

LIFE CYCLE ASSESSMENT

LASER PRINTER C3326DW

According to ISO 14040 and ISO 14044



Lexmark's innovative imaging solutions and technologies help customers worldwide print, secure and manage information with ease, efficiency and unmatched value. Lexmark simplifies the complex intersection of digital and printed information.

As part of the commitment to our customers, Lexmark performs Life Cycle Analysis on our products. The results of the LCA analysis continues to assist Lexmark in reducing the environmental impact of the hardware, software and services offered to our customers.

With color output up to 26 [24] pages per minute*, high-yield replacement toner cartridges and connectivity via Wi-Fi and gigabit Ethernet, the Lexmark C3326dw provides the added performance small workgroups need, all in a compact package. Powered by a 1-GHz multi-core processor and 512 MB of memory, this lightweight printer is easy to set up and easy to keep going. With one-piece toner cartridges and long-life imaging components, you'll spend more time printing and less time replacing supplies. Standard two-sided printing saves paper, while Lexmark full spectrum security helps protect your network.

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

This document is the summary of an LCA study aiming to represent the product properties, related assumption, impact categories and potential environmental impact results of Lexmark's C3326dw printer product. Lexmark generates LCAs for a series of printers and multi-functional devices. The LCAs are critically reviewed by an independent expert. Each LCA is created using the same software model and workflows while changing only printer-specific data points via parameter settings. Each LCA submitted for critical review will then be accompanied by a brief technical summary of the relevant data points, as well as a methodology report.

This LCA study is carried out based on ISO 14040 and ISO 14044, and generally follows the requirements of the Product Category Rules (PCR) Guidance for the product category printers and multi-function printing units, version 2, published by UL Environment (ULE) in April 2018. This LCA study has a few deviations from the PCR, including the following:

- The PCR bases the images per day calculation on the Version 2.0 of the Imaging Equipment ENERGY STAR® Program Requirements. However, using this estimation method results in a calculated printing volume that greatly exceeds actual customer usage. In this study, the images per day calculation has been replaced by actual customer printing data, Average Monthly Print Volumes (AMPV), per product family. The new methodology aligns with realistic customer printing.
- The PCR requires using ReCiPe 2016 or TRACI 2.1 as the impact assessment methodology. This study selects TRACI 2.1 as it is currently the only impact assessment methodology framework that incorporates US average conditions to establish characterization factors (Bare, 2012) (EPA, 2012). For global warming potential, the TRACI characterization factors are not the most current, therefore it is assessed based on the current IPCC characterization factors taken from the 6th Assessment Report (IPCC, 2021) for a 100-year timeframe (GWP100) as this is currently the most commonly used metric.
- Sphera updated paper dataset is selected to replace dataset developed based on information from the American Forest and Paper Association (NCASI, 2010).

COMPANY	Lexmark	
PRODUCT SYSTEM	Laser Printer C3326dw	
REFERENCE STANDARD	<i>ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines</i> . Geneva: International Organization for Standardization.	
DATE OF ISSUE	11/14/2024	
CONTENTS OF THE REPORT	Product definition Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and critical review	
This life cycle assessment was independently reviewed in accordance with ISO 14044 by:		
		Thomas Gloria, Indust. Ecology Consultants

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw
Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Product Description

Product Type	Color Laser Printer
Printer Model	C3326dw
Maximum Print Speed	26 pages per minute
Intended use	primarily office
Range of applications	print images or text in mono or color onto paper or paper-like media
Product Lifetime	5 years
Introduction Date	7/16/2019
Product Specifications	www.lexmark.com
Functional Unit	The functional units has been defined as (1) a 1,000 page simplex job; (2) lifetime page simplex job
Product Characterization	Enhance small-workgroup productivity with color output up to 26 [24] pages per minute*, high-yield replacement toner cartridges and connectivity via Wi-Fi, USB and gigabit Ethernet- all in the Lexmark C3326dw. Its 1-GHz multi-core processor lets you tackle big jobs, while Lexmark full-spectrum security helps protect your data. The printer product delivered to the customer consists of the printer, a power cord, printed setup instructions, a CD/DVD that includes the User Guide and Printer Drivers and an initial set of product supplies. The printer is delivered in packaging that can be recycled locally and is not needed for product operation. Product supplies include toner cartridges, imaging kits and the fusing mechanism. The power supply is internal to the product and the imaging kit and fusing mechanism are installed at the factory. Only the toner cartridges must be installed by the customer. The printer can be setup by the customer without outside assistance.

