Declaration Owner

Sloan Valve Company
10500 Seymour Avenue, Franklin Park, IL 60131
P: 847.671.4300 / 800.982.5839 · www.sloan.com

Product Group

Water Closets

The water closet products covered by this Environmental Product Declaration (EPD) are based on an average of multiple products.

Functional Unit

One water closet used for a period of 10 years.

The scope of this EPD is Cradle-to-Grave.

EPD Number and Period of Validity

SCS-EPD-04679
EPD Valid October 2, 2017 through October 1, 2022

Product Category Rule

PCR for Building-Related Products and Services in North America. Adapted for UL Environment from the range of EPDs of the Institute Construction and Environment e.V. (IBU).

Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 2.0. June 2017.
Part B: Requirements on the EPD for Sanitary Ceramics. V1.1. December 2015.

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

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

PCR review, was conducted by	The Independent Expert Committee, SVR
Approved Date: October 2, 2017 – End Date: October 1, 2022	
Independent verification of the declaration and data, according to ISO 14025:2006	☐ internal ☑ external
Third party verifier	Tom Gloria, PhD, Industrial Ecology Consultants

PRODUCT

Product Description

Sloan water closets are white vitreous china exchangeable devices that can be connected to a plumbing system to deliver and drain water and are designed to help conserve water. The representative water closet works with 1.1 to 1.6 gpf (gallons per flush)/4.2 to 6.0 Lpf (liters per flush), is made of vitreous china with a 1-½" (38 mm) top spud, a 1-½" (38.1 mm) I.P.S. top spud inlet, a 2-1/8" (54 mm) fully glazed trapway, and a water spot area ranging from 10" x 7-½" (254 mm x 191 mm) to 11-¼" x 8-½" (286 mm x 216 mm). Sloan water closets are International Association of Plumbing and Mechanical Officials (APMO) certified to meet or exceed American Society of Mechanical Engineers (ASME) A112.19.2 standards, are WaterSense listed by the US Environmental Protection Agency, and meet Americans with Disabilities Act (ADA) guidelines and American National Standard Institute (ANSI) A117.1 requirements.

The following water closets are represented in this EPD:

Water Closet Model Numbers Represented by EPD		
ST2469-STG	ST2039-STG	ST2019
ST2469	ST2039	ST2009-STG
ST2459-STG	ST2029-STG	ST2009
ST2459-BPL	ST2029-BPL	
ST2459	ST2029	

Applications

Sloan water closets are installed in restrooms for commercial buildings, airports, stadiums, and the healthcare and hospitality sectors.

Technical Data

- Minimum flow rate: 25 GPM
- Maximum static pressure: 80 PSI
- Minimum flowing pressure: 25 PSI

Delivery Status

Sloan water closets are delivered by truck to the customer. Total nominal weight of product with packaging delivered is 28 kg. The nominal dimensions of the representative product are:

L 26" (660 mm), H 14.13" (359 mm), W 15.44 (392 mm)

Material Resources

The material composition and availability of raw material resources of the representative water closet is shown in Table 1.

Table 1. *Material composition (in % of mass) of the water closet.*

Material	Amount (kg)	Percent of Total Weight	Percent Pre-consumer Recycled Content	Percent Post-consumer Recycled Content	Scrap Rate (%)
Clay	11	44%	3.0%	4.0%	15%
Quartz	8.2	33%	3.0%	4.0%	15%
Feldspar	5.4	22%	3.0%	4.0%	15%
SloanTec™ Hydrophobic Glaze	<0.0010	<0.010%	0.0%	0.0%	0.0%
Total	**25**	**100%**	**3.0%**	**4.0%**	**15%**

The representative water closet weight is based on the average of the minimum (22 kg) and maximum (27 kg) weights of the Sloan water closet products represented by this EPD.

Product Manufacture

Sloan water closets are manufactured in Hangzhou, China. Raw materials, including clay, quartz, and feldspar are mixed with water and ground thoroughly to form a uniform slip. The slip is screened and magnetically separated in an agitating tank. The ware are then cast in plaster molds and then dried before a glazing process. After glazing, the body is sent for drying and firing. The final products are sorted and packaged for distribution.

