HIGH PERFORMANCE POLYMERS

EPD®

ENVIRONMENTAL PRODUCT DECLARATION

RADILON® S (PA6)
RADILON® A (PA6.6)

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Document compliant with ISO 14025.

RADICI GROUP

THE GROUP

Radici Novacips SpA, headquarters of the High Performance Polymers Business Area of RadiciGroup – a leading Italian multinational in the chemicals, plastics and synthetic fibres industries – is one of the world's finest **producers of polyamide and polyester engineering plastics**, with production and sales sites located in Europe, Asia, North America and South America.

With seven production plants, strategically located in Italy, Germany, China, Brazil, the USA and Mexico, RadiciGroup High Performance Polymers offers processing, quality control, research and technical development support. A network of sales units – with a strong presence in Italy, Germany, France, Spain, the UK, China, India, the USA, Brazil and Mexico – makes Radici Novacips a truly global organization capable of meeting the needs of its customers in the worldwide plastics industry on a timely basis.

RadiciGroup High Performance Polymers is a vertically integrated compounder, whose strengths range from the independent management of its whole production chain, including the vertical **integration** of raw materials, to the **flexibility** and **support given to its customers**.

RadiciGroup High Performance Polymers is an integrated organization able to offer comprehensive service, including **manufacturing**, **quality control**, **research** and **application development support**. The latter is a vital component of Radici Novacips' and RadiciGroup High Performance Polymers' strategy. Thus, through the use of Computer Aided Engineering services, RadiciGroup High Performance Polymers can provide customers with technological support in applications development, and now, in the design of products with greater environmental sustainability.

In the area of plastic materials, RadiciGroup offers a complete range of products including: **polyamides (Radilon®, Heramid®, Radistrong® and Torzen®)**, **polyesters (Raditer®)**, **polyacetals (Heraform®) and thermoplastic elastomers (Heraflex®)**.

Radici Novacips products, and RadiciGroup High Performance Polymers products in general, are widely used in the **automotive** and **electrical/electronics sectors** and in **technical/industrial applications**.

PRODUCTION SITES

RADICIGROUP HIGH PERFORMANCE POLYMERS has production sites in:

- **ITALY** RADICI NOVACIPS SpA Villa d'Ogna and RADICI NOVACIPS SpA Chignolo d'Isola
- **GERMANY** RADICI PLASTICS GmbH
- **CHINA** RADICI PLASTICS (Suzhou) Co., Ltd.
- **BRAZIL** RADICI PLASTICS Ltda.
- **The USA** RADICI PLASTICS USA Inc.
- **MEXICO** RADICI PLASTICS MEXICO S. de R.L. de C.V.

*The products covered in this **EPD** are manufactured at the **Villa d'Ogna** plant.*

SOCIAL AND ENVIRONMENTAL RESPONSIBILITY

In 2003 RadiciGroup and Radici Novacips started their journey towards process and product sustainability by joining the **voluntary Responsible Care® initiative**. In 2004 RadiciGroup published its first Social Report prepared along the guidelines of the Study Group for Social Reporting Standards (Gruppo di Studio del Bilancio Sociale, or GBS).
In 2010 RadiciGroup sustainability efforts accelerated with the launch of RadiciGroup for Sustainability, a project encompassing initiatives targeted at the development and **continuous improvement of Group products** based on the Life Cycle Assessment method, as well as the improvement of Group information quality with the adoption of the Global Reporting Initiative (GRI) framework for the preparation of the RadiciGroup Sustainability Report. The first Report was published in 2011 and received external assurance at the **GRI B+ application level**.
As Radici Novacips is equipped with strong systems for Environmental Management (ISO 14001- certified since 2006), Safety Management (ISO 45001, OHSAS 18001 certified since 2010) and Quality Management (ISO 9001:2001-certified since 1993, as well as IATF 16949-certified) and is supported by strong Research and Development and Application Marketing departments with a high rate of product innovation, the company has decided to charge its best staff with the task of formulating products with the highest sustainability and designing ways to measure the environmental impact of the products. Methods, people, training, research and transparent communication: these are the cornerstones of the Radici Novacips sustainability project.

