AN ENVIRONMENTAL PRODUCT DECLARATION

According to ISO 14025:2006 and ISO 21930:2017

RESIDENTIAL 1-PIECE TOILET PRODUCT GROUP

FGI-INDUSTRIES (FGI) is pleased to present this average product group environmental product declaration (EPD) for its residential 1-piece toilet. This EPD was developed in compliance with ISO 14025:2006, ISO 21930:2017 and is verified by ASTM International.

This cradle-to-grave EPD includes life cycle assessment (LCA) results for the production, construction, use, and end-of -life stages of FGI's residential 1-piece toilet product group. This EPD is intended for both business-to-business and business-to-consumer communication.

For more information about FGI-Industries sanitary ware products and product lines, please visit: www.fgi-industries.com.

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ASTM CERTIFICATION PAGE

This Type III Environmental Product Declaration (EPD) presents the cradle-to-grave LCA results for FGI's residential 1-piece toilet product group. The EPD results are representative of FGI's residential 1-piece toilet product group (weighted average) as manufactured by Huida Sanitary Ware Co., Ltd and distributed in North America by FGI under various brand names. This EPD also reports minimum and maximum values for the product group in accordance with the sub-product category rule.

This EPD is certified by ASTM to conform to the UL PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010, Version 3.2, December 2018 and UL PCR Part B: Sanitary Ceramics, UL 10010–2, June 2018, as well as to the requirements of ISO 14025:2006, ISO 21930:2017, ISO 14040:2006, ISO 14044:2006, and ASTM International's General Program Instructions, Version: 8.0, Revised 04/29/2020. This EPD is intended for business-to-business and business-to-consumer audiences.

PROGRAM OPERATOR	ASTM International
DECLARATION HOLDER	FGI – Industries (Corporate Canada) 5970 Chedworth Way, Unit B Mississauga, ON, L5R 4G5 Canada Link: www.fgi-industries.com *The owner of the declaration is liable for the underlying information and evidence.*
DECLARATION NUMBER	EPD 459
PRODUCT GROUP AND NAME	*Vitreous Sanitary Ceramic Wares* Residential 1-piece toilet (UNSPSC code 30181505)
DECLARED PRODUCT AND UNIT	FGI's residential 1-piece toilet product group (weighted average), one piece
PRODUCT DEFINITION	- Integrated bowl and tank - Single lever or dual flush options and rates - Tank–lined and unlined options - Various heights - Round or elongated bowl - Includes all hardware
REFERENCE PCR	UL Environment ***Part A****:* Life Cycle Assessment Calculation Rules and Report Requirements, December 2018, v3.2, UL 10010. UL Environment, Product Category Rule Guidance for Building-Related Products and Services; ***Part B***: Sanitary Ceramic EPD Requirements, June 2018, UL 10010–2.

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APPLICABLE MARKETS	North America
DATE OF ISSUE AND VALIDITY PERIOD	24-05-2023 – 5 years
EPD TYPE	Company-specific product group EPD (weighted average), including minimum and maximum results
EPD SCOPE	Cradle-to-grave (A1 to C4)
REFERENCE YEAR FOR MANUFACTURER PRIMARY DATA	2021
LCA SOFTWARE AND VERSION NUMBER	SimaPro v9.4.0.2
LCI DATABASES	Ecoinvent v3.8, USLCI database
LCIA METHODOLOGY	TRACI 2.1 v1.06, CED (LHV) v1.0, CML-baseline, v4.7
EPD VERIFICATION This EPD was independently verified by ASTM in accordance with ISO 14025, ISO 21930, and the reference PCR:	Tim Brooke ASTM International 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428-2959, USA www.astm.org *For any explanatory material, please contact the program operator.*
LCA REVIEW The LCA report was independently reviewed to be in accordance with ISO 14025, ISO 21930, ISO 14040/44, and the reference PCR by: External X	Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA
EPD PREPARED BY: Athena Sustainable Materials Institute	Athena Sustainable Materials Institute 280 Albert Street, Suite 404 Ottawa, Ontario, Canada K1P 5G8 info@athenasmi.org http://www.athenasmi.org

LIMITATIONS:

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Sanitary Ceramic products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building use phase as instructed under this PCR.

Full conformance with the PCR for Sanitary Ceramics allows EPD comparability only when all stages of a life cycle have been considered when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to different results upstream or downstream of the declared life cycle stages.

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COMPANY DESCRIPTION

Over the course of 35 years, FGI Industries Ltd has built an industry-wide reputation for product innovation, quality, and excellent customer service. FGI is currently focused on the following product categories: sanitaryware, bath furniture, shower systems, custom kitchen cabinetry and other accessory items. FGI's sanitaryware products are manufactured by Huida Sanitary Ware Co., Ltd, at the facility located at No.7, Huida Road, Huanggezhuang Town, Fengnan District, Tangshan, Hebei, China.

