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3form® Varia Ecoresin® PETG panels

An award-winning 3form product, Varia Ecoresin® has the added benefit of being made from a specially-formulated copolyester resin that combines performance with environmental responsibility.

Varia Ecoresin incorporates 40% pre-consumer recycled content without compromising aesthetics or overall physical properties, is compatible with one of the largest post-consumer recycle streams, and is GREENGUARD® Indoor Air Quality Certified.

Environmental Information

Declared Unit 1 meter squared
Mass per Declared Unit 12.7 kg

Quantities per Declared Unit

Life Cycle Impact Assessment (CML 2001)

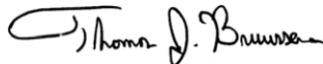
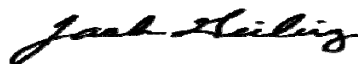

	Unit	Quantity
Global Warming	[kg CO ₂ -eq]	48.8
Acidification	[kg SO ₂ -eq]	0.213
Eutrophication	[kg Phosphate-eq]	0.0156
Ozone Depletion	[kg R11-eq]	6.00E-05
Photochemical Ozone Creation	[kg Ethene-eq]	0.0243
Abiotic Depletion, Elements	[kg Sb-eq]	1.47E-05
Abiotic Depletion, Fossil	[MJ]	863

Life Cycle Inventory Indicators

Secondary Materials	[kg]	4.98
Secondary Fuels	[MJ]	0
Freshwater Use	[m ³]	0.227
Non-renewable Energy	[MJ]	903
Renewable Energy	[MJ]	67.7
Hazardous Waste	[kg]	1.58E-07
Non-hazardous Waste	[kg]	0.196
Radioactive Waste	[kg]	0.0140



**Certified
Environmental
Product Declaration**
www.nsf.org

EPD Information			
Program Operator		NSF International	
Declaration Holder		3form	
Product Varia Ecoresin	Date of Issue 10/29/2014	Period of Validity 3 years	Declaration Number EPD10040
This EPD was independently verified by NSF International in accordance with ISO 14025:		 Tom Bruursema Bruursema@nsf.org	
<input type="checkbox"/> Internal <input checked="" type="checkbox"/> External			
This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR:		 Jack Geibig jgeibig@ecoform.com	
LCA Information			
Basis LCA		Life Cycle Analysis of Building Panels 9/19/2014	
 PE INTERNATIONAL SUSTAINABILITY PERFORMANCE		PE International Takuma Ono T.Ono@pe-international.com	
This life cycle assessment was critically reviewed in accordance with ISO 14044 by:		Jack Geibig EcoForm jgeibig@ecoform.com	
PCR Information			
Program Operator		The International EPD System	
Reference PCR		Construction Products and CPC 54 Construction Services	
Date of Issue		March 15, 2103	
PCR review was conducted by:		Martin Erlandsson, IVL Swedish Environmental Research Institute martin.erlandsson@ivl.se	

Environmental Programs and Policies

Sustainability Statement

We believe that we must be responsible for our products through their entire life-cycle, with a diligent focus on the balance of people, planet, and profit.

Sustainability Platform

Zero Waste 1

3form's sustainability initiatives are collectively known as Path to Zero, and include five main directives designed to minimize our footprint, while we create awardwinning building materials and architectural hardware solutions for the Architecture + Design industry:

Furthering 3form's successful zero-waste-to-landfill initiative, we have begun a path to become a Zero Waste manufacturing facility. This will be done through aggressive recycling, reduced waste creation, and innovative manufacturing.

Carbon Neutrality 2

3form is committed to energy and fuel efficiency measures, and the purchase of renewable energy credits (RECs) and verified emission reductions (VERs) to offset those emissions we do cause through our operations.

Responsible Manufacturing 3

Social responsibility as well as environmental awareness have been integrated into 3form's manufacturing ethos.