Radici Novacips' decision to use LCAs to develop and prepare **Product Environmental Declarations for its products**, including the most innovative ones, reflects its commitment to support collaborative endeavours with its customers in order to develop a market in line with the most recent international trends, all the while keeping an eye on the **sustainability of its economic development** through recyclable products, the measurement of environmental impact. Thanks to the vertical integration with the other business areas of RadiciGroup that supply polymer, which have also activated the monitoring of environmental impacts with the LCA methodology, primary data provided by Radici Chimica for Polyamide 66 have been used for this Declaration.
The same vertical integration allows, given the physical proximity to the supplier plants, to drastically reduce incoming transport, which partly takes place pneumatically.
Moreover, Radici Novacips runs its production plant in Villa d'Ogna exclusively with hydroelectric power, which is locally produced by Geogreen, a Radici company founded to supply **"zero kilometre"** renewable energy to Group companies.
Because of the main characteristic of polyamides (they are thermoplastic polymers) and their chemical nature (they have been formed by multi-condensation reactions), the materials produced by Radici Novacips can be recycled, reused and even regenerated (EPD S-P-00707 Heramid® A - PA66). Due to the chemical reactivity of polyamides, even materials that have previously been subjected to high temperature processing or have reached the end of their useful life can be converted – through mechanical post-processing such as fragmentation or grinding EPD S-P-00708 Polyamide Scrap Recovery Service)into second-generation raw materials with chemical, physical and mechanical performance which is, in some cases, equal to that of first generation raw materials.

**ATTESTATO DI CONFORMITA' IMPRONTA AMBIENTALE DI PRODOTTO PRODUCT ENVIRONMENTAL FOOTPRINT (PEF) Raccomandazione della Commissione 2013/179/UE Allegato II PEF001/20 emesso il 07/09/2020 da Certiquality).*

THE PRODUCT

Radilon® A is the brand name for polyamide 66, a copolymer of adipic acid and hexamethylenediamine. Nylon 66 features a high melting point, superior stiffness and good abrasion resistance, and allows for the ease of moulding thin-wall parts with very fast cycles. This EPD covers **RADILON® A RV 250**, **RADILON® A RV 300** and **RADILON® A RV 350**.

Radilon® S is the brand name for polyamide 6, a copolymer of caprolactam. Nylon 6 is easy to process; it has a lower melting point, excellent impact strength particularly on conditioned samples, and is softer than nylon 66. The second family of products covered by this EPD comprises **RADILON® S RV 250**, **RADILON® S RV 300** and **RADILON® S RV 350**.

The range of glass-fibre reinforced polyamides covered in this EPD includes materials with different glass-fibre percentages. As the reinforcement increases, certain characteristics such as stiffness and dimensional stability improve even at high temperatures.

The tables below can be used to compare different grades of glass-reinforced Radilon® S and Radilon® A (25%, 30% and 35% GF fill by weight). One can easily notice that the main differences are related to their thermal properties (melting temperature and heat deflection temperature – HDT).

The geographical scope of the EPD is Europe.

INFORMATION PERTAINING TO THE USE PHASE AND PRODUCT END OF LIFE

Polyamides make up a small percentage of the plastics produced today. The strength and dimensional stability of **Radilon® RVs** make them ideal for applications requiring a long life. Thus, unlike other plastics typically used for packaging, polyamides have not received the same attention with respect to end-of- life recycling regulations.

The existing regulations pertain to the main application sectors of this material (directives concerning the recovery of electrical and electronic equipment and automobile end of life). In collaboration with its customers, Radici Novacips is launching a pilot project aimed at recovering polyamide components.

The recovered materials, after suitable mechanical processing, may be reused in applications of value, albeit with lower requirements in terms of performance compared to the original target applications. In any case, the materials would be used in the same application sectors where the polyamide waste originated and for relatively long-use applications.

ENVIRONMENTAL PERFORMANCE ASSESSMENT

Product environmental performance was assessed using the Life Cycle Assessment (LCA) method, from the extraction of the raw materials to the distribution of the finished product. The study was conducted following ISO 14040 standards, using software SimaPro v9, and the product category rules set forth in PCR 2010:16 PLASTICS IN PRIMARY FORM, approved by the International EPD System Technical Committee.