PRODUCT DESCRIPTION AND APPLICABLE STANDARDS

This EPD represents FGI's packaged residential 1-piece toilet product group (weighted average) as manufactured by Huida Sanitary Ware Co., Ltd and distributed in North America by FGI under various brand names (see Table 2). The weighted average across all FGI's packaged residential 1-piece toilets is calculated based on production volume for the reference year 2021 as described in UL PCR Part A, Section 2.5.2.

Residential 1-piece toilet (FGI's product group)

- Vitreous China
- Integrated bowl and tank
- Single lever or dual flush options and rates
- Tank – lined and unlined options
- Various heights
- Round or elongated bowl
- Includes all hardware.

Certifications

– IAPMO cUPC
– ASME A112.19.2 / CSA B45.1
– LEED Compliant
– US EPA WaterSense®
– MaP Premium Tested 1000g
– ADA Guidelines & ANSI A117.1
– CSA B651 barrier-free standard

MATERIAL CONTENT

Table 1 below presents the material content of FGI's packaged residential 1-piece toilet product group on a percent basis (%).

Table 1. Base material content of the product- FGI's packaged residential 1-piece toilet product group

Material	Function	Quantity (% by weight)
Clay	Slip and glaze ingredient	50%-60%
Feldspar	Slip and glaze ingredient	20%-30%
Silica	Slip and glaze ingredient	5%-10%
Hardware and Packaging	Miscellaneous Hardware and Packaging	5%-10%

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MANUFACTURING, PACKAGING, TRANSPORTATION, AND INSTALLATION

Vitreous ceramic sanitary ware is manufactured in China by casting a mix of clay, feldspar, and silica with water into a reusable mold. When partially dried, the casting is then sprayed with an aqueous glaze and fired in a kiln to "vitrify" the ware. The product is then fitted with hardware, packaged, and shipped to various NA distribution locations.

The declared product group is transported from the Chinese plant to distribution locations in Canada and the USA by truck, ocean freight, and rail. The declared product group is transported from the distribution locations to the installation site 500 km by truck (see Table 3, Module A4).

Vitreous ceramic sanitary ware is packaged primarily with double-wall corrugated containerboard. Other packaging materials include expanded polystyrene (EPS) and honeycomb paperboard blocking. This EPD conservatively assumes that packaging materials are disposed in landfill (see Table 3, module A5). Per PCR Table 7, no operational energy use (manual) is assumed to be consumed during the installation (A5).

CONDITIONS OF USE, RSL, CLEANING AND MAINTENANCE

One-piece residential toilet product group will include water use impacts in the EPD results (see Table 3, module B7).

The reference service life (RSL) of one-piece residential toilet product group is assumed 20 years (see Table 3).

One-piece residential toilet product group is assumed to require 52 cleanings per year with 50 ml of 10% HCL solutions (see Table 3, module B2).

No repair, replacement, refurbishment, or operational energy use are assumed to be required during the service life of 20 years (see Table 3, modules B3, B4, B5 and B6).

END-OF-LIFE STAGE

Per PCR Table 7, no operational energy use (manual) is assumed to be consumed during the deconstruction (C1).

Per PCR, section 2.19, the FGI's LCA model assumes that the vitreous portion of the product and accessories are transported 100 km by truck to the final disposal and landfilled.

DESCRIPTION OF THE FUNCTIONAL UNIT

The functional unit for this study is FGI's packaged residential 1-piece toilet product group (weighted average) with a reference service life (RSL) of 20 years over a service life of 20 years. Table 2 describes the functional unit. FGI's minimum and maximum values are one packaged residential 1-piece toilet having the lowest or highest mass in the product group.

Table 2. Description of functional unit- FGI's packaged residential 1-piece toilet product group

Name	Value	Unit
Declared product group	One packaged residential 1-piece toilet product group	
FGI's weighted average mass (min/max)	51.67 (21.46/60.44)	kg
Conversion factor to 1kg	0.019	
FGI's weighted average flush rate (min/max)	4.5E-3 (3.9E-3/4.8E-3)	m^3pf
Flow rate	-	m^3/sec
Brands	Avenue®, contrac®, Foremost®, Proflo®, Signature Hardware®, Project Source®	

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SYSTEM BOUNDARY

The system boundary for the EPD is cradle-to-grave as depicted in Figure 1 below and in accordance with PCR.