- Globally focused social equity is built through 3form's innovative Full Circle program, in which we direct-source artisan materials from developing regions in a manner that provides improved economic opportunity and health and education benefits, while also helping to protect community and cultural integrity.
- Local social equity is also enhanced through corporate philanthropy, employee benefit programs, community engagement, and volunteerism.
- Focused Life Cycle Assessments on 3form products, as well as awareness of material inputs, resource usage, and continuing improvements in manufacturing ensures 3form products meet stringent quality standards while making the least impact footprint from cradle to gate.
- Incorporation of recycled materials is a hallmark of 3form, where product development teams work to create innovative products that use less virgin materials or non-renewable resources. Varia Ecoresin®, a flagship 3form product, contains an average of 40% preconsumer content, while other 3form products contain up to 100% recycled content.
- Reclaim and Reform programs have been established to help ensure responsible management of 3form products, after their service life is over. Through these waste-reduction initiatives, 3form will take back used panels, and repurpose imperfect panels to give them another life and prevent them from entering the waste stream.

Materials Transparency 4

Many 3form materials have independent certifications attesting to recycled content, indoor air quality friendly qualities, and other beneficial attributes. With a growing focus on healthy buildings, we have been investing in creating Environmental Product Declarations (EPDs), and Health Product Declarations (HPDs), to offer an exceptional level of transparency and assurance to our customers.

Employee Engagement 5

This is 3form's sustainability in action by our team. On-going trainings, in-house audits, sustainability-focused clinics and activities, commute reduction rewards and consistent sustainability feedback help ensure that employees contribute to our goals, as well as have a personal understanding of their importance. We believe that sustainability should extend beyond 3form's workplace, and encourage employees to lessen their individual footprints in their daily lives.

Sustainability Programs and Initiatives



US Green Building Council

As a long-time member of the USGBC, 3form recognizes the importance of the LEED rating system to sustainable design. 3form materials help achieve LEED credits across a number of categories and were selected for use in the USGBC's headquarters in Washington DC. We are committed to promoting sustainable building practices and education through our national and local Chapter memberships.



The Climate Registry

3form achieved Climate Registered™ status by successfully measuring our carbon footprint according to The Climate Registry's best-in-class program, then having it third party verified and voluntarily reporting the data on The Climate Registry's website.



ISO 14001:2004

Environmental management standards to help organizations minimize how their operations negatively impact the environment; comply with applicable laws, regulations, and other environmentally-oriented requirements; and make continual improvements. 3form's facilities are certified ISO 14001.



Scientific Certification Systems

Offers a variety of certifications, including one for the use of recycled materials. All claims are certified in accordance with U.S. FTC Guides for the Use of Environmental Marketing Claims and ISO 14021 standards. Chroma is SCS certified for 38% recycled content.



GREENGUARD

Third party certification gives assurance that products and building materials designed for use indoors meet strict chemical emissions limits. Includes performance-based standards to define products and processes with low chemical and particle emissions.



EPA Green Power Partnership

A voluntary program of the U.S. EPA that recognizes companies for their procurement of green power. 3form is a member of the Green Power Leadership Club.



Salt Lake City e2 Business

The Salt Lake City environmentally and economically sustainable (e2) business program is designed to recognize and support the Salt Lake City business community and economy. 3form is an e2 Business.



Emissions Offset

Through 3Degrees, 3form supports Green-e Climate certified renewable energy projects. These projects avoid greenhouse gas emissions and help us offset the emissions we generate in our operations and business travel.

Comparability

This EPD meets the requirements for comparability with products evaluated in accordance to the guiding PCR document. EPDs from different programs may not be comparable.



Specification of the Product

General, mechanical, optical, and thermal specifications for Varia Ecoresin panels are summarized in Table 1.

