SLOAN®
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VERIFIED by SCS GLOBAL SERVICES
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner

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

Product Group

TruFlush Sensor-activated Flushometer (TRF 8156; TRF 8196)
TruFlush Manual Flushometer (TRF 156; TRF 196)

Functional Unit

Use of flushometer over a period of 75 years.

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

EPD Number and Period of Validity

SCS-EPD-06756
EPD Valid March 10, 2021 through March 9, 2026
Version: May 3, 2021

Product Category Rule

PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018

PCR Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements. Version 1. UL Environment. October 2020.

Program Operator

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

SCSglobal SERVICES

Declaration Owner:	Sloan Valve Company
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LCA Practitioner:	Gerard Mansell, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA 1.10 software and the Ecoinvent v3.7 database
Product RSL:	10 years
Markets of Applicability:	Globally, with the exception of North America
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Grave
LCIA Method and Version:	CML-IA and TRACI 2.1
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
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. UL Environment. Sept. 2018
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements. Version 1. UL Environment. October 2020.
Part B PCR Review conducted by:	Thomas Gloria (Chair), Industrial Ecology Consultants; Christopher Marozzi, Lixil Water Technologies Americas; Kim Lewis, Sustainable Minds
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
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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.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. Sloan Valve Company

Sloan is the world's leading manufacturer of commercial plumbing systems and has been in operation since 1906. Headquartered in Franklin Park, Illinois, USA, the company is at the forefront of the green building movement and provides smart, sustainable restroom solutions by manufacturing water-efficient products such as flushometers, electronic faucets, sink systems, soap dispensing systems, and vitreous china fixtures for commercial, industrial, and institutional markets worldwide.

2. Product

2.1 PRODUCT DESCRIPTION

TruFlush Sensor Activation Flushometer is a piston based sensor activated flushing system, which dispenses precise 6 liter or 4.8 liter per flush and also performs well in reclaimed water. Specifically designed and engineered to fit the needs of the global commercial restrooms with the quality and reliability of Sloan. It is truly complimenting the 'Green Built Environment' with regards to water efficiency. It provides hands-free activation for improved hygiene and operated by battery with hardwire option. It performs equally from 0.7 bar to 7 bar i.e.,10 psi to 100 psi. Made of heavy duty brass and front plate metal with nickel coating. Compared to the commonly used metering valve that simply open and closes wasting water, the TruFlush Flushometer actually controls the amount of water used. Sloan flushometer products belong to the Commercial Flushometer Valves product group (CSI[1] code 22 42 43).

The following TruFlush flushometers are represented by this EPD:

Product Type	Water Closets		Urinals	
	Model #	Flush Volume	Model #	Flush Volume
Sensor-activated	TRF 8156-1.6	(1.6 gpf / 6.0 Lpf)	TRF 8196-0.5	(0.5 gpf / 1.9 Lpf)
Sensor-activated	TRF 8156-1.28	(1.28 gpf / 4.8 Lpf)	TRF 8196-0.25	(0.25 gpf/ 1.0 Lpf)
Sensor-activated	-	-	TRF 8196-0.125	(0.125 gpf/ 0.47 Lpf)
Manual	TRF 156-1.6	(1.6 gpf / 6.0 Lpf)	TRF 196-0.5	(0.5 gpf / 1.9 Lpf)
Manual	TRF 156-1.28	(1.28 gpf / 4.8 Lpf)	TRF 196-0.25	(0.25 gpf/ 1.0 Lpf)
Manual	-	-	TRF 196-0.125	(0.125 gpf/ 0.47 Lpf)

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

[1] Construction Specifications Institute (CSI)

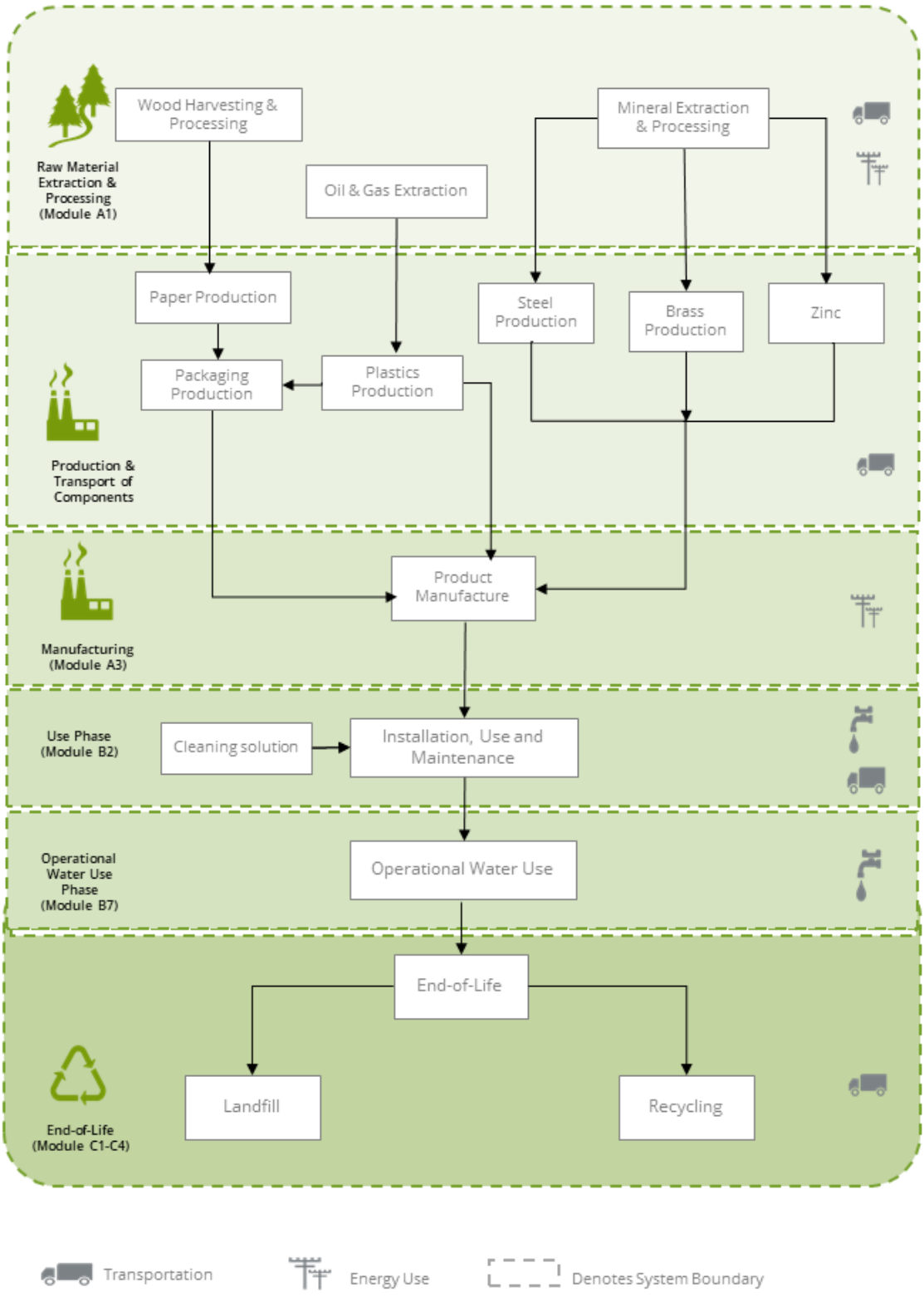

Figure 1. *Flow Diagram for the life cycle of the TruFlush Flushometer product system.*

2.3 APPLICATION

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

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-grave, including raw material extraction and processing, transportation, product manufacture, product delivery, installation and use, and product disposal. The life cycle phases included in the product system boundary are shown below.