DECLARED UNIT

The declared unit is 1 kg of compound in granular form packed in bags or octabins.

GENERAL SYSTEM BOUNDARIES

The system boundaries shown in the following figure include the pre-production phase (upstream processes) and the production phase (core processes) of the compound, from cradle to gate. The finished product distribution phase is included as part of the post-production phase (downstream processes).

The system boundaries are defined following the rules set forth in the relevant PCR document.

The pre-production phase (upstream processes) comprises:

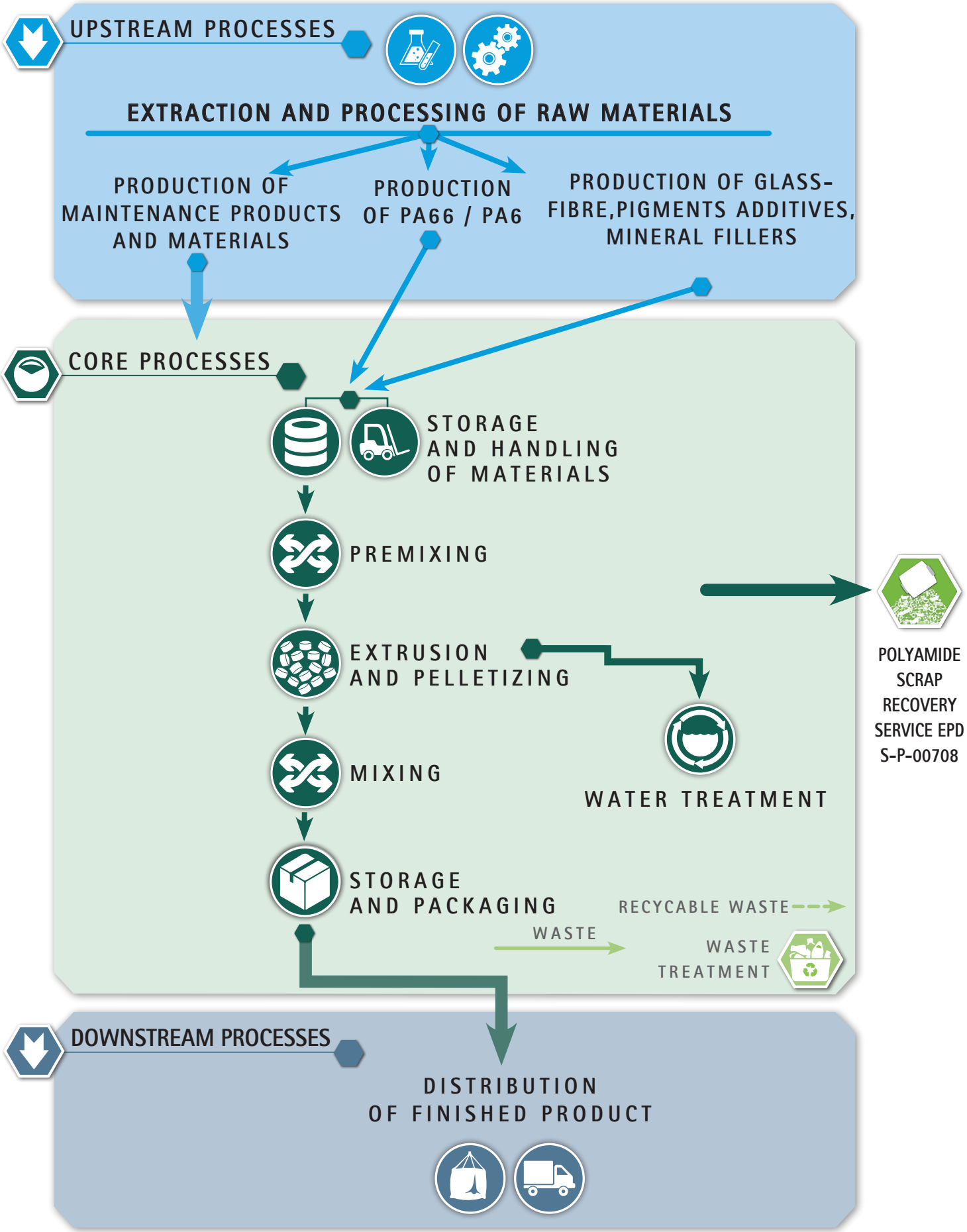
- Extraction and processing of raw materials
- Polymer production
- Production of additives and other input materials (glass fibre, mineral fills, pigments, etc.)
- Maintenance products and materials production

