Declaration Owner

Benjamin Moore
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Products:

Ultra Spec® 500 Interior Latex Paint

Functional Unit

One square meter of covered and protected substrate for a period of 60 years, exhibiting a 97% opacity after drying.

EPD Number and Period of Validity

SCS-EPD-07975
EPD Valid June 14, 2022 through June 13, 2027

Product Category Rule

Product Category Rule for Environmental Product Declarations. Architectural Coatings: NAICS 325510. NSF International. Valid through June 23, 2022.

Program Operator

SCS Global Services
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Declaration Owner:	Benjamin Moore
Address:	101 Paragon Drive, Montvale, NJ 07645
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Declaration Validity Period:	Valid June 14, 2022 through June 13, 2027
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
Product:	Ultra Spec® 500 Interior Latex Paint
LCA Practitioner:	Gerard Mansell, PhD., SCS Global Services
LCA Software:	OpenLCA v1.10 & ecoinvent v3.7
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Product Category Rule:	Product Category Rule for Environmental Product Declarations. Architectural Coatings: NAICS 325510. NSF International. Valid through June 23, 2022.
PCR Review conducted by:	Thomas Gloria Ph.D., Industrial Ecology Consultants
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants

Declaration Contents:

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044 and 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

ABOUT BENJAMIN MOORE

Founded in 1883, Benjamin Moore is North America's favorite paint, color and coatings brand. A leading manufacturer of premium quality residential and commercial coatings, Benjamin Moore maintains a relentless commitment to innovation and sustainable manufacturing practices. The portfolio spans the brand's flagship paint lines including Aura®, Regal® Select, Ultra Spec®, ben®, ADVANCE®, ARBORCOAT® and more. Benjamin Moore is renowned for its expansive color collection of more than 3,500 colors, and its design tools for consumers and professionals alike, including the Benjamin Moore Color Portfolio® app. Benjamin Moore paints are available exclusively from 7,500 locally owned and operated paint, decorating and hardware retailers throughout the United States and Canada as well as 75 countries globally.

PRODUCT DESCRIPTION

The Benjamin Moore's Ultra Spec 500 interior latex paint products are primarily water- and acrylic resin-based and are available with various finishes and bases. Zero-VOC Ultra Spec 500 is a professional-quality interior coating designed to meet the needs of professional painting contractors and are manufactured at Benjamin Moore's facilities in the United States. The products are used in various interior and exterior commercial and residential applications. The specific products included in this EPD are listed in Table 1.

Table 1. *Benjamin Moore Ultra Spec® 500 products included in the LCA scope.*

Finish	Available Bases	VOC content (g/L)	Manufacturing Location(s)
Flat	white; 1X base; 2X base; 3X base; 4X base	0.0	Johnstown, NY; Dallas, TX; Newark, NJ; Pell City, AL
Low-Sheen Eggshell	white; 1X base; 2X base; 3X base; 4X base	0.0	Johnstown, NY; Newark, NJ; Pell City, AL
Eggshell	white; 1X base; 2X base; 3X base; 4X base	0.0	Johnstown, NY; Dallas, TX; Newark, NJ; Pell City, AL; Milford, MA;
Semi-gloss	white; 1X base; 2X base; 3X base; 4X base	0.0	Milford, MA
Satin/Pearl	white; 1X base; 2X base; 3X base; 4X base	0.0	Milford, MA; Newark, NJ

The Benjamin Moore products provide the primary function of surface coating and substrate protection. According to ISO 14044, the functional unit is "the quantified performance of a product system, for use as a reference unit." The functional unit used in the study, as specified in the PCR, is 1 square meter (m^2) of covered and protected substrate for a period of 60 years (the assumed average lifetime of a building), exhibiting a 97% opacity after drying. The reference flow for the study varies by specific product and depends on the paint coverage, or spread rate (m^2/L), and the product lifetime. For the paint products considered, the recommended coverage varies from ~350-450 ft^2/gal. A representative value of 400 ft^2/gal (~9.82 m^2/L) is assumed for the assessment. The reference flows for the products are summarized in Table 2.

Table 2. *Reference flows and reference service lifetimes for the Benjamin Moore Ultra Spec® 500 products.*

Finish	Reference Flow (kg/L)
Flat	1.34
Low-Sheen Eggshell	1.27
Eggshell	1.27
Satin/Pearl	1.23
Semi-gloss	1.17

As per PCR guidance, colorants are adding at the point of purchase of the product depending on the specific base paint. Table 3 summarizes the amount of colorant to be added to each of the Benjamin Moore paint products included in the assessment.

