Declaration Owner
Sloan Valve Company
10500 Seymour Avenue, Franklin Park, IL 60131
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Product
Sloan CX Sensor Flushometers

Functional Unit
Sensor activated flushometers are intended for use with toilet or urinal fixtures as the dispensing unit for the water supplied. These fixtures are primarily installed in the commercial environment including commercial buildings, airports, stadiums, healthcare, hospitality sectors, etc. The functional unit is defined as "10 years of use of a flush valve (or flushometer) for toilets and urinals in an average US commercial environment". The lifespan of 10 years is an industry accepted average lifetime that is based on the economic lifespan of a product. However, the flushometer lifespan may well greatly exceed 10 years with proper maintenance.

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

EPD Number and Period of Validity
SCS-EPD-06683
EPD Valid January 22, 2021 through January 21, 2026

Product Category Rule
Part A: LCA Calculation Rules and Report Requirements v2018; Sustainable Minds (March 2018).

Part B: Product Group Definition | Commercial Flushometer Valves Product Group v3.0; Sustainable Minds (July 3, 2018).

Program Operator
SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
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Declaration Owner:	Sloan Valve Company
Address:	10500 Seymour Avenue, Franklin Park, IL 60131
Declaration Number:	SCS-EPD-06683
Declaration Validity Period:	January 22, 2021 through January 21, 2026
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Aditi Suresh, SCS Global Services
LCA Software:	SimaPro vv8.3
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☒ internal ☐ external
LCA Reviewer:	Gerard Mansell, Ph.D., SCS Global Services
Part A Product Category Rule:	LCA Calculation Rules and Report Requirements v2018; Sustainable Minds (March 2018).
Part A PCR Review conducted by:	Part A PCR review conducted by the SM TAB, tab@sustainableminds.com
Part B Product Category Rule:	Product Group Definition | Commercial Flushometer Valves Product Group v3.0; Sustainable Minds (July 3, 2018).
Part B PCR Review conducted by:	Part B PCR review conducted by the SM TAB, tab@sustainableminds.com
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	

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

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.

PRODUCT

The following CX sensor flushometers are represented by this EPD:

Water Closets		Urinals	
Model #	Flush Volume	Model #	Flush Volume
CX 8154	(1.28 gpf / 4.8 Lpf)	CX 8198	(0.125 gpf/ 0.5 Lpf)
CX 8158	(1.28 gpf / 4.8 Lpf)	CX 8198	(0.25 gpf/ 1.0 Lpf)
		CX 8198	(0.5 gpf/ 1.9 Lpf)

gpf = gallons per flush | *Lpf = liters per flush*

PRODUCT DESCRIPTION

The Sloan sensor CX is a concealed sensor flushometer which provides a clean look without the need for a chase, meaning up to 60% more usable space in every restroom. The CX features an integral control stop and adjustable flush connection, with an all-vertical, in-line, rough-in. Once installed all the servicing of repair parts can be done in front of the wall. The CX will help reduce your buildings water footprint with 0.125 gpf, 0.25 gpf 0.5, gpf, and 1.28 gpf options. CX consists of industry's smallest front access wall panel, nearly 70% smaller than the industry standard. The concealed, clean valve and body design is ideal for new construction or as a renovation to most existing plumbing systems.

CX Sensor Flushometer

CX sensor faucets are available with the following features:

- Fixed volume piston with filtered O-ring bypass
- Front access wall plate requires no rear access plumbing chase
- Sensor activated, hands-free operation
- Battery operated with hardwired option
- Electronic override button
- Low battery indicator light
- Vandal resistant wall plate
- Adjustable flush connection

MATERIAL RESOURCES

The material composition and availability of raw material resources of the CX sensor flushometers are shown in Table 1. Information on product packaging is shown in Table 2.