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

Table 1. *Life cycle phases included in the TruFlush flushometer product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	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 = Module Included | MND = Module Not Declared

2.5 TECHNICAL DATA

- Flow rate – water closet: 1.28 gpf – 1.6 gpf
- Flow rate – urinal: 0.50 gpf – 0.125 gpf
- Maximum flowing pressure: 80 PSI
- Minimum flowing pressure: 15 PSI

2.6 MARKET PLACEMENT/APPLICATION RULES

Technical specifications and product performance results for the flushometer products can be found on the manufacturer's www.sloan.com.

2.7 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

Sloan TruFlush flushometers are packaged with corrugated cartons and plastic wrap and delivered by truck to the customer.

2.8 MATERIAL COMPOSITION

The material composition of the TruFlush products is shown in Table 2.

Table 2. *Material composition of the flushometer products, in kg and percent of total mass.*

Material	TruFlush Sensor Activated		TruFlush Manual Activated	
	Mass (kg)	Percent mass	Mass (kg)	Percent mass
ABS	0.260	9.6%	0.168	8.7%
Brass	1.38	51%	0.907	47%
EPDM	$1.60x10^{-2}$	0.59%	$1.70x10^{-2}$	0.88%
Nylon	$7.00x10^{-2}$	2.6%	$8.40x10^{-2}$	4.4%
Other (Battery; Electrical components)	0.214	7.9%	0.00	0%
Paper	$2.70x10^{-2}$	1%	$2.70x10^{-2}$	1.4%
Plastics	$3.30x10^{-2}$	1.2%	0.00	0%
POM (Celcon M90)	$8.10x10^{-2}$	3%	$8.80x10^{-2}$	4.6%
Polystyrene	$4.90x10^{-2}$	1.8%	0.00	0%
Silicon	$1.00x10^{-3}$	0.037%	$1.00x10^{-3}$	0.052%
Stainless Steel	$1.70x10^{-2}$	0.63%	$6.90x10^{-2}$	3.6%
Steel	$1.40x10^{-2}$	0.52%	$2.60x10^{-2}$	1.3%
Zinc	0.552	20%	0.540	28%
Total Product	**2.16**	**100%**	**1.39**	**100%**

No substances required to be reported as hazardous are associated with the production of this product

2.9 MANUFACTURING

Sloan TruFlush flushometers are manufactured in India. The manufacturer provided primary data for their annual production, resource use and electricity consumption and waste generation at the facility. Electricity consumption is modeled using Ecoinvent datasets for the regional electricity grid resource mix.

2.10 PACKAGING

The material composition of the product packaging is shown in Table 3.

Table 3. *Material composition of packaging for the flushometers, in kg and percent of total mass.*

Material	TruFlush Sensor Activated		TruFlush Manual Activated	
	Mass (kg)	Percent mass	Mass (kg)	Percent mass
Plastic	$2.00x10^{-3}$	0.22%	$1.00x10^{-3}$	0.11%
Corrugated	0.898	100%	0.894	100%
Total Packaging	**0.900**	**100%**	**0.895**	**100%**

2.11 PRODUCT INSTALLATION

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

2.12 USE CONDITIONS

There are no special use conditions associated with the products.

2.13 PRODUCT REFERENCE SERVICE LIFE AND BUILDING ESTIMATED SERVICE LIFE

The Reference Service Life (RSL) of the product is 10 years. The building Estimated Service Life (ESL) is 75 years, consistent with the PCR.

2.14 RE-USE PHASE

Reuse at end-of-life via collection and processing of flushometers is not typical. It is assumed that no materials are recovered and processed for these purposes.

2.15 DISPOSAL

At end-of-life, the product are disposed of in a landfill, consistent with PCR guidance. Transportation of flushometers assumes a 62 miles (100 kilometer) distance to disposal, based on the PCR. Recycling of packaging materials are based on PCR guidance for recycling rates for plastic (10%) and corrugated (10%). For packaging materials not recycled are assumed landfilled.

While the product is assumed to be disposed of in a landfill, as required by the PCR, over 75% of the product mass includes valuable metals which can be recycled, including brass, stainless steel, and zinc.

2.16 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at www.sloan.com.

3. LCA: Calculation Rules

3.1 FUNCTIONAL UNIT

The functional unit is defined as one complete flushometer product installed and maintained over the 75-year building lifetime. Per PCR requirements, a 10 year life span is assumed for the flushometer. However, the flushometer lifespan is expected to exceed 10 years with proper maintenance. The reference flow and the total number of product replacements and life cycles required during the 75-year time horizon of the assessment are presented in Table 3.

Table 3. *Functional unit and refernce flows for the product systems under study*.

Functional Unit	TruFlush Sensor Activated	TruFlush Manual Activated
Functional Unit	One flushometer installed for use over the 75-year ESL.	One flushometer installed for use over the 75-year ESL.
Reference Flow (kg)	2.71	1.93
Reference Service Life – RSL (years)	10	10
Replacement Cycle (ESL/RSL-1)	6.5	6.5

3.2 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 life cycle phases included in the EPD scope are described in Table 4 and illustrated in Figure 1.

Table 4. *The modules and unit processes included in the scope for the product system.*

Module	Module Description	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Extraction and processing of raw materials for the product components.
A2	Transport (to the manufacturer)	Transport of component materials to the manufacturing facilities
A3	Manufacturing, including ancillary material production	Manufacturing of products and packaging (incl. upstream unit processes)
A4	Transport (to the building site)	Transport of product (including packaging) to the building site
A5	Construction-installation process	Impacts from the installation of product are assumed negligible. Only impacts from packaging disposal are included in this phase
B1	Product use	Use of the product in a commercial building setting. There are no associated emissions or impacts from the use of the product
B2	Product maintenance	Maintenance of products over the 75-year ESL, including periodic cleaning.
B3	Product repair	Production and transportation of certain sensor flushometer components, waste processing and disposal from maintenance processes
B4	Product replacement	The materials and energy required for replacement of the product over the 75-year ESL of the assessment are included in this phase
B5	Product refurbishment	The product is not expected to require refurbishment over its lifetime
B6	Operational energy use by technical building systems	There is no operational energy use associated with the use of the product
B7	Operational water uses by technical building systems	Operational water use based on the gallons per flush specifications for flushometers.
C1	Deconstruction, demolition	Demolition of the product is accomplished using hand tools with no associated emissions and negligible impacts
C2	Transport (to waste processing)	Transport of the product to waste treatment at end-of-life
C3	Waste processing for reuse, recovery and/or recycling	The products are disposed of by recycling, landfilling or incineration which require no waste processing
C4	Disposal	Disposal of the product
D	Reuse-recovery-recycling potential	Module Not Declared

3.3 PRODUCT SPECIFIC CALCULATION FOR USE PHASE

The recommended maintenance regime is prescribed by the manufacturer and includes daily cleaning with a cleaning solution.

3.4 UNITS

All data and results are presented using SI units.

3.5 ESTIMATES AND ASSUMPTIONS

- Electricity use at the manufacturing facility was allocated to the products based on the product mass as a fraction of the total production.
- The manufacturing facility under review is located in India. An Ecoinvent inventory dataset for the Indian energy grid mix was used to model resource use and emissions from electricity use at the manufacturing facility.