	Product Stage			Construction Process Stage		Use Stage							End of Life Stage				Benefits and Loads Beyond the System Boundaries	
Cradle to grave with options	Raw material supply	Transport	Manufacturing	Transport from gate to the site	Assembly/ Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential	Reference Service Life
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND	

Description of the System Boundary Stages Corresponding to the PCR
(X = Included; MND = Module Not Declared)

Figure 1. Declared life cycle stages and their information modules as per the PCR

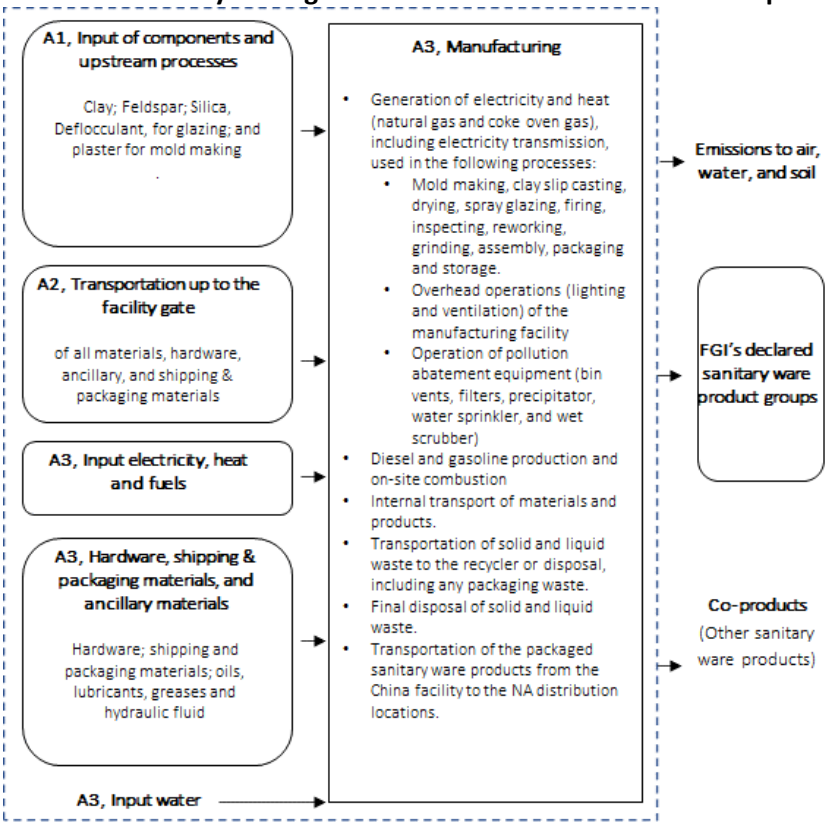

Figure 2. Production stage (A1 to A3) system boundary of FGI's vitreous ceramic sanitary ware

CUT-OFF RULES

The cut-off criteria as per the governing PCR were followed. Per ISO 21930, 7.1.8, all input/output data required were collected and included in the LCI modelling. No known flows are deliberately excluded from this EPD. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD.

Per PCR, 3.2, this EPD excludes the following items:

Capital goods and infrastructure flows.

Personnel-related activities, such as travel and office supplies.

ALLOCATION

The manufacturing facility in China produces various sanitary ceramics products, so allocation was necessary. “Mass” was used as the physical parameter for allocating flows between the FGI and other distributors of sanitary ceramic products to calculate the input material flows, energy flows (electricity and fuels), ancillary materials used at the facility, total water consumption, process emissions to air and water and waste flows. “Mass” based, plant-specific data for each piece of the product group were used to calculate the input raw materials, hardware, shipping, and packaging materials, and transportation data. The LCI modeling accounts for on-site processes' manufacturing yield (waste loss). In addition, allocation related to transport is based on the mass of transported inputs and outputs.

ESTIMATES AND ASSUMPTIONS

Key assumptions and estimates are as follows (also see Table 3):

- Product transport impacts from the production facility in China to distribution locations in North America is captured in module A3 on a weighted average basis.
- Product transport from North American distribution locations to the point of installation (A4) and from the final customer to landfill (C2) are modelled based on the default values prescribed in the PCR.
- Product and packaging are assumed to be landfilled at the end of life.

DATA COLLECTION, SOURCES, AND CALCULATIONS

Primary gate-to-gate LCI manufacturing and inbound/outbound transportation data were collected for the declared product groups for the reference year 2021 (12 consecutive months).