Product Installation

The installation of water closets is completed using hand tools and manual labor, and does not require any electricity or other resources.

Packaging

The material composition and availability of raw material resources of packaging is shown in Table 2.

Table 2. *Material composition (in % of mass) of packaging for the water closet.*

Material	Amount (kg)	Percent of Total Weight	Percent Pre-consumer Recycled Content	Percent Post-consumer Recycled Content	Scrap Rate (%)
Fluted paper	2.7	84%	5.0%	95%	4.8%
Copper	0.21	6.4%	4.0%	96%	3.9%
Rubber	$2.9x10^{-2}$	0.90%	1.0%	99%	2.2%
Total	**2.9**	**100%**	**4.9%**	**95%**	**4.7%**

Conditions of Use

It is important to note that water use impacts are assigned to the device that controls water flow to avoid double counting (e.g., flushometer), which is outside the scope of this Environmental Product Declaration. Sloan water closets are assumed to require daily cleaning with 50 mL of 10% HCl solution.

Environment and Health during use

No release of substances from the water closet to air, soil, or water are expected to occur.

Reference Service Life

The Reference Service Life (RSL) of the fixture is assumed to be 10 years.

Extraordinary Effects

No environmental or health impacts are expected due to extraordinary effects including fire and/or water damage and product destruction.

Re-use Phase

Reuse at end-of-life via collection and processing of water closets is possible but not widely available. It is assumed that no materials are recovered and processed for these purposes.

Disposal

It is assumed that fixture products at end-of-life are disposed of in a landfill. Transportation of water closets assumes a 62 miles (100 kilometer) distance to disposal, based on the Plumbing Manufacturers International (PMI) Product Category Rule (PCR) Guidance for Kitchen and Bath Vessel Fixtures. Recycling of packaging materials are based on 2014 statistics regarding municipal solid waste generation and disposal in the United States from the US Environmental Protection Agency. For packaging materials not recycled, it is assumed that 20% are incinerated and 80% go to landfill. Transportation of disposal packaging assumes a 20 mile (32 kilometer) distance based on the US Environmental Protection Agency WARM model.

Further Information

Further information on the products covered by this Environmental Product Declaration can be found on the manufacturers' website: https://www.sloan.com/commercial-bathroom-products/water-closets

ADDITIONAL ENVIRONMENTAL INFORMATION

Over one billion gallons of water are wasted in the U.S. every year because of inefficient toilets, urinals and faucets. Sloan's high efficiency fixtures and lavatories have been engineered for optimal performance with Sloan flushometers and faucets, and together, these systems conserve an enormous volume of water over the life of the products.

All of the fixtures in this EPD are manufactured in our state of the art, Leadership in Energy and Environmental Design (LEED) Silver, zero municipal water facility in China. This facility was designed to capture rainwater and store it in underground storage tanks where it is then processed to drinking water quality. This water is then used to support the entire engineering center; from test benches and restrooms to showrooms and landscaping

Sloan's 1.28 gpf closets and 1.1. gpf toilet systems combine high quality vitreous china water closets with our high-efficiency sensor flushometers to create a system that uses 20% less water & 31% less water respectively than the 1.6 gpf EPA standard.

Any Sloan closet is available with our SloanTec™ Hydrophobic Glaze. A proprietary glaze that imparts permanent hydrophobic (water-repellent) and oleophobic (oil-repellent) properties to our vitreous china. This permanent glaze lowers the surface energy of vitreous china resulting in the ability of liquid and solid waste to adhere.