- The Reference Service Life (RSL) of the products was modeled as 10 years, as prescribed by the PCR.
- No specific data were available to estimate the downstream transportation distance from the manufacturing facility to the installation sites. Assumptions from Part B PCR were used to estimate the transport distance for the flushometers.
- The maintenance phase of the product life cycle was modeled based on the manufacturer's recommended guidance, including daily cleaning with a mild cleaning solution.
- For the product end-of-life, disposal of product and product packaging is modeled based on the PCR guidance regarding recycling rates for packaging materials. The product is assumed to be landfilled at end-of-life.
- Transportation of the product and packaging waste materials at end-of-life assumes a 62 mile (100 kilometers) distance to disposal, based on PCR guidance. Datasets representing disposal in a landfill are from Ecoinvent.

The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted considering this limitation.

3.6 CUT-OFF RULES

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.

3.7 DATA SOURCES

Unit processes are developed with OpenLCA v1.10 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 3.7.

Table 5. *Data sources for the Sloan® TruFlush flushometer product system.*

Component	Dataset	Data Source	Publication Date
PRODUCT			
ABS			
ABS ABS (recycled)	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S/RER	EI v3.7	2020
	ABS, 20% pre-, recycled | acrylonitrile-butadiene-styrene copolymer | Cutoff, S/RER	EI v3.7	2020
	injection moulding | injection moulding | Cutoff, S/RoW	EI v3.7	2020
Brass	brass production, 65% pre-, recycled | brass | Cutoff, S/RoW	EI v3.7	2020
	metal working, average for metal product manufacturing | metal working, average for metal product manufacturing | Cutoff, S/RoW	EI v3.7	2020
EPDM	synthetic rubber production | synthetic rubber | Cutoff, S/RoW	EI v3.7	2020
Nylon		EI v3.7	2020
Nylon 6 Polymer - 33% Glass Filled Nylon 66	nylon 6 production | nylon 6 | Cutoff, S/RoW	EI v3.7	2020
	nylon 6-6 production, glass-filled | nylon 6-6, glass-filled | Cutoff, S/RoW	EI v3.7	2020
	injection moulding | injection moulding | Cutoff, S/RoW	EI v3.7	2020
Other			
Battery; electrical components	AA Battery - LCI/	EI v3.7; Ramsey Hamade et al.	2020; 2020
	steel production, converter, low-alloyed | steel, low-alloyed | Cutoff, S/RoW	EI v3.7	2020
	electronics production, for control units | electronics, for control units | Cutoff, S/RoW	EI v3.7	2020
Paper	kraft paper production | kraft paper | Cutoff, S/RoW	EI v3.7	2020
Plastics		EI v3.7	2020
Plastic CELCON M90 HIPS	polyethylene production, high density, granulate | polyethylene, high density, granulate | Cutoff, S/RoW	EI v3.7	2020
	Polyoxymethylene (POM) PlasticsEurope/EU-27	PlasticsEurope	2018
	polystyrene production, high impact, 20% pre-, recycled | polystyrene, high impact | Cutoff, S/RoW	EI v3.7	2020
	injection moulding | injection moulding | Cutoff, S/RoW		
Silicon	silicone product production | silicone product | Cutoff, S/RoW	EI v3.7	2020
Stainless Steel	steel production, chromium steel 18/8, hot rolled | steel, chromium steel 18/8, hot rolled | Cutoff, S/RoW	EI v3.7	2020
	metal working, average for steel product manufacturing | metal working, average for steel product manufacturing | Cutoff, S/RoW	EI v3.7	2020
Steel	steel production, converter, low-alloyed | steel, low-alloyed | Cutoff, S/RoW	EI v3.7	2020
	metal working, average for steel product manufacturing | metal working, average for steel product manufacturing | Cutoff, S/RoW	EI v3.7	2020
Zinc	Zamak, 30% pre-, recycled	EI v3.7	2020
	metal working, average for metal product manufacturing | metal working, average for metal product manufacturing | Cutoff, S/RoW	EI v3.7	2020
PACKAGING			
Plastic	packaging film production, low density polyethylene | packaging film, low density polyethylene | Cutoff, S/RoW	EI v3.7	2020
Corrugated	containerboard production, linerboard, kraftliner | containerboard, linerboard | Cutoff, S/RoW	EI v3.7	2020
TRANSPORT			
Road	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, S/RoW	EI v3.7	2020
Ship	transport, freight, sea, container ship | transport, freight, sea, container ship | Cutoff, S/GLO	EI v3.7	2020
RESOURCES			
Grid electricity	market group for electricity, medium voltage | electricity, medium voltage | Cutoff, S/IN	EI v3.7	2020
Heat - diesel	market for diesel, burned in building machine | diesel, burned in building machine | Cutoff, S/GLO	EI v3.7	2020
Water	market group for tap water | tap water | Cutoff, S/GLO	EI v3.7	2020

3.8 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 6. *Data quality assessment for the 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 India. 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 as specified by the PCR.
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 fabrication 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 v3.7 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 Sloan's manufacturing facility represents 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 v3.7 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 was not available for all suppliers 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.

3.9 PERIOD UNDER REVIEW

The period of review is the calendar year 2020.

3.10 ALLOCATION

Manufacturing resource use was allocated to the products based on mass. The flushometers include some 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.

3.11 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.

4. LCA: Scenarios and Additional Technical Information

Delivery and Installation stage (A4 - A5)

In accordance with the Part B PCR, a transportation distance of 500 km is assumed from the distributor to the installation site, by diesel truck. Transportation parameters for modeling product distribution are summarized in Table 7.

Table 7. *Product distribution parameters (A4).*

Transport Mode	TruFlush Sensor Activation	TruFlush Manual Activation
Diesel truck – Fuel utilization (L/100 km)	18	18
Diesel truck – Capacity utilization (%)	76%	76%
Diesel truck – Distance (km)	500	500
Gross mass of products transported[1] (kg)	3.61	2.82

[1] Including packaging

The impacts associated with the product installation are assumed negligible. The impacts associated with packaging disposal are included with the installation phase as per PCR requirements.

Table 8. *Installation parameters for the flushometer products (A5).*

Parameter		TruFlush Sensor Activation	TruFlush Manual
Ancillary materials (kg)		negligible	negligible
Net freshwater consumption (m^3)		-	-
Electricity consumption (kWh)		-	-
Product loss per functional unit (kg)		negligible	negligible
Waste materials generated by product installation (kg)		negligible	negligible
Output materials resulting from on-site waste processing (kg)		n/a	n/a
Mass of packaging waste (kg)	Corrugated	0.898	0.894
	Plastic	2.00×10^{-3}	1.00×10^{-3}
Biogenic carbon contained in packaging (kg CO_2)		1.65	1.64
Direct emissions (kg)		-	-

Use stage (B1)

No impacts are associated with the use of the product over the Reference Service Lifetime. Impacts from water use are reported in module B7.

Maintenance stage (B2)

The maintenance stage includes cleaning. The cleaning type, amount, and frequency assumptions are based on the manufacturer's recommended guidance.