Table 1. *Material composition (in % of mass) of CX sensor flushometers.*

Material	Percent Mass	Availability			
		Renewable	Non-Renewable	Pre-Consumer Recycled Content	Post-Consumer Recycled Content
Brass	54%		Yes	18%	0%
Zamak 3	22%		Yes	0%	0%
ABS	7.5%		Yes	0%	0%
Stainless Steel	7.2%		Yes	0%	0%
High Impact Polystrene (HIPS)	2.3%		Yes	0%	0%
Celcon M90	1.9%		Yes	0%	0%
PCB Assembly	0.92%		Yes	0%	0%
Plastic combined with copper	0.74%		Yes	0%	0%
Lexan	0.64%		Yes	0%	0%
Battery	0.53%		Yes	0%	0%
EPDM	0.52%		Yes	0%	0%
Bisphenol-A Type Epoxy Resin	0.48%		Yes	0%	0%
Isolphorone Diamine, Nonyl Phenol, N-Aminoethyl Piperazine	0.48%		Yes	0%	0%
Steel	0.30%		Yes	0%	0%
Polypropylene with copper	0.26%		Yes	0%	0%
Nylon 6	0.20%		Yes	0%	0%
Rubber	0.11%	Yes		0%	0%
Polyamide	0.11%		Yes	0%	0%
Methacrylate ester	0.076%		Yes	0%	0%
Neodymium	0.020%		Yes	0%	0%
High Density Polyethylene (HDPE)	0.020%		Yes	0%	0%
Polypropylene	0.020%		Yes	0%	0%
Low Density Polyethylene (LDPE)	0.010%		Yes	0%	0%
Vulcanized fibre	0.010%		Yes	0%	0%
Nylon 6, 6 with phosphor bronze	0.004%		Yes	0%	0%
PVC, Tinned Copper	0.0002%		Yes	0%	0%
TOTAL	**100%**				

Table 2. *Material composition (in % of mass) of packaging for CX sensor flushometers.*

Material	% Mass	Availability			
		Renewable	Non-Renewable	Pre-Consumer Recycled Content	Post-Consumer Recycled Content
Cardboard	~100%	Yes		0%	30%
Paper pulp	Negligible	Yes		0%	0%
TOTAL	**100%**				

ADDITIONAL ENVIRONMENTAL INFORMATION

The Sloan sensor CX is Watersense labeled. The EPA WaterSense program was developed in 2006 and is a partnership program by the EPA. Similar to the Energy Star program for appliances and other energy consuming devises, WaterSense promotes the importance of water efficiency. Products and services that have the WaterSense label have been certified to be at least 20% more efficient than the baseline.

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 and LEED v4.1 points and/or complying with CAL Green and other building codes.

LIFE CYCLE ASSESSMENT OVERVIEW

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			Construction Process		Use							End-of-Life				Benefits & 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 the	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	NR	X	X	NR	NR	NR	X	X	X	X	X	MND

X = Included, MND = module not declared, NR = not relevant

The following provides a brief overview of the Modules included in the product system for Sloan® sensor flushometers.

Module A1 Raw material extraction and processing, processing of secondary material inputs for sensor flushometers

This module includes the potential environmental impacts associated with the extraction and processing of raw materials for various component parts in the sensor flushometer. The brass components are one of the primary materials, comprising of at least 54% of the flushometer product composition on a mass basis.

Module A2: Transportation

This module includes the transportation of all material components (such as plastics, stainless steel, synthetic rubber, etc.) from the suppliers to the Andover manufacturing facility in Massachusetts as well as the flush valve components from a Chicago based manufacturing facility to Andover facility.

Module A3: Manufacturing and Assembly of CX Sensor Flushometer

This module includes the manufacturing and assembly of the sensor and solenoid modules, and final assembly and packaging of the flushometer at the Andover facility.

Module A4: Transportation & Delivery to the site

This module includes the impacts associated with transportation of finished sensor flushometers to the installation site.

Module A5: Construction & Installation

The installation of CX sensor flushometer is performed with hand tools and does not require any ancillary material input. This module considers the impacts associated with waste processing and disposal of product packaging waste generated during the installation process.

Module B1: Normal use of the product

This module includes environmental impacts arising through normal anticipated use of the product. This module is not applicable because the anticipated use of the flushometer is accounted for in *Module B7: Operational water use*.

Module B2: Maintenance

This module considers the impacts associated with cleaning and maintenance of the product over a 10-year period. Typical maintenance involves cleaning of the flushometer with a damp cloth. In accordance with Part B PCR, cleaning of the CX sensor flushometer is assumed to occur daily using 10 ml of 1% sodium lauryl sulfate solution. The flushometers are cleaned daily for a period of 10 years, corresponding to the functional unit for the assessment. Additionally, waste processing and disposal related to these maintenance activities are included in this module.