		TYPICAL VALUE 0.236" (6 MM)	
PROPERTY*	ASTM METHOD	SI	U.S.
GENERAL			
Declared Unit			1 m ²
Panel Mass			12.7 kg
Panel Gauge			1.00 cm
Panel Volume			0.0100 m ³
Density	D 1505	1,270 kg/m ³	79 lb/ft ³
Water Absorption	D 570 23° C (73° F), 24h immersion	0.10%	0.10%
MECHANICAL			
Tensile Stress @ Yield	D 638	53 MPa	7,700 psi
Tensile Stress @ Break	D 638	26 MPa	3,800 psi
Elongation @ Yield	D 638	5.00%	5.00%
Elongation @ Break	D 638	40%	40%
Tensile Modulus	D 638	—	—
Flexural Modulus	D 790	2,000 MPa	290,000 psi
Flexural Strength	D 790	83 MPa	12,000 psi
Shear Strength	D 732	62 MPa	9,000 psi
Shear Modulus	—	—	—
Rockwell Hardness	D 785	117	117
Safety Glazing	ANSI 97.1	PASS	
Izod Impact Strength, notched	D 256 @ 73°F	62 J/m	1.2 ft·lbf/in.
	D 256 @ 32°F	—	—
	D 256 @ -22°F	—	—
Impact Strength, Unnotched	D 4812 @ 73°F	NB**	NB**
	D 4812 @ 32°F	—	—
	D 4812 @ -22°F	—	—
Impact Resistance— Puncture, Energy @ Max. Load	D 3763 @ 73°F	71 J	53 ft·lbf
	D 3763 @ 32°F	93 J	69 ft·lbf
	D 3763 @ 14°F	96 J	71 ft·lbf
	D 3763 @ -4°F	>100 J	>74 ft·lbf
	D 3763 @ -22°F	>100 J	>74 ft·lbf
THERMAL			
Cont. Max Use	—	65°C	150°F
Temperature -Varia			
Cont. Max Use Temperature - Dichroic/ Reflect	—	60°C	140°F
Cont. Max Use	—	60°C	140°F
Temperature - Wood			
Heat Deflection Temp	D 648 @ 264psi	73°C	164°F
Vicat Softening Temperature	D 1525 @ 1 kg	—	—
Forming Temperature	—	—	—
Thermal Conductivity	ASTM D 5930	0.205 W/ m·K	0.118 Btu/hr·ft ² ·°F
Coefficient of Thermal Expansion	ASTM D 696	7x10 ⁻⁵ mm/ mm/°C	4x10 ⁻⁵ in/ in/°F

Table 1: Select Mechanical and Physical Properties for 3form Varia Ecoresin

Relevant Functional Properties

3form Varia Ecoresin conforms to the 2009 International Building Code ® for light-transmitting plastics. Relevant standards are summarized in Table 2.

TEST	3FORM VARIA ECORESIN	RESULT
ASTM D 2843 Smoke Density	71.60%	PASS Less than 75
ASTM D 635 Flame Spread	Self extinguishing	PASS CC1
ASTM D 1929 Self-ignition Temperature	716°F	PASS Greater than 650°F
UL94	Flame Class - HB	PASS
UPITT Mortality Test	PASS	Not more toxic than wood
NFPA 286 1/4" thickness + below (walls only or ceilings only) 3/8" thickness + below (walls in standoff configuration or ceilings only)	Pass Pass	Class A Class A
ASTM E84 Flame Spread, 3/16" thickness Smoke generated	26 250	Class B: 26-75 <450
ASTM E84 Flame Spread, 1/4" thickness Smoke generated	65 425	Class B: 26-75 <450
ASTM E84 Flame Spread, 1/2" thickness Smoke generated	55 400	Class B: 26-75 <450
ASTM E84 Flame Spread, 3/4" thickness Smoke generated	35 450	Class B: 26-75 <450
ASTM E84 Flame Spread, 1" thickness Smoke generated	20 250	Class A: 0-25 <450

Table 2: Relevant ASTM standards applicable to Varia Ecoresin panels



Declared Unit and Reference Flow

Since this analysis follows a basic module PCR, specific functions for each product category were not defined and are not necessary under the cradle-to-gate system boundary. Therefore, all products were evaluated on a per-m² basis will be analyzed under the declared unit of 1 m² of panel product as sold by 3form.

The reference flow was determined by calculating the average Varia Ecoresin panel gauge produced in 2013, weighted by production masses. The reference flow for Varia Ecoresin panels is 12.7 kg.



Content of Material and Chemical Substances

Varia Ecoresin panels are comprised almost entirely of polyester terephthalate, glycol-modified (PETG), with an SCS certified recycled content of 40%. The total material composition is summarized in Table 3. Materials comprising a minimum of 99% the product weight is included in the declaration.