Table 9. *Maintenance parameters for the Sloan flushometer products.*

Parameter	Unit	TruFlush Sensor Activated	TruFlush Manual Activated
Maintenance cycle	Cycles / RSL	2,600	2,600
Maintenance cycle	Cycles / ESL	19,500	19,500
Maintenance process	-	Cleaning	Cleaning
Net freshwater consumption	kg/RSL	23.40	23.40
Cleaning agent (10% sodium lauryl sulfate solution)	kg/RSL	2.60	2.60
Further assumptions	-	Daily cleaning	Daily cleaning

Repair/Refurbishment stage (B3; B5)

This stage includes any anticipated repair events during the reference service life of the TruFlush flushometers. Based on the manufacturer's recommendation, alkaline batteries of the sensor activated flushometers require replacement up to three times over a 10-year period. This module considers the impacts associated with the production and transportation of components required for product repair.

Replacement stage (B4)

The materials and energy required for replacement of the product over the 75-year ESL of the assessment are included in this stage.

Building operation stage (B6 – B7)

There is no operational energy associated with the use of the product.

The operational use phase considers the volume of water required per flush, the embedded energy required for water supply, distribution and wastewater treatment, and the number of flushes over the 75-year building lifetime. The volume required per flush (expressed in terms of gallons per flush) varies depending on the design specification of the flushometer. The assumed number of flushes per day and product type are in accordance with Part B of the PCR. This study evaluated the different use phase scenarios for toilet and urinal fixtures, as indicated below as summarized in Table 10.

Table 10. *Assumptions for the Operational Use Phase Scenario. (gpf = gallons per flush)*

Parameter	Water Closets		Urinal Fixtures		
Sensor flushometers Water Use (Gallons per flush, gpf)	1.6 gpf	1.28 gpf	0.5 gpf	0.25 gpf	0.125 gpf
Number of flushes per day	60 flushes per day		60 flushes per day		
Number of flushes over a 10-year period (Assuming 260 working days per year)	156,000 flushes in 10 years		156,000 flushes in 10 years		

Disposal stage (C1 - C4)

Deconstruction and dismantling of the installed product is performed manually with hand tools and does not require any resource use. Waste processing of flushometers for reuse, recycling, and energy recovery is possible but not widely available. It is assumed that the product at end-of-life is disposed of in a landfill consistent with the PCR guidance.

No specific data are available regarding the recycling rate of product and packaging materials at end-of-life. The recycling rates used for the packaging materials are based on the PCR and are summarized in Table 11. Materials not recycled are sent to landfill. The end-of-life disposal scenario parameters for the product system are summarized in Table 12.

Table 11. *Recycling rates for product and packaging materials at end-of-life.*

Material	Recycling Rate
Paper & Pulp	10%
Plastic	10%

Table 12. *End-of-life disposal scenario parameters for the Sloan products.*

Parameter		TruFlush Sensor Activation	TruFlush Manual Activated
Assumptions for scenario development		100% landfill	100% Landfill
Collection process			
Collected with mixed construction waste (kg)		3.61	2.82
Recovery	n/a		
Disposal (kg)	Recycled	-	-
	Landfill	3.61	2.82
	Incineration	-	-
Removals of biogenic carbon[1] (kg CO_2 eq)		n/a	n/a

[1] excluding packaging

Transportation of the product at end-of-life assumes a 100 km (62 mile) distance via diesel truck to disposal, based on the UL Part B PCR Guidance. Datasets representing disposal in a landfill are from Ecoinvent.

5. LCA: Results

Results of the Life Cycle Assessment are presented below. 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.

The following environmental impact category indicators are reported using characterization factors based on the U.S. EPA's TRACI 2.1 and CML-IA.

CMLI-A Impact Category	Unit	TRACI 2.1 Impact Category	Unit
Global Warming Potential (GWP)	kg CO_2 eq	Global Warming Potential (GWP)	kg CO_2 eq
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq	Ozone Depletion Potential (ODP)	kg CFC 11 eq
Acidification Potential of soil and water (AP)	kg SO_2 eq	Acidification Potential (AP)	kg SO_2 eq
Eutrophication Potential (EP)	kg PO_4^{3-} eq	Eutrophication Potential (EP)	kg N eq
Photochemical Oxidant Creation Potential (POCP)	kg C_2H_4 eq	Smog Formation Potential (SFP)	kg O_3 eq
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb eq	Fossil Fuel Depletion Potential (ADP_{fossil})	MJ Surplus, LHV
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ, LHV	-	-

These 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.

The following inventory parameters, specified by the PCR, are also reported.

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	**CRU:** Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	**MR:** Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Table 13. *CML-IA Life Cycle Impact Assessment (LCIA) results for Sloan TruFlush Sensor Activated flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	GWP	ODP	AP	EP	POCP	ADPE	ADPF
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg $(PO_4)^{3-}$ eq	kg C_2H_4 eq	kg Sb eq	MJ eq
Total	251	$1.07x10^{-5}$	1.58	1.17	$6.88x10^{-2}$	$1.67x10^{-4}$	3,050
	100%	100%	100%	100%	100%	100%	100%
A1	14.7	$8.22x10^{-7}$	0.130	0.112	$5.43x10^{-3}$	$2.08x10^{-5}$	174
	5.9%	7.7%	8.3%	9.6%	7.9%	12%	5.7%
A2	0.261	$4.51x10^{-8}$	$1.62x10^{-3}$	$2.93x10^{-4}$	$4.85x10^{-5}$	$2.21x10^{-9}$	3.80
	0.10%	0.42%	0.10%	0.03%	0.07%	0.00%	0.12%
A3	12.6	$2.24x10^{-7}$	$5.33x10^{-2}$	$2.54x10^{-2}$	$2.03x10^{-3}$	$5.43x10^{-8}$	148
	5.0%	2.1%	3.4%	2.2%	2.9%	0.03%	4.9%
A4	0.368	$6.41x10^{-8}$	$1.42x10^{-3}$	$3.34x10^{-4}$	$4.73x10^{-5}$	$3.23x10^{-9}$	5.43
	0.15%	0.60%	0.09%	0.03%	0.07%	0.00%	0.18%
A5	1.35	$2.21x10^{-8}$	$7.01x10^{-4}$	$2.30x10^{-3}$	$2.86x10^{-4}$	$6.86x10^{-10}$	1.84
	0.54%	0.21%	0.04%	0.20%	0.42%	0.00%	0.06%
B1	0	0	0	0	0	0	0
B2	18.3	$9.17x10^{-7}$	$8.48x10^{-2}$	$3.21x10^{-2}$	$5.70x10^{-3}$	$1.01x10^{-7}$	403
	7.3%	8.5%	5.4%	2.8%	8.3%	0.06%	13%
B3	8.58	$5.02x10^{-7}$	$7.35x10^{-2}$	$5.71x10^{-2}$	$3.58x10^{-3}$	$1.04x10^{-5}$	107
	3.4%	4.7%	4.7%	4.9%	5.2%	6.2%	3.5%
B4	194	$8.08x10^{-6}$	1.23	0.934	$5.16x10^{-2}$	$1.36x10^{-4}$	2,200
	77%	75%	78%	80%	75%	81%	72%
B5	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0
B7	Refer to Table 17						
C1	0	0	0	0	0	0	0
C2	0.343	$5.97x10^{-8}$	$1.60x10^{-3}$	$3.43x10^{-4}$	$5.22x10^{-5}$	$1.19x10^{-9}$	4.69
	0.14%	0.56%	0.10%	0.03%	0.08%	0.00%	0.15%
C3	0	0	0	0	0	0	0
C4	0.247	$5.35x10^{-9}$	$1.47x10^{-4}$	$3.04x10^{-3}$	$5.17x10^{-5}$	$2.92x10^{-10}$	0.489
	0.10%	0.05%	0.01%	0.26%	0.08%	0.00%	0.02%
D	MND	MND	MND	MND	MND	MND	MND