Table 3. *Colorant amounts added per liter of paint applied, by base type.*

Benjamin Moore Base	Colorant (mL/L)
white/soft white	-
1X base (Tintable white)	23
2X base (Light base)	31
3X base (Deep base)	78
4X base (Accent base)	93

PRODUCT CHARACTERISTICS

In accordance with the PCR, paint products have both a design life, determined by performance characteristics based on ASTM durability testing, and a market-based lifetime, which is the estimated lifetime of a coating based on the use pattern of the product. Life cycle impact assessment results are calculated for both design and market-based lifetimes. For interior coatings design life thresholds are determined using scrub resistance (ASTM D2486- 06(2012)e1), burnish (ASTM D6736-08(2013)), and washability (ASTM D4828-94(2012)e1) tests. Performance characteristics for exterior coatings are determined using Blistering (ASTM D714- 02(2007)), Erosion (ASTM D662- 93(2011)), Flaking/Peeling (ASTM D772-86(2011)), and Biologic Growth (ASTM D3274-95 or -09(2013)) testing results. Based on these testing results, the coatings are classified as low, medium or high quality with a corresponding design lifetime as specified by the PCR.

The Benjamin Moore latex paints are included in the Approved Product List (APL) of the Master Painters Institute (MPI) demonstrating superior product performance. The MPI develops technical standards and executes paint testing in accordance with the standards, using ASTM compliant testing equipment and methods. There are over 200 Standards for coating performance, each of which are required to pass all the specified tests for the applicable standard. The APL includes High-Performance alternatives for many categories which are tested against a much tougher set of requirements and testing procedures. Accordingly, the Benjamin Moore paint product lines considered in the LCA scope are modeled based on the high quality design lifetime, as specified in the PCR. For the Ultra Spec® 500 interior latex paint products included in the EPD, a design-based lifetime of 15 years and a market-based lifetime of 5 years are assigned.

The Benjamin Moore products are used in various interior and exterior commercial and residential applications. Detailed product characteristics can be found at the manufacturer's website (https://www.benjaminmoore.com/). Product images are provided below.

1Flat (T535)	Eggshell (T538)	Low Sheen (T537)	Semi-gloss (T546)	Satin/Pearl (T545)

PRODUCT COMPOSITION

Benjamin Moore's latex paint products are primarily water- and acrylic resin-based and contain minerals, pigments, and other additives such as preservatives, defoamers, thickeners, and surfactants. Table 4 summarizes the material composition as a percentage of the total mass per reference flow averaged over all base types for each product assessed.

Table 4. *Average material component summary for the Benjamin Moore* ***Ultra Spec® 500*** *interior latex paint products, by finish, as a percentage of total mass per liter of paint.*

Component	Flat	Low Sheen	Eggshell	Satin/Pearl	Semi-gloss
Water	28%	24%	27%	25%	26%
Latex	26%	38%	40%	43%	49%
Titanium dioxide	20%	19%	17%	16%	14%
Kaolin	6.2%	8.2%	3.4%	4.2%	3.9%
Limestone	21%	11%	6.3%	2.4%	2.5%
Feldspar	0%	7.5%	3.5%	4.5%	1.1%
Polyurethane	0.24%	0.54%	1.4%	0.59%	0.63%
Acrylic resin	0%	3.5%	3.2%	3.3%	2.9%
Dispersant	0.64%	0.66%	0.7%	0.78%	0.84%
Ethoxylated alcohols	0.44%	1%	0.87%	2.1%	1.8%
Cellulose	0.66%	0.52%	0.53%	0.27%	0%
Defoamer	0.63%	0.52%	0.62%	0.47%	0.47%
Silica	2.3%	0%	0%	0%	0%
Pigments	0.02%	0.045%	0.037%	0.13%	0.032%
Other	1.9%	2.5%	2.5%	3.1%	3.6%

LIFE CYCLE STAGES AND SYSTEM BOUNDARY

The system under study includes the extraction of raw materials and processing, manufacturing, delivery and installation, use, and disposal (end-of-life). The cradle-to-grave system boundary includes all unit processes contributing measurably to the category indicator results. The life cycle stages specified by the PCR are described relative to the LCA study below and illustrated in Figure 1.

Stage 1 – Product Stage

The product stage begins with the extraction of raw materials from nature and includes pre-processing of materials, intermediate processing, transportation to the Benjamin Moore production facilities, and paint production. This stage ends when the final product is packaged for shipping. The treatment of any wastes formed during production are included in this stage.

