Environmental Product Declaration

(PCR: Construction Products V1.1)

ALPOLIC™ NC / A1

Non-combustible Aluminium Composite Panel

MITSUBISHI CHEMICAL

MITSUBISHI CHEMICAL INFRATEC CO.,LTD.

ALPOLIC™

Environmental Product Declaration (EPD)

in accordance with ISO 14025 and EN 15804:2012+A1:2013.

EPD Registration No. SP-03725 | Version 1.0

Issued 24/08/2021 | Valid until 24/08/2026

AUSTRALASIA EPD®

Company Information

Product-related or management system-related certifications:

ISO 9001 – Quality management systems.

ISO 14001 – Environmental Management Systems.

AS 1530.1/1530.3, EN13501-1 (ISO1182), BS476-4 Fire Test.

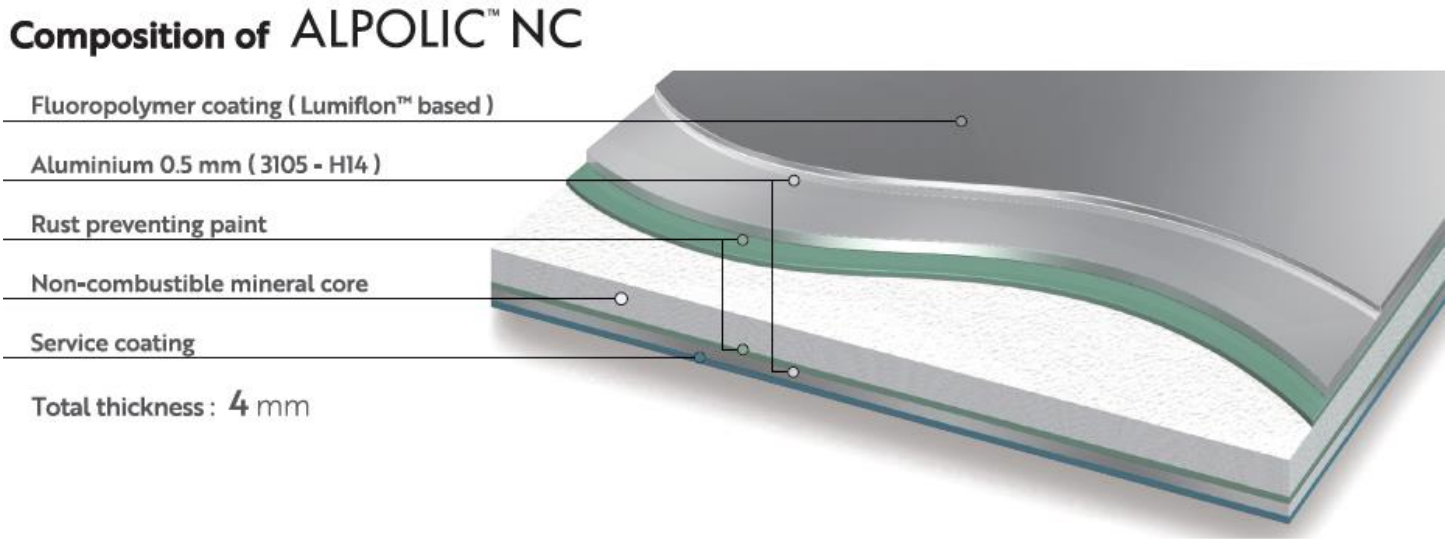
Name and location of production site: Mitsubishi Chemical Infratec Co., Ltd., Japan.

ALPOLIC™ NC / ALPOLIC™ A1

ALPOLIC™NC / ALPOLIC™ A1 is an aluminium composite material (ACM) with a non-combustible core, suitable for exterior or interior claddings, soffit linings, and roof covering in new buildings and retrofit applications wherever a non-combustible material is required. The ALPOLIC™ NC / ALPOLIC™ A1 product is manufactured by Mitsubishi Chemical Infratec Co., Ltd. and is furnished by approved distributors and authorised dealers. Network Architectural is the distributor for ALPOLIC™ NC in Australia. ALPOLIC™ A1 is another name for ALPOLIC™ NC.

United Nations Central Product Classification (UN CPC) code: 314/415/3814 (EPD International, 2020).