Table 14. *TRACI Life Cycle Impact Assessment (LCIA) results for Sloan TruFlush Sensor Activated flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	GWP	ODP	AP	EP	SFP	FFD
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg N eq	kg O_3 eq	MJ eq
Total	246	$1.43x10^{-5}$	1.63	2.53	21.4	243
	100%	100%	100%	100%	100%	100%
A1	14.5	$1.04x10^{-6}$	0.132	0.246	1.56	17.2
	5.9%	7.3%	8.1%	9.7%	7.3%	7.1%
A2	0.260	$6.01x10^{-8}$	$1.82x10^{-3}$	$3.00x10^{-4}$	$3.97x10^{-2}$	0.545
	0.11%	0.42%	0.11%	0.01%	0.19%	0.22%
A3	12.5	$3.71x10^{-7}$	$5.78x10^{-2}$	$5.05x10^{-2}$	0.883	4.39
	5.1%	2.6%	3.5%	2.0%	4.1%	1.8%
A4	0.366	$8.54x10^{-8}$	$1.66x10^{-3}$	$4.08x10^{-4}$	$4.02x10^{-2}$	0.775
	0.15%	0.60%	0.10%	0.02%	0.19%	0.32%
A5	1.10	$2.95x10^{-8}$	$8.89x10^{-4}$	$5.89x10^{-3}$	$2.10x10^{-2}$	0.268
	0.45%	0.21%	0.05%	0.23%	0.10%	0.11%
B1	0	0	0	0	0	0
B2	18.0	$1.12x10^{-6}$	$8.71x10^{-2}$	$6.33x10^{-2}$	1.01	53.8
	7.3%	7.9%	5.3%	2.5%	4.7%	22%
B3	8.46	$6.21x10^{-7}$	$7.44x10^{-2}$	0.125	0.895	9.34
	3.4%	4.4%	4.6%	4.9%	4.2%	3.8%
B4	191	$1.08x10^{-5}$	1.27	2.03	16.9	156
	77%	76%	78%	80%	79%	64%
B5	0	0	0	0	0	0
B6	0	0	0	0	0	0
B7	Refer to Table 17					
C1	0	0	0	0	0	0
C2	0.343	$7.95x10^{-8}$	$1.98x10^{-3}$	$2.54x10^{-4}$	$5.60x10^{-2}$	0.707
	0.14%	0.56%	0.12%	0.01%	0.26%	0.29%
C3	0	0	0	0	0	0
C4	0.204	$7.14x10^{-9}$	$1.79x10^{-4}$	$8.18x10^{-3}$	$3.83x10^{-3}$	$6.90x10^{-2}$
	0.08%	0.05%	0.01%	0.32%	0.02%	0.03%
D	MND	MND	MND	MND	MND	MND

Table 15. *CML-IA Life Cycle Impact Assessment (LCIA) results for Sloan TruFlush Manual flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	GWP	ODP	AP	EP	POCP	ADPE	ADPF
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg $(PO_4)^{3-}$ eq	kg C_2H_4 eq	kg Sb eq	MJ eq
Total	159	$6.03x10^{-6}$	0.910	0.588	$4.06x10^{-2}$	$8.13x10^{-5}$	1,950
	100%	100%	100%	100%	100%	100%	100%
A1	7.56	$3.69x10^{-7}$	$6.75x10^{-2}$	$5.08x10^{-2}$	$2.75x10^{-3}$	$1.08x10^{-5}$	87.2
	4.7%	6.1%	7.4%	8.6%	6.8%	13%	4.5%
A2	0.142	$2.45x10^{-8}$	$7.90x10^{-4}$	$1.51x10^{-4}$	$2.41x10^{-5}$	$1.21x10^{-9}$	2.07
	0.09%	0.41%	0.09%	0.03%	0.06%	0.00%	0.11%
A3	9.15	$1.71x10^{-7}$	$3.87x10^{-2}$	$1.86x10^{-2}$	$1.50x10^{-3}$	$4.29x10^{-8}$	107
	5.7%	2.8%	4.3%	3.2%	3.7%	0.05%	5.5%
A4	0.287	$5.01x10^{-8}$	$1.11x10^{-3}$	$2.61x10^{-4}$	$3.70x10^{-5}$	$2.52x10^{-9}$	4.25
	0.18%	0.83%	0.12%	0.04%	0.09%	0.00%	0.22%
A5	1.35	$2.20x10^{-8}$	$6.98x10^{-4}$	$2.28x10^{-3}$	$2.85x10^{-4}$	$6.83x10^{-10}$	1.83
	0.85%	0.36%	0.08%	0.39%	0.70%	0.00%	0.09%
B1	0	0	0	0	0	0	0
B2	18.3	$9.17x10^{-7}$	$8.48x10^{-2}$	$3.21x10^{-2}$	$5.70x10^{-3}$	$1.01x10^{-7}$	403
	11%	15%	9.3%	5.5%	14%	0.12%	21%
B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
B4	122	$4.44x10^{-6}$	0.715	0.482	$3.02x10^{-2}$	$7.04x10^{-5}$	1,340
	77%	73%	79%	82%	75%	87%	69%
B5	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0
B7	Refer to Table 17						
C1	0	0	0	0	0	0	0
C2	0.244	$4.24x10^{-8}$	$1.14x10^{-3}$	$2.44x10^{-4}$	$3.71x10^{-5}$	$8.48x10^{-10}$	3.34
	0.15%	0.70%	0.12%	0.04%	0.09%	0.00%	0.17%
C3	0	0	0	0	0	0	0
C4	$9.49x10^{-2}$	$3.65x10^{-9}$	$9.07x10^{-5}$	$1.76x10^{-3}$	$1.97x10^{-5}$	$1.68x10^{-10}$	0.323
	0.06%	0.06%	0.01%	0.30%	0.05%	0.00%	0.02%
D	MND	MND	MND	MND	MND	MND	MND

Table 16. *TRACI Life Cycle Impact Assessment (LCIA) results for Sloan TruFlush Manual flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	GWP	ODP	AP	EP	SFP	FFD
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg N eq	kg O_3 eq	MJ eq
Total	156	$8.24x10^{-6}$	0.940	1.26	12.3	159
	100%	100%	100%	100%	100%	100%
A1	7.45	$4.80x10^{-7}$	$6.72x10^{-2}$	0.112	0.745	9.04
	4.8%	5.8%	7.1%	8.8%	6.1%	5.7%
A2	0.141	$3.27x10^{-8}$	$8.94x10^{-4}$	$1.61x10^{-4}$	$1.99x10^{-2}$	0.296
	0.09%	0.40%	0.10%	0.01%	0.16%	0.19%
A3	9.11	$2.78x10^{-7}$	$4.20x10^{-2}$	$3.71x10^{-2}$	0.646	3.31
	5.8%	3.4%	4.5%	2.9%	5.2%	2.1%
A4	0.287	$6.68x10^{-8}$	$1.30x10^{-3}$	$3.19x10^{-4}$	$3.15x10^{-2}$	0.606
	0.18%	0.81%	0.14%	0.03%	0.26%	0.38%
A5	1.10	$2.93x10^{-8}$	$8.84x10^{-4}$	$5.85x10^{-3}$	$2.09x10^{-2}$	0.267
	0.70%	0.36%	0.09%	0.46%	0.17%	0.17%
B1	0	0	0	0	0	0
B2	18.0	$1.12x10^{-6}$	$8.71x10^{-2}$	$6.33x10^{-2}$	1.01	53.8
	12%	14%	9.3%	5.0%	8.2%	34%
B3	0.00	0.00	0.00	0.00	0.00	0.00
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
B4	120	$6.17x10^{-6}$	0.739	1.04	9.78	91.4
	77%	75%	79%	82%	80%	57%
B5	0	0	0	0	0	0
B6	0	0	0	0	0	0
B7	Refer to Table 17					
C1	0	0	0	0	0	0
C2	0.244	$5.66x10^{-8}$	$1.40x10^{-3}$	$1.81x10^{-4}$	$3.99x10^{-2}$	0.503
	0.16%	0.69%	0.15%	0.01%	0.32%	0.32%
C3	0	0	0	0	0	0
C4	$8.01x10^{-2}$	$4.86x10^{-9}$	$1.10x10^{-4}$	$4.74x10^{-3}$	$2.49x10^{-3}$	$4.64x10^{-2}$
	0.05%	0.06%	0.01%	0.38%	0.02%	0.03%
D	MND	MND	MND	MND	MND	MND