Stage 2 – Design and Construction Stage

The design and construction phase begin with the packaged and finished paint product leaving the production facility and ends with the coating being delivered to the point of application. Within this stage, a paint product may go through several facilities including distribution warehousing, as well as storage at the point of sale. This stage also includes the addition of colorant at the point of sale, per the PCR.

Stage 3 – Use and Maintenance Stage

The use stage begins with the application of the product to a substrate and ends with any leftover coating and discarded packaging going to end-of-life stage. A 10% loss rate was included per the PCR. This stage does not require any energy (products are applied manually), but includes the VOCs emitted over the paint's lifetime. Potential environmental impacts associated with repaints needed to fulfill the functional unit are attributed to the original stage in which they occurred (e.g., production of the coating for the repaint is attributed to Stage 1 – Product Stage).

Stage 4 – End-of-Life Stage

The end-of-life stage begins when any applied or unused paint and primary packaging is ready for disposal or recycling and ends when these products are landfilled or transformed as part of the recycling process.

PRODUCT LIFE CYCLE FLOW DIAGRAM

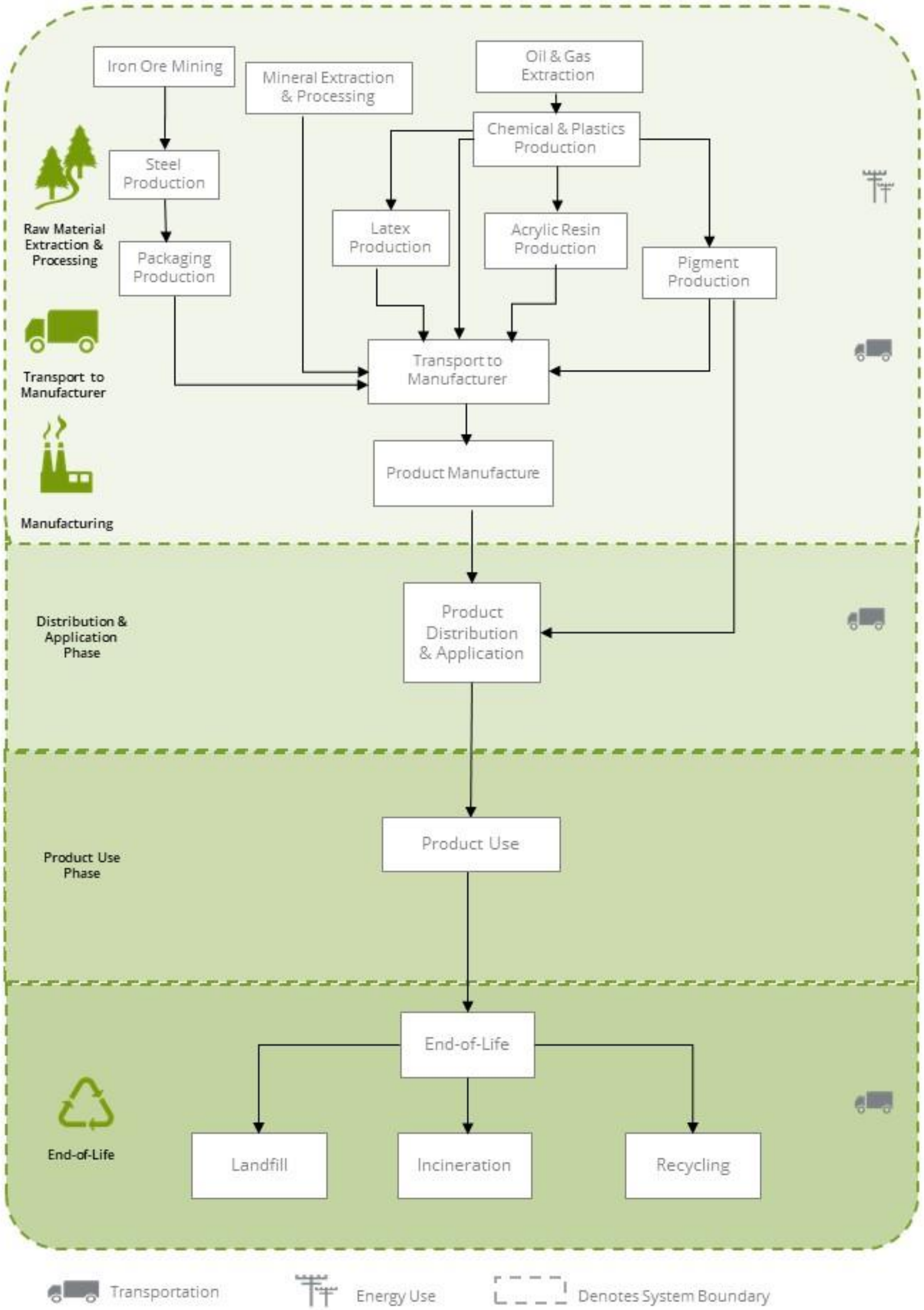

Figure 1. *Flow diagram and system boundaries for the life cycle of the Benjamin Moore products.*