Module B3: Repair

This module includes any anticipated repair events during the reference service life of the CX sensor flushometers. Based on the manufacturer's recommendation, the alkaline batteries 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.

Module B4-B5: Replacement and refurbishment

These modules include anticipated replacement or refurbishment events during the reference service life associated with replacing a whole product (Module B4) and restoration of parts to a condition in which the products can perform its required function (Module B5). These modules are not applicable to CX sensor flushometers as these products are not expected to be replaced as a whole product over a 10 year period. The replacement of certain worn out parts are considered as repair in Module B3.

Module B6: Operational Energy Use

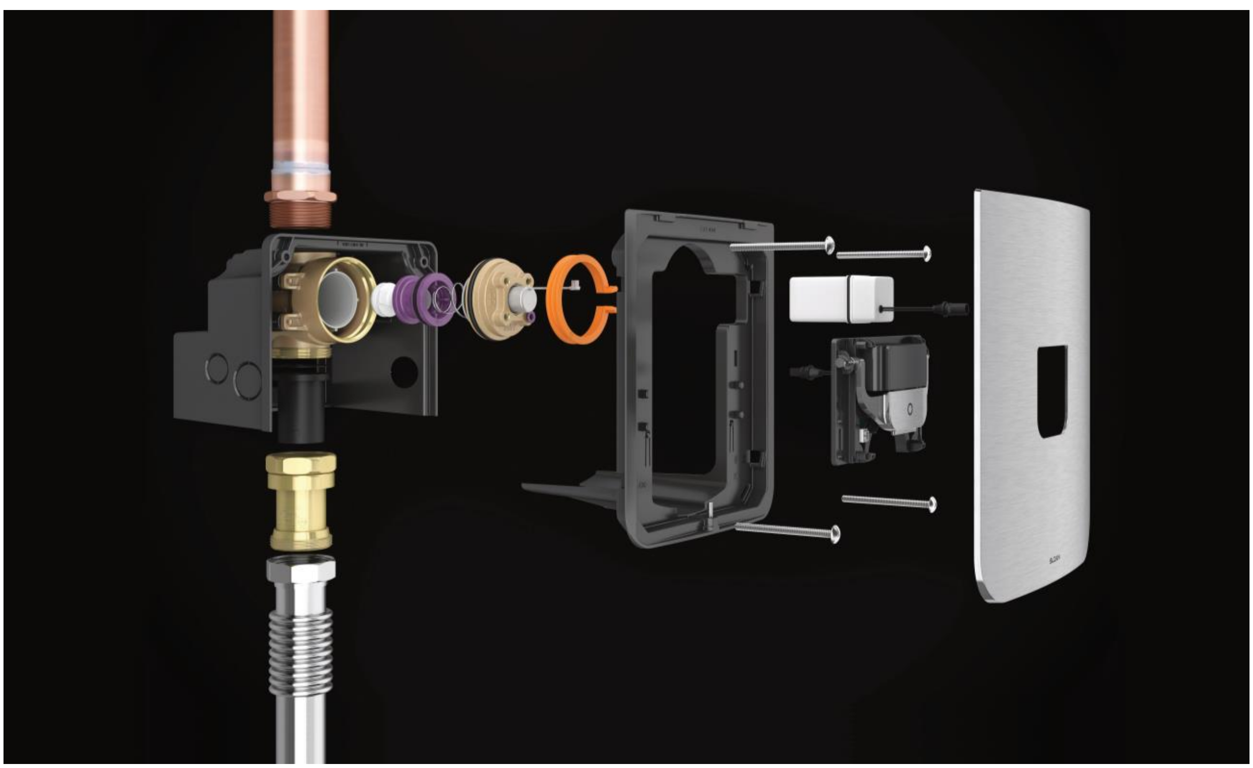
The boundary of this module includes energy use during the operation of the product, together with its associated environmental aspects and impacts including processing and transportation of any waste generated on-site due to the use of energy. This module is not applicable because the CX sensor flushometer is battery operated and as such, there is no primary energy consumption associated with these products.