Table 17. *Impact results for Module B7: Operational Water Use for the Sloan TruFlush products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	USE SCENARIOS FOR B7: Operational Water Use (as per Part B PCR Framework)				
	WATER CLOSETS (60 flushes per day over 10 year period)		URINAL FIXTURES (60 flushes per day over 10 year period)		
	1.6 gpf	1.28 gpf	0.5 gpf	0.25 gpf	0.125 gpf
CML					
GWP (kg CO_2 eq)	5,510	4,410	1,720	861	430
ODP (kg CFC-11 eq)	$1.32x10^{-3}$	$1.06x10^{-3}$	$4.12x10^{-4}$	$2.06x10^{-4}$	$1.03x10^{-4}$
AP (kg SO_2 eq)	23.7	19.0	7.41	3.70	1.85
EP (kg PO_4^{3-} eq)	12.2	9.75	3.81	1.90	0.95
POCP (kg C_2H_4 eq)	1.33	1.06	0.415	0.208	0.104
ADPE (kg Sb eq)	$1.93x10^{-4}$	$1.54x10^{-4}$	$6.02x10^{-5}$	$3.01x10^{-5}$	$1.51x10^{-5}$
ADPF (MJ eq)	61,700	49,400	19,300	9,640	4820
TRACI					
GWP (kg CO_2 eq)	5,450	4,360	1,700	852	426
ODP (kg CFC-11 eq)	$1.40x10^{-3}$	$1.12x10^{-3}$	$4.37x10^{-4}$	$2.18x10^{-4}$	$1.09x10^{-4}$
AP (kg SO_2 eq)	24.1	19.3	7.53	3.76	1.88
EP (kg N eq)	25.7	20.6	8.04	4.02	2.01
SFP (kg O_3 eq)	307	246	96.0	48.0	24
FFD (MJ eq.)	4,770	3,820	1,490	745	373

Table 18. *Resource use for the Sloan TruFlush Sensor Activated flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	PERE	PERM	PENRE	PENRM	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
Total	483	0.00	INA	INA	8.90	0.00	0.00	15.0
	100%	0.00			100%	0.00	0.00	100%
A1	32.4	0.00	INA	INA	1.19	0.00	0.00	1.05
	6.7%	0.00			13%	0.00	0.00	7.0%
A2	$4.11x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$2.59x10^{-3}$
	0.01%	0.00			0.00%	0.00	0.00	0.02%
A3	24.7	0.00	INA	INA	0.00	0.00	0.00	0.616
	5.1%	0.00			0.00%	0.00	0.00	4.1%
A4	$6.12x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$3.86x10^{-3}$
	0.01%	0.00			0.00%	0.00	0.00	0.03%
A5	$2.15x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.31x10^{-3}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.01%
B1	0	0	0	0	0	0	0	0
B2	38.7	0.00	INA	INA	0.00	0.00	0.00	1.85
	8.0%	0.00%			0.00%	0.00%	0.00%	12%
B3	14.7	0.00	INA	INA	0.00	0.00	0.00	0.584
	3.0%	0.00			0.00%	0.00	0.00	3.9%
B4	372	0.00	INA	INA	7.71	0.00	0.00	10.9
	77%	0.00%			87%	0.00%	0.00%	73%
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	Refer to Table 22							
C1	0	0	0	0	0	0	0	0
C2	$1.76x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.51x10^{-3}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.01%
C3	0	0	0	0	0	0	0	0
C4	$8.69x10^{-3}$	0.00	INA	INA	0.00	0.00	0.00	$5.17x10^{-4}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.00%
D	MND	MND	MND	MND	MND	MND	MND	MND

Table 19. *Waste flows for the Sloan TruFlush Sensor Activated flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	HWD	NHWD	RWD-HL	RWD-LL	CRU	MR	MER	EE
	kg	kg	kg	kg	kg	kg	kg	MJ
Total	$3.66x10^{-2}$	68.6	$1.03x10^{-3}$	$5.47x10^{-3}$	0.00	0.675	Neg.	Neg.
	100%	100%	100%	100%	0.00	100%	Neg.	Neg.
A1	$3.99x10^{-3}$	3.58	$1.10x10^{-4}$	$4.02x10^{-4}$	0.00	0.00	Neg.	Neg.
	11%	5.2%	11%	7.3%	0.00	0.00%	Neg.	Neg.
A2	$9.49x10^{-6}$	0.166	$1.92x10^{-7}$	$2.53x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.03%	0.24%	0.02%	0.46%	0.00	0.00%	Neg.	Neg.
A3	$4.81x10^{-5}$	0.988	$1.36x10^{-5}$	$1.47x10^{-4}$	0.00	0.00	Neg.	Neg.
	0.13%	1.4%	1.3%	2.7%	0.00	0.00%	Neg.	Neg.
A4	$1.44x10^{-5}$	0.261	$2.88x10^{-7}$	$3.59x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.04%	0.38%	0.03%	0.66%	0.00	0.00%	Neg.	Neg.
A5	$4.58x10^{-6}$	0.820	$1.12x10^{-7}$	$1.25x10^{-5}$	0.00	$9.00x10^{-2}$	Neg.	Neg.
	0.01%	1.2%	0.01%	0.23%	0.00	13%	Neg.	Neg.
B1	0	0	0	0	0	0	0	0
B2	$2.19x10^{-4}$	1.69	$4.42x10^{-5}$	$2.87x10^{-4}$	0.00	0.00	Neg.	Neg.
	0.60%	2.5%	4.3%	5.3%	0.00	0.00%	Neg.	Neg.
B3	$5.83x10^{-3}$	2.81	$5.36x10^{-5}$	$2.37x10^{-4}$	0.00	0.00	Neg.	Neg.
	16%	4.1%	5.2%	4.3%	0.00	0.00%	Neg.	Neg.
B4	$2.65x10^{-2}$	55.6	$8.09x10^{-4}$	$4.28x10^{-3}$	0.00	0.585	Neg.	Neg.
	72%	81%	78%	78%	0.00	87%	Neg.	Neg.
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	Refer to Table 22							
C1	0	0	0	0	0	0	0	0
C2	$1.27x10^{-5}$	$2.23x10^{-2}$	$7.79x10^{-8}$	$3.34x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.03%	0.03%	0.01%	0.61%	0.00%	0.00%	Neg.	Neg.
C3	0	0	0	0	0	0	0	0
C4	$8.81x10^{-7}$	2.71	$4.58x10^{-8}$	$3.04x10^{-6}$	0.00	0.00	Neg.	Neg.
	0.00%	4.0%	0.00%	0.06%	0.00%	0.00%	Neg.	Neg.
D	MND	MND	MND	MND	MND	MND	MND	MND