LIFE CYCLE INVENTORY RESULTS

The resource use and emissions from each step of the product life cycle are summed to obtain the life cycle inventory results. Table 5 and Table 6 present the results for additional parameters (energy and waste flows) as specified in the PCR, averaged across the latex paint products assessed for a design-based and market-base3d lifetime, respectively. The LCIA and inventory flow results were calculated using the OpenLCA model and summarized for the functional unit from cradle-to-grave. Where necessary, the lower heating value is used for energy flow calculation

Table 5. *Resource and waste flows for the Benjamin Moore* ***Ultra Spec® 500*** *interior latex paint products. Production-weighted average results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Unit	Ultra Spec® 500 - Flat	Ultra Spec® 500 – Low Sheen	Ultra Spec® 500 - Eggshell	Ultra Spec® 500 - Satin/Pearl	Ultra Spec® 500 - Semi-gloss
Energy & Resources						
Use of renewable primary energy	MJ, LHV	0.969	0.827	0.724	0.771	0.613
Use of renewable primary energy resources used as raw materials	MJ, LHV	0.00	0.00	0.00	0.00	0.00
Use of nonrenewable primary energy	MJ, LHV	INA	INA	INA	INA	INA
Use of nonrenewable primary energy resources used as raw materials	MJ, LHV	INA	INA	INA	INA	INA
Nonrenewable material resources	kg	6.61	5.49	4.75	5.27	3.81
Renewable material resources	kg	0.00	0.00	0.00	0.00	0.00
Use of secondary materials	kg	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.
Nonrenewable secondary fuels	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.
Use of net fresh water	m^3	0.113	0.114	0.111	0.110	0.108
Waste Flows						
Nonhazardous waste	kg	1.28	1.13	1.06	1.10	0.935
Hazardous waste	kg	1.99×10^{-4}	2.64×10^{-4}	2.74×10^{-4}	2.91×10^{-4}	3.10×10^{-4}
High-level radioactive waste	kg	3.57×10^{-6}	3.08×10^{-6}	2.65×10^{-6}	3.01×10^{-6}	2.13×10^{-6}
Low-level Radioactive waste	kg	5.49×10^{-5}	4.50×10^{-5}	4.04×10^{-5}	4.44×10^{-5}	3.45×10^{-5}
Components for re-use	kg	0.00	0.00	0.00	0.00	0.00
Materials for recycling	kg	9.91×10^{-2}	9.91×10^{-2}	9.91×10^{-2}	9.91×10^{-2}	9.91×10^{-2}
Materials for energy recovery	kg	Neg.	Neg.	Neg.	Neg.	Neg.
Exported energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.

INA – Indicator not assessed | Neg. = Negligible

Table 6. *Resource and waste flows for the Benjamin Moore* ***Ultra Spec® 500*** *interior latex paint products. Production-weighted average results are shown for 1 m^2 of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Unit	Ultra Spec® 500 - Flat	Ultra Spec® 500 – Low Sheen	Ultra Spec® 500 - Eggshell	Ultra Spec® 500 - Satin/Pearl	Ultra Spec® 500 - Semi-gloss
Energy & Resources						
Use of renewable primary energy	MJ, LHV	2.91	2.48	2.17	2.31	1.84
Use of renewable primary energy resources used as raw materials	MJ, LHV	0.00	0.00	0.00	0.00	0.00
Use of nonrenewable primary energy	MJ, LHV	INA	INA	INA	INA	INA
Use of nonrenewable primary energy resources used as raw materials	MJ, LHV	INA	INA	INA	INA	INA
Nonrenewable material resources	kg	19.8	16.5	14.2	15.8	11.4
Renewable material resources	kg	0.00	0.00	0.00	0.00	0.00
Use of secondary materials	kg	0.00	0.00	0.00	0.00	0.00
Renewable secondary fuels	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.
Nonrenewable secondary fuels	MJ, LHV	Neg.	Neg.	Neg.	Neg.	Neg.
Use of net fresh water	m^3	0.340	0.342	0.333	0.329	0.324
Waste Flows						
Nonhazardous waste	kg	3.85	3.38	3.18	3.30	2.81
Hazardous waste	kg	5.98×10^{-4}	7.92×10^{-4}	8.21×10^{-4}	8.72×10^{-4}	9.31×10^{-4}
High-level radioactive waste	kg	1.07×10^{-5}	9.25×10^{-6}	7.94×10^{-6}	9.02×10^{-6}	6.38×10^{-6}
Low-level Radioactive waste	kg	1.65×10^{-4}	1.35×10^{-4}	1.21×10^{-4}	1.33×10^{-4}	1.03×10^{-4}
Components for re-use	kg	0.00	0.00	0.00	0.00	0.00
Materials for recycling	kg	0.892	0.892	0.892	0.892	0.892
Materials for energy recovery	kg	Neg.	Neg.	Neg.	Neg.	Neg.
Exported energy	MJ	Neg.	Neg.	Neg.	Neg.	Neg.