Data calculation procedures follow ISO 14044 and ISO 21930. The LCA model was developed using SimaPro v.9.4.0.2 2023. SimaPro LCA software contains recognized databases (e.g., ecoinvent v3.8, 2021 database, Allocation, Cut-off by classification, and U.S. LCI Database, 2015) that provide LCI datasets for upstream, core, and downstream material and processes. SimaPro 9.4.0.2 2023 also contains the U.S. EPA TRACI v2.1 2012 and CML-baseline version 4.7 2016 LCIA methodologies, and the Cumulative Energy Demand, LHV (NCV) version 1.0 November 2018 which are used for this LCA study. Per ISO 21930, 7.2.2 (2), when transforming the inputs and outputs of combustible material into inputs and outputs of energy, the net calorific value (lower heating value) of fuels is applied according to scientifically based and accepted values specific to the combustible material.

DATA QUALITY REQUIREMENTS AND ASSESSMENT

Data Quality Requirements	Description
Technology Coverage	Data represents the prevailing technology in use in China. For all upstream and core materials and processes, China-specific or international typical or average industry LCI datasets were utilized whenever available. *Technological representativeness is characterized as "high".*
Geographic Coverage	The geographic region considered is Global. The geographic coverage of all LCI databases and datasets is provided in the background LCA report. *Geographical representativeness is characterized as "high".*
Time Coverage	Activity data are representative as of 2021. - Porcelain (clay slip) production collected for the reference year 2021 (12 months); - Inbound/ outbound transportation data- primary data collected from the Chinese plant and from FGI to distribution locations in Canada and the USA: the reference year 2021 (12 months); - Generic data: the most appropriate LCI datasets were used as found in the US LCI Database, ecoinvent v.3.8 database, November 2021. *Temporal representativeness is characterized as "medium" to "high".*
Completeness	All relevant, specific processes, including inputs (raw materials, energy, water flows, ancillary materials, hardware, shipping and packaging), outputs (emissions to air, water and land, liquid and solid waste, and production volume), inbound and outbound transportation data, and flow rates per product were considered and modeled to provide a product group average for each of the product systems of interest. The completeness of the cradle-to-grave process chain in terms of process steps is rigorously assessed for all products of interest and documented in the LCA report. Crosschecks concerning the completeness and plausibility of input and output flows were continuously conducted. The LCA team conducted mass and energy balances at the facility and product levels. Whenever data gaps, outliers, or other inconsistencies were identified, Athena engaged with the data provider to clarify and/or resolve any open issues.
Consistency	To ensure consistency, the LCI modeling of the production weighted input and output LCI data for each sanitary ware product used the same LCI modeling structure, which consisted of input raw, secondary, ancillary, hardware and packaging materials, intermediate products, energy flows, water inputs, product outputs, emissions to air, water and soil, and solid and liquid waste disposal (if applicable). Similarly, all downstream scenarios were based on the same model.
Reproducibility	Internal reproducibility is possible since the data and the models are stored and available in the *Athena FGI LCI database* developed in SimaPro, 2023. A high level of transparency is provided throughout the report as the weighted average LCI profile is presented, as well as minimum and maximum inputs/outputs. Key primary (manufacturer-specific) and secondary (generic) LCI data sources are summarized in the Project Report. External reproducibility is possible with access to the project report. However, the project report is not in the public domain.
Transparency	Activity and LCI datasets, including data sources, are transparently disclosed in the project report.
Uncertainty	As this study presents an average product group EPD results, the PCR requires reporting min/max range results, which summarize the expected range of possible outcomes together. As such, the min/max range of EPD results duly addresses the uncertainty of the average product group EPD results and any conclusions that may be drawn.

LCA MODELING SCENARIOS (A4-C4)

Table 3. LCA modeling scenarios – Residential 1-piece toilet product group

Transport from gate to the building site (A4)		
Name	**Value**	**Unit**
Litres of fuel[1]	30.2	l/kg*km
Transport from gate to the building site	500	km
Capacity utilization (including empty runs)	-	
Gross density of products transported	-	
Capacity utilization volume factor	-	

[1] https://www.lcacommons.gov/lca-collaboration/National_Renewable_Energy_Laboratory/USLCI_Public_2023_Q1_v1/dataset/PROCESS/a685da05-1a42-3fe1-a68b-6db458be5e07

Installation into the building (A5)		
Name	**Value**	**Unit**
Auxiliary material	-	kg
Water consumption	-	m³
Other resources	-	km
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Product loss per functional unit	-	kg
Waste material at the construction site-Average	6.35	kg
Output materials-on-site waste processing	-	kg
Direct emissions to ambient air, soil and water	-	kg
Transport from building site to landfill	100	km

Reference service life		
Name	**Value**	**Unit**
Reference service life (RSL)	20	years
Building Estmated Service life	75	years