LIFE CYCLE ASSESSMENT



Lexmark[™]

Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Technical Data

Product Specifications		Lexmark Color Printer 3-series (C3326dw)	
Printing			
Display		2-line LCD display	
Print Speed		Up to: Black: 26 ppm ¹ (Letter) / Color: 26 ppm ¹ (Letter)	
Time to First Page		As fast as: Black: 10.9 seconds / Color: 10.9 seconds	
Print Resolution		Black: 4800 CQ (2400 x 600 dpi) / Color: 4800 CQ (2400 x 600 dpi)	
Memory		Standard: 512 MB / Maximum: 512 MB	
Hard Disk		Not Available	
Recommended Monthly Page Volume		600 - 2500 pages ²	
Maximum Monthly Duty Cycle		Up to: 50000 pages per month ³	
Supplies⁴			
Laser Cartridge Yields		up to: 2,500 ⁵ -page Color (CMY) High Yield Cartridges / up to: 3,000 ⁵ -page Black High Yield Cartridge / up to: 1,500 ⁵ -page Black and Color (CMYK) Cartridges	
Cartridge(s) Shipping with Product		750 ⁵ -page Black Return Program Toner Cartridge ⁵ , 500 ⁵ -page Color (CMY) Return Program Toner Cartridge ⁵	
Paper Handling			
Included Paper Handling		100-Sheet Output Bin, Single-Sheet Manual Feed, Automatic 2-sided printing, 250-Sheet Input	
Paper Input Capacity		Up to: Standard: 250+1 pages 20 lb or 75 gsm bond / Maximum: 250+1 pages 20 lb or 75 gsm bond	
Paper Output Capacity		Up to: Standard: 100 pages 20 lb or 75 gsm bond / Maximum: 100 pages 20 lb or 75 gsm bond	
Media Types Supported		Paper Labels, Card Stock, Plain Paper, Envelopes, Glossy Paper, Refer to the Paper & Specialty Media Guide	
Media Sizes Supported		A6, Oficio, 7 3/4 Envelope, 9 Envelope, JIS-B5, A4, Legal, A5, Hagaki Card, Letter, B5 Envelope, Statement, C5 Envelope, Executive, Universal, DL Envelope, Folio, 10 Envelope	
General Information⁶			
Standard Ports		802.11b/g/n Wireless, USB 2.0 Specification Hi-Speed Certified (Type B), Ethernet 10/100/1000 BaseTX (RJ-45)	
Noise Level		Operating: 52 dBA (Print)	
Specified Operating Environment		Humidity: 8 to 80% Relative Humidity / Altitude: 0 - 3048 Meters (10,000 Feet) / Temperature: 10 to 32°C (50 to 90°F)	
Limited Warranty		See Statement of Limited Warranty: 1-Onsite Repair, Next Business Day	
Size / Weight		H x W x D: 9.6 x 16.2 x 15.5 in. / 35.5 lb.	
ENERGY STAR Typical Electricity Consumption		TEC: 0.31 kilowatt-hours per week	

All information is subject to change without notice. Lexmark is not liable for any errors or omissions.

¹ Print and copy speeds measured in accordance with ISO/IEC 24734 and ISO/IEC 24735 respectively (ESAT). For more information see: www.lexmark.com/ISOspeeds.