INA – Indicator not assessed | Neg. = Negligible

LIFE CYCLE IMPACT ASSESSMENT

The impact assessment for the EPD is conducted in accordance with requirements of the ISO 14040/44 and the PCR. Impact category indicators are estimated using the TRACI 2.1 characterization method. The following impact indicators, specified by the PCR, are reported below:

TRACI 2.1 Impact Category	Unit
Global Warming Potential (GWP)	kg CO_2 eq
Ozone Depletion Potential (ODP)	kg CFC 11 eq
Acidification Potential (AP)	kg SO_2 eq
Eutrophication Potential (EP)	kg N eq
Smog Formation Potential (SFP)	kg O_3 eq
Fossil Fuel Depletion Potential (ADP_{fossil})	MJ Surplus, LHV

Production-weighted results of the Life Cycle Assessment are presented below for each paint product and finish. Results are average across all base type for each product and weighted by the production at each facility. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Table 7. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Flat*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	1.55	0.228	0.00	0.286
	%	75%	11%	0%	14%
Acidification	kg SO_2 eq	9.71×10^{-3}	7.00×10^{-4}	0.00	1.42×10^{-4}
	%	92%	6.6%	0%	1.3%
Eutrophication	kg N eq	5.46×10^{-3}	1.36×10^{-4}	0.00	3.74×10^{-3}
	%	58%	1.5%	0%	40%
Smog formation	kg O_3 eq	0.115	1.32×10^{-2}	0.00	2.75×10^{-3}
	%	88%	10%	0%	2.1%
Ozone depletion	kg CFC-11 eq	1.22×10^{-7}	2.84×10^{-8}	0.00	3.84×10^{-9}
	%	79%	18%	0%	2.5%
Fossil fuel depletion	MJ surplus	3.15	0.260	0.00	3.78×10^{-2}
	%	91%	7.5%	0%	1.1%

Table 8. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Eggshell*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	1.42	0.264	0.00	0.269
	%	73%	14%	0%	14%
Acidification	kg SO_2 eq	8.49×10^{-3}	7.25×10^{-4}	0.00	1.33×10^{-4}
	%	91%	7.8%	0%	1.4%
Eutrophication	kg N eq	4.05×10^{-3}	1.30×10^{-4}	0.00	3.52×10^{-3}
	%	53%	1.7%	0%	46%
Smog formation	kg O_3 eq	0.109	1.23×10^{-2}	0.00	2.58×10^{-3}
	%	88%	10%	0%	2.1%
Ozone depletion	kg CFC-11 eq	8.10×10^{-8}	2.68×10^{-8}	0.00	3.61×10^{-9}
	%	73%	24%	0%	3.2%
Fossil fuel depletion	MJ surplus	3.74	0.245	0.00	3.56×10^{-2}
	%	93%	6.1%	0%	0.88%

Table 9. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Low Sheen*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	1.52	0.238	0.00	0.270
	%	75%	12%	0%	13%
Acidification	kg SO_2 eq	9.26×10^{-3}	6.91×10^{-4}	0.00	1.33×10^{-4}
	%	92%	6.8%	0%	1.3%
Eutrophication	kg N eq	4.65×10^{-3}	1.29×10^{-4}	0.00	3.52×10^{-3}
	%	56%	1.6%	0%	42%
Smog formation	kg O_3 eq	0.115	1.24×10^{-2}	0.00	2.59×10^{-3}
	%	88%	9.6%	0%	2%
Ozone depletion	kg CFC-11 eq	9.52×10^{-8}	2.69×10^{-8}	0.00	3.62×10^{-9}
	%	76%	21%	0%	2.9%
Fossil fuel depletion	MJ surplus	3.75	0.246	0.00	3.56×10^{-2}
	%	93%	6.1%	0%	0.88%