Component	Percent composition
PETG	60%
Recycled PETG	40%
Decorative leaves	<1%
Color weave (Polyester fabric)	<1%
Polyethylene film	<1%
TPU adhesive	<1%

Table 3: Primary and auxiliary material inputs by percentage composition



System Boundaries

The PCR requires, at minimum, to report environmental impacts of activities up to the factory gate, with subsequent life cycle stages optionally reported. This is considered by the PCR to be the cradle-to-gate system boundary. Life cycle stages beyond the gate (transportation to installation site, installation, maintenance, deconstruction, disposal, and recycling) are not considered in this declaration (Table 4).

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE (not relevant)							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D

Table 4: The declared EN 15804 aggregation modules (A1, A2, A3) shown in bold blue borders

In accordance with the PCR, the reference service life (RSL) is not specified.

The geographic scope of the system is in North America; thus, the geographic validity of the EPD is also North America.

Electricity consumption is entirely from the regional grid mix of Salt Lake City.



Environmental Impact Potentials

This section contains the absolute results for each product per the declared unit. The following section (interpretation) provides a visual breakdown of the relative impacts, allowing for a more intuitive understanding of where impacts occur in the product life cycle. Biogenic carbon is excluded in the global warming potential calculations. The environmental inventory and impacts are reported per EN 15804, as follows:

Environmental Impacts (CML 2001 and TRACI 2.1)

GWP	Global warming potential
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential of land and water
EP	Eutrophication potential
POCP	Formation potential of tropospheric ozone photochemical oxidants
ADPE	Abiotic depletion potential for non-fossil resources
ADPF	Abiotic depletion potential for fossil resources
POCP/SFP	Photochemical Ozone Creation Potential / Smog formation potential

Resource Use

PENRT	Total use of non-renewable primary energy resources
PENRE	Use of non renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	Use of non-renewable primary energy resources used as raw materials
PERT	Total use of renewable primary energy resources
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials;
PERM	Use of renewable primary energy resources used as raw materials
SM	Use of secondary material
SF	Use of secondary renewable fuel
FW	Use of net fresh water

Output Flows and Waste Categories

HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed

	UNIT	TOTAL	A1 - RAW MATERIAL	A2 - TRANSPORT	A3 - MANUFACTURING
CML 2001 – April 2013					
GWP	kg CO ₂ -eq.	48.8	36.5	1.67	10.6
AP	kg SO ₂ -eq.	0.213	0.194	8.71E-03	0.0111
EP	kg Phosphate-eq.	0.0156	0.0118	2.04E-03	1.77E-03
ODP	kg R11-eq.	6.00E-05	6.00E-05	1.41E-11	3.21E-10
POCP	kg Ethene-eq.	0.0243	0.0219	1.12E-03	1.26E-03
ADPe	kg Sb-eq.	1.47E-05	1.10E-05	2.13E-07	3.41E-06
ADPf	MJ	863	716	23.8	123
TRACI 2.1					
GWP	kg CO ₂ -eq.	48.84	36.53	1.67	10.64
AP	kg SO ₂ -eq.	0.208	0.184	0.0114	0.0125
EP	kg N-eq.	0.0103	7.60E-03	7.30E-04	2.01E-03
ODP	kg CFC11-eq.	8.05E-05	8.05E-05	1.49E-11	3.42E-10
SFP	kg O ₃ -eq.	2.47	1.87	0.37	0.23
Use of Resources					
SM	kg	4.98	4.98	0	0
SF	MJ	0	0	0	0
FW	m ³	0.227	0.128	1.65E-03	0.097
PENRT	MJ	903	754	24.0	126
PENRE		903	754	24.0	126
PENRM		0	0	0	0
PERT	MJ	67.7	47.4	0.149	20.1
PERE		31.8	11.5	0.149	20.1
PERM		35.9	35.9	0	0
Other Indicators Describing Waste Categories					
HWD	kg	1.58E-07	1.58E-07	0	0
NHWD	kg	0.196	0.196	0	0
RWD	kg	0.0140	0.0130	4.95E-05	9.68E-04

Table 5: CML and TRACI LCIA impacts, resource use, and waste categories for Varia Ecoresin panels, by EN 15804 life cycle modules

Figure 1 shows visually that the module A1 – Raw materials is the dominant contributor cross all CML impact categories. The A1 module includes the primary panel resin and primary packaging materials. Moreover, 3form procures panels from extruders, which are finished to specification at the Salt Lake City facility. Therefore, the extrusion process is considered an upstream burden and not included in the module A3 – Manufacturing. When the 3form supply chain is apportioned to the EN 15804 life cycle modules, only the energy, water, and wastes generated during finishing is attributed to the A3 module.