Maintenance (B2)		
Name	**Value**	**Unit**
Maintenance process information	-	
Maintenance cycle-RSL	1040	Number/RSL
Maintenance cycle-ESL	3900	Number/ESL
Water consumption	-	m³
Auxiliary material (cleaning agent per RSL)	54.6	kg
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Power output of equipment	-	kW
Material loss	-	kg
Direct emissions to air, soil and water	-	kg
Maintenance per year	52	
Cleaning agent	50	ml
Density cleaning solution	1.05	g/ml
Cleaning Solution	10% HCl solution	

Repair (B3)		
Name	**Value**	**Unit**
Repair process information	-	-
Inspection process information	-	-
Repair cycle-RSL	-	Number/RSL
Repair cycle-ESL	-	Number/ ESL
Water consumption	-	m³
Auxiliary	-	kg
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Material loss	-	kg
Direct emissions to air, soil and water	-	kg

Replacement (B4)		
Name	**Value**	**Unit**
Replacement cycle-RSL	0	(RSL/RSL)-1
Replacement cycle-ESL	2.8	(ESL/RSL)-1
Electricity consumption	-	kWh
Liters of fuel	-	l/100 km
Water consumption	-	m³
Auxiliary material	-	kg
Replacement of worn parts	-	kg
Direct emissions to air, soil and water	-	kg

Refurbishment (B5)		
Name	**Value**	**Unit**
Refurbishment cycle-RSL	-	Number/RSL
Refurbishment cycle-ESL	-	Number/ESL
Electricity consumption	-	kWh
Liters of fuel	-	l/100 km
Water consumption	-	m³
Auxiliary material	-	kg
Replacement of worn parts	-	kg
Direct emissions to air, soil and water	-	kg

Operational energy use (B6) and water use (B7)		
Name	**Value**	**Unit**
Water consumption-Average	164.5	m³/p/RSL
Electricity consumption	0	kWh
Other energy carriers	-	MJ
Equipment output	-	kW
Direct emissions to air, soil and water	-	kg
Uses per day	5.05	flushes/day/person

End of life (C1-C4)		
Name	**Value**	**Unit**
Collected separately	-	kg
Mixed construction waste-Average	45.33	kg
Reuse	-	kg
Recycling	-	kg
Energy recovery	-	kg
Landfilling-Average	45.33	kg
Transport from building site to landfill (C2)	100	km

LIFE CYCLE ASSESSMENT RESULTS

This section summarizes the product group average life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the weighted average cradle-to-grave life cycle inventory inputs and outputs analysis (Table 4). Tables 5 and 6 present the life cycle results for minimum mass and maximum mass product satisfying the function – a packaged residential 1-piece toilet. As per the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD.
It should be noted that *LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks*.

Table 4. Cradle-to-grave (A1-C4) EPD Results – Residential 1-piece toilet product group (Weighted average), RSL 20 years

Impact category and inventory indicators	Unit	Total	A1-A3	A4	A5	B2	B7	C2	C4
GWP 100[1)]	kg CO_2 eq	260.4	119.4	2.5	0.2	4.3	132.4	1.4	0.1
ODP[1)]	kg CFC-11 eq	2.2E-05	1.2E-05	1.0E-10	3.5E-09	1.9E-06	8.8E-06	6.1E-11	2.5E-08
SFP[1)]	kg O_3 eq	21.8	13.6	0.8	0.1	0.4	6.5	0.4	0.03
AP[1)]	kg SO_2 eq	1.336	0.696	0.033	0.002	0.026	0.563	0.015	0.001
EP[1)]	kg N eq	1.006	0.391	0.002	1.3E-04	0.015	0.597	0.001	1.2E-04
FFD[1)]	MJ surplus, LHV	260.1	111.6	5.3	0.5	4.1	135.4	3.0	0.2
ADPf[2)]	MJ, LHV	3,334.5	1,713.2	35.5	3.1	50.7	1,510.0	20.6	1.5
RPRE	MJ, LHV	291.8	68.1	0.0	0.0	5.1	218.6	0.0	0.0
RPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRPRE	MJ, LHV	3,763.5	1,749.0	35.9	3.1	56.4	1,896.8	20.8	1.5
NRPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
SM[3)]	kg	0.022	0.022	0	0	0	0	0	0
RSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
RE[3)]	MJ, LHV	0	0	0	0	0	0	0	0
FW[3)]	m^3	165.7	0.8	0	0	0.2	164.7	0	3.3E-05
HWD[3)]	kg	8.2E-02	8.2E-02	0	0	0	0	0	0
NHWD[3)]	kg	65.6	13.9	0	6.4	0	0	0	45.3
HLRW[3)]	m^3	3.8E-07	2.1E-08	0	3.7E-13	5.0E-09	3.5E-07	0	2.6E-12
ILLRW[3)]	m^3	5.5E-06	2.2E-06	0	1.2E-09	7.9E-08	3.3E-06	0	8.4E-09
CRU[3)]	kg	0	0	0	0	0	0	0	0
MR[3)]	kg	0.097	0.097	0	0	0	0	0	0
MER[3)]	kg	0	0	0	0	0	0	0	0
EE[3)]	MJ, LHV	0	0	0	0	0	0	0	0