Table 10. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Semi-gloss*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	1.37	0.264	0.00	0.249
	%	73%	14%	0%	13%
Acidification	kg SO_2 eq	7.98×10^{-3}	7.00×10^{-4}	0.00	1.23×10^{-4}
	%	91%	7.9%	0%	1.4%
Eutrophication	kg N eq	3.34×10^{-3}	1.21×10^{-4}	0.00	3.25×10^{-3}
	%	50%	1.8%	0%	48%
Smog formation	kg O_3 eq	0.108	1.15×10^{-2}	0.00	2.39×10^{-3}
	%	89%	9.4%	0%	2%
Ozone depletion	kg CFC-11 eq	6.61×10^{-8}	2.50×10^{-8}	0.00	3.34×10^{-9}
	%	70%	26%	0%	3.5%
Fossil fuel depletion	MJ surplus	4.11	0.229	0.00	3.29×10^{-2}
	%	94%	5.2%	0%	0.75%

Table 11. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Satin/Pearl*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 15-year design-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	1.58	0.199	0.00	0.264
	%	77%	9.8%	0%	13%
Acidification	kg SO_2 eq	9.44×10^{-3}	6.32×10^{-4}	0.00	1.31×10^{-4}
	%	93%	6.2%	0%	1.3%
Eutrophication	kg N eq	4.51×10^{-3}	1.26×10^{-4}	0.00	3.45×10^{-3}
	%	56%	1.6%	0%	43%
Smog formation	kg O_3 eq	0.120	1.23×10^{-2}	0.00	2.53×10^{-3}
	%	89%	9.1%	0%	1.9%
Ozone depletion	kg CFC-11 eq	9.32×10^{-8}	2.64×10^{-8}	0.00	3.54×10^{-9}
	%	76%	21%	0%	2.9%
Fossil fuel depletion	MJ surplus	4.14	0.241	0.00	3.49×10^{-2}
	%	94%	5.5%	0%	0.79%

Table 12. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Flat*** *interior latex paint products. Results are shown for 1 m[2] of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	4.65	0.685	0.00	0.859
	%	75%	11%	0%	14%
Acidification	kg SO_2 eq	2.91×10^{-2}	2.10×10^{-3}	0.00	4.25×10^{-4}
	%	92%	6.6%	0%	1.3%
Eutrophication	kg N eq	1.64×10^{-2}	4.09×10^{-4}	0.00	1.12×10^{-2}
	%	58%	1.5%	0%	40%
Smog formation	kg O_3 eq	0.344	3.96×10^{-2}	0.00	8.24×10^{-3}
	%	88%	10%	0%	2.1%
Ozone depletion	kg CFC-11 eq	3.66×10^{-7}	8.53×10^{-8}	0.00	1.15×10^{-8}
	%	79%	18%	0%	2.5%
Fossil fuel depletion	MJ surplus	9.44	0.779	0.00	0.114
	%	91%	7.5%	0%	1.1%

Table 13. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Eggshell*** *interior latex paint products. Results are shown for 1 m[2] of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	4.25	0.792	0.00	0.807
	%	73%	14%	0%	14%
Acidification	kg SO_2 eq	2.55×10^{-2}	2.17×10^{-3}	0.00	3.99×10^{-4}
	%	91%	7.8%	0%	1.4%
Eutrophication	kg N eq	1.22×10^{-2}	3.90×10^{-4}	0.00	1.05×10^{-2}
	%	53%	1.7%	0%	46%
Smog formation	kg O_3 eq	0.326	3.70×10^{-2}	0.00	7.75×10^{-3}
	%	88%	10%	0%	2.1%
Ozone depletion	kg CFC-11 eq	2.43×10^{-7}	8.05×10^{-8}	0.00	1.08×10^{-8}
	%	73%	24%	0%	3.2%
Fossil fuel depletion	MJ surplus	11.2	0.736	0.00	0.107
	%	93%	6.1%	0%	0.88%

Table 14. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Low Sheen*** *interior latex paint products. Results are shown for 1 m[2] of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	4.57	0.713	0.00	0.809
	%	75%	12%	0%	13%
Acidification	kg SO_2 eq	2.78×10^{-2}	2.07×10^{-3}	0.00	4.00×10^{-4}
	%	92%	6.8%	0%	1.3%
Eutrophication	kg N eq	1.39×10^{-2}	3.88×10^{-4}	0.00	1.06×10^{-2}
	%	56%	1.6%	0%	42%
Smog formation	kg O_3 eq	0.344	3.73×10^{-2}	0.00	7.76×10^{-3}
	%	88%	9.6%	0%	2%
Ozone depletion	kg CFC-11 eq	2.86×10^{-7}	8.07×10^{-8}	0.00	1.08×10^{-8}
	%	76%	21%	0%	2.9%
Fossil fuel depletion	MJ surplus	11.3	0.737	0.00	0.107
	%	93%	6.1%	0%	0.88%