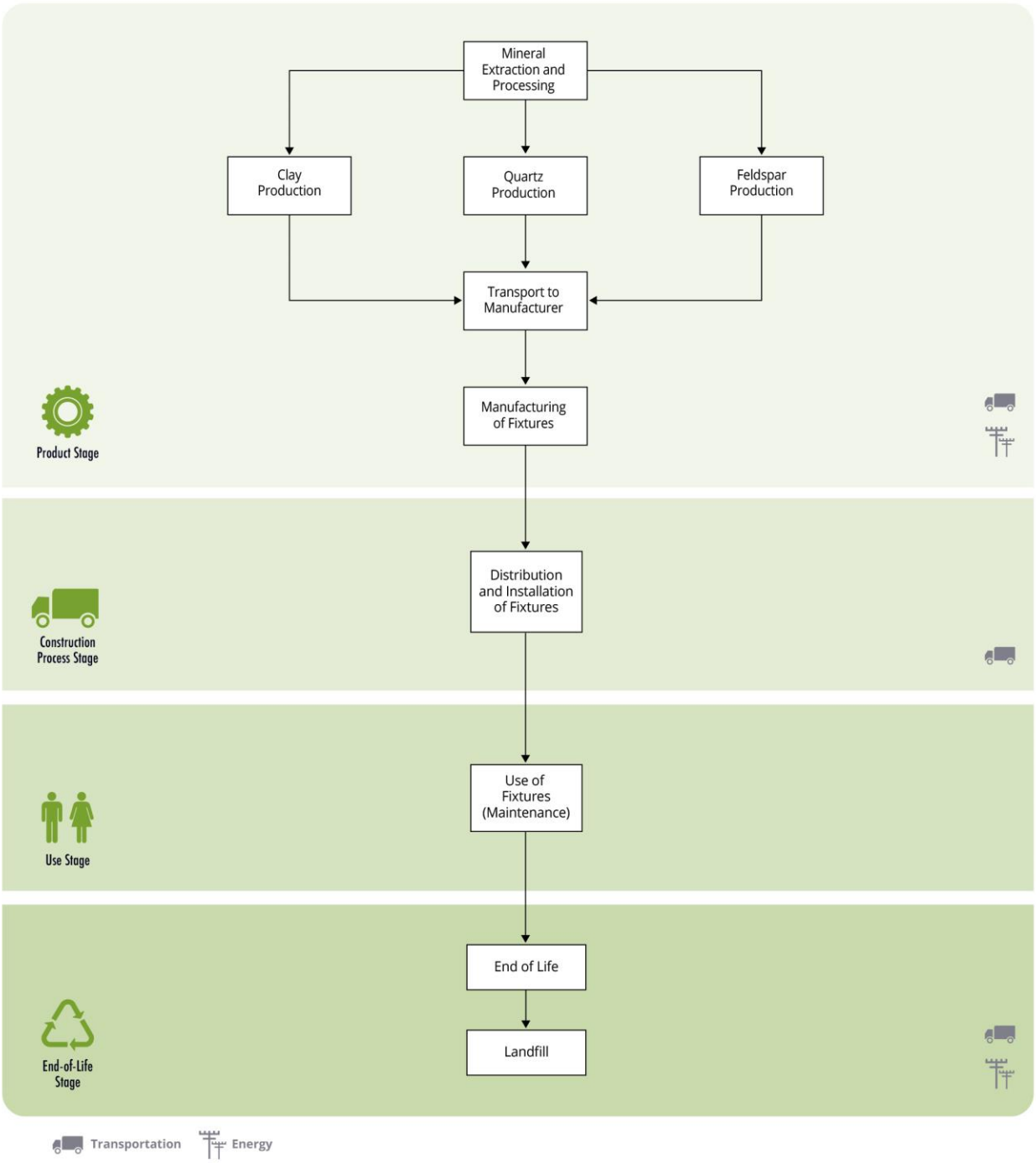
LCA: CALCULATION RULES

Functional Unit

The functional unit declared in this Environmental Product Declaration is one water closet used for a period of 10 years.

System Boundary

The scope of this EPD is cradle-to-grave, including product stage (raw material extraction and processing, transport to the manufacturer, and manufacturing), construction (transport for use and installation), use (cleaning/maintenance, repair, replacement, and refurbishment), and end-of-life (de-construction/demolition, transport, waste processing, and disposal). The benefits and loads beyond the system boundary for reuse, recovery, and recycling potential (module D), are not included in this study. The diagram below is a representation of the most significant contributions to the life cycle of the



Estimates and Assumptions

The assessment relied on several assumptions, described below.