² "Recommended Monthly Page Volume" is a range of pages that helps customers evaluate Lexmark's product offerings based on the average number of pages customers plan to print on the device each month. Lexmark recommends that the number of pages per month be within the stated range for optimum device performance, based on factors including: supplies replacement intervals, paper loading intervals, speed, and typical customer usage. ³ "Maximum Monthly Duty Cycle" is defined as the maximum number of pages a device could deliver in a month using a multishift operation. This metric provides a comparison of robustness in relation to other Lexmark printers and MFPs. ⁴ Product functions only with replacement cartridges designed for use in a specific geographical region. See www.lexmark.com/regions for more details. ⁵ Average continuous black or continuous composite CMY declared cartridge yield up to this number of standard pages in accordance with ISO/IEC 19798. ⁶ Printers are sold subject to certain license/agreement conditions. See www.lexmark.com/printerlicense for details.

© 2019 Lexmark. All rights reserved.

Lexmark, the Lexmark logo and Union are trademarks of Lexmark International, Inc., registered in the United States and/or other countries. AirPrint and the AirPrint Logo are trademarks of Apple, Inc. Google Cloud Print[™] is a trademark of Google, LLC. Mopria®, the Mopria® Logo[™] and the Mopria® Alliance logos are registered trademarks and service marks of Mopria Alliance, Inc. in the United States and other countries. Unauthorized use is strictly prohibited. All other trademarks are the property of their respective owners. This product includes software developed by the OpenSSL Project for use in the Open SSL Toolkit (<http://www.openssl.org/>).

LIFE CYCLE ASSESSMENT



Lexmark™

Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Declaration of Basic Materials

The printer consists of mechanical, electromechanical, and electronic components. Its material composition can be described using the basic material fractions given below. Please note that the category 'Electronics' also includes all wiring.

Material	Mass (kg)
Plastics (recyclable)	3.95
Plastics (non-recyclable)	1.27
Ferrous Metals	9.92
Aluminum	0.497
Copper	0
Glass	0.126
Electronics	0.768
Other Materials	0.119
Total	16.6

Table 1: Basic Material Declaration

Product Supply Chain

The printer is manufactured and assembled in Southeast China. The cartridges for the North American market are manufactured and assembled in Juarez, Mexico.

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw
Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Life Cycle Assessment Results

The following sections describe the printer's cradle-to-gate resource use and potential environmental impacts over the full printer life cycle. These represent the typical impacts for an average system sold in the North American market. All impacts are presented per functional units.

Printer Manufacturing Resources Use

Table 2 displays the use of material resources (kg) and of non-renewable as well as renewable primary energy demand necessary for printer manufacturing, but excludes other life cycle stages of the printer (cradle-to-gate). Likewise, material and energy consumption associated with printer packaging, cartridges, and paper is excluded here.

Use of Material Resources [kg]	
Non-Renewable	659
Renewable (excl. water)	964
Water	1.51E009
Use of Non-Renewable Primary Energy [MJ]	
Crude Oil	279
Hard Coal	803
Lignite	19
Natural Gas	449
Uranium	76.4
Use of Renewable Primary Energy [MJ]	
Biomass	5.09E-006
Geothermal	3.05
Solar	117
Wind	54.5
Hydropower	63.6

Table 2: Use of Material and Energy Resources for Printer Manufacturing (Cradle-to-Gate)

Energy Consumption During Utilization

Based on the ENERGY STAR® Typical Energy Consumption (TEC) test methodology, the printer is expected to have the following power consumption for an assumed average job load.