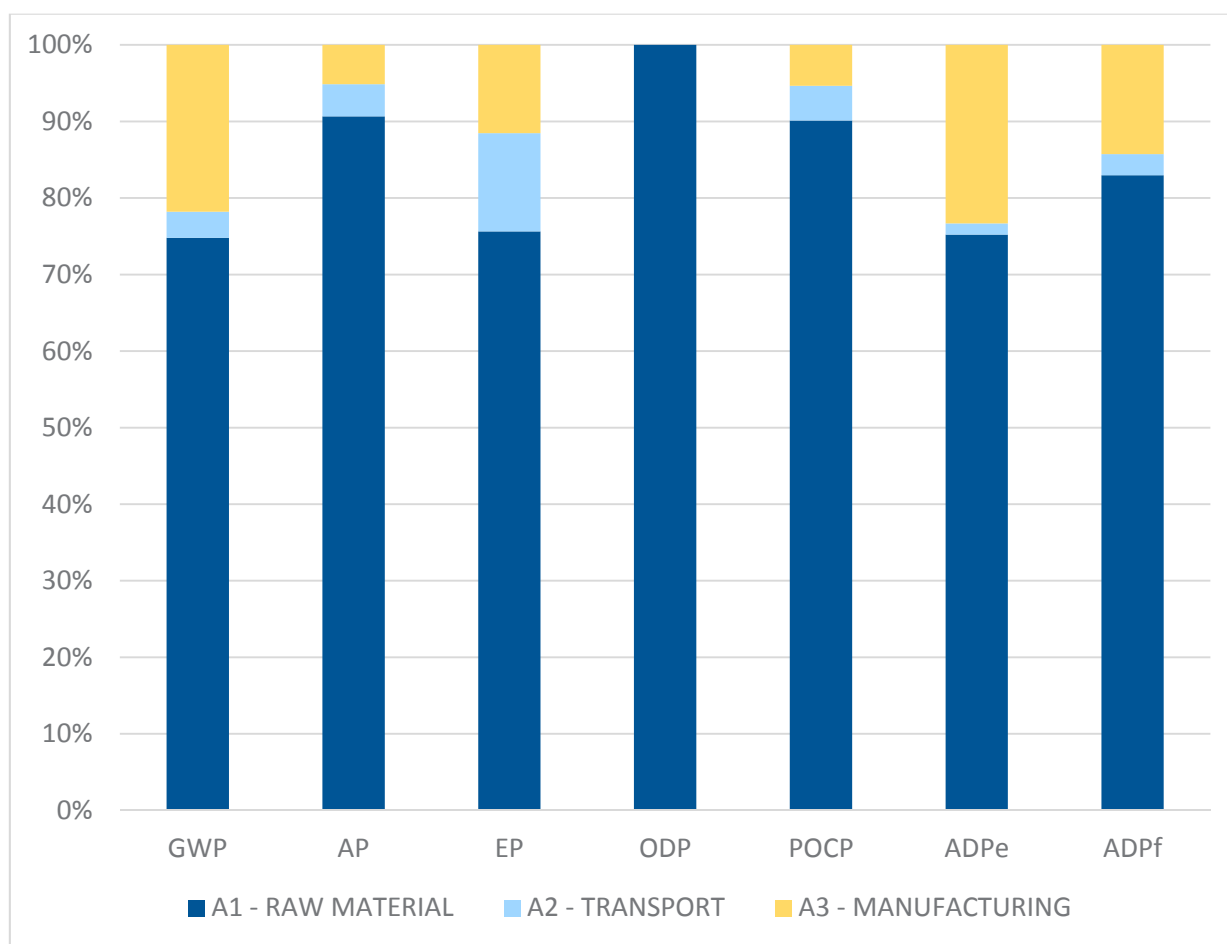


Figure 1: CML 2001 impacts by EN15804 life cycle modules

The declared impacts represent the production-weighted average Varia Ecoresin panel gauge of 1.00cm. However, 3form offers Varia Ecoresin panels ranging from 0.0794 cm to 2.54 cm. Assuming the LCIA scales linearly by panel gauge, Varia Ecoresin panels can range from 8% to 255% of the declared quantities, depending on the product gauge.