Neg. = Negligible

Table 20. *Resource use for the Sloan TruFlush Manual flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	PERE	PERM	PENRE	PENRM	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
Total	354	0.00	INA	INA	5.80	0.00	0.00	9.22
	100%	0.00			100%	0.00	0.00	100%
A1	19.1	0.00	INA	INA	0.773	0.00	0.00	0.521
	5.4%	0.00			13%	0.00	0.00	5.6%
A2	$2.26x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.43x10^{-3}$
	0.01%	0.00			0.00%	0.00	0.00	0.02%
A3	22.8	0.00	INA	INA	0.00	0.00	0.00	0.455
	6.4%	0.00			0.00%	0.00	0.00	4.9%
A4	$4.79x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$3.02x10^{-3}$
	0.01%	0.00			0.00%	0.00	0.00	0.03%
A5	$2.14x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.31x10^{-3}$
	0.01%	0.00%			0.00%	0.00%	0.00%	0.01%
B1	0	0	0	0	0	0	0	0
B2	38.7	0.00	INA	INA	0.00	0.00	0.00	1.85
	11%	0.00%			0.00%	0.00%	0.00%	20%
B3	0.00	0.00	INA	INA	0.00	0.00	0.00	0.00
	0.00%	0.00			0.00%	0.00	0.00	0.00%
B4	273	0.00	INA	INA	5.02	0.00	0.00	6.39
	77%	0.00%			87%	0.00%	0.00%	69%
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	Refer to Table 22							
C1	0	0	0	0	0	0	0	0
C2	$1.25x10^{-2}$	0.00	INA	INA	0.00	0.00	0.00	$1.07x10^{-3}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.01%
C3	0	0	0	0	0	0	0	0
C4	$4.28x10^{-3}$	0.00	INA	INA	0.00	0.00	0.00	$2.67x10^{-4}$
	0.00%	0.00%			0.00%	0.00%	0.00%	0.00%
D	MND	MND	MND	MND	MND	MND	MND	MND

INA = Indicator not assessed

Table 21. *Waste flows for the Sloan TruFlush Manual flushometer product over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Module	HWD	NHWD	RWD-HL	RWD-LL	CRU	MR	MER	EE
	kg	kg	kg	kg	kg	kg	kg	MJ
Total	$1.92x10^{-2}$	44.8	$4.97x10^{-4}$	$3.13x10^{-3}$	0.00	0.671	Neg.	Neg.
	100%	100%	100%	100%	0.00	100%	Neg.	Neg.
A1	$2.47x10^{-3}$	1.97	$4.93x10^{-5}$	$1.90x10^{-4}$	0.00	0.00	Neg.	Neg.
	13%	4.4%	9.9%	6.1%	0.00	0.00%	Neg.	Neg.
A2	$5.26x10^{-6}$	$9.30x10^{-2}$	$1.06x10^{-7}$	$1.37x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.03%	0.21%	0.02%	0.44%	0.00	0.00%	Neg.	Neg.
A3	$3.65x10^{-5}$	0.725	$1.05x10^{-5}$	$1.10x10^{-4}$	0.00	0.00	Neg.	Neg.
	0.19%	1.6%	2.1%	3.5%	0.00	0.00%	Neg.	Neg.
A4	$1.13x10^{-5}$	0.204	$2.25x10^{-7}$	$2.81x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.06%	0.45%	0.05%	0.90%	0.00	0.00%	Neg.	Neg.
A5	$4.56x10^{-6}$	0.815	$1.12x10^{-7}$	$1.24x10^{-5}$	0.00	$8.95x10^{-2}$	Neg.	Neg.
	0.02%	1.8%	0.02%	0.40%	0.00	13%	Neg.	Neg.
B1	0	0	0	0	0	0	0	0
B2	$2.19x10^{-4}$	1.69	$4.42x10^{-5}$	$2.87x10^{-4}$	0.00	0.00	Neg.	Neg.
	1.1%	3.8%	8.9%	9.2%	0.00	0.00%	Neg.	Neg.
B3	0.00	0.00	0.00	0.00	0.00	0.00	Neg.	Neg.
	0.00%	0.00%	0.00%	0.00%	0.00	0.00%	Neg.	Neg.
B4	$1.65x10^{-2}$	37.4	$3.92x10^{-4}$	$2.47x10^{-3}$	0.00	0.582	Neg.	Neg.
	86%	83%	79%	79%	0.00	87%	Neg.	Neg.
B5	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	0	0	0
B7	Refer to Table 22							
C1	0	0	0	0	0	0	0	0
C2	$9.07x10^{-6}$	$1.59x10^{-2}$	$5.54x10^{-8}$	$2.38x10^{-5}$	0.00	0.00	Neg.	Neg.
	0.05%	0.04%	0.01%	0.76%	0.00%	0.00%	Neg.	Neg.
C3	0	0	0	0	0	0	0	0
C4	$4.94x10^{-7}$	1.93	$2.19x10^{-8}$	$2.06x10^{-6}$	0.00	0.00	Neg.	Neg.
	0.00%	4.3%	0.00%	0.07%	0.00%	0.00%	Neg.	Neg.
D	MND	MND	MND	MND	MND	MND	MND	MND

Neg. = Negligible

Table 22. *Resource use and waste flows for Module B7: Operational Water Use for the Sloan TruFlush products over a 75-yr time horizon. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	USE SCENARIOS FOR B7: Operational Water Use (as per Part B PCR Framework)				
	WATER CLOSETS (60 flushes per day over 10 year period)		URINAL FIXTURES (60 flushes per day over 10 year period)		
	1.6 gpf	1.28 gpf	0.5 gpf	0.25 gpf	0.125 gpf
Resources					
PERE (MJ)	70,500	56,400	22,000	11,000	5,500
PERM (MJ)	0.00	0.00	0.00	0.00	0.00
PENRE (MJ)	0.00	0.00	0.00	0.00	0.00
PENRM (MJ)	0.00	0.00	0.00	0.00	0.00
SM (kg)	0.00	0.00	0.00	0.00	0.00
RSF (MJ)	0.00	0.00	0.00	0.00	0.00
NRSF (MJ)	0.00	0.00	0.00	0.00	0.00
FW (m^3)	13,000	10,400	4,050	2,030	1,020
Wastes					
HWD (kg)	0.120	$9.60x10^{-2}$	$3.75x10^{-2}$	$1.87x10^{-2}$	$9.35x10^{-3}$
NHWD (kg)	960	768	300	150	75
RWD-HL (kg)	$6.63x10^{-2}$	$5.31x10^{-2}$	$2.07x10^{-2}$	$1.04x10^{-2}$	$5.2x10^{-3}$
RWD-LL (kg)	0.228	0.182	$7.11x10^{-2}$	$3.56x10^{-2}$	$1.79x10^{-2}$
CRU (kg)	0.00	0.00	0.00	0.00	0.00
MFR (kg)	0.00	0.00	0.00	0.00	0.00
MER (kg)	0.00	0.00	0.00	0.00	0.00
EE (MJ)	0.00	0.00	0.00	0.00	0.00

6. LCA: Interpretation

The contributions to total impact indicator results are dominated by the operational water use phase (B7) and the product replacement phase (B4). Of the remaining life cycle phases, the product use and maintenance phase (B2) is generally the largest contributor to overall impacts for the Sensor-activated flushometer followed by the raw material extraction and processing (A1), product repair (B3) and the product manufacturing phase (A3). For the Manual flushometer, excluding phases B3 and B7, impact indicator results are dominated by the use and maintenance phase followed by the raw material extraction and processing and product manufacturing phases. Other life cycle phase contributions are minimal. Figure 2 and Figure 3 display the CML-IA impact indicators results, excluding phases B4 and B7.