	Per 1,000 page	Per product lifetime
Energy Consumption During Utilization [kWh]	4.46	75.4

Table 3: At-wall power consumption during utilization

LIFE CYCLE ASSESSMENT



Lexmark™

Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Life Cycle Impact Assessment

The following provides an overview of the potential printer life cycle impacts with emissions classified and characterized to standard environmental impact metrics based on TRACI 2.1 method. Global warming potential is evaluated based on IPCC AR6. Ecotoxicity and human toxicity are not included in this study, due to their respective uncertainties.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
IPCC AR6 GWP 100, excl biogenic CO ₂ [kg CO ₂ eq.]	2.15E01	1.84E01	3.64E02	3.11E02
AP [kg SO ₂ eq.]	1.12E-01	9.79E-02	1.90E00	1.65E00
EP [kg N eq.]	1.21E-02	4.63E-03	2.05E-01	7.82E-02
ODP [kg CFC 11 eq.]	3.94E-08	3.94E-08	6.65E-07	6.65E-07
RDP [MJ surplus energy]	3.47E01	3.05E01	5.86E02	5.16E02
SFP [kg O ₃ eq.]	1.38E00	1.10E00	2.32E01	1.85E01

Table 3: Summary of Life Cycle Impact Assessment Results

LIFE CYCLE ASSESSMENT



Lexmark

Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Interpretation of Results

Dominance Analysis

Due to the 5 year lifetime and the number of pages printed per day based on the actual customer printing information, the use phase with paper heavily dominates the life cycle impacts. The below tables and charts display the results of the dominance analysis for each impact category addressed in Table 3. The first row in each table, labeled Printer, is the printer manufacturing phase which includes raw material extraction and manufacturing.

Global Warming Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	7.05E00	7.05E00	1.19E02	1.19E02
Use phase <LC>	1.44E01	1.13E01	2.43E02	1.91E02
EoL phase <LC>	8.55E-02	8.55E-02	1.45E00	1.45E00

Table 4: GWP100 dominance analysis [kg CO2 equiv]

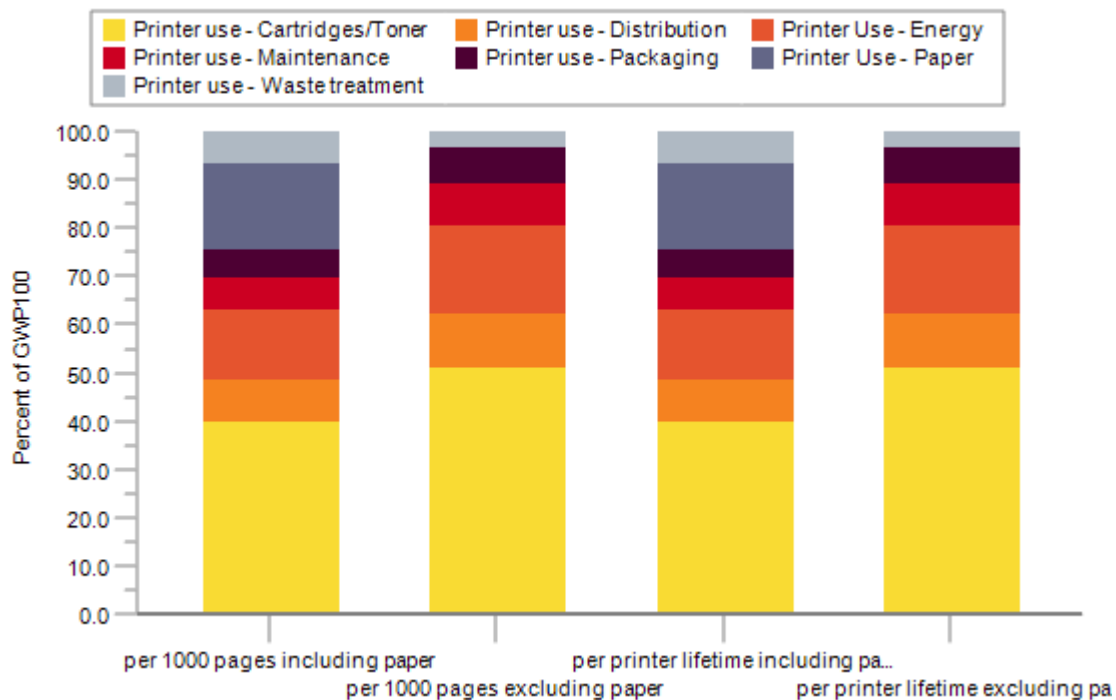


Figure 1: GWP100 dominance analysis of the life cycle stage

Total lifetime distribution: 45.13 kg CO2eq

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Ozone Depletion Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	1.08E-09	1.08E-09	1.83E-08	1.83E-08
Use phase <LC>	3.83E-08	3.83E-08	6.47E-07	6.47E-07
EoL phase <LC>	5.88E-16	5.88E-16	9.94E-15	9.94E-15

