Environmental Product Declaration

SANITSER VITREOUS CHINA CERAMIC SANITARY WARE

Revision:
draft

Verification date:

Valid until:

CPC code:

SANITSER

With the contribution of the LIFE financial instrument of the European Community

1. SANITSER LIFE Project

SANITSER project aims to revise the production process in the Vitreous Sanitary Ware (VSW) ceramic sector by introducing relevant amounts of glass cullet waste from urban waste disposal in the ceramic blends formulations. The project focuses process innovations designed to:

a) provide a sustainable management, in terms of recovery of large amounts of glass cullet waste (soda lime glass: SLG),
b) improve environmental performances of the ceramic sector by reducing CO_2 emissions,
c) enhance sustainability by energy saving and natural resources preservation.

Taking profit from promising solutions emerged in Partners' previous studies/lab-scale experimentations, SANITSER is meant to tackle technological hurdles hampering the introduction of SLG in VSW production, through following targets:

- Deep re-definition of the best performing firing time-temperature cycles as a function of the SLG content.
- Optimization of the firing cycles and slips composition to guarantee preservation of technological quality of the final ceramic bodies with respect to present standards for marketability.
- Revision of the glaze compositions in the context of firing time-temperature cycles fixed anew.
- Adjustment of the process dynamics/parameters as a function of the rheological properties of new slips formulated with SLG.

Expected results have been obtained in the final industrial stage, preceded by a long research period, a pilot production stage and a pre-industrial production stage.

2. SANITSER Partners

Minerali Industriali srl was set up following the merger of two historic Italian groups in the mining sector: Maffei, founded in the early 1900s and Gruppo Minerali operating since the '70s.
Nowadays Minerali Industriali controls one company in Italy, one in Tunisia, two in Egypt, one in Scotland, one in Brazil, one in Colombia, one in Guatemala, two in Mexico, one in Czech Republic and one in Bulgaria: Maffei Sarda Silicati, Minerali Industriali Tunisia, Egyptian International Industrial Minerals, Suez Company for Minerals, Lochaline Quartz Sand, Gruppo Minerali do Brasil, Colombia Minerales Industriales, Mineral Resources de Guatemala, Mexican Silicates, Ecominerali Mexicana, Czech Silicat e Minerali Industriali Bulgaria.
Moreover has two minority stake in the companies Sea Gull of Oristano (OR) and Tco of Livorno (LI).

Life Cycle Engineering (LCE) is an independent consulting firm, providing professional solutions and tools for Life Cycle Assessment (LCA), eco-design, environmental communications and regulatory compliance to private companies and business associations.
LCE also participates in institutional projects with the European Commission, the United Nations Development/Environmental Programme and some national/regional agencies. In the last few years, LCE has been involved in several H2020, LIFE and service contract projects with the European Commission (EU PROJECTS).
LCE is an accredited member of the "POLIGHT Innovation Pole", a consortium of innovative small medium enterprises geared towards developing sustainability and green technologies.

G.E.M.I.C.A. Srl was established in 1996 in Quartaccio (Lazio region, Italy). The company produces ceramic glazes for ceramic industry such as vitreous china sanitary ware, fire clay shower floors, tableware of soft earthenware and porcelain. 60% of its clients are located in the Civita Castellana ceramic district, the other 40% are domestic and international clients mainly of the European market.

SETEC srl, located in Civita Castellana (Italy), operates in the ceramic sector for over 20 years.
It is specialized in technologies for the production of sanitary-ware, tableware and other ceramic articles.
The business sectors are: Machinery Division (supply turnkey plants with start-up of new production lines and equipment for complete plants); Technical Services (Process Engineering, Know-How and fine tuning of bodies and glazes with client's raw materials); Technical Assistance for single ceramic process phases for the start-up of new plants and long-term.