- Representative inventory data from Ecoinvent, version 3.3, was used to reflect the energy mix for electricity use at the manufacturing facility.
- Distances and mode from distribution center to installation site is based on the PMI PCR Guidance for Kitchen and Bath Vessel Fixtures.
- Distance and mode from building site to waste processing is based on the PMI PCR Guidance for Kitchen and Bath Vessel Fixtures.
- Inventory data for unit processes in the system were modeled with data taken from Ecoinvent, version 3.3.

Cut-off Criteria

The cut-off criteria for including or excluding materials, energy, and emissions data from the study are in accordance with the PCR and are listed below.

- Mass and energy flows that consist of less than 1% may be omitted from the inventory analysis
- Cumulative omitted mass or energy flows shall not exceed 5%

Background Data

Unit processes are developed with SimaPro 8.3 software, drawing upon data from multiple sources. Primary data were provided by the manufacturer for their processes and upstream transport. The primary sources of secondary life cycle inventory data are from Ecoinvent, version 3.3.

Table 3. *Data sources used for the life cycle assessment.*

Flow	Dataset	Data Source	Publication Date
Product Materials			
Clay	Clay {RoW}| clay pit operation | Alloc Rec, U	Ecoinvent	2016
Silica	Silica sand {RoW}| production | Alloc Rec, U	Ecoinvent	2016
Feldspar	Feldspar {RoW}| production | Alloc Rec, U	Ecoinvent	2016
Packaging			
Fluted paper	Linerboard {RoW}| treatment of recovered paper to, testliner | Alloc Rec, U	Ecoinvent	2016
Copper	Metal working, average for copper product manufacturing {RoW}| processing | Alloc Rec, U	Ecoinvent	2016
Rubber	Injection moulding {RoW}| processing | Alloc Rec, U	Ecoinvent	2016
Ancillary Materials in Manufacturing			
Gypsum	Gypsum, mineral {GLO}| market for | Alloc Rec, U	Ecoinvent	2016
Electricity/Heat/Resources for Manufacturing			
Electricity	Electricity, medium voltage {CN}| market group for | Alloc Rec, U	Ecoinvent	2016
Natural Gas	Heat, district or industrial, natural gas {CN}| heat production, natural gas, at industrial furnace >100kW | Alloc Rec, U	Ecoinvent	2016
Water	Tap water {RoW}| market for | Alloc Rec, U	Ecoinvent	2016
Cleaning Materials			
10% HCl solution	Hydrochloric acid, without water, in 30% solution state {RoW}| market for | Alloc Rec, U; Water, deionised, from tap water, at user {RoW}| production | Alloc Rec, U	Ecoinvent	2016
Transportation			
Road	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | Alloc Rec, U	Ecoinvent	2016
Ship	Transport, freight, sea, transoceanic ship {GLO}| market for | Alloc Rec, U	Ecoinvent	2016
Waste	Municipal waste collection service by 21 metric ton lorry {RoW}| market for municipal waste collection service by 21 metric ton lorry | Alloc Rec, U	Ecoinvent	2016

CN: China; RoW: Rest-of-World; GLO: Global; U: Unit process; Alloc Rec: Allocation, recycled content.

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage Age of data and the minimum length of time over which data is collected	Manufacturer data (primary data) are based on 2016 annual production, respectively. Representative datasets (secondary data) used for upstream and background processes are generally less than 5 years old. All primary data used represented an average of at least one year's worth of data collection.
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. Representative data used in the assessment are representative of China, Global, or "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes.
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.
Precision Measure of the variability of the data values for each data expressed (e.g. variance)	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one year and over multiple operations, which is expected to reduce the variability of results.
Completeness Percentage of flow that is measured or estimated	Except where noted, the LCA model included all known mass and energy flows. In some instances, surrogate data used to represent upstream operations (processing of reclaimed packaging and product materials) may be missing some data which is propagated in the model. No known processes or activities contributing to more than 10% of the total environmental impact for each indicator are excluded. In total, these missing data represent less than 5% cumulative omitted mass or energy flows from the inventory analysis.
Representativeness Qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage)	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. Some proxy datasets are used to represent unit processes due to the lack of data available (processing of reclaimed packaging materials).
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 and are all sourced from Ecoinvent. 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	For manufacturing, packaging, and upstream transport, and transport of final product to distribution center, primary data were provided by the manufacturer. Distances and modes from distribution center to installation site is based on Table 5 of PMI PCR Guidance for Kitchen and Bath Vessel Fixtures. All other secondary data were taken from Ecoinvent, version 3.3.
Uncertainty of the Information Uncertainty related to data, models, and assumptions	Uncertainty related to the product materials and packaging is low. Data for upstream operations relied upon use of existing representative datasets. These datasets contained relatively recent data (<5 years), but lacked specific geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact methods required by the PCR include impact potentials, which lack characterization of providing and receiving environments or tipping points.