Geographical scope: Final product produced in Japan and sold by Network Architectural in the Australian market.



Functional unit / declared unit: 1 m^2 of ALPOLIC™NC / ALPOLIC™ A1.
Scope: Cradle to gate with options.
Reference service life: 20 years[1].
Databases and LCA software used: AusLCI 2.2, Ecoinvent 3.6, Industry Data 2.0 databases; USLCI, SimaPro 9.1.0.11 software.
Data collection period: Data collected from January 2021-April 2021 as per annual manufacturing data of 2020-2021.

[1] The reference service life is taken with respect to the warranty provided by Mitsubishi Chemical Infratec Co., Ltd. ALPOLIC™NC / ALPOLIC™ A1 is still used in structures older than 30 years.

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product that is based on a consistent set of rules known as Product Category Rules (PCR). EPDs within the same product category from different programs may not be comparable. This EPD is for a specific construction product and follows the Construction products and construction services; registration 2012:01; version 2.33.

Please note that EPDs of construction products may not be comparable if they do not comply with EN 15804. The EPD owner has the sole ownership, liability, and responsibility for the EPD.

Declaration Owner:

Mitsubishi Chemical Infratec Co., Ltd.
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PCR Information

PCR:
Construction products and construction services; registration 2012:01; version 2.33
PCR review conducted by:
The international EPD System

Independent third-party verification

Independent verification of the declaration and data, according to ISO 14025:
☐ EPD process certification (Internal)
☑ EPD verification (External)

Third Party Verifier

Jonas Bengtsson, Edge Environment, L5, 39 East Esplanade, Manly NSW 2095 Australia.

Procedure Follow-up

Procedure for follow-up of data during EPD validity involves third party verifier:
☑ Yes ☐ No

Product Information

ALPOLIC™ NC / ALPOLIC™ A1 is composed of a non-combustible core sandwiched between two skins of 0.5mm thick aluminium alloy (3105-H14). The surface is finished with a high-performance Lumiflon-based fluoropolymer coating as standard. ALPOLIC™ NC / ALPOLIC™ A1 is available in finishes of Solid Colours, Metallic Colours, Sparkling Colours, Prismatic Colours, and Patterns. In these finishes, Lumiflon-based fluoropolymer paints are applied in the manufacturer's continuous coil coating lines. For the LCA study, a metallic-based colour by Lumiflon is selected. The backside facing the structural wall or steel after the installation as a cladding panel has a polyester-based coating or a service coating as corrosion protection. The surface ALPOLIC™ NC / ALPOLIC™ A1 is also protected with a co-extruded white and black coloured removable and self-adhesive film. The product is made of 50% recycled aluminium and all aluminium can be recycled at the end of the product's life.

The properties of ALPOLIC™ NC / ALPOLIC™ A1 are listed below,

Table 1 Properties of ALPOLIC™ NC / ALPOLIC™ A1

Physical Properties		
Item	**Unit**	
Panel weight	kg/m2	8.6
Thermal expansion (ASTM D696)	×10-6 /°C	20.6
Thermal conductivity (ISO 8990)	W/m.K	0.4
Deflection temperature (ISO 75-2)	°C	115
Mechanical Properties		
Tensile strength (ASTM E8)	MPa or N/mm2	48.2
0.2% proof stress (ASTM E8)	MPa or N/mm2	46.5
Elongation (ASTM E8)	%	2.7
Flexural elasticity (ASTM D7250)	GPa or kN/mm2	45.6

Background Data

The overall temporal scope for background data is less than 10 years. The temporal scope for AUSLCI V1.36, a shadow database of modified ecoinvent 2.2 processes is March 2021. For ecoinvent 3.6 the temporal scope is September 2019. The USLCI 2015 dataset has the temporal scope of 2015 (SimaPro , 2019).

For geographical scope, background datasets and activities within Australia are taken from AUSLCI and are Australian-specific unit processes. For datasets and activities in Japan, the library used is ecoinvent and global scope is taken into consideration except for electricity use, where Japan-specific data was available in the AUSLCI library.