Table 15. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Semi-gloss*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	4.11	0.792	0.00	0.747
	%	73%	14%	0%	13%
Acidification	kg SO_2 eq	2.39×10^{-2}	2.10×10^{-3}	0.00	3.70×10^{-4}
	%	91%	7.9%	0%	1.4%
Eutrophication	kg N eq	1.00×10^{-2}	3.64×10^{-4}	0.00	9.76×10^{-3}
	%	50%	1.8%	0%	48%
Smog formation	kg O_3 eq	0.325	3.44×10^{-2}	0.00	7.17×10^{-3}
	%	89%	9.4%	0%	2%
Ozone depletion	kg CFC-11 eq	1.98×10^{-7}	7.51×10^{-8}	0.00	1.00×10^{-8}
	%	70%	26%	0%	3.5%
Fossil fuel depletion	MJ surplus	12.3	0.686	0.00	9.88×10^{-2}
	%	94%	5.2%	0%	0.75%

Table 16. *Life Cycle Impact Assessment (results for the Benjamin Moore* ***Ultra Spec® 500 Satin/Pearl*** *interior latex paint products. Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on a 5-year market-based lifetime.*

Impact Category	Units	Product Manufacture	Design & Construction	Use & Maintenance	End-of-Life
Global warming	kg CO_2 eq	4.73	0.597	0.00	0.792
	%	77%	9.8%	0%	13%
Acidification	kg SO_2 eq	2.83×10^{-2}	1.90×10^{-3}	0.00	3.92×10^{-4}
	%	93%	6.2%	0%	1.3%
Eutrophication	kg N eq	1.35×10^{-2}	3.79×10^{-4}	0.00	1.03×10^{-2}
	%	56%	1.6%	0%	43%
Smog formation	kg O_3 eq	0.360	3.68×10^{-2}	0.00	7.60×10^{-3}
	%	89%	9.1%	0%	1.9%
Ozone depletion	kg CFC-11 eq	2.80×10^{-7}	7.91×10^{-8}	0.00	1.06×10^{-8}
	%	76%	21%	0%	2.9%
Fossil fuel depletion	MJ surplus	12.4	0.723	0.00	0.105
	%	94%	5.5%	0%	0.79%

SUPPORTING TECHNICAL INFORMATION

Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

Period under review

The period of review is calendar year 2020.

Allocation

This study follows the allocation guidelines of ISO 14044 and sought to minimize the use of allocation wherever possible. The PCR requires primary data for allocation based on physical relationships (e.g., volume, energy content, or mass-based relationships). Alternatively, economic allocation may be applied. The secondary databases used for the product system (discussed below) apply allocation based primarily on physical relationships.

Resource use at the Benjamin Moore facilities (e.g., electricity and fuel use) were allocated to the product based on the product weight as a fraction of the total annual facility production (i.e., mass-based allocation). Electricity use at each manufacturing facility was modeled using the applicable eGRID regional inventory dataset from the Ecoinvent LCI database.

Impacts from transportation, including product distribution to point of sale, were allocated based on the mass of material and distance transported.

Estimates and Assumptions

- The Benjamin Moore production facilities are located in various eGRID EPA NERC sub-regions. Ecoinvent inventory datasets were modified to reflect the applicable eGRID energy mix to estimate resource use and emissions from electricity use at each facility.
- Electricity and resource use at the production facilities were allocated to the products based on product mass utilizing annual production data for 2020 provided by the manufacturer.
- Much of the upstream raw materials extraction and processing could not be modeled with actual process information. Representative data from the Ecoinvent LCI databases were utilized as appropriate.
- For end-of-life, disposal of the product packaging is modeled based on 2018 statistics for municipal solid waste generation and disposal in the United States, from the US Environmental Protection Agency. These data provide recycling rate estimates for household and municipal waste, durable and non-durable goods, as well as for packaging and containers.
- For final disposal of the product and packaging materials at end-of-life, all materials are assumed to be transported 7 miles by diesel truck to either a landfill, incineration facility, or material reclamation facility (for recycling). Datasets representing disposal in a landfill and waste incineration are from Ecoinvent.

It should also be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The PCR allows for the results for several inventory flows related to resource use and waste flows to be reported as "other parameters". These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted taking into account this limitation.