See Notes after Table 6

Table 5. Cradle-to-grave (A1-C4) EPD Results – Residential 1-piece toilet product group (Minimum), RSL 20 years

Impact category and inventory indicators	Unit	Total	A1-A3	A4	A5	B2	B7	C2	C4
GWP 100[1)]	kg CO_2 eq	144.2	49.0	1.0	0.1	4.3	89.0	0.6	0.046
ODP[1)]	kg CFC-11 eq	1.2E-05	4.6E-06	4.3E-11	1.5E-09	1.9E-06	5.9E-06	2.5E-11	1.0E-08
SFP[1)]	kg O_3 eq	10.5	5.2	0.4	0.0	0.4	4.4	0.2	0.0
AP[1)]	kg SO_2 eq	0.702	0.277	0.014	0.001	0.026	0.379	0.006	4.4E-04
EP[1)]	kg N eq	0.578	0.161	0.001	5.6E-05	0.015	0.401	3.4E-04	4.8E-05
FFD[1)]	MJ surplus, LHV	147.1	48.3	2.2	0.2	4.1	91.0	1.3	0.1
ADPf[2)]	MJ, LHV	1,809.3	718.3	14.7	1.3	50.7	1,015.2	8.5	0.6
RPRE	MJ, LHV	181.4	29.3	0.0	0.0	5.1	147.0	0.0	0.0
RPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRPRE	MJ, LHV	2,091.7	734.7	14.9	1.3	56.4	1,275.2	8.6	0.6
NRPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
SM[3)]	kg	0.022	0.022	0	0	0	0	0	0
RSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
RE[3)]	MJ, LHV	0	0	0	0	0	0	0	0
FW[3)]	m^3	111.2	0.3	0	0	0.2	110.7	0	1.3E-05
HWD[3)]	kg	3.3E-02	3.3E-02	0	0	0	0	0	0
NHWD[3)]	kg	27.0	5.6	0	2.7	0	0	0	18.7
HLRW[3)]	m^3	2.5E-07	9.2E-09	0	1.6E-13	5.0E-09	2.4E-07	0	1.1E-12
ILLRW[3)]	m^3	3.1E-06	8.0E-07	0	5.0E-10	7.9E-08	2.2E-06	0	3.5E-09
CRU[3)]	kg	0	0	0	0	0	0	0	0
MR[3)]	kg	0.097	0.097	0	0	0	0	0	0
MER[3)]	kg	0	0	0	0	0	0	0	0
EE[3)]	MJ, LHV	0	0	0	0	0	0	0	0

See Notes after Table 6

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Table 6. Cradle-to-grave (A1-C4) EPD Results – Residential 1-piece toilet product group (Maximum), RSL 20 years

Impact category and inventory indicators	Unit	Total	A1-A3	A4	A5	B2	B7	C2	C4
GWP 100[1)]	kg CO_2 eq	291.0	139.2	2.9	0.3	4.3	142.5	1.7	0.1
ODP[1)]	kg CFC-11 eq	2.5E-05	1.4E-05	1.2E-10	4.3E-09	1.9E-06	9.4E-06	7.0E-11	2.9E-08
SFP[1)]	kg O_3 eq	25.0	16.0	1.0	0.1	0.4	7.0	0.4	0.04
AP[1)]	kg SO_2 eq	1.513	0.822	0.038	0.003	0.026	0.606	0.017	0.001
EP[1)]	kg N eq	1.117	0.456	0.002	1.6E-04	0.015	0.642	9.6E-04	1.4E-04
FFD[1)]	MJ surplus, LHV	290.2	129.9	6.1	0.6	4.1	145.6	3.5	0.3
ADPf[2)]	MJ, LHV	3,739.0	1,992.8	41.5	3.8	50.7	1,624.6	23.9	1.8
RPRE	MJ, LHV	320.8	80.5	0.0	0.0	5.1	235.2	0	7.4E-03
RPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRPRE	MJ, LHV	4,203.1	2,034.2	41.9	3.8	56.4	2,040.8	24.1	1.8
NRPRM[3)]	MJ, LHV	0	0	0	0	0	0	0	0
SM[3)]	kg	0.022	0.022	0	0	0	0	0	0
RSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
NRSF[3)]	MJ, LHV	0	0	0	0	0	0	0	0
RE[3)]	MJ, LHV	0	0	0	0	0	0	0	0
FW[3)]	m^3	178.3	1.0	0	0	0.2	177.2	0	3.8E-05
HWD[3)]	kg	9.6E-02	9.6E-02	0	0	0	0	0	0
NHWD[3)]	kg	76.6	16.2	0	7.8	0	0	0	52.6
HLRW[3)]	m^3	4.1E-07	2.4E-08	0	4.5E-13	5.0E-09	3.8E-07	0	3.0E-12
ILLRW[3)]	m^3	6.2E-06	2.5E-06	0	1.5E-09	7.9E-08	3.6E-06	0	9.8E-09
CRU[3)]	kg	0	0	0	0	0	0	0	0
MR[3)]	kg	0.097	0.097	0	0	0	0	0	0
MER[3)]	kg	0	0	0	0	0	0	0	0
EE[3)]	MJ, LHV	0	0	0	0	0	0	0	0