System Boundaries and Life Cycle Stages

Life Cycle Stages

The system boundary describes the life cycle stages and the processes included in the LCA. The stages include raw material supply (A1), transportation (A2), manufacturing (A3), optional transport to the final site (A4), deconstruction (C1), transport at end-of-life (C2), waste processing (C3), waste disposal (C4) as well as reuse, recycling, and recovery. The module selected for this study is Cradle to gate with options, modules C1–C4, module D. The additional module is A4.

Table 2: Life cycle stages of ALPOLIC™ NC / ALPOLIC™ A1

	Life Cycle Stage		Life Cycle Module	Declared Module
Upstream processes	A1	Raw material supply	Product stage	X
Core Processes	A2	Transportation		X
	A3	Manufacturing		X
Downstream Processes	A4	Transport to final site	Construction stage	X
	A5	Installation at the construction site		X
	B1	Use	Use stage	ND
	B2	Maintenance		ND
	B3	Repair		ND
	B4	Replacement		ND
	B5	Refurbishment		ND
	B6	Energy use to operate building-integrated technical systems		ND
	B7	Operational water use by building integrated technical systems		ND
	C1	Deconstruction	End-of-life stage	X
	C2	Transport		X
	C3	Waste processing		X
	C4	Waste disposal		X
Other Environmental Stage	D	Reuse recovery recycling potential	Reuse, recovery, recycling stage	X

System Diagram

The life cycle of ALPOLIC™ NC / ALPOLIC™ A1 is divided into three different processes – upstream, core, and downstream processes. The upstream processes include the flows of raw materials. The core processes include all activities that the manufacturing organisation controls, i.e. transportation of the materials to the manufacturing factory and the actual method of manufacturing the final product. The downstream processes include the steps controlled by a consumer and the disposal or recycling options of the products. The figure below shows the process diagram of ALPOLIC™ NC / ALPOLIC™ A1. The boxes in green are the flows included in this study's system boundary. The installation and use phases of the product are not included in this project, in line with the 'cradle to gate with options' modelling according to the relevant product category rules (The international EPD System, 2021).