Module B7: Operational Water Use

This module includes water use during the operation of the product, together with its associated environmental aspects and impacts considering the life cycle of water which includes production, delivery, and wastewater treatment. Impacts were calculated depending on the water use (gallons per flush) specifications of CX sensor flushometers.

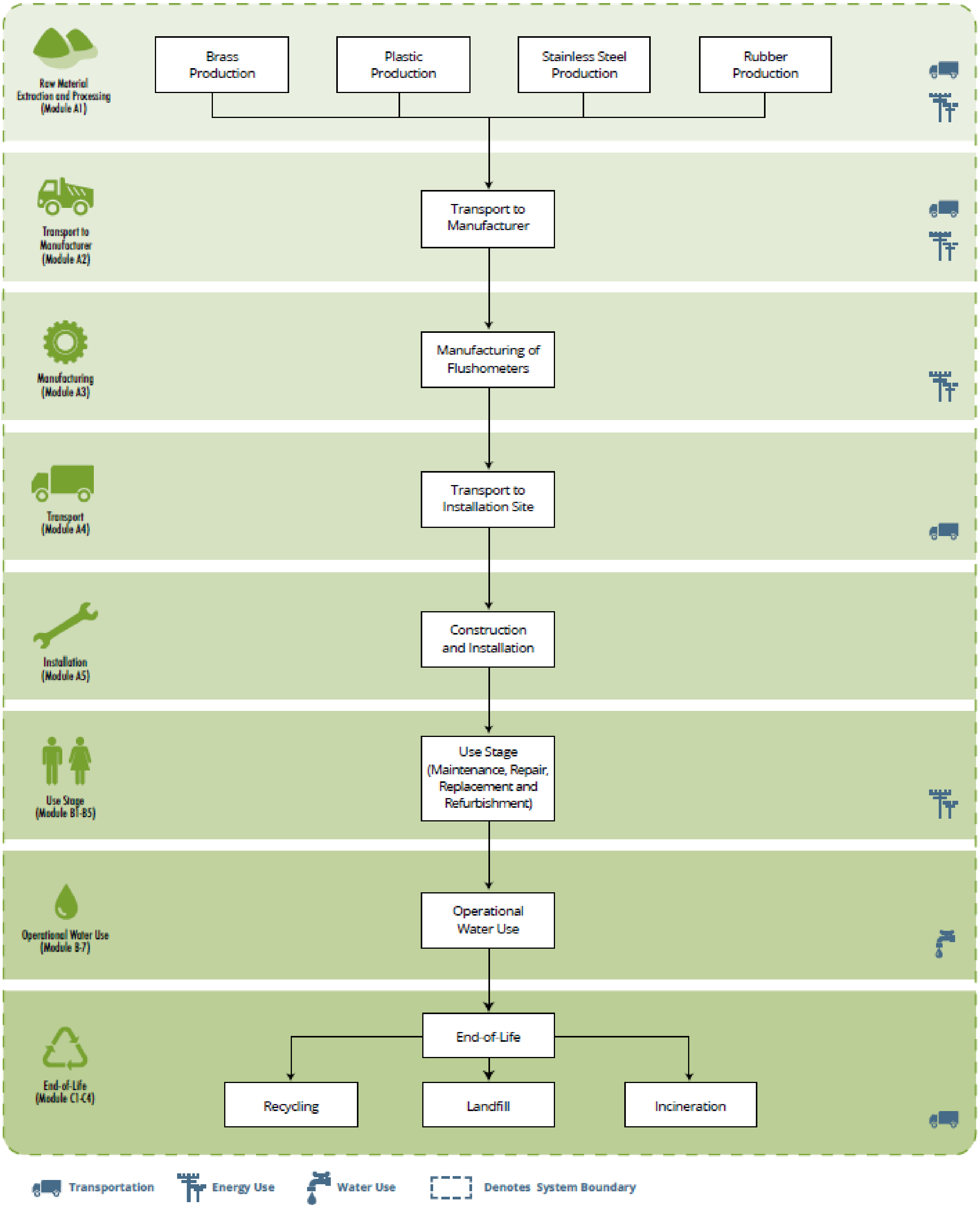
Module C1-C4: End-of-Life

The end-of-life stage of the product starts when it is replaced, dismantled or deconstructed from the building. Impacts for deconstruction and dismantling processes were not modeled in the LCA as it is a manual process with hand tools, and does not require any energy input for removal of the product. The impacts associated with transportation of waste materials to processing facilities, waste processing of material components and waste disposal of the product are included in these modules.