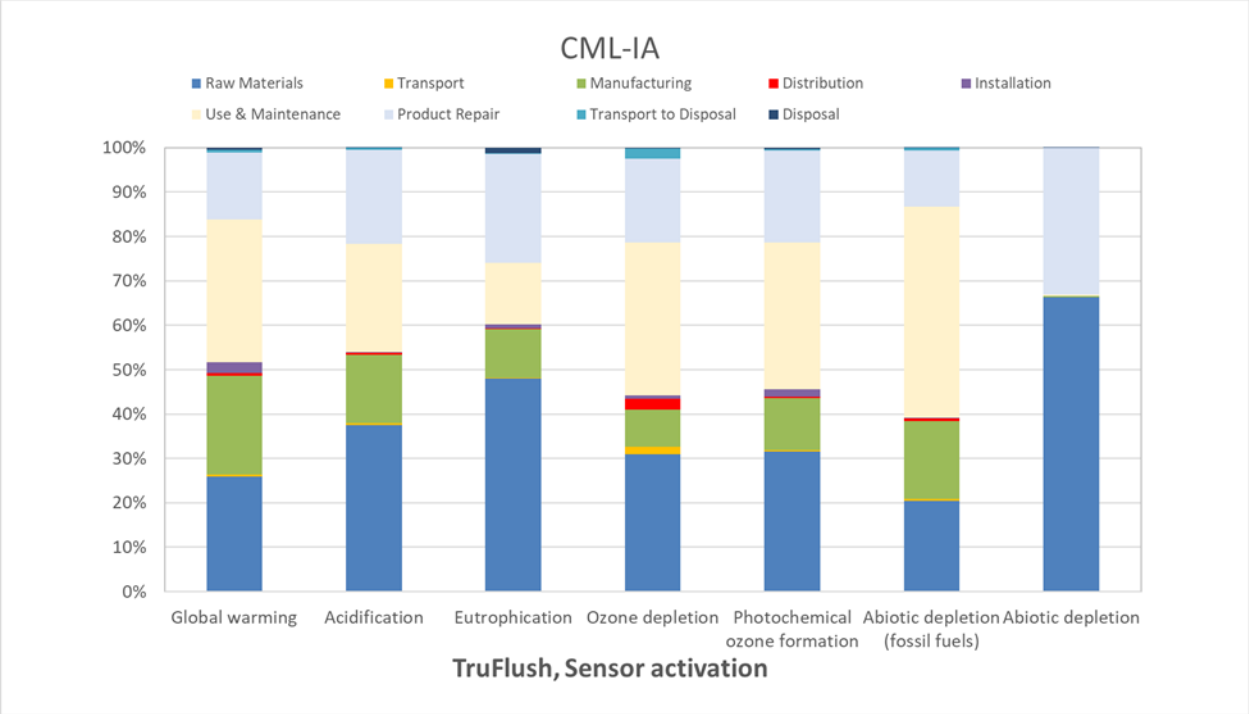

Figure 2. *Contribution analysis for the Sloan TruFlush Sensor Activated – CML-IA. (excluding product replacements (B4) and operational water use (B7)).*

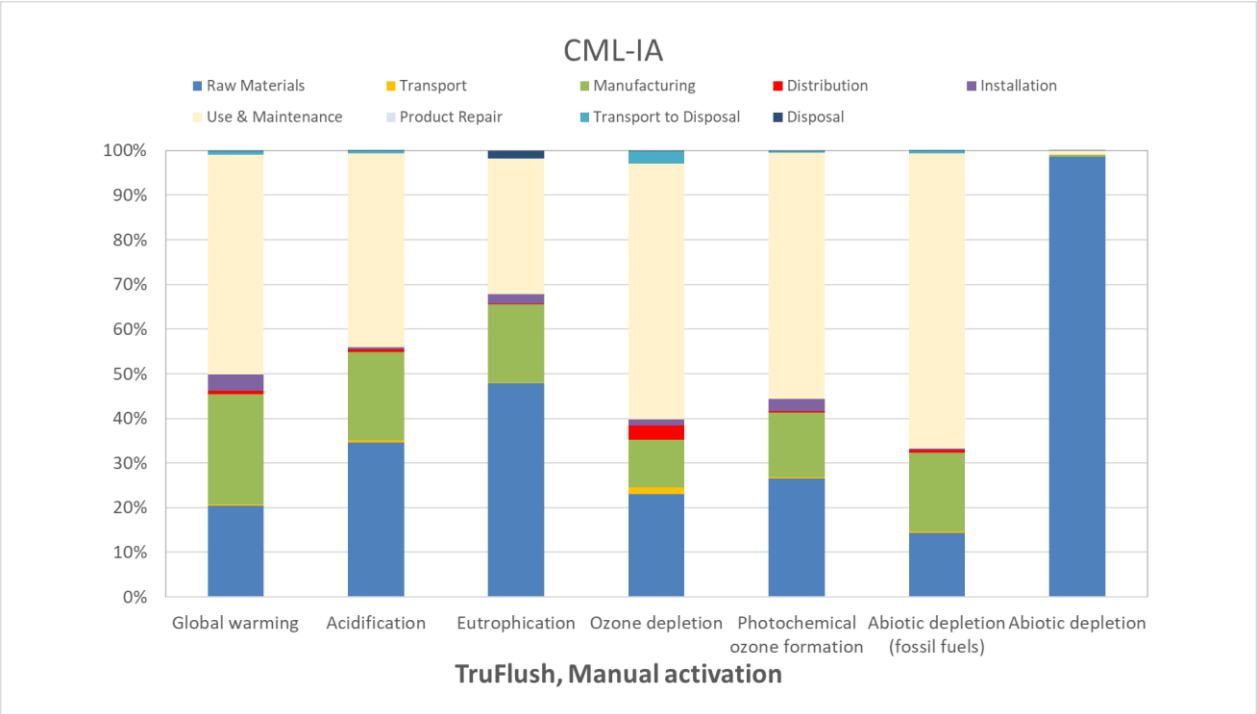

Figure 3. *Contribution analysis for the Sloan TruFlush Manual Activated flushometer – CML-IA. (excluding product replacements (B4) and operational water use (B7)).*

7. Additional Environmental Information

Sloan is a proud member of the United States Green Building Council (USGBC) and through the use of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, Sloan recognizes and validates the importance of best-in-class building strategies and practices of high performing green buildings. Sloan's flushometers within this EPD can be used to help achieve water efficiency goals as well as gaining USGBC LEED v4 points and/or complying with CAL Green and other building codes.

For more information on Sloan's certifications and environmental initiatives please view the website at www.sloan.com.

8. References

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For more information, contact:

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

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
Main +1.510.452.8000 | fax +1.510.452.8001