Varia Ecoresin is SCS certified to be comprised of 40% recycled content. A production-weighted average Varia Ecoresin with 40% recycled content achieves a 21% lower GWP when compared to an equivalent production-weighted average Varia Ecoresin panel with no assumed recycled content, as seen in Figure 2. Similar reductions occur in the other CML impact categories.

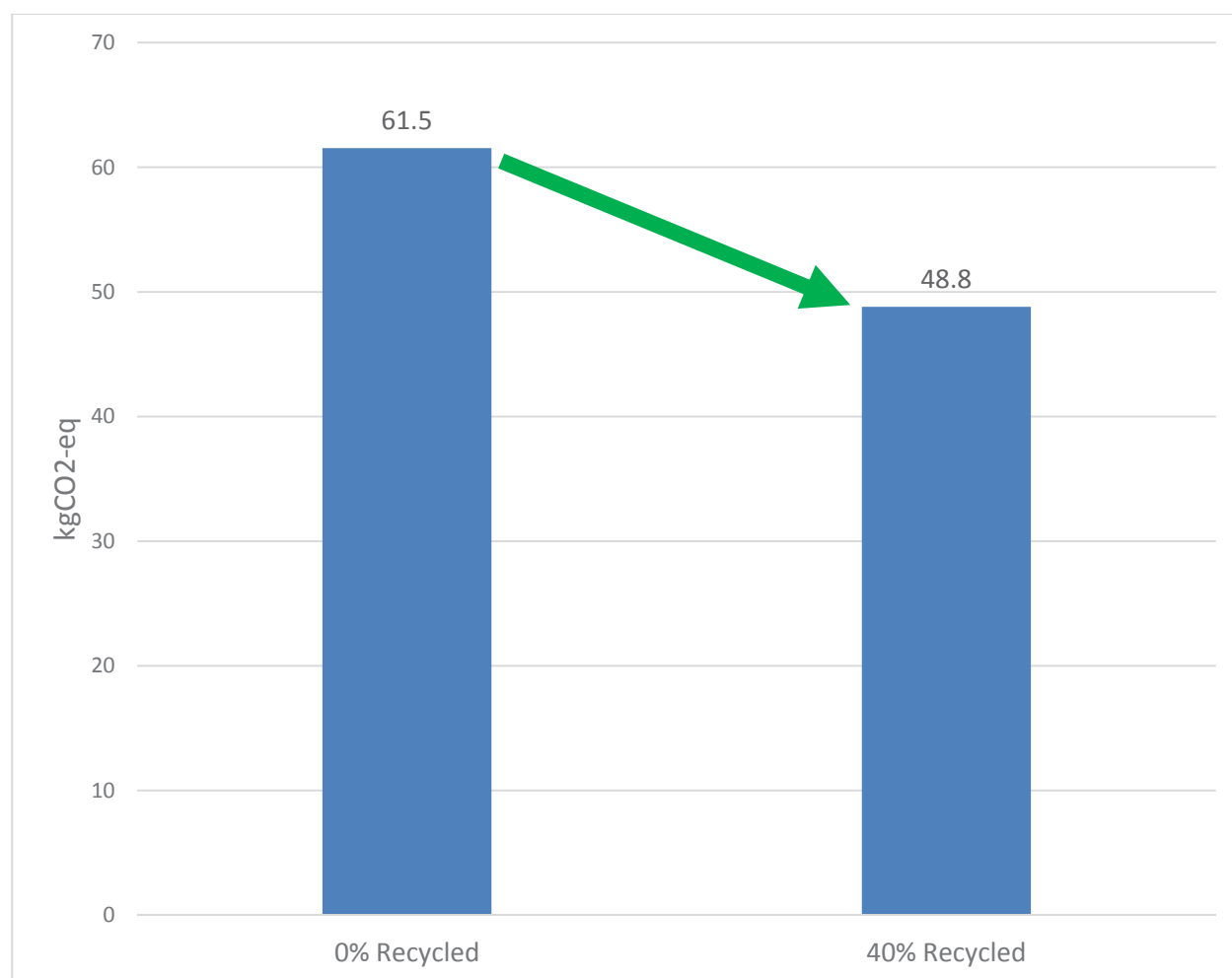


Figure 2: GWP of a 40% recycled PETG Varia Ecoresin panel compared to Varia Ecoresin panel with no recycled content (source: background LCA report, section 6.2, pg 33 - 35)

Release of Substances During the Use Stage

3form Varia Ecoresin has a GREENGUARD Gold Certification and tested in accordance with UL 2821 test method to show compliance to emission limits on UL 2818. Section 7.1 and 7.2.



Additional Environmental Information

Cleaning and Maintenance Guidance

It is possible for Varia Ecoresin to become damaged by scratching. Patent (high-gloss) is the only Varia Ecoresin finish that may be repaired requiring use of a flame polishing technique. Light scratches and scuffs on the sandstone-textured surface finish can be repaired with a plastic polish. The majority of 3form products have a surface finish that would be ruined by buffing.

3form Varia Ecoresin, like all thermoplastic resin materials, should be cleaned periodically. A regular, seasonal cleaning program will dramatically help prevent noticeable weathering and dirt build-up. 3form recommends the use of the following common cleaning products: Windex®, Formula 409®, Simple Green®, Fantastik®, Virex®, 10:1 water/bleach solution.

Rinse the sheets with lukewarm water. (Be careful not to expose edges of organic or fabric interlayers to water) Remove dust and dirt from Varia Ecoresin with a soft cloth or sponge and a solution of mild soap and/or liquid detergent in water. A 50:50 solution of isopropyl alcohol and water also works well. Rinse thoroughly with lukewarm water.

Always use a soft, damp cloth to blot dry. Rubbing with a dry cloth can scratch the material and create a static charge. Never use scrapers or squeegees on Varia Ecoresin. Also, avoid scouring compounds, gasoline, benzene, acetone, carbon tetrachloride, certain deicing fluids, lacquer thinner, or other strong solvents.