PROCESS FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle for CX sensor flushometers. The following life cycle stages are included: production (Modules A1-A3); construction & installation (Module A4-A5); product use (Modules B1-B7); and end-of-life (Modules C1-C4).



LIFE CYCLE IMPACT ASSESSMENT

Life cycle impact assessment is the process of converting the life cycle inventory results into a representation of potential environmental and human health impacts. For example, emissions of carbon dioxide, methane, and nitrous oxide (inventory data) together contribute to climate change (impact assessment). The impact assessment for the EPD is conducted in accordance with the requirements of the Product Category Rule (PCR). Impact category indicators were estimated using TRACI v2.1 characterization method, including Global Warming Potential (100 year time horizon), Acidification Potential, Eutrophication Potential, Smog formation, Ozone Depletion Potential, and Fossil Fuel Depletion Potential.

Table 3. *Results for 10 years of use of a CX sensor flushometer.*

Impact Category	Production			Construction & Installation		Use			End-of-Life			
	Raw Material Extraction/ Processing	Transport to the Manufacturer	Manufacturing	Transportation	Installation	Maintenance	Repair	Operational Water Use	Demolition	Transportation	Waste Processing	Disposal
	A1	A2	A3	A4	A5	B2	B3	B7	C1	C2	C3	C4
Ecological Indicators												
Acidification (kg SO_2 eq)	0.74	6.1x10^{-3}	7.6x10^{-3}	1.0x10^{-3}	2.0x10^{-5}	5.1x10^{-2}	3.2x10^{-3}	See Table 4	0.0	3.7x10^{-3}	2.7x10^{-3}	2.5x10^{-3}
Eutrophication (kg N eq)	1.4	1.7x10^{-3}	2.5x10^{-2}	2.4x10^{-4}	4.2x10^{-4}	2.1x10^{-2}	4.7x10^{-3}		0.0	5.3x10^{-4}	2.4x10^{-3}	1.6x10^{-2}
Global Warming (kg CO_2 eq)	45	0.58	2.7	0.22	0.07	8.30	0.21		0.0	0.64	0.73	2.2
Ozone Depletion (kg CFC-11 eq)	2.0x10^{-6}	1.1x10^{-7}	8.2x10^{-8}	4.3x10^{-8}	2.2x10^{-10}	8.2x10^{-7}	1.4x10^{-8}		0.0	1.2x10^{-7}	3.6x10^{-8}	5.8x10^{-8}
Human Health Indicators												
Smog (kg O_3 eq)	3.6	7.3x10^{-2}	5.2x10^{-2}	2.4x10^{-2}	3.3x10^{-4}	0.50	1.7x10^{-2}	See Table 4	0.0	0.10	3.2x10^{-2}	3.5x10^{-2}
Resource Depletion												
Fossil Fuel Depletion (MJ surplus)	2.0x10^{-6}	1.1x10^{-7}	8.2x10^{-8}	4.3x10^{-8}	2.2x10^{-10}	8.2x10^{-7}	1.4x10^{-8}	See Table 4	0.0	1.4	0.51	0.71

The operational use phase (Module B7) considers the volume of water required per flush, the embedded energy required for water supply and flushometer operation, distribution and wastewater treatment, and the number of flushes over a 10-year period. The volume required per flush (expressed in terms of gallons per flush) varies depending on the design specification of the sensor flushometers for toilet and urinal fixtures.