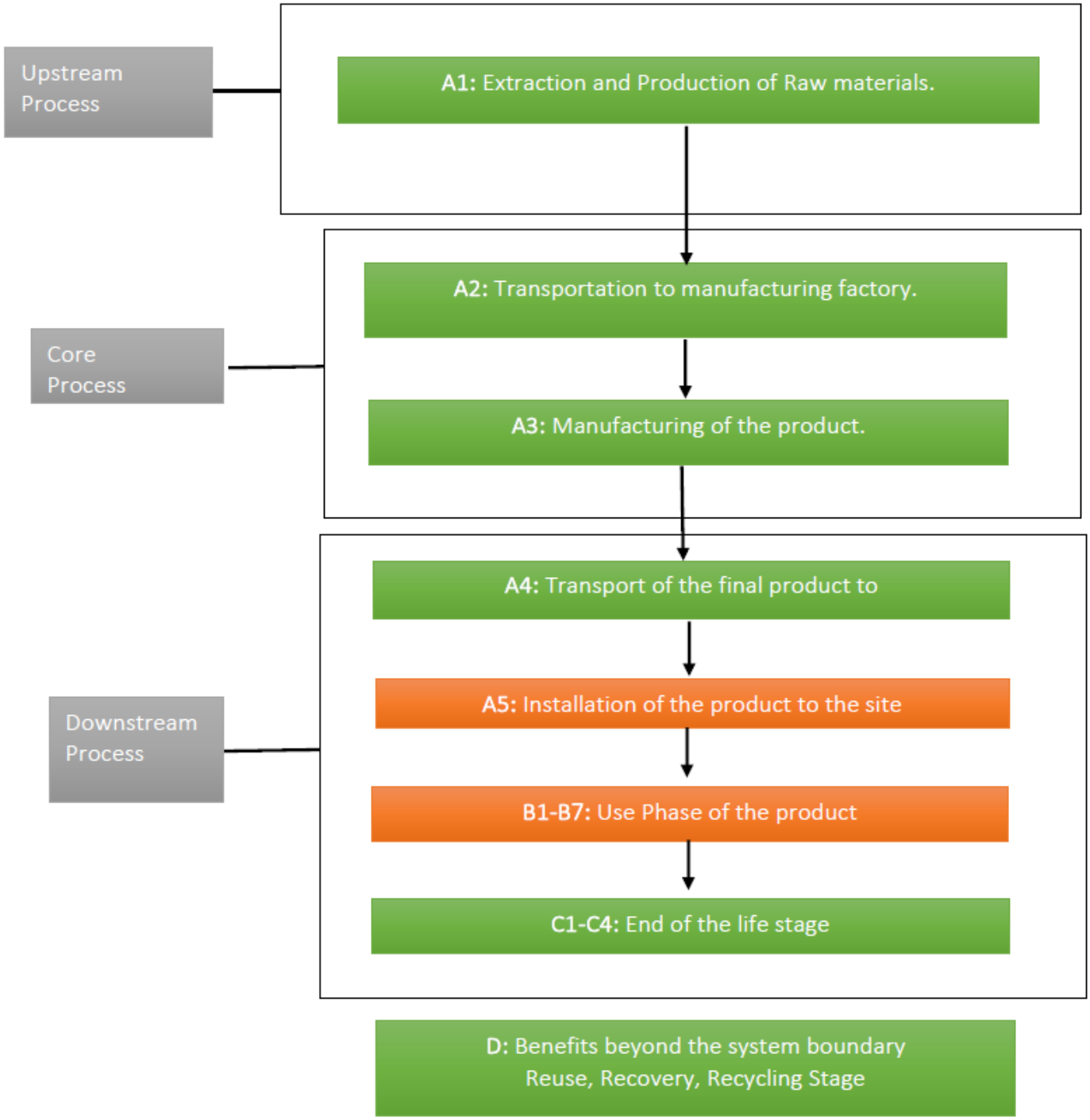

Figure 1: Process diagram ALPOLIC™ NC / ALPOLIC™ A1

End-of-life Scenarios

In scenario 1, the LCA is modelled with an assumption that 100% aluminium is recovered from the aluminium composite panel at the end of its reference life of 20 years. In scenario 2, the LCA is modelled

with an assumption that only 50% of the aluminium is recycled. It is assumed that heat treatment is used to separate aluminium from other composite materials. The assumption is that recycling occurs in the Australian market. The rest of the product ends up in the sanitary landfill.

The end-of-life of packaging by the suppliers is also taken into consideration. Packaging materials like steel are recycled. The rest were considered to end up in the sanitary landfill.

Data Quality, Temporal Scope, and Geographical Scope

The modelling of ALPOLIC™ NC / ALPOLIC™ A1 is of high quality as detailed company-specific data about the product ingredients, suppliers, the annual energy, and water consumption was provided for this study. Furthermore, data for upstream and downstream processes are retrieved from suitable averages in the AusLCI V1.36, Ecoinvent 3.6, and USLCI 2015 databases and are converted into data ideal for Japan.

ALPOLIC™ NC / ALPOLIC™ A1 is manufactured in Japan, and the suppliers of materials used in this product are also from Japan. The product is supplied globally. The geographical scope is Japan and Australia.

The temporal scope of the study is the period for which the data was collected. The production volume data is for the year 2020-2021.

Table 3: Data sources, temporal scope, and data quality

Module	Input/Output	Data resource	Temporal Scope	Data Quality
A1,A2	Raw material for the final product	Mitsubishi Chemical Infratec Co.,Ltd. provided Material Datasheet(MSDS) of the product and the paint coating used on the product. They also provided information on different packaging materials used by the suppliers. The photos of the final packaging materials were provided by them. They shared the manufacturing process of the product by explaining it through flowcharts. The Energy use (Electricity and Gas) and Water use per functional unit are calculated by dividing the energy usage reported on utility bills by the quantity of production of ALPOLIC™ NC panels at Mitsubishi Chemical Infratec's factory in Japan.	2020-2021	High
	Packaging from the suppliers			
	Transportation- Supplier location- Final Manufacturing location			
	Final product packaging			
A3	Manufacturing process for Aluminium Composite Panels		2020-2021	High
	Water usage in manufacturing factory per functional unit		2020-2021	
	Energy Usage in manufacturing factory per functional unit			
A4	Port transport to Network Architectural	Network Architectural Distance between Mitsubishi, Japan, and their Australian suppliers Network Architectural	2020-2021	High
	Japan to Australia-Sea transport			
	Manufacturing factory to Port Transport			
C1	Manual Deconstruction	Network Architectural	2020-2021	High

