The variations across other core indicators for Modules A-C are shown in Table 16.

Since Module C is included in the EPD, the use of Module A1-A3 results without considering the results of Module C is discouraged.

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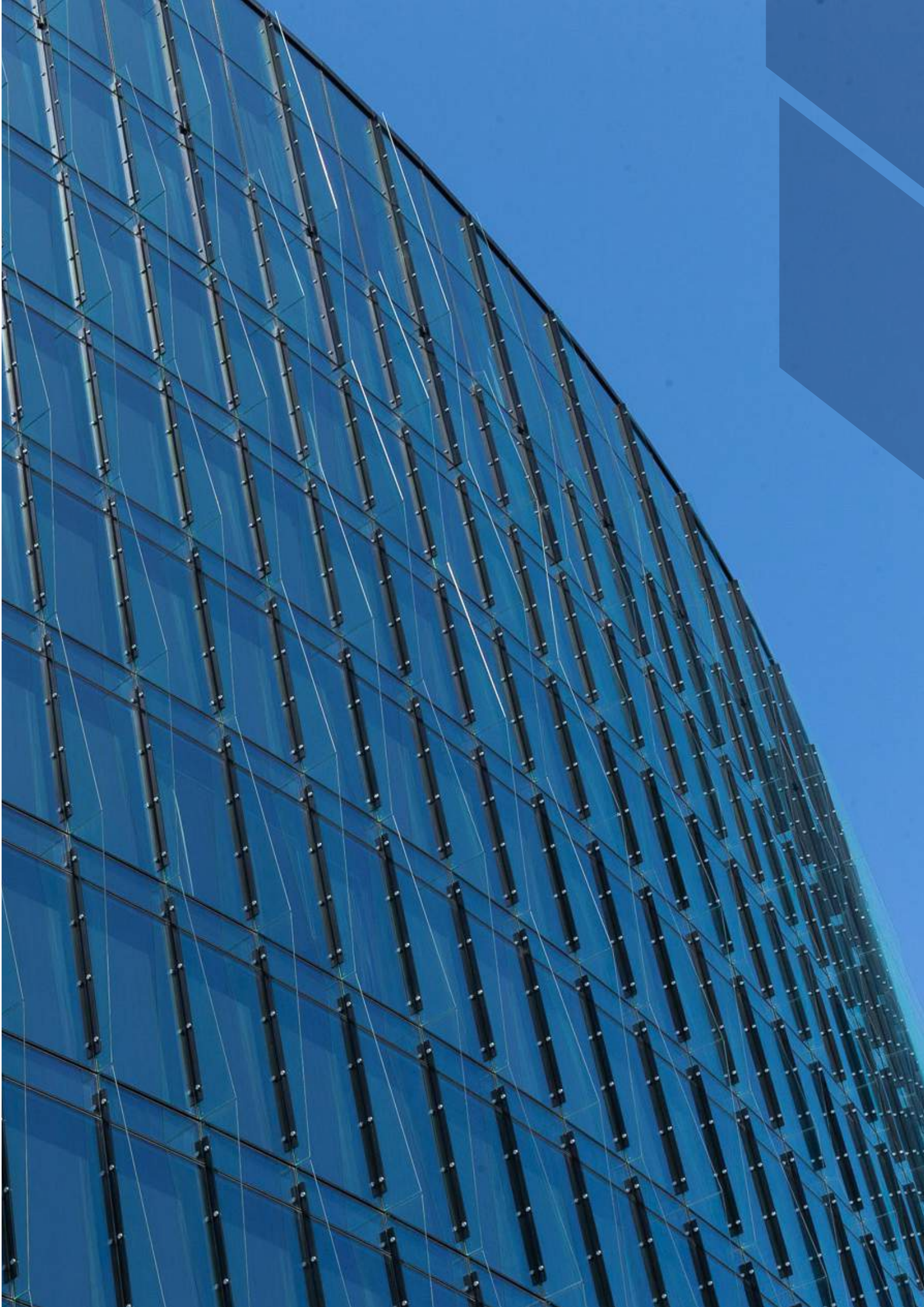

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