Table 4. *Results for Module B7: Operational Water Use scenarios for toilet and urinal fixtures (60 flushes per day over 10 year period.*

Impact Category	USE SCENARIO FOR B7: Operational Water Use			
	WATER CLOSETS (60 flushes per day over 10 years)	URINAL FIXTURES (60 flushes per day over 10 years)		
	1.28 gpf	0.125 gpf	0.25 gpf	0.5 gpf
Ecological Indicators				
Acidification ($kg\ SO_2\ eq$)	3.7	0.36	0.71	1.4
Eutrophication (kg N eq)	1.9	0.19	0.37	0.75
Global Warming ($kg\ CO_2\ eq$)	530	52	100	210
Ozone Depletion (kg CFC-11 eq)	$1.3x10^{-5}$	$1.3x10^{-6}$	$2.5x10^{-6}$	$5.0x10^{-6}$
Human Health Indicators				
Smog ($kg\ O_3\ eq$)	23	2.3	4.6	9.2
Resource Depletion				
Fossil Fuel Depletion (MJ surplus)	380	38	75	150

ADDITIONAL ENVIRONMENTAL PARAMETERS

ISO 21930 requires that several parameters be reported in the EPD, including resource use, waste categories and output flows, and other environmental information. The results for these parameters are shown in Table 5 and Table 6.

Acronym	Parameter
RPR_E	Renewable primary resources used as an energy carrier (fuel)
RPM_E	Renewable primary resources with energy content used as material
$NRPR_E$	Non- renewable primary resources used as an energy carrier (fuel)
$NRPM_E$	Non- renewable primary resources with energy content used as material
SM	Secondary materials
RSF	Renewable secondary fuels
NRSF	Non- renewable secondary fuels
RE	Recovered energy
NHW	Non-hazardous waste disposed
HW	Hazardous waste disposed
RW	Radioactive waste disposed
CFR	Components for reuse
MFR	Materials for recycling
MER	Materials for energy recovery
EE_I	Exported energy from incineration
EE_L	Exported energy from landfill

Table 5. *Results for 10 years of use of a CX sensor flushometer by module. Results representing energy flows are calculated using lower heating (i.e., net calorific) values.*

Environmental parameter	Production			Construction & Installation		Use			End-of-Life			
	Raw Material Extraction/ Processing	Transport to the Manufacturer	Manufacturing	Transportation	Installation	Maintenance	Repair	Operational Water Use	Demolition	Transportation	Waste Processing	Disposal
	A1	A2	A3	A4	A5	B2	B3	B7	C1	C2	C3	C4
RPR_E (MJ)	49	0.16	2.8	$5.2x10^{-2}$	$1.5x10^{-3}$	6.2	0.29	See Table 6	0.0	$4.2x10^{-2}$	0.55	0.52
RPM_E (MJ)	0.17	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
$NRPR_E$ (MJ)	429	9.5	26	3.8	$3.0x10^{-2}$	237	2.8		0.0	$3.4x10^{-3}$	$1.9x10^{-2}$	$1.9x10^{-2}$
$NRPM_E$ (MJ)	0.24	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
SM (MJ)	$4.0x10^{-3}$	0.0	0.080	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
RSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Water Use (m^3)	1.8	$9.1x10^{-3}$	$3.9x10^{-2}$	$2.9x10^{-3}$	$5.5x10^{-5}$	1.0	$1.3x10^{-2}$		0.0	$3.4x10^{-3}$	$1.9x10^{-2}$	$1.9x10^{-2}$
NHW (kg)	35	0.52	3.2	0.30	$5.7x10^{-2}$	0.48	$4.5x10^{-2}$		0.0	$4.0x10^{-2}$	0.18	3.0
HW (kg)	$6.2x10^{-3}$	$5.0x10^{-6}$	$2.1x10^{-5}$	$1.9x10^{-6}$	$3.2x10^{-8}$	$1.0x10^{-4}$	$1.2x10^{-4}$		0.0	$3.2x10^{-6}$	$1.6x10^{-2}$	$6.4x10^{-6}$
RW (kg)	$1.9x10^{-4}$	$1.0x10^{-5}$	$1.6x10^{-5}$	$4.1x10^{-6}$	$1.4x10^{-8}$	$3.2x10^{-5}$	$9.5x10^{-7}$		0.0	$1.1x10^{-5}$	$3.1x10^{-6}$	$5.7x10^{-6}$
CFR (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	3.7	0.0
MFR (kg)	0.0	0.0	0.0	0.0	0.13	0.0	0.0		0.0	0.0	1.7	0.0
MER (kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
EE, Total (MJ)	0.0	0.0	0.0	0.0	0.24	0.0	0.0		0.0	0.0	0.0	1.1
EE_I, Electricity (MJ)	0.0	0.0	0.0	0.0	0.052	0.0	0.0		0.0	0.0	0.0	0.36
EE_I Heat (MJ)	0.0	0.0	0.0	0.0	0.10	0.0	0.0		0.0	0.0	0.0	0.72
EE_L, Electricity (MJ)	0.0	0.0	0.0	0.0	0.080	0.0	0.0		0.0	0.0	0.0	0.0
EE_L, Heat (MJ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Biogenic CO_2 (kg CO_2)	0.0	0.0	-0.46	0.0	0.16	0.0	0.0		0.0	$3.1x10^{-2}$	1.5	1.6