Period under Review

The period of review is calendar year 2016.

Allocation

Manufacturing resource use was allocated to the products based on mass. The representative water closet includes recycled content, which are allocated using the recycled content allocation method, also known as the 100-0 cut off method. Impacts from transportation were allocated based on the mass of material and distance transported.

Comparability

The PCR this EPD is 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.

LCA: SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

The following provides a brief overview of the modules included in the product system for Sloan® water closet products.

Module A1: Raw material extraction and processing, processing of secondary material inputs

This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. This includes the extraction of all raw materials, including the transport to the manufacturing site. Resource use and emissions associated with both extraction and processing of the raw materials are included.

Module A2: Transportation

The impacts associated with the transport of the processed raw materials to the manufacturing facility.

Module A3: Manufacture

This stage includes all the relevant manufacturing processes and flows, including the impacts from energy use and emissions at the manufacturing facility. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are not included. This stage also includes the production of packaging and ancillary materials.

Module A4: Transportation & Delivery to the site

This module includes the impacts associated with transportation of finished water closet to US based distribution centers and the subsequent delivery to the installation site. Distribution of the washdown urinal to the point of installation assumed a transport distance of 10,600 km by ocean freighter and 3,335 km by diesel truck. The gross mass transported is 28 kg, which includes the product and its packaging.

Module A5: Construction & Installation

Installation is performed manually and any ancillary material used is considered negligible over the life cycle of the product. This module also includes the transport and disposal of packaging. Transport of packaging to disposal assumed a distance of 32 km by diesel truck. The gross mass of packaging transported is 2.9 kg.

Module B1: Normal use of the product

No release of substances from the water closet to indoor or outdoor air, soil, or water are expected to occur.

Module B2: Maintenance

The maintenance stage includes cleaning. The cleaning type, amount, and frequency assumptions are derived from the PMI PCR Guidance for Kitchen and Bath Vessel Fixtures. Daily cleaning with 50 mL of 10% HCl solution is assumed. This is equivalent to 3,650 cleanings or a total of 191 kg of cleaning solution over the 20 year RSL.

Module B3-B5: Repair, Replacement, and Refurbishment

Any repair of the installed product is typically performed manually and any ancillary material used is considered to be negligible. There is no anticipated replacement or refurbishment of the installed product over the declared reference service life.

Module B6: Operational Energy Use

This module is not applicable because water closets do not require energy during the operation of the product.

Module B7: Operational Water Use

Water use impacts are assigned to the device that controls water flow rate (e.g., flushometer) to avoid double counting, which is outside the scope of this Environmental Product Declaration.

Module C1-C4: End-of-Life

Deconstruction and dismantling of the installed product is performed manually with hand tools and does not require any resource use. Transport of the installation product from building site to waste processing is assumed to be 100 km by diesel truck and is derived from the PMI PCR Guidance for Kitchen and Bath Vessel Fixtures. Waste processing of water closets for reuse, reycling, and energy recovery is possible but not widely available. As such, it is assumed that no materials are collected separately, recovered, and processed for these purposes. It is assumed that the product at end-of-life is disposed of in a landfill, equivalent to 25 kg of inert landfill waste.

LCA: RESULTS

The system boundary is cradle-to-grave and includes resource extraction and processing, product manufacture and assembly, distribution/transport, use and maintenance, and end-of-life. The diagram below illustrates the life cycle stages included in this EPD.