Notes to Tables 4, 5 and 6:
[1)] Calculated as per U.S EPA TRACI v2.1, with IPCC 2013 (AR 5), SimaPro v 9.4.0.2.
GWP 100, excludes biogenic CO_2 removals and emissions associated with any biobased products, including bio-based packaging; There is no biogenic content in the declared products.100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5), TRACI v2.1 with AR5, v1.06. FFD is required in LEED v4.1 MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations.
UL Part A, "*these six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes*".
[2)] ADPf are calculated as per CML-IA Baseline v4.7 2016, SimaPro v 9.4.0.2.
[3)] Calculated as per ACLCA ISO 21930 Guidance 2019.
[4)] Per ISO 21930, 7.1.7.1, "individual indicators for information modules A1, A2 and A3 may be aggregated to a total for each indicator in the production stage"
[5)] The environmental burden of modules B1, B3, B4, B5, B6, C1 and C4 is null.
[6)] The following abbreviations are used for Impact category and inventory indicators:

Global warming potential, GWP-100
Ozone depletion potential, ODP
Smog formation potential, SFP
Acidification potential, AP
Eutrophication potential, EP
Fossil fuel depletion, FFD
Abiotic depletion potential, fossil ADPf
Renewable primary resources used as an energy carrier (fuel), RPR_E
Renewable primary resources with energy content used as material, RPR_M
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_E$
Non-renewable primary resources with energy content used as material, $NRPR_M$
Secondary materials, SM
Renewable secondary fuels, RSF
Non-renewable secondary fuels, NRSF
Recovered energy, RE
Consumption of freshwater, FW
Hazardous waste disposed, HWD
Non-hazardous waste disposed, NHWD
High-level radioactive waste, conditioned, to final repository, HLRW
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW
Components for re-use, CRU
Materials for recycling, MR
Materials for energy recovery, MER
Recovered energy exported from the product system, EE

INTERPRETATION

Figure 3 below provides a contribution analysis by information module across the LCIA indicators and primary energy use. As is evident, the Production stage (A1-A3) and Operational water use (B7) account for the majority of the LCIA impacts and energy use. Maintenance (B2) and Transport to site (A4) are the third and fourth largest contributors to the GWP-100. The cleaning agent (B2) is diluted (10% HCl solution) hence it does not have a significant contribution to the total results. Manufacturing impacts are primarily driven by energy use (electricity, natural gas, and coke-oven gas).