Table 6. *Results for scenarios for Module B7: Operational Water Use scenarios for water closets and urinal fixtures (60 flushes per day over 10 year period). Results representing energy flows are calculated using lower heating (i.e., net calorific) values.*

Impact Category	USE SCENARIO FOR B7: Operational Water Use			
	WATER CLOSETS (60 flushes per day over 10 years)	URINAL FIXTURES (60 flushes per day over 10 years)		
	1.28 gpf	0.125 gpf	0.25 gpf	0.5 gpf
RPR_E (MJ)	370	36	72	143
RPM_E (MJ)	0.0	0.0	0.0	0.0
$NRPR_E$ (MJ)	8,720	850	1,700	3,400
$NRPM_E$ (MJ)	0.0	0.0	0.0	0.0
SM (MJ)	0.0	0.0	0.0	0.0
RSF (MJ)	0.0	0.0	0.0	0.0
NRSF (MJ)	0.0	0.0	0.0	0.0
RE (MJ)	0.0	0.0	0.0	0.0
Water Use (m^3)	17	1.6	3.2	6.4
NHW (kg)	15	1.5	2.9	5.9
HW (kg)	$1.1x10^{-2}$	$1.1x10^{-3}$	$2.2x10^{-3}$	$4.4x10^{-3}$
RW (kg)	$3.1x10^{-3}$	$3.0x10^{-4}$	$6.0x10^{-4}$	$1.2x10^{-3}$
CFR (kg)	0.0	0.0	0.0	0.0
MFR (kg)	0.0	0.0	0.0	0.0
MER (kg)	0.0	0.0	0.0	0.0
EE, Total (MJ)	0.0	0.0	0.0	0.0
EE_I, Electricity (MJ)	0.0	0.0	0.0	0.0
EE_I Heat (MJ)	0.0	0.0	0.0	0.0
EE_L, Electricity (MJ)	0.0	0.0	0.0	0.0
EE_L, Heat (MJ)	0.0	0.0	0.0	0.0
Biogenic CO_2 (kg CO_2)	0.0	0.0	0.0	0.0

Interpretation of Results

For CX sensor flushometers used with water closets and urinal fixtures, the major hotspot in the product life cycle lies in the operational water use (Module B7), followed by raw material extraction and processing (Module A1), which primarily includes the production of brass components. For CX sensor flushometers used with urinal fixtures, the contribution from raw material extraction and processing (Module A1) is largest for acidification and eutrophication, while the contribution from operational water use (Module B7) is the largest for global warming and ozone depletion. This difference is mainly observed due to the flush volume and the number of flushes per day over the 10 year reference service life. The impacts associated with use phase are mainly because of the embedded energy in water supply, distribution and wastewater treatment. As such, the operational water use data used for Module B7 has a significant influence on the final results depending on the number of assumed flushes and the water delivered per flush (gallons per flush). Overall, the flushometer manufacturing operations occurring at the Sloan manufacturing facilities (Module A3) contribute less than 4% of impacts across all impact categories.