Table 5: ODP dominance analysis [kg CFC-11 equiv]

Acidification Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	3.23E-02	3.23E-02	5.45E-01	5.45E-01
Use phase <LC>	7.97E-02	6.52E-02	1.35E00	1.10E00
EoL phase <LC>	4.15E-04	4.15E-04	7.02E-03	7.02E-03

Table 6: AP dominance analysis [kg SO₂ equiv]

Eutrophication Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	1.37E-03	1.37E-03	2.32E-02	2.32E-02
Use phase <LC>	1.07E-02	3.22E-03	1.81E-01	5.44E-02
EoL phase <LC>	3.60E-05	3.60E-05	6.09E-04	6.09E-04

Table 7: EP dominance analysis [kg N equiv]

Resource Depletion Potential (fossil fuel)

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	6.83E00	6.83E00	1.15E02	1.15E02
Use phase <LC>	2.77E01	2.35E01	4.68E02	3.98E02
EoL phase <LC>	1.59E-01	1.59E-01	2.68E00	2.68E00

Table 8: RDP dominance analysis [MJ surplus energy]

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Smog Formation Potential

	per 1000 pages including paper	per 1000 pages excluding paper	per printer lifetime including paper	per printer lifetime excluding paper
Printer	2.97E-01	2.97E-01	5.02E00	5.02E00
Use phase <LC>	1.07E00	7.89E-01	1.81E01	1.33E01
EoL phase <LC>	9.50E-03	9.50E-03	1.60E-01	1.60E-01

Table 9: SFP dominance analysis [kg O₃ equiv]