C2	End of the life Transport-100km distance is assumed for transport to resource recovery and waste treatment facility	Network Architectural provided information that the product needs to be manually deconstructed.	----	Low
C3	End of the life treatment- Treatment to separate Aluminium from other materials in the panel	Assumption- Average distance of 100km is taken into consideration as per resource recovery facilities in Australia.		Medium
C4	End of the life- and disposal of other materials through sanitary landfill	Assumption		Medium
D	Recycling of aluminium, packaging paper, steel drum packaging	Information provided by Mitsubishi Chemical Infratec on how the product can be manually separated at end of life.		Medium

Allocations

In the manufacturing of ALPOLIC™ NC / ALPOLIC™ A1 no co-product or by-product is obtained. Allocation of any production processes to more than one product is therefore not needed.

In the International EPD System framework, the methodological choices for allocation for reuse, recycling, and recovery have been set according to the polluter pays principle (PPP). This means that the waste generator shall carry the total environmental impact until the point in the product's life cycle at which the waste is transported to a scrapyard or the gate of a waste processing plant (collection site). The subsequent user of the waste shall carry the environmental impact from the processing and refinement of the waste but not the environmental impact caused in any previous life cycles (EPD International, 2021).

Any allocations directly embedded in the LCA database processes were adopted. The energy and water calculations are allocated based on electricity consumption and production of ALPOLIC™ NC in the Mitsubishi Chemical Infratec Co., Ltd. manufacturing unit. Electricity, gas, and water consumption are calculated based on the production volume of the year 2020. The total Energy/water consumed by the manufacturing unit in Japan was divided by the volume of ALPOLIC™ NC produced for that year to find the individual consumption value of each product.

Content Declaration

The material composition for ALPOLIC™ NC / ALPOLIC™ A1 is given in Table 4.

Table 4 Materials used for 1m² ALPOLIC™ NC / ALPOLIC™ A1

Materials	Quantity in percentage
Aluminium	31.3%
Core Material	67.4%
Coatings	1.3%
Sum	100.00%

Environmental Performance

Environmental Impact Assessment Methods

The table below represents the Environmental Indicators calculated in this study and the methods used to calculate them in the SimaPro Software.

Table 5 Overview of environmental impact assessment methods used in the study

Environmental Indicators	SimaPro Method
Climate change- total	Greenhouse Gas Protocol V1.02 / C02 eq (kg)
Climate change - fossil	
Climate change - biogenic	
Climate change - land use and land use change C02 eq (kg)	
Eutrophication- Fresh water (kg P eq)	EF 3.0 Method (adapted) V1.00
Eutrophication- Terrestrial mol N eq	
Eutrophication- marine (kg N eq)	
Eutrophication- Fresh water (kg PO4 eq)	Eutrophication- Fresh water (kg P eq) * 3.07
Ozone layer depletion (kg CFC-11 eq)	CML-IA baseline V3.6
Photochemical oxidation (kg C2H4 eq)	
Depletion of abiotic resources (elements), kg Sb equivalents	
Depletion of abiotic resources (fossil), MJ net calorific value	
Acidification (kg SO2 eq)	
Photochemical oxidation (kg NMVOC)	Recipe 2008
Human toxicity, cancer impacts (cases):	USEtox (recommended) V1.04
Human toxicity non-cancer (cases):	
Freshwater ecotoxicity (PAF.m3.day)	
Land use (Pt)	EF 3.0 Method (adapted) V1.00 / EF 3.0
Ionising radiation (kBq U-235 eq)	EN 15804 +A2 Method V1.00 / EF 3.0
Particulate matter (disease inc.)	
Water Use (m^3)	AWARE1.02
Radioactive waste (Kg)	EDIP 2003 method
Hazardous waste (Kg)	EDIP 2003 method
Non-hazardous waste (Kg)	EDIP 2003 method (Sum of Bulk waste and Slag waste)
Primary energy resources Renewable- Use as energy carrier (MJ)	Cumulative Energy Demand V1.11 method: calculated as sum of renewable – biomass, renewable – wind, solar, geothermal, and renewable – water.
Primary energy resources Renewable- Use as raw materials (MJ)	Manual calculation
Primary energy resources Renewable- Primary energy resources Non-renewable- Use as energy carrier (MJ)	Cumulative Energy Demand V1.11 method: calculated as sum of non-renewable – fossil, non-renewable – nuclear, and non-renewable – biomass.
Use as raw materials (MJ)	Manual calculation
Secondary material resources (MJ)	Manual calculation
Renewable secondary fuels (Kg)	0
Non-renewable secondary fuels (MJ)	0
Net use of fresh water (m^3)	Recipe 2016 Midpoint V1.04