Product Stage			Construction Process Stage		Use Stage							End-of-life Stage				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

X = Included in system boundary; MND = Module not declared

The choice of categories and indicators used in the assessment are taken from the PCR. Impact category indicators are estimated using TRACI 2.1. All results are calculated using SimaPro, version 8.3, and values are rounded to two significant digits. Results reported as *neg* represent "negligible". In accordance with Part A of the PCR, the average coefficient of variation across all impact categories for water closet products is 4.1%.

Table 4. *List of impact categories, impact category acronyms, LCIA method, and units for reporting of results.*

Impact Category	Acronym	LCIA Method	Reporting Unit
Global Warming Potential	GWP	IPCC 2013, 100 years	Kilograms CO_2 eq
Acidification Potential	AP	TRACI 2.1	Kilograms SO_2 eq
Smog	SP	TRACI 2.1	Kilograms O_3 eq
Eutrophication Potential	EP	TRACI 2.1	Kilograms N eq
Ozone Depletion Potential	ODP	TRACI 2.1	Kilograms CFC-11 eq
Fossil Fuel Depletion	FFD	TRACI 2.1	MJ surplus

Table 5. *Impact category results reported by for water closets maintained for 10 years.*

Module	GWP (kg CO_2 eq)	ODP (kg CFC-11 eq)	AP (kg SO_2 eq)	EP (kg N eq)	SP (O_3 eq)	FFD (MJ surplus)
Total	100	$2.4x10^{-5}$	0.53	0.28	7.3	150
	100%	100%	100%	100%	100%	100%
A1	0.59	$4.9x10^{-8}$	$4.0x10^{-3}$	$1.5x10^{-3}$	$5.6x10^{-2}$	0.69
	0.58%	0.21%	0.76%	0.54%	0.77%	0.47%
A2	2.0	$3.8x10^{-7}$	$9.4x10^{-3}$	$2.3x10^{-3}$	0.22	4.5
	2.0%	1.6%	1.8%	0.83%	3.0%	3.1%
A3	38	$1.2x10^{-6}$	0.14	$5.4x10^{-2}$	1.0	68
	37%	5.0%	27%	20%	14%	47%
A4	12	$2.1x10^{-6}$	0.11	$1.6x10^{-2}$	2.0	25
	12%	9.0%	21%	5.7%	27%	17%
A5	0.82	$2.5x10^{-8}$	$9.3x10^{-4}$	$4.2x10^{-3}$	$2.2x10^{-2}$	0.29
	0.81%	0.10%	0.18%	1.5%	0.31%	0.20%
B1	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B2	45	$1.9x10^{-5}$	0.24	0.20	3.4	40
	44%	81%	46%	71%	47%	27%
B3	neg	neg	neg	neg	neg	neg
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B4	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B5	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B6	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B7	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C1	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C2	3.2	$5.8x10^{-7}$	$1.8x10^{-2}$	$2.6x10^{-3}$	0.50	6.8
	3.1%	2.4%	3.5%	0.94%	6.9%	4.7%
C3	0.0	0.0	0.0	0.0	0.0	0.0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
C4	0.14	$4.6x10^{-8}$	$1.2x10^{-3}$	$2.6x10^{-4}$	$2.8x10^{-2}$	0.57
	0.14%	0.20%	0.23%	0.093%	0.39%	0.39%

The key life cycle inventory data parameters are taken from the PCR, which include resource use, output flows, and waste categories. All results are calculated using SimaPro software, version 8.3, and values are rounded to two significant digits. Results reported in MJ are calculated using higher heating values. Results reported as *INA* represent "indicators not assessed".