The production phase (core processes) comprises:

- Transportation of all input materials to the production plant for the production phase
- Storage and handling of materials
- Premixing of compound ingredients
- Extrusion and pelletizing
- Mixing
- Storage and packaging
- Production of primary and secondary packaging for finished products
- Treatment of process waters
- Transportation and treatment of waste generated in the various phases

Post-production processes (Downstream Processes) comprise finished product distribution to the main European and international destinations. The product use, product end-of-life and packaging phases have been excluded. Process water treatment and production waste treatment have been included within the system boundaries.

FIG. 2.1 SYSTEM BOUNDARIES



CUT-OFF RULES

In compliance with the provisions of the relevant PCR, 99% of the input flows were considered.

DATA QUALITY

The data quality rules followed for this EPD are those defined in the relevant PCR document. In accordance with said rules, use was made of both specific data gathered directly from the production sites during the year 2019 and generic data extracted from the **Ecoinvent 3.5 and Industry Data 2.0**.

PRODUCT ENVIRONMENTAL PROFILES

Below are reported the product environmental profiles of the following families of products:

- RADILON® A 25% glass-fibre
- RADILON® A 30 % glass-fibre
- RADILON® A 35% glass-fibre
- RADILON® S 25% glass-fibre
- RADILON® S 30% glass-fibre
- RADILON® S 35% glass-fibre

The data reported are for 1 kg of compound and are broken down into: pre-production (upstream processes), production (core processes) and post-production (downstream processes).

Composition of the Product

RADILON® A
Polyamide 66 glass fiber reinforced 25-35%
Base used:
Polyamide 66
Glass fibre reinforce: 25-35%
Additives and master: 1-5%

The product is packaged in bags or octabins and distributed on wooden pallets.

RADILON® S
Polyamide 6 glass fiber reinforced 25-35%
Base used:
Polyamide 66
Glass fibre reinforce: 25-35%
Additives and master: 1-5%

The product is packaged in bags or octabins and distributed on wooden pallets.

ENVIRONMENTAL PROFILE
RADILON® A RV 250

RADILON® A - PA66		
	NORM	**25% GF**
Trade Name		**RADILON® A RV250 (*)**
ISO code	**ISO 1043**	**PA66 GF25** **PA66 -T GF25**
IUPAC name		Polyhexamethylene adipamide
CAS number		32131-17-2
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	Polyamide-66 based compounds, reinforced with 25% Glass Fiber for improved strength and stiffness.	
Density	ISO 1183	1300 ÷ 1320 kg/m3
MFR	ISO 1133	40 ÷ 50 g/10'
Tensile strength at break	ISO 527	150 ÷ 170 MPa
Melting T	ISO 11357	260°C
HDT @ 1.8 MPa	ISO 75f	230 ÷ 245 °C
Charpy Impact Notched	ISO 179: 2010	9.5 ÷ 12.5 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) *Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.*

(**) *MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.*

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	5,31E+00	5,10E+00	9,16E-02	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	3,44E-03	3,13E-03	2,79E-04	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	2,50E-03	2,34E-03	1,35E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**5,32E+00**	**5,11E+00**	**9,20E-02**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,55E-02	1,44E-02	6,69E-04	4,08E-04
Eutrophication		kg PO_4--- eq	4,91E-03	4,68E-03	1,49E-04	8,55E-05
Photochemical oxidation		kg NMVOC	1,35E-02	1,25E-02	6,29E-04	4,60E-04
Abiotic depletion, elements		kg Sb eq	7,73E-06	7,18E-06	2,17E-07	3,42E-07
Abiotic depletion, fossil fuels		MJ	9,65E+01	9,35E+01	1,29E+00	1,72E+00
Water scarcity		m^3 eq	1,47E+01	1,43E+01	4,37E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	8,60E+01	8,26E+01	1,47E+00	1,86E+00
	Used as raw material	MJ	2,55E+01	2,55E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**1,11E+02**	**1,08E+02**	**1,47E+00**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	4,28E+00	1,68E+00	2,59E+00	1,84E-02
	Used as raw material	MJ	1,30E+00	4,64E-01	8,33E-01	5,98E-03
	TOTAL	**MJ**	**5,58E+00**	**2,14E+00**	**3,42E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	3,41E-01	3,30E-01	1,03E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	2,85E-01	1,61E-01	4,19E-02	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	1,13E-04	9,36E-05	7,43E-06	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