Background Data

Primary data were provided by Benjamin Moore for their manufacturing facilities. The sources of secondary LCI data are the Ecoinvent database.

Table 17. *Data sources for the Benjamin Moore Latex Paint product system.*

Component	Dataset	Data Source	Publication Date
PRODUCT			
Water	market group for tap water | tap water | Cutoff, S/GLO	EI v3.8	2021
Latex	latex production | latex | Cutoff, S/RoW	EI v3.8	2021
Titanium dioxide	market for titanium dioxide | titanium dioxide | Cutoff, S/RoW	EI v3.8	2021
Feldspar	feldspar production | feldspar | Cutoff, S/RoW	EI v3.8	2021
Limestone	limestone production, crushed, washed | limestone, crushed, washed | Cutoff, S/RoW	EI v3.8	2021
Acrylic resin	acrylic dispersion production, product in 65% solution state | acrylic dispersion, without water, in 65% solution state | Cutoff, S/RoW; styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S/RoW	EI v3.8	2021
Kaolin	kaolin production | kaolin | Cutoff, S/RoW	EI v3.8	2021
Polyurethane	polyurethane production, flexible foam | polyurethane, flexible foam | Cutoff, S/RoW; market group for tap water | tap water | Cutoff, S/GLO	EI v3.8	2021
Silica	silica sand production | silica sand | Cutoff, S/RoW	EI v3.8	2021
Dispersant	polycarboxylates production, 40% active substance | polycarboxylates, 40% active substance | Cutoff, S/RoW; market group for tap water | tap water | Cutoff, S/GLO	EI v3.8	2021
Cellulose	cellulose fibre production | cellulose fibre | Cutoff, S/RoW	EI v3.8	2021
Defoamer	ethoxylated alcohol (AE7) production, petrochemical | ethoxylated alcohol (AE7) | Cutoff, S/RoW	EI v3.8	2021
Ethoxylated alcohols	ethoxylated alcohol (AE7) production, petrochemical | ethoxylated alcohol (AE7) | Cutoff, S/RoW	EI v3.8	2021
Pigments	carbon black production | carbon black | Cutoff, S/GLO	EI v3.8	2021
Other	zinc oxide production | zinc oxide | Cutoff, S/RoW	EI v3.8	2021
	ammonia production, steam reforming, liquid | ammonia, anhydrous, liquid | Cutoff, S/RNA	EI v3.8	2021
	chemical production, inorganic | chemical, inorganic | Cutoff, S/GLO	EI v3.8	2021
	chemical production, inorganic | chemical, inorganic | Cutoff, S/GLO	EI v3.8	2021
	propylene glycol production, liquid | propylene glycol, liquid | Cutoff, S/RoW	EI v3.8	2021
PACKAGING			
Steel	steel production, converter, low-alloyed | steel, low-alloyed | Cutoff, S/RoW	EI v3.8	2021
COLORANTS			
Colorant	Carbon black (furnace black; deep black pigment), production mix, at plant, furnace black, deep black pigment, 1 kg/DE	GaBi	2014
RESOURCES			
Grid electricity - Johnstown, NY	Electricity, medium voltage, per kWh - NYUP/NYUP	EI v3.8; eGRID	2021; 2018
Grid electricity - Dallas, TX	Electricity, medium voltage, per kWh - ERCT/ERCT	EI v3.8; eGRID	2021; 2018
Grid electricity - Newark, NJ	Electricity, medium voltage, per kWh - RFCE/RFCE	EI v3.8; eGRID	2021; 2018
Grid electricity - Milford, MA	Electricity, medium voltage, per kWh - NEWE/NEWE	EI v3.8; eGRID	2021; 2018
Grid electricity - Pell City, AL	Electricity, medium voltage, per kWh - SRSO/SRSO	EI v3.8; eGRID	2021; 2018
Natural gas	heat production, natural gas, at boiler modulating >100kW | heat, district or industrial, natural gas | Cutoff, S/RoW	EI v3.8	2021
TRANSPORTATION			
Truck transport	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, S/RoW	EI v3.8	2021
Ship transport	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S/GLO	EI v3.8	2021

Data Quality

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 18. *Data quality assessment for the Benjamin Moore latex Paint product system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old (typically 2016). All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2020.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data for the US. Surrogate data used in the assessment are representative of global or European operations. Data representative of European operations are considered sufficiently similar to actual processes. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative process datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.8 data where available. Different portions of the product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturing facilities represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI data, Ecoinvent v3.8 LCI data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for upstream operations were not available and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

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