3. Product specifications

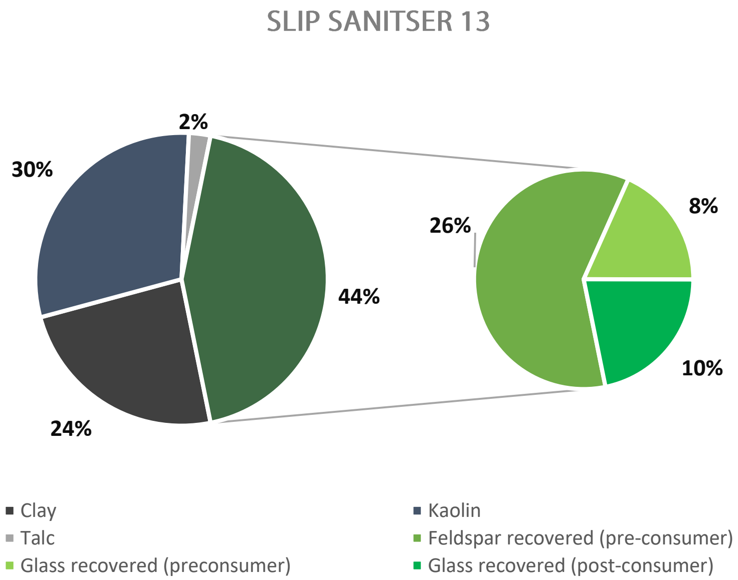
The products considered in this study are **vitreous china ceramic sanitary wares**. These products are usually made of clay, feldspar, quartz and kaolin in the traditional recipes, while part of these raw materials have been substituted by secondary raw materials in the innovative SANITSER formulations.

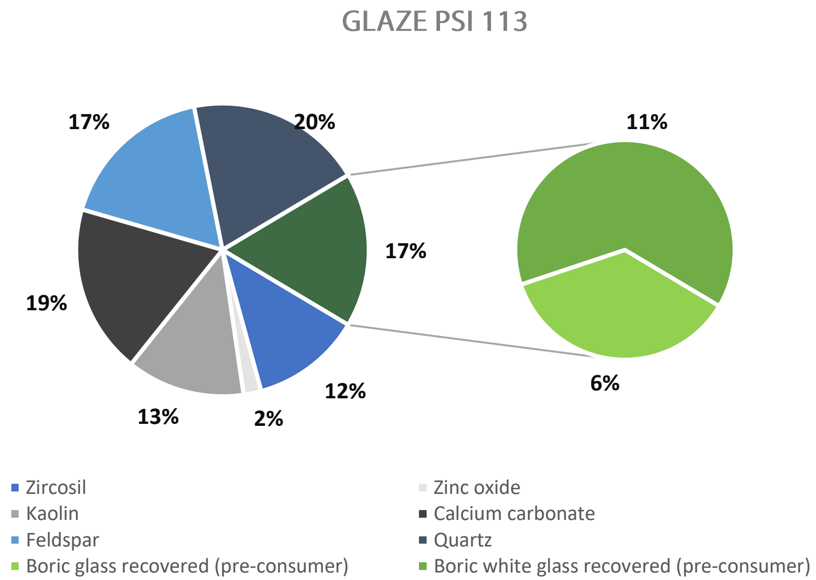
All data are referred to the products manufactured during the industrial stage of SANITSER project, which are little sinks and toilets, with an average weight of 12.7 kg.

The glass cullet adopted in SANITSER originates from an advanced treatment process of glass scraps discarded after the primary urban waste separation process. This glass, which is mixed with impurities, dirt and other materials, corresponds to around 200 000 tons/year, which can thus be recovered.

Besides, other recycled raw materials are used to produce the SANITSER ceramic body. These include ceramic scraps, sand and minerals deriving from stone processing waste. Moreover, different types of special glasses were introduced into the ceramic glaze formulation, such as recycled TV screens, lamps, and neon tubes.