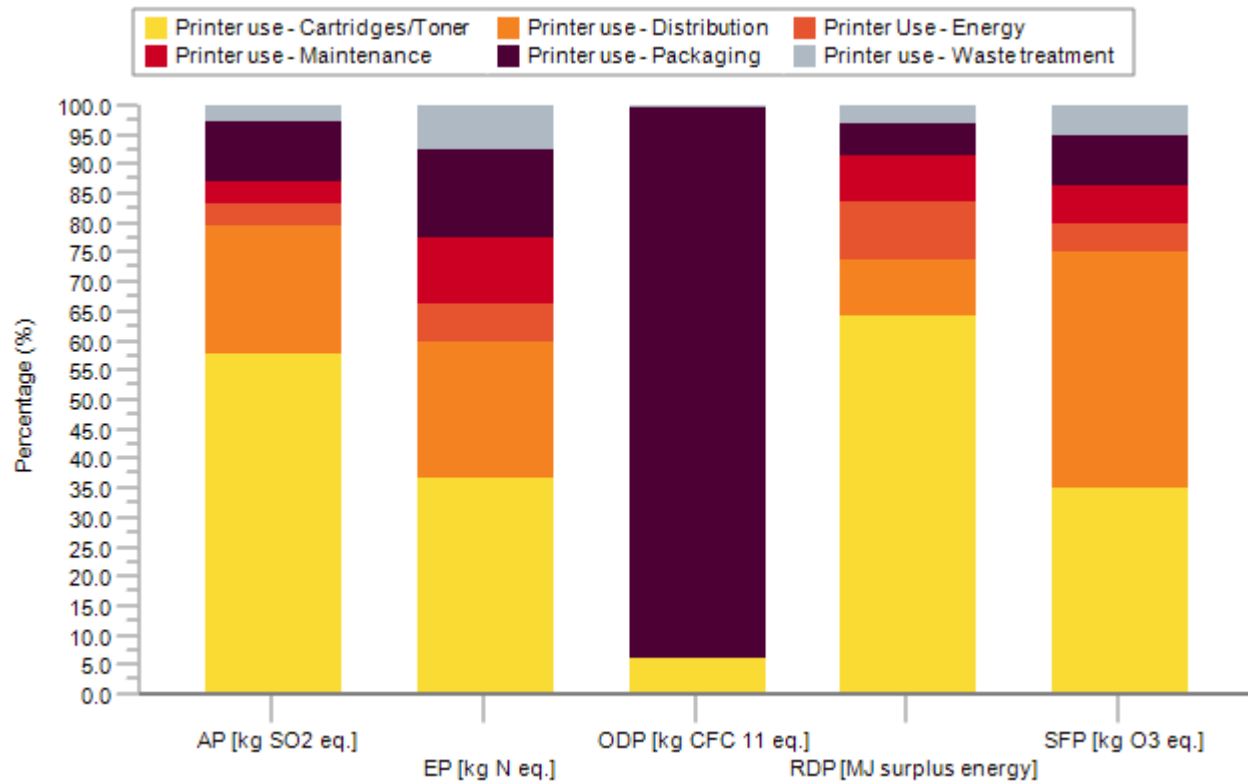


Figure 2: Contribution analysis of the use phase (per 1000 pages excluding paper)

Assumptions and Estimations

Assumptions and estimations are documented in the methodology report, which was provided for critical review purposes alongside this document. The LCA results represent the specific printer model as sold in the North American market.

The model assumes a printer lifetime of five (5) years. The printer is modeled to print an average pages per day

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

based on actual customer printing information. The printer further possesses an automatic mechanical duplexing feature.

Power consumption figures are based on ENERGY STAR® testing of the printer using the average job load described above. Consumables rate of consumption is based on the market-average yield across all available cartridge capacities. In addition, market-average use of remanufactured cartridges is taken into account, as applicable.

Transportation distances to the end consumer are based on their points of origin and the population-weighted average distance to the 100 most populous cities in the continental US based on 2020 census data. The printer as well as replacement fuser kits and waste toner bottles are manufactured in China and shipped to the point of use from the distribution center near Jeffersonville, IN, while the cartridges and the imaging unit are shipped from Ciudad Juarez, MX to Jeffersonville, IN.

The paper dataset developed by Sphera represents European and used as proxy in lieu of current US data.

The End-of-Life treatment for the printer is based on the assumption that 90 % of the printers are either recycled or remanufactured, while the remainder is disposed of through local waste streams, where the metal fractions are assumed to be recycled and the remainder landfilled. The EoL cartridges are assumed to be split as such: 80% to remanufacturing or recycling, and 20% landfill.

In accordance with the cut-off methodology, materials sent to End-of-Life recycling are considered to cross the system boundary without any further transformation. Only the impacts associated with waste transportation and disposal are included in the results.

Description of Data and Period Under Consideration

All primary data is based on technical documentation and sales data accessed in 2024. All background data is taken from the MLC 2024-10.9.0.31 Databases. No primary data is collected from the Original Equipment Manufacturer's manufacturing plant.

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw
Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Data Quality

Manufacturing data of printers and consumables is based on a combination of Bills of Material and teardown analyses and is considered to be of overall high quality with low uncertainty. Distribution from printer manufacturing to the end consumer is representative of logistical data from Lexmark and best estimates of US average shipping distances, and is of moderate quality and high uncertainty.

Printer power consumption represents measured power consumed during printer operation. The electricity consumed is calculated based on TEC specification, and is of high quality and moderate uncertainty. Toner cartridge use is based on expected yields based on the ISO test standards for cartridge use, and is of high quality and low uncertainty. Replacement rate for consumable parts is based on part design specifications, and is of high quality and moderate uncertainty.

The disposition of the printer and consumables at End-of-Life is based on best-available information by the respective experts at Lexmark. This data is of average quality and moderate uncertainty.