SUPPORTING TECHNICAL INFORMATION

Data Sources. *Data sources used for the LCA. Materials less than 1% of product mass are not listed.*

Material	Dataset	Publication Date
CX Sensor Flushometer Product		
Brass components	Brass {GLO}| market for | Alloc Rec, U1 (represents brass from other suppliers)	2016
Stainless steel	Steel, chromium steel 18/8, hot rolled {GLO}| market for | Alloc Rec, U[1]	2016
PCB assembly	Printed wiring board, through-hole mounted, unspecified, Pb free {GLO}| market for | Alloc Rec, U[1]	2016
Rubber	Literature[2]	2016
Celcon	Polypropylene, granulate {GLO}| market for | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
EPDM	Synthetic rubber {GLO}| market for | Alloc Rec, U[1]	2016
Neodymium	Neodymium oxide {GLO}| average, no market transport| Alloc Rec, U1	2016
ABS	Acrylonitrile-butadiene-styrene copolymer {GLO}| market for | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
Steel	Steel, chromium steel 18/8, hot rolled {GLO}| market for | Alloc Rec, U[1]	2016
Zamak	Zamak3 {GLO} | market for | Alloc Rec[1,3]	2016
Battery	Battery cell, Li-ion {RoW}| production | Alloc Rec, U[1]	2016
Lexan	Polycarbonate {RoW}| production | Alloc Rec, U[1]	2016
Polypropylene	Polypropylene, granulate {RoW}| production | Alloc Rec, U[1];	2016
HDPE	Polyethylene, high density, granulate {RoW}| production | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
LDPE	Polyethylene, low density, granulate {RoW}| production | Alloc Rec, U[1]; Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
Nylon 6	Nylon 6 {GLO}| market for | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
Nylon 6,6	Nylon 6,6 {GLO}| market for | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
HIPS	Polystyrene, high impact {GLO}| market for | Alloc Rec, U	2016
Methacrylate	Methyl methacrylate {RoW}| production | Alloc Rec, U[1]	2016
Bisphenol-A Type Epoxy Resin	Bisphenol A epoxy based vinyl ester resin {GLO}| market for | Alloc Rec, U[1]	2016
Tinned copper w/PVC	Copper {GLO}| average, no market transport | Alloc Rec, U[1]; Metal working, average for copper product manufacturing {GLO}| market for | Alloc Rec, U[1]	2016
Plastic/copper combination component	Copper {GLO}| primary production from concentrate | Alloc Rec, U[1]; Synthetic rubber {RoW}| production | Alloc Rec, U[1]; Injection moulding {GLO}| market for | Alloc Rec, U[1]	2016
Copper	Copper {GLO}| average, no market transport | Alloc Rec, U1 Metal working, average for copper product manufacturing {RoW}| processing | Alloc Rec, U[1]	2016
Packaging		
Cardboard	Corrugated board box {RoW}| production | Alloc Rec, U[1]	2016
Paper pulp	Kraft paper, bleached {RER}| production | Alloc Rec, U[1]	2016
Energy Use		
Electricity	The dataset represents the supply mix of electricity for eGRID power subregions representing the locations of manufacturing facilities operated by SLOAN.[3]	2016
Operational water use	Electricity, medium voltage {US}| market group for | Alloc Rec, U[1]	2016
Natural Gas	Heat, district or industrial, natural gas {GLO}| market group for | Alloc Rec, U[1]	2016
Transportation		
Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | Alloc Rec[1]	2016
Ship	Transport, freight, sea, transoceanic ship {GLO}| market for | Alloc Rec, U[1]	2016

[1]Ecoinvent 3.3 Life Cycle Database; [2]Jawjit, W., et al., (2009); [3]SCS Global Services

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 provided primary data on product manufacturing for U.S. based Sloan facilities based on annual production for 2018. Representative datasets (secondary data) used for upstream and background processes are generally less than 10 years old from original publication, but almost all have been updated in the last two years.
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 is considered to be of high quality and provide the best possible representation available with current data. Datasets used in the assessment are representative of the US, Global, and "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes and are of good data quality.
Technology Coverage: Specific technology or technology mix	Data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Data was collected for all key processes including flushometer production and assembly, polishing and plating and packaging.
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 sensor diaphragm flushometers. 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	Overall, data used in the assessment represent actual processes for production of CX sensor flushometers. Data is considered to be representative of the actual technologies used for flushometer production.
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 data.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturer's facilities represent an annual average. Primary data were available for all key processes across the supply chain including flushometer production and assembly, packaging, transportation for CX sensor flushometers. LCI datasets from Ecoinvent were used to model all unit processes.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to the product materials and packaging is low. These datasets are considered to be representative as primary data was collected from the Sloan production facilities. Uncertainty related to the impact assessment methods used in the study is relatively high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

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