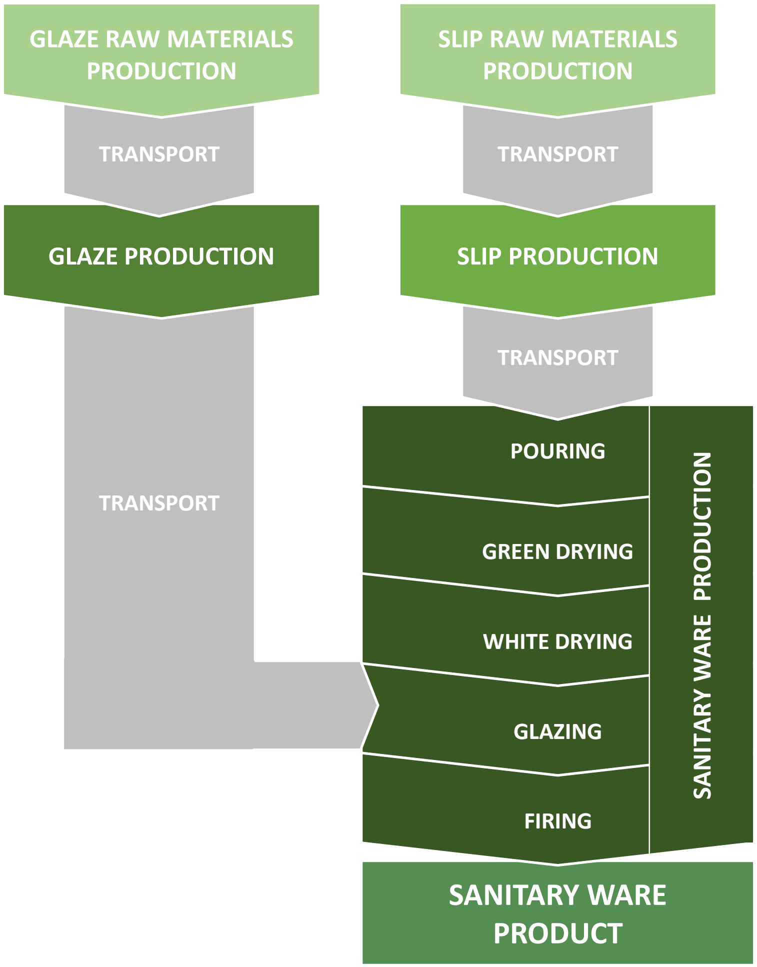
CONTENT DECLARATION





4. Ceramic sanitary ware production process

The life cycle of a vitreous china ceramic sanitary ware starts with the extraction and/or the production of raw materials. Primary materials are extracted from ground and refined to obtain the required dimension and purity. Recycled raw materials are obtained starting from pre or post-consumer waste, which are cleaned and refined until obtaining the same quality of primary raw materials.
After transportation, raw materials are used together with water for the preparation of glaze and slip. These processes are not affected by the presence of recycled materials and have the same characteristics of the traditional processes.
The two semi-products are transported to the final sanitary ware manufacturing plant, where firstly the slip is poured within moulds for casting, and then it goes through two drying stages (green and white drying), which have different operative conditions.
The obtained body is glazed and finally fired at 1 170°C.



5. Scope

Sanitary ware production took place in Civita Castellana district.
Companies involved in the production processes are:

SANITARY WARE MANUFACTURING	SCARABEO - http://www.scarabeosrl.com AMERINA CERAMICS - http://www.ceramicaamerina.it KERASAN - http://www.kerasan.it ALICE CERAMICS - http://www.aliceceramica.com/it

SLIP PRODUCTION	SETEC – Project partner
GLAZE PRODUCTION	G.E.M.I.C.A. – Project partner

6. Declared unit

According to the Product Category Rules PCR 2012:01 V 2.01 "Construction products and construction services", the declared unit is 1 ton of sanitary ware product.

7. Allocations

Where co-products are present, mass allocation is applied, following indications of reference PCR 2012:01.

8. Cut-off rules

Some stages of the life cycle have been excluded from this analysis because they are not modified by the innovative SANITSER technology and have an overall low impact.