AN ENVIRONMENTAL PRODUCT DECLARATION

Residential 1-piece toilet product group

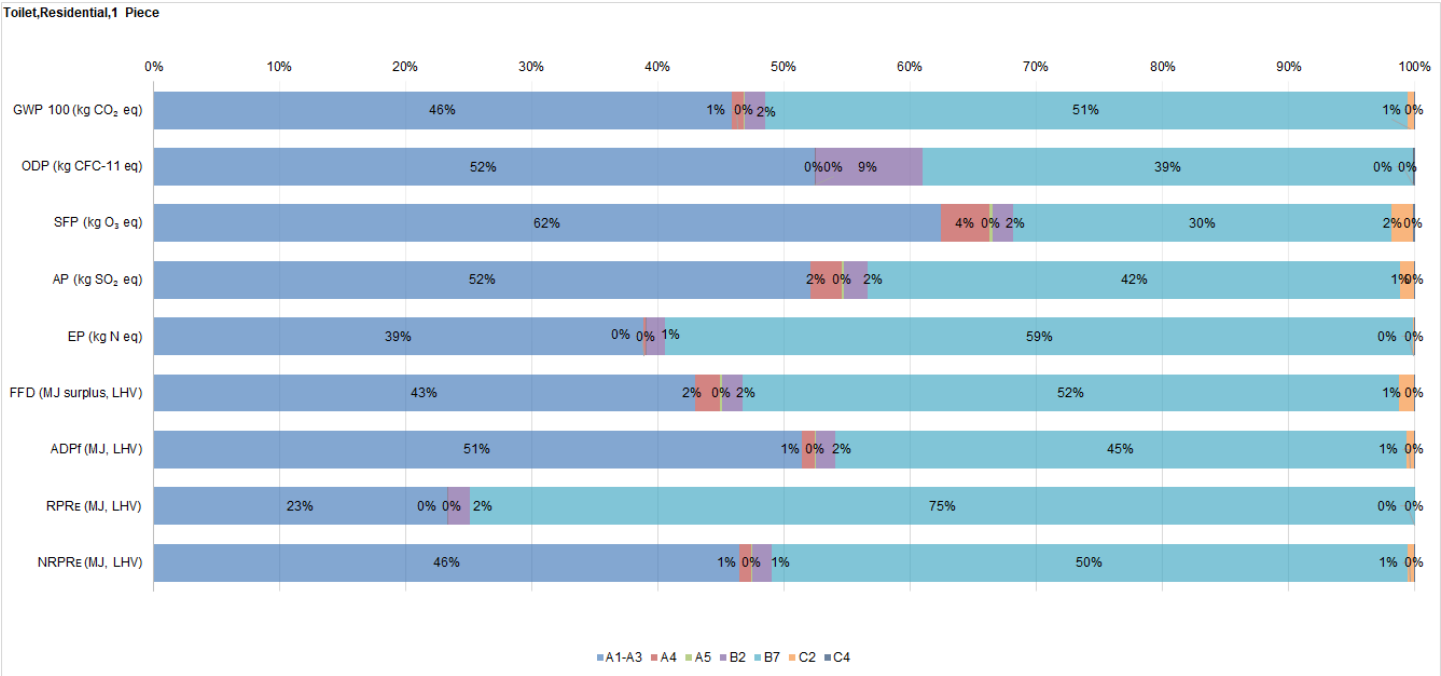

Figure 3. Cradle-to-grave (A1-C4) EPD results – Residential 1-piece toilet product group (weighted average)- % Contribution by module

ADDITIONAL ENVIRONMENTAL INFORMATION

- Applicable Green Building Certification Schemes
  The US Green Building Council's Leadership in Energy and Environmental Design (LEED) v4 and v4.1 green rating system reward building projects across the LEED rating systems (Building Design and Construction, BD+C, Interior Design and Construction, ID+C, Neighborhood Development, ND, and Homes), for selecting products from manufacturers who have disclosed and verified potential environmental impacts.
  LEED v4.1, MR Credit 2, EPDs- Option 1 applies to BD+C rating system (New Construction, Core & Shell, Schools, Retail, Data Centers, Warehouses & Distribution Centers, Hospitality, and Healthcare: 1 point); ID+C rating system (Commercial Interiors, Retail, and Hospitality: 1 point), ND rating system (new land developments, land redevelopments, residential, mixed-use, commercial, and industrial: 1 point); and Homes rating system (Homes, Multifamily Low-rise, Multifamily Midrise: 1 point).
- The Huida Sanitary Ware Co., Ltd is ISO 9001 and ISO 14001 certified.
- Pollution abatement equipment in use at the Huida Sanitary Ware Co includes bin vents, drum filters, precipitators, water sprinklers and wet scrubbers to limit particulate matter emissions or general dust control.
- *No substances of high concern were identified in the framework of this EPD.*

REFERENCES

1. ISO 14025:2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
2. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.
3. UL Environment, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, December 2018, version 3.2.
4. UL Environment, Product Category Rule for Building-Related Products and Services Part B: Sanitary Ceramic Environmental Product Declaration Requirements, June 2018.
5. ISO 14040:2006/Amd 1:2020 Environmental management - Life cycle assessment - Principles and framework.
6. ISO 14044:2006/Amd1:2017/Amd2:2020 Environmental management - Life cycle assessment - Requirements and guidelines.
7. ASTM Program Operator Rules. Version: 8.0, Revised 04/29/2020.
8. PRé 2019.SimaPro LCA Software v9.4.0.2, 2023. https://simapro.com/
9. Athena Institute, Life Cycle Assessment of FGI-Industries Sanitary Wares, May 2023 (81 pages).
10. LEED v4.1, MRc2: Environmental Product Declarations, https://leeduser.buildinggreen.com/credit/NC-v4.1/MRc2#tab-credit-language
11. ACLCA 2019, Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017. The American Centre for Life Cycle Assessment. May, 2019. https://aclca.org/aclca-iso-21930-guidance/