Environmental Impacts

The impacts are represented with respect to the life cycle modules and processes. The upstream process which includes raw material extraction has the highest effects. Module D has negative impact values as aluminium and packaging materials like recycled steel and paper will reduce the burden from disposal and raw materials of future life cycles.

Table 6 Environmental Impacts for ALPOLIC™ NC/ ALPOLIC™ A1 *scenario 1 and Scenario 2*

Parameters		Unit	Upstream Process	Core Process	Downstream Process			Scenario 1 Other Environmental benefits	Scenario 2 Other Environmental benefits
			A1	A2-A3	A4	C1-C2	C3-C4	D	D
Global Warming Potential (GWP)	Fossil CO2 eq	kg CO2 eq	4.86E+01	2.20E+00	4.58E+00	2.59E-01	1.56E-01	-5.27E+01	-2.63E+01
	Biogenic CO2 eq	kg CO2 eq	-2.00E+00	1.18E-02	6.84E-04	2.72E-05	2.82E-01	-7.62E-02	-3.81E-02
	CO2 eq from land transformation	kg CO2 eq	1.10E-01	3.65E-04	1.46E-04	2.86E-05	3.32E-06	-2.28E-04	-1.14E-04
	Total	kg CO2 eq	4.67E+01	2.21E+00	4.58E+00	2.59E-01	4.37E-01	-1.06E+02	-5.29E+01
Eutrop--hication	Eutrophication, freshwater	kg P eq	1.59E-02	1.03E-04	1.04E-04	1.13E-05	4.20E-06	-1.57E-03	-7.83E-04
	Eutrophication, freshwater	kg PO_4 eq	4.90E-02	3.17E-04	3.19E-04	3.47E-05	1.29E-05	-4.81E-03	-2.40E-03
	Eutrophication, marine	kg N eq	5.41E-02	2.74E-03	1.80E-02	3.80E-04	1.67E-02	-4.76E-02	-2.38E-02
	Eutrophication, terrestrial	mol N eq	5.40E-01	2.72E-02	1.98E-01	4.17E-03	2.07E-03	-5.16E-01	-2.58E-01
Abiotic depletion		kg Sb eq	8.79E-04	1.69E-05	1.09E-05	2.32E-06	1.49E-07	-1.80E-05	-9.00E-06
Abiotic depletion (fossil fuels)		MJ	5.00E+02	3.40E+01	5.12E+01	3.54E+00	1.94E+00	-2.92E+02	-1.46E+02
Ozone layer depletion (ODP)		kg CFC-11 eq	1.91E-06	2.75E-07	4.45E-07	3.87E-08	2.19E-08	-1.21E-06	-6.05E-07
Photochemical oxidation		kg NMVOC	1.60E-01	7.88E-03	5.10E-02	1.25E-03	3.50E-03	-1.56E-01	-7.79E-02
Acidification		mol H+ eq	3.13E-01	7.54E-03	4.48E-02	1.20E-03	5.58E-04	-3.58E-01	-1.79E-01
Water Depletion		m3	5.42E+01	5.79E+00	3.44E+01	1.32E+00	6.36E-01	-1.28E+03	-6.42E+02

Table 7 represents additional impacts for ALPOLIC™ NC / ALPOLIC™ A1.