Table 6. *List of key life cycle inventory parameters, parameter acronyms, and units for reporting of results.*

Key Life Cycle Inventory Parameter	Acronym	Reporting Unit
Renewable primary energy as energy carrier	PERE	Megajoules
Renewable primary energy resources as material utilization	PERM	Megajoules
Total use of renewable primary energy resources	PERT	Megajoules
Non-renewable primary energy as energy carrier	PENRE	Megajoules
Non-renewable primary energy as material utilization	PENRM	Megajoules
Total use of non-renewable primary energy resources	PENRT	Megajoules
Use of secondary material	SM	Kilograms
Use of renewable secondary fuels	RSF	Megajoules
Use of non-renewable secondary fuels	NRSF	Megajoules
Use of net fresh water	FW	Cubic meters
Hazardous waste disposed	HWD	Kilograms
Non-hazardous waste disposed	NHWD	Kilograms
Radioactive waste disposed	RWD	Kilograms
Components for re-use	CRU	Kilograms
Materials for recycling	MFR	Kilograms
Materials for energy recovery	MER	Kilograms
Exported electric energy	EEE	Megajoules
Exported thermal energy	EET	Megajoules

Table 7. *Resource use results for water closets maintained for 10 years.*

Module	PERE (MJ)	PERM (MJ)	PERT (MJ)	PENRE (MJ)	PENRM (MJ)	PENRT (MJ)	SM (kg)	RSF (MJ)	NRSF (MJ)	FW (m^3)
Total	77	0.0	77	INA	INA	1,400	0.0	neg	neg	6.0
A1	0.38	0.0	0.38	INA	INA	7.3	0.0	neg	neg	$3.7x10^{-2}$
A2	0.40	0.0	0.40	INA	INA	33	0.0	neg	neg	$2.3x10^{-2}$
A3	13	0.0	13	INA	INA	550	4.7	neg	neg	0.55
A4	2.8	0.0	2.8	INA	INA	190	0.0	neg	neg	0.16
A5	$2.2x10^{-2}$	0.0	$2.2x10^{-2}$	INA	INA	2.1	0.0	neg	neg	$1.7x10^{-3}$
B1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B2	61	0.0	61	INA	INA	600	0.0	neg	neg	5.2
B3	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg
B4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2	0.21	0.0	0.21	INA	INA	48	0.0	neg	neg	$1.7x10^{-2}$
C3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C4	0.10	0.0	0.10	INA	INA	4.2	0.0	neg	neg	$6.2x10^{-3}$

Table 8. *Waste and outflows for water closets maintained for 10 years.*

Module	HWD (kg)	NHWD (kg)	RWD (kg)	CRU (kg)	MFR (kg)	MER (kg)	EEE (MJ)	EET (MJ)
Total	$2.3x10^{-3}$	42	$5.4x10^{-4}$	0.0	neg	neg	neg	neg
A1	$1.5x10^{-5}$	0.9	$4.2x10^{-6}$	0.0	neg	neg	neg	neg
A2	$1.9x10^{-5}$	1.5	$3.6x10^{-5}$	0.0	neg	neg	neg	neg
A3	$4.4x10^{-4}$	2.6	$2.0x10^{-5}$	0.0	neg	neg	neg	neg
A4	$1.1x10^{-4}$	6.3	$2.0x10^{-4}$	0.0	neg	neg	neg	neg
A5	$8.9x10^{-7}$	0.58	$2.3x10^{-6}$	0.0	neg	neg	neg	neg
B1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B2	$1.7x10^{-3}$	4.1	$2.2x10^{-4}$	0.0	neg	neg	neg	neg
B3	neg	neg	neg	neg	neg	neg	neg	neg
B4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2	$1.6x10^{-5}$	0.20	$5.4x10^{-5}$	0.0	neg	neg	neg	neg
C3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C4	$2.7x10^{-6}$	26	$4.4x10^{-6}$	0.0	neg	neg	neg	neg

LCA: INTERPRETATION

The interpretation phase conforms to ISO 14044 with further guidance from the International Reference Life Cycle Data System (ILCD) General Guide for Life Cycle Assessment. The interpretation included the use of evaluation and sensitivity checks to steer the iterative process during the assessment, and a final evaluation including completeness, sensitivity, and consistency checks, at the end of the study.

For water closets, the major hotspot in the supply chain lies in the maintenance of the fixture, specifically cleaning (Module B2), followed by manufacturing (Module A3), primarily from the use of natural gas.

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For more information contact:

Sloan Valve Company
10500 Seymour Avenue, Franklin Park, IL 60131
P: 847.671.4300 | 800.982.5839 | www.sloan.com

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.50.452.8000 | fax +1.510.452.8001