ENVIRONMENTAL PROFILE
RADILON® A RV 300

RADILON® A - PA66		
	NORM	**30% GF**
Trade Name		**RADILON® A RV300 (*)**
ISO code	**ISO 1043**	**PA66 GF30** **PA66 -T GF30**
IUPAC name		Polyhexamethylene adipamide
CAS number		32131-17-2
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	Polyamide-66 based compounds, reinforced with 30% Glass Fiber for improved strength and stiffness.	
Density	ISO 1183	1340 ÷ 1360 kg/m3
MFR	ISO 1133	30 ÷ 40 g/10'
Tensile strength at break	ISO 527	165 ÷ 195 MPa
Melting T	ISO 11357	260°C
HDT @ 1.8 MPa	ISO 75f	235 ÷ 250 °C
Charpy Impact Notched	ISO 179: 2010	10 ÷ 15 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.

(**) MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	5,06E+00	4,85E+00	9,91E-02	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	3,79E-03	3,48E-03	2,82E-04	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	2,71E-03	2,54E-03	1,37E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**5,07E+00**	**4,86E+00**	**9,95E-02**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,58E-02	1,46E-02	7,41E-04	4,08E-04
Eutrophication		kg PO4--- eq	4,93E-03	4,68E-03	1,57E-04	8,55E-05
Photochemical oxidation		kg NMVOC	1,35E-02	1,24E-02	6,84E-04	4,60E-04
Abiotic depletion, elements		kg Sb eq	8,61E-06	8,04E-06	2,30E-07	3,42E-07
Abiotic depletion, fossil fuels		MJ	9,35E+01	9,04E+01	1,40E+00	1,72E+00
Water scarcity		m^3 eq	1,46E+01	1,42E+01	4,37E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	8,44E+01	8,10E+01	1,59E+00	1,86E+00
	Used as raw material	MJ	2,33E+01	2,33E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**1,08E+02**	**1,04E+02**	**1,59E+00**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	4,53E+00	1,85E+00	2,67E+00	1,84E-02
	Used as raw material	MJ	1,36E+00	5,17E-01	8,33E-01	5,98E-03
	TOTAL	**MJ**	**5,89E+00**	**2,36E+00**	**3,50E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	3,38E-01	3,27E-01	1,04E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	3,08E-01	1,80E-01	4,52E-02	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	1,24E-04	1,04E-04	8,10E-06	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

ENVIRONMENTAL PROFILE
RADILON® A RV 350

RADILON® A - PA66		
	NORM	**35% GF**
Trade Name		**RADILON® A RV350 (*)**
ISO code	**ISO 1043**	**PA66 GF35** **PA66 -T GF35**
IUPAC name		Polyhexamethylene adipamide
CAS number		32131-17-2
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	Polyamide-66 based compounds, reinforced with 35% Glass Fiber for improved strength and stiffness.	
Density	ISO 1183	1390 ÷ 1420 kg/m3
MFR	ISO 1133	15 ÷ 25 g/10'
Tensile strength at break	ISO 527	170 ÷ 205 MPa
Melting T	ISO 11357	260°C
HDT @ 1.8 MPa	ISO 75f	235 ÷ 250 °C
Charpy Impact Notched	ISO 179: 2010	11 ÷ 17 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.