Excluded processes are:
- Auxiliary materials production and utilization;
- Moulds production, utilization and end of life;
- Final product distribution.

The 100% of the recipes has been considered for both slip and glaze.

9. System boundaries

The study is "cradle to gate". Subsequent phases (e.g. transport to installation place, installation and use phase) are not considered, as not mandatory required by PCR 2012:01.

According to the PCR 2012:01 the main activities are listed and divided in three subsystems: A1 (UPSTREAM Process), A2 and A3 (CORE Module).

RAW MATERIALS SUPPLY

- Raw materials extraction and processes ;
- Packaging materials production;
- Secondary materials recycling treatment (collection of waste material and transport to recycling treatment has been considered part of the system);
- Fuels and electricity from grid:
  - Extraction and processing of natural gas for core energy demand;
  - Generation of electricity from national grid (Italian mix, IEA 2015).

TRASPORTATION

- External transportation of all input materials to the core processes.

MANUFACTURING

- Slip production process;
- Glaze production process;
- Intermediate products transportation to sanitary ware production process;
- Sanitary ware production process;
- Natural gas combustion for energy purposes, within the slip production and the sanitary ware production;
- Treatment processes of waste generated by the three manufacturing processes; regarding the recycling process, the system under study is only responsible for the transportation of the waste to the of the facility;
- Final treatment process for packaging materials.

10. Environmental performances

USE OF RENEWABLE MATERIAL RESOURCES	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	1 646	2	<1	1 649
Use of renewable primary energy resources used as raw materials	MJ	12	<1	16	29
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1 658	3	16	1 677

USE OF NON RENEWABLE MATERIAL RESOURCES	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	38 548	1 578	45	40 172
Use of non-renewable primary energy resources used as raw materials	MJ	84	<1	<1	84
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	38 633	1 578	45	40 256

10. Environmental performances

USE OF SECONDARY MATERIALS AND FUELS	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Use of secondary material	kg	503	<1	<1	**503**
Use of renewable secondary fuels	MJ	<1	<1	<1	**<1**
Use of non-renewable secondary fuels	MJ	<1	<1	<1	**<1**

WATER RESOURCES	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Use of net fresh water	m^3	156 973	139	5	157 117

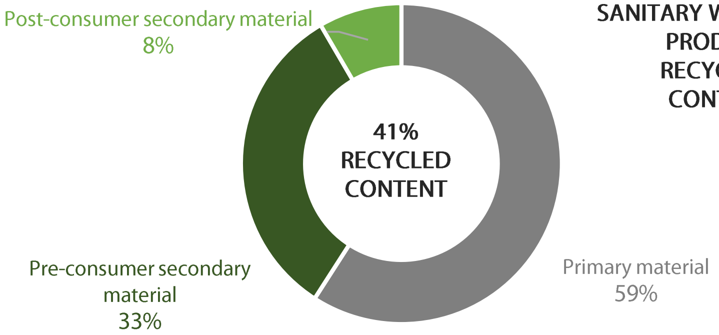
WASTE GENERATION AND TREATMENT	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Hazardous waste	kg	<1	<1	<1	**<1**
Non-hazardous waste	kg	5	<1	2	7
Radioactive waste disposed	kg	<1	<1	<1	**<1**

10. Environmental performances

POTENTIAL ENVIRONMENTAL IMPACTS	UNITS PER DU	UPSTREAM PROCESSES	CORE PROCESSES		TOTAL
		A1	A2	A3	
Global Warming Potential (GWP 100)	kg CO_2 eq	864	119	1 303	2 287
Ozone Depletion Potential (ODP)	g CFC 11	0.3	<0.01	<0.01	0.3
Acidification Potential (AP)	g SO_2 eq	3 366	468	295	4 129
Eutrophication Potential (EP)	g PO_4^{3-}	361	96	73	530
Photochemical Ozone Creation Potential (POCP)	g C_2H_4	175	10	34	219
Abiotic Depletion Potential (ADP), elements	g Sb eq	0.1	<0.01	<0.01	0.1
Abiotic Depletion Potential (ADP), fossil	MJ	36 813	1 564	45	38 422

11. Additional information

The use of secondary materials allows the decrease of resources consumption: within glaze and slip dry recipes the use of primary material resources can be reduced by 19% and 44% respectively,. Moreover, within SANITSER 13 slip, the utilization of post-consumer waste (Glass filler GS-VF) is a real valorization of the material, which usually is not recycled as glass due to its poor quality.