Background Data

All background datasets relevant to production, power generation, transportation, and material disposal were taken from Sphera's MLC 2024-10.9.0.31 Databases.

The additional use of third-party background data from industry associations (e.g., worldsteel) is documented in the methodology report. They represent the latest LCI data as available in the MLC 2024-10.9.0.31 Databases.

Allocation and Methodological Principles

No significant allocations have been considered for the production of the printer. Allocation of production or use impacts across the various functions of a multi-function system is not included (i.e., allocation of production impacts to the provision of scanning services) and the impacts from all life cycle stages are considered within the system boundaries for the printing system.

Treatment of recycled or resold material is not considered in the body of the LCA, in accordance with the cut-off methodology.

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

References and Standards

Bare, J. (2012). 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. Washington, D.C.: U.S. EPA.

EPA (2021) ENERGY STAR® Program Requirements for Imaging Equipment – Test Method (Rev. Nov-2021)
<https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Imaging%20Equipment%20Version%203.2%20Final%20Specification.pdf>

ISO (2006a) ISO 14025: Environmental labels and declarations – Type III environmental declarations – Principles and procedures. International Organization for Standardization. Geneva.

ISO (2006b) ISO 14040: Environmental management - Life cycle assessment – Principles and framework. International Organization for Standardization. Geneva.

ISO (2006c) ISO 14044: Environmental management - Life cycle assessment – Requirements and guidelines. International Organization for Standardization. Geneva.

NCASI (2010) Life Cycle Assessment of North American Printing and Writing Paper Products – Final Report. Prepared for the American Forest and Paper Association (AF&PA) and the Forest Products Association of Canada (FPAC) by the National Council for Air and Stream Improvement, Inc. Research Triangle Park, NC

Sphera. (2025) *LCA for Experts Documentation*. Retrieved from Sphera Solutions, Inc.:
<https://sphera.com/solutions/product-stewardship/life-cycle-assessment-software-and-data/lca-for-experts/>

ULE (2018) Product Category Rules for preparing an environmental product declaration (EPD) for printers and multi-function printing units (v2.0). UL Environment. Washington, DC. Expired in April, 2023.

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw

Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Contact Information



Lexmark International, Inc.
740 W. New Circle Road
Lexington, KY 40550
Tel: +1-859-232-2000

LIFE CYCLE ASSESSMENT



Laser Printer C3326dw
Printers and multi-functional printing units

According to ISO 14040 and ISO 14044

Critical Reviewer:

Thomas P. Gloria, Ph. D.
Industrial Ecology Consultants
35 Bracebridge Rd.
Newton, MA 02459-1728
direct: 617.553.4929
email: t.gloria@industrial-ecology.com

Dr. Gloria is a certified Life Cycle Professional (LCACP) through the American Center for Life Cycle Assessment.

LIFE CYCLE ASSESSMENT



Lexmark

Letter of Equivalency

LCA Model Evaluated: C3326dw

Equivalent Models: CS331dw

Life Cycle Assessments (LCA) are in accordance with ISO 14040 and ISO 14044. Life Cycle Assessments provide information on a number of environmental impacts of products over their life cycle. LCAs may be used equivalently for programs with multiple configurations if the differences in configurations are evaluated and determined to be negligible to the global warming impact. Printer configurations with the same parameters for mass, typical electricity consumption (TEC), rated pages per minute are considered equivalent. In many cases, several configurations are identical, but the model names are different among various sales channels. For printer configurations that have slight differences, they are determined to be equivalent only when those differences are considered to have a negligible contribution to the LCA results.

Accuracy of Results and Comparability: LCAs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. LCAs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. LCAs from different programs may not be comparable.

Exclusions: LCAs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. LCAs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Full details are documented in the LCAs methodology report, which was provided for verification purposes alongside the LCA. Assumptions and estimations generally follow the governing PCR on printing equipment. The LCA results represent the specific printer model as sold in the North American market.