Disposal, Recycling, and Reuse

This product is not regarded as hazardous waste. Dispose in accordance with local regulations. 3form recommends panels be recycled or placed into other suitable uses whenever possible.

As part of sustainability commitments, 3form takes responsibility for its products over their entire life cycle, when possible. 3form Reclaim program reuses and recycles materials removed from installations or from full-sized panels damaged in production. Pieces available through Reclaim meet 3form's rigorous quality control standards, and are considered **first-quality**, with professional trimming to final size, as listed.

3form also offers the Reform program, in which materials are made available at low cost. Reform materials are considered **second-quality**.

For more information, see <http://www.3-form.com/reclaim>.



References

CML 2001	Guinée et al. "An operational guide to the ISO-standards (Centre for Milieukunde (CML), Leiden 2001." Center for Environmental Sciences (CML) at the University of Leiden, The Netherlands. Last Updated 2010.
EN 15804	European Committee for Standardization (CEN). "EN15804:2012. Sustainability of construction works – Environmental product declarations— Core rules for the product category of construction products"
GaBi Databases 2013	PE International Inc. "GaBi Databases 2013". November 2013. Documentation available at http://database-documentation.gabi-software.com/support/gabi/
ISO 14040	International Standard Organization. ISO 14040:2006-10, Environmental management – Life cycle assessment – Principles and framework (ISO 14040:2006)." German and English version EN ISO 14040:2006. Geneva. 2006
ISO 14044	International Standard Organization. "ISO 14044:200610, Environmental management – Life cycle assessment – Requirements and guidelines (ISO 14044:2006)." German and English version EN ISO 14044:2006 Geneva. 2006
EPD 2012	The International EPD System. 2012, January. Product Category Rules: Construction Products and CPC 54 Construction Services. Version 1.2.
BARE 2012	J. Bare, Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) - Software Name and Version Number: TRACI version 2.1 - User's Manual, U.S. EPA, 2012.



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