SANITARY WARE PRODUCT RECYCLED CONTENT

12. Glossary

GLOBAL WARMING POTENTIAL (GWP)

It represents the total amount of greenhouse gases emitted either directly or indirectly by human activity along the entire life cycle. It is expressed in equivalent mass of carbon dioxide (CO2-eq).

PHOTOCHEMICAL OZONE CREATION POTENTIAL (POCP)

It is the emissions of the oil combustion there are hydrocarbons not burned and SOX. In the presence of sun light these two categories of compound react to form ozone that is dangerous if it is in direct contact with people. Photo-smog is standardised by reporting the amounts of these substances as g of ethylene-equivalents.

ABIOTIC DEPLETION POTENTIAL (ADP)

Abiotic resource depletion includes depletion of nonrenewable resources, i.e. fossil fuels, metals and minerals.

GROSS ENERGY REQUIREMENT (GER)

It is all the energy attributable to a production system, consisting of the sum of all the energies for all the operations from the raw materials extraction. Gross energy is divided into: direct energy, feedstock energy, production and delivery energy, transport energy and biomass energy.

OZONE DEPLETION POTENTIAL (ODP)

The presence of compounds such as chlorofluorocarbons (CFC) and chlorofluoromethane, (CFM) in association with ultra-violet radiation, promotes the decomposition of ozone in the stratospheric layer (10-40 km). To quantify this impact standardization factors are used to report to g of trichlorofluoromethane (CFC11)

ACIDIFICATION POTENTIAL (AP)

It is the result of SO_2, of NO_x, and NH_3, which are responsible for the acid rainfall phenomenon. This can provoke damage to forests and agriculture, as well as to aquatic ecosystems and manmade structures.

EUTROPHICATION POTENTIAL (EP)

The release of sulphur, nitrogen, phosphorous and degradable organic substances into the atmosphere and water courses may cause nutrient enrichment (eutrophication), which in turn may result in algal blooms. The increased algal growth is usually associated with a decrease in water quality for other flora and fauna, because once dead the algae decompose under the action of aerobic bacteria. This decomposition process consumes oxygen, and in extreme cases can lead to anaerobic conditions. The standardisation of eutrophication is made reporting the amounts of the inventoried substances to g of O2-equivalents.

12. References

- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- General Programme Instructions for the International EPD® System v. 2.5 (2015)
- Product Category Rules PCR 2012:01 V 2.01, "Construction products and construction services"
- Baldo, Marino, Rossi; "Analisi del ciclo di vita LCA – Nuova edizione aggiornata"; Edizioni Ambiente; 2008
- SimaPro ver. 8.3 (www.pre.nl)
- Ecoinvent (http://www.ecoinvent.org/)

EPD of construction products may not be comparable if they do not comply with EN 15804;

Programme related information

EPD® programme	
LCA report	Life Cycle Assessment Report
Date of publication	
EPD® validity	
Independent verification of the declaration and data, according to EN ISO 14025 : 2006	☐ EPD® External verification ☐ EPD® Process certification
Third party verifier	
Third party verifier accredited or approved by	
Reference Product category rules (PCR)	PCR 2012:01 (versions 2.01, Construction products and construction services. Multiple UN CPC codes
Product category rules (PCR) review conducted by	The Technical Committee of the International EPD® System Contact via info@environdec.com
Contacts	For additional information related to SANITSER project or in regards to this environmental declaration, please contact: **Assunta Filareto – Filareto@studiolce.it**