(**) MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	4,94E+00	3,99E+00	8,39E-01	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	3,69E-03	1,77E-03	1,88E-03	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	2,48E-03	1,68E-03	7,68E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**4,94E+00**	**3,99E+00**	**8,41E-01**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,57E-02	9,70E-03	5,64E-03	4,08E-04
Eutrophication		kg PO4--- eq	4,89E-03	3,19E-03	1,61E-03	8,55E-05
Photochemical oxidation		kg NMVOC	1,33E-02	9,07E-03	3,81E-03	4,60E-04
Abiotic depletion, elements		kg Sb eq	8,63E-06	3,48E-06	4,81E-06	3,42E-07
Abiotic depletion, fossil fuels		MJ	8,84E+01	7,60E+01	1,07E+01	1,72E+00
Water scarcity		m^3 eq	1,31E+01	1,25E+01	6,00E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	8,07E+01	6,43E+01	1,45E+01	1,86E+00
	Used as raw material	MJ	2,21E+01	2,21E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**1,03E+02**	**8,64E+01**	**1,45E+01**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	4,54E+00	8,93E-01	3,62E+00	1,84E-02
	Used as raw material	MJ	1,35E+00	2,49E-01	1,09E+00	5,98E-03
	TOTAL	**MJ**	**5,88E+00**	**1,14E+00**	**4,72E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	3,04E-01	2,85E-01	1,82E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	3,05E-01	1,13E-01	1,10E-01	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	1,21E-04	5,85E-05	5,05E-05	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

ENVIRONMENTAL PROFILE
RADILON® S RV 250

RADILON® S - PA6		
	NORM	**25% GF**
Trade Name		**RADILON® S RV250 (*)**
ISO code	**ISO 1043**	**PA6 GF25** **PA6 -T GF25**
IUPAC name		Polycaprolactam
CAS number		25038-54-4
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	Polyamide-6 based compounds, reinforced with 25% Glass Fiber for improved strength and stiffness.	
Density	ISO 1183	1300 ÷ 1320 kg/m3
MFR	ISO 1133	5 ÷ 15 g/10'
Tensile strength at break	ISO 527	150 ÷ 165 MPa
Melting T	ISO 11357	220°C
HDT @ 1.8 MPa	ISO 75f	190 ÷ 200 °C
Charpy Impact Notched	ISO 179: 2010	10 ÷ 13 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.

(**) MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	5,77E+00	5,57E+00	9,00E-02	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	1,55E-03	1,24E-03	2,80E-04	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	6,38E-04	4,69E-04	1,35E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**5,77E+00**	**5,57E+00**	**9,04E-02**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,51E-02	1,40E-02	6,99E-04	4,08E-04
Eutrophication		kg PO4--- eq	4,76E-03	4,52E-03	1,51E-04	8,55E-05
Photochemical oxidation		kg NMVOC	1,29E-02	1,18E-02	6,47E-04	4,60E-04
Abiotic depletion, elements		kg Sb eq	5,49E-06	4,94E-06	2,08E-07	3,42E-07
Abiotic depletion, fossil fuels		MJ	8,59E+01	8,29E+01	1,26E+00	1,72E+00
Water scarcity		m^3 eq	8,15E+00	7,71E+00	4,37E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	7,56E+01	7,23E+01	1,44E+00	1,86E+00
	Used as raw material	MJ	2,82E+01	2,82E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**1,04E+02**	**1,00E+02**	**1,44E+00**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	3,73E+00	9,40E-01	2,77E+00	1,84E-02
	Used as raw material	MJ	1,05E+00	2,07E-01	8,33E-01	5,98E-03
	TOTAL	**MJ**	**4,78E+00**	**1,15E+00**	**3,61E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	1,93E-01	1,82E-01	1,03E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	1,91E-01	6,83E-02	4,00E-02	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	5,32E-05	3,41E-05	7,30E-06	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

ENVIRONMENTAL PROFILE
RADILON® S RV 300

RADILON® S - PA6		
	NORM	**30% GF**
Trade Name		**RADILON® S RV300 (*)**
ISO code	**ISO 1043**	**PA6 GF30** **PA6 -T GF30**
IUPAC name		Polycaprolactam
CAS number		25038-54-4
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	**Polyamide-66 based compounds, reinforced with 30% Glass Fiber for improved strength and stiffness.**	
Density	ISO 1183	1340 ÷ 1360 kg/m3
MFR	ISO 1133	4 ÷ 14 g/10'
Tensile strength at break	ISO 527	155 ÷ 180 MPa
Melting T	ISO 11357	220°C
HDT @ 1.8 MPa	ISO 75f	195 ÷ 205 °C
Charpy Impact Notched	ISO 179: 2010	10 ÷ 15 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.