Table 7 Other impacts for ALPOLIC™ NC/ ALPOLIC™ A1 scenario 1 and Scenario 2

Parameters	Unit	Upstream Process	Core Process	Downstream Process			Scenario 1 Other Environmental benefits	Scenario 2 Other Environmental benefits
		A1	A2-A3	A4	C1-C2	C3-C4	D	D
Land use	Dimensionless	2.99E+02	9.58E+00	4.14E+01	1.52E+00	3.76E+00	-1.25E+02	-6.23E+01
Human toxicity, cancer	CTUh	8.55E-09	1.53E-10	1.96E-10	1.38E-11	1.79E-12	-2.70E-09	-1.35E-09
Human toxicity, non-cancer	CTUh	1.26E-09	8.37E-10	5.17E-10	1.00E-10	9.93E-13	-1.91E-09	-9.57E-10
Freshwater ecotoxicity	CTUe	2.51E-01	5.52E-03	6.73E-03	4.28E-04	2.01E-04	-3.84E-02	-1.92E-02
Ionising radiation	kBq U-235 eq	1.58E+00	6.82E-02	3.06E-02	5.32E-03	3.46E-04	-2.18E-02	-1.09E-02
Particulate matter	disease inc.	3.87E-06	9.31E-08	1.38E-07	1.30E-08	3.81E-09	-4.32E-06	-2.16E-06
Acidification	kg SO2 eq	2.63E-01	5.76E-03	2.93E-02	7.93E-04	3.57E-04	-1.15E-01	-5.73E-02
Photochemical oxidation	kg C2H4 eq	1.55E-02	2.72E-04	5.58E-04	3.00E-05	7.95E-05	-1.01E-02	-5.07E-03

Table 8 Resource Use Parameters for ALPOLIC™ NC / ALPOLIC™ A1 scenario 1 and Scenario 2

Parameter		Unit	Upstream Process	Core Process	Downstream Process			Scenario 1 Other Environmental benefits	Scenario 2 Other Environmental ' benefits
			A1	A2-A3	A4	C1-C2	C3-C4	D	D
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	7.25E+01	3.55E-01	6.96E-01	3.74E-02	9.06E-03	-3.40E+01	-1.70E+01
	Used as raw materials	MJ, net calorific value	1.54E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	8.79E+01	3.55E-01	6.96E-01	3.74E-02	9.06E-03	-3.40E+01	-1.70E+01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	5.30E+02	3.44E+01	5.13E+01	3.56E+00	1.94E+00	-2.92E+02	-1.46E+02
	Used as raw materials	MJ, net calorific value	4.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	5.35E+02	3.44E+01	5.13E+01	3.56E+00	1.94E+00	-2.92E+02	-1.46E+02
Secondary material resources		Kg	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m3	1.37E+00	1.30E-01	7.99E-01	3.08E-02	1.48E-02	-2.98E+01	-1.49E+01

Table 9 represents waste flows for ALPOLIC™ NC / ALPOLIC™ A1 Scenario 1 and Scenario 2.

Table 9 Waste flows for ALPOLIC™ NC / ALPOLIC™ A1 scenario 1 and scenario 2

Parameters	Unit	Upstream Process	Core Process	Downstream Process			Scenario 1 Other Environ mental benefits	Scenario 2 Other Environ mental benefits
		A1	A2-A3	A4	C1-C2	C3-C4	D	D
Radioactive Waste	Kg	8.48E-04	6.93E-05	3.63E-05	7.17E-06	2.52E-07	-2.81E-06	-1.40E-06
Hazardous Waste	Kg	1.29E-03	5.88E-05	4.52E-05	5.23E-06	1.01E-06	2.13E-03	1.06E-03
Non-Hazardous Waste	Kg	1.13E+01	6.03E-01	4.66E-01	8.68E-02	1.04E+01	-6.46E+00	-3.23E+00

Table 10 represents output flows for ALPOLIC™ NC / ALPOLIC™ A1 Scenario 1 and scenario 2.

Table 10 Output flows for ALPOLIC™ NC / ALPOLIC™ A1 scenario 1 and scenario 2

Parameters	Unit	Upstream processes	Core processes	Downstream processes			Scenario 1 Other Environ mental benefits	Scenario 2 Other Environ mental benefits
		A1	A2-A3	A4	C1-C2	C3-C4	D	D
Reuse	kg	0	0	0	0	0	0	0
Materials for recycling	kg	3.17	0	0	0	0	0	0
Energy recovered	MJ	0	0	0	0	0	0	0
Energy exported	MJ	0	0	0	0	0	0	0
Energy exported, thermal	MJ	0	0	0	0	0	0	0

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