(**) MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	5,54E+00	5,32E+00	9,78E-02	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	1,82E-03	1,51E-03	2,82E-04	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	7,44E-04	5,74E-04	1,37E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**5,54E+00**	**5,33E+00**	**9,82E-02**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,55E-02	1,43E-02	7,75E-04	4,08E-04
Eutrophication		kg PO4--- eq	4,76E-03	4,52E-03	1,60E-04	8,55E-05
Photochemical oxidation		kg NMVOC	1,29E-02	1,17E-02	7,02E-04	4,60E-04
Abiotic depletion, elements		kg Sb eq	6,27E-06	5,71E-06	2,20E-07	3,42E-07
Abiotic depletion, fossil fuels		MJ	8,21E+01	7,90E+01	1,37E+00	1,72E+00
Water scarcity		m^3 eq	7,63E+00	7,19E+00	4,37E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	7,34E+01	7,00E+01	1,57E+00	1,86E+00
	Used as raw material	MJ	2,61E+01	2,61E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**9,95E+01**	**9,60E+01**	**1,57E+00**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	3,77E+00	1,08E+00	2,68E+00	1,84E-02
	Used as raw material	MJ	1,09E+00	2,52E-01	8,33E-01	5,98E-03
	TOTAL	**MJ**	**4,86E+00**	**1,33E+00**	**3,51E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	1,82E-01	1,71E-01	1,04E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	2,13E-01	8,77E-02	4,27E-02	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	6,15E-05	4,17E-05	7,93E-06	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

ENVIRONMENTAL PROFILE
RADILON® S RV 350

RADILON® S - PA6		
	NORM	**35% GF**
Trade Name		**RADILON® S RV350 (*)**
ISO code	**ISO 1043**	**PA6 GF35** **PA6 -T GF35**
IUPAC name		Polycaprolactam
CAS number		25038-54-4
GHS classification		N.a. (not dangerous)

TECHNICAL DESCRIPTION	**Polyamide-6 based compounds, reinforced with 35% Glass Fiber for improved strength and stiffness.**	
Density	ISO 1183	1390 ÷ 1410 kg/m3
MFR	ISO 1133	2 ÷ 12 g/10'
Tensile strength at break	ISO 527	165 ÷ 195 MPa
Melting T	ISO 11357	220°C
HDT @ 1.8 MPa	ISO 75f	200 ÷ 205 °C
Charpy Impact Notched	ISO 179: 2010	11 ÷ 16 kJ/m^2
Flame behaviour	UL 94	HB @ 0.8 mm

(*) Follows letters and numbers designating the specific grade with regards to particular functions s.a. thermal stabilization, lubrication, color.

(**) MFR PA66 275°C@5Kg - MFR PA6 250°C@5Kg.

Environmental impacts

IMPACT CATEGORY		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Global warming (GWP100a)	Global warming-Fossil	kg CO_2 eq	5,29E+00	5,07E+00	1,03E-01	1,14E-01
	Global Warming-Biogenic	kg CO_2 eq	2,04E-03	1,73E-03	2,84E-04	2,95E-05
	Global Warming-Land Use	kg CO_2 eq	8,39E-04	6,66E-04	1,40E-04	3,33E-05
	TOTAL	**kg CO_2 eq**	**5,29E+00**	**5,07E+00**	**1,03E-01**	**1,14E-01**
Acidification (fate not incl.)		kg SO_2 eq	1,55E-02	1,42E-02	8,31E-04	4,08E-04
Eutrophication		kg PO4--- eq	4,73E-03	4,48E-03	1,68E-04	8,55E-05
Photochemical oxidation		kg NMVOC	1,27E-02	1,15E-02	7,51E-04	4,60E-04
Abiotic depletion, elements		kg Sb eq	6,91E-06	6,33E-06	2,33E-07	3,42E-07
Abiotic depletion, fossil fuels		MJ	7,81E+01	7,50E+01	1,45E+00	1,72E+00
Water scarcity		m^3 eq	7,10E+00	6,65E+00	4,38E-01	8,85E-03

Use of resources and other indicators

PARAMETER		UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Primary Energy Resources - Non Renewable	Used as energy carrier	MJ	7,09E+01	6,74E+01	1,64E+00	1,86E+00
	Used as raw material	MJ	2,40E+01	2,40E+01	0,00E+00	0,00E+00
	TOTAL	**MJ**	**9,49E+01**	**9,14E+01**	**1,64E+00**	**1,86E+00**
Primary Energy Resources - Renewable	Used as energy carrier	MJ	3,97E+00	1,19E+00	2,76E+00	1,84E-02
	Used as raw material	MJ	1,12E+00	2,83E-01	8,33E-01	5,98E-03
	TOTAL	**MJ**	**5,09E+00**	**1,47E+00**	**3,59E+00**	**2,44E-02**
Secondary Material		kg	0	0	0	0
Renewable secondary fuels		MJ	0	0	0	0
Non-renewable secondary fuels		MJ	0	0	0	0
Water consumption		m^3	1,70E-01	1,59E-01	1,04E-02	3,19E-04
Agricultural land use for renewable material production*		m^2	0	0	0	0

*Note: nor secondary materials and energy nor biogenic raw materials are used.

Waste production

WASTE	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Not-hazardous waste disposed	kg	2,24E-01	9,57E-02	4,58E-02	8,24E-02
Hazardous waste disposed	kg	8,77E-03	0,00E+00	8,77E-03	0,00E+00
Radioactive waste*	kg	6,87E-05	4,83E-05	8,58E-06	1,19E-05

** The item reported is attributable EXCLUSIVELY to the share of waste allocated to the nuclear part of national electricity energy mix.*

Output flows

PARAMETER	UNIT	TOTAL	UPSTREAM	CORE	DOWNSTREAM
Components for reuse	kg	0	0	0	0
Materials for recycling	kg	2,92E-02	0,00E+00	2,92E-02	0,00E+00
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

DIFFERENCES COMPARED TO THE PREVIOUS VERSION

All primary data used for the Declaration refer to the year 2019. The data referring to Polyamide 66 are primary data, processed by Radici Chimica SpA and subjected to third party verification The document is also updated to the latest version of the General Program Instruction 3.01 and to the PCR version 3.01, thus also updating the types of indicators.

ADDITIONAL INFORMATION

CONTACTS

RADICI NOVACIPS SpA
REGISTERED OFFICE
AND PRODUCTION UNIT:
Via Bedeschi, 20
IT - 24040 CHIGNOLO D'ISOLA (BG)
Tel. +39 035 4991311
Fax +39 035 994386

info.plastics@radicigroup.com
www.radicigroup.com/plastics

RADICI NOVACIPS SpA
PRODUCTION UNIT:
Via Provinciale, 1331
IT - 24020 VILLA D'OGNA (BG)
Tel. +39 0346 22453
Fax +39 0346 23730

TECHNICAL SUPPORT:

Quota Sette S.r.l. – Thiene (VI), Italy
For further information on this EPD®, please contact:
susanna.caprotti@radicigroup.com

PCR review conducted by:
The International EPD® System Technical Committee
Chair: Paola Borla
Contact at info@environdec.com

PCR Moderator(s):
Maurizio Fieschi, Paolo Simon Ostan.

Independent verification of the declaration and data, according to ISO 14025: 2006:

☐ **External** ■ **EPD Process Certification**

Third Party Verifier:
CERTIQUALITY S.r.l. - Istituto di Certificazione della qualità

Accredited by:
ACCREDIA

Accreditation No.:
003H

Programme:
The International EPD® System

EPD International AB
Box 210 60
SE-100 31 Stockholm, Sweden
www.environdec.com
Info@environdec.com

EPDs within this product category that come from different programmes may not be comparable.

Radici Novacips SpA has the sole ownership, liability and responsibility of the EPD®

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