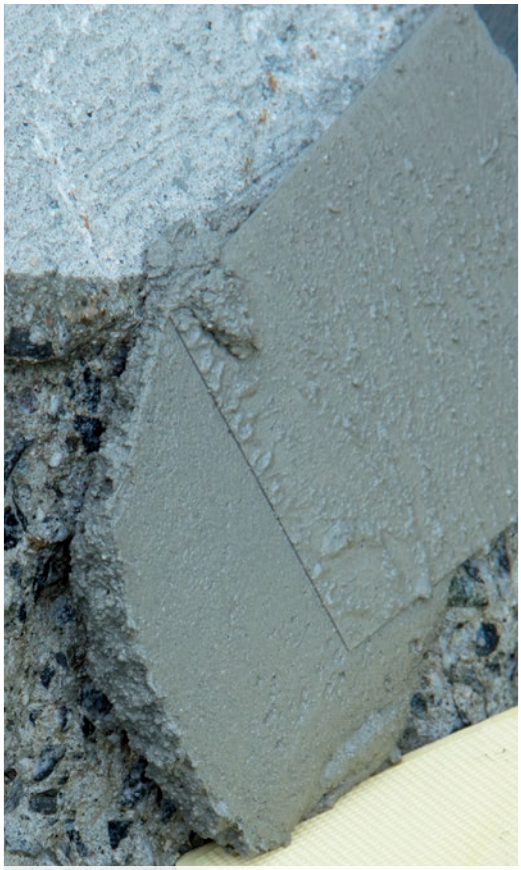
EPD®

THE INTERNATIONAL EPD® SYSTEM

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 for

Redisit
Redirep 25 RSF
Redirep 45 RSF



Programme:	Programme operator:	EPD registration number:	Publication date:	Valid until:	Geographical scope:
The International EPD® System; www.environdec.com	**EPD International AB**	**S-P-01574**	**2019-10-21**	**2024-10-20**	**International**

www.mapei.com

MAPEI®

ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

1. COMPANY DESCRIPTION / GOAL & SCOPE

Founded in 1937 in Milan, Italy, Mapei produces adhesives and complementary products for laying all types of floor, wall and coating materials, and also specializes in other chemical products used in the building industry, such as waterproofing products, specialty mortars, admixtures for concrete, products for underground constructions and for the restoration of concrete and historical buildings.

There are currently 85 subsidiaries in the Mapei Group, with a total of 80 production facilities located around the world in 35 different countries and in 5 different continents. Mapei also has 31 central laboratories. Most locations are ISO 9001 and ISO 14001 or EMAS-certified.

Mapei's strategy of internationalization is based on two main objectives: being closer to local needs and lowering transportation costs. With the declared objective of being close to buyers and clients, Mapei's presence in the five continents enables the company to comply with the requirements of each location, and to use only locally-based managers and qualified personnel, without changing the approach of Mapei.

Mapei invests 12% in its company's total work-force and 5% of its turnover in Research & Development; in particular, 70% of its R&D efforts are directed to develop eco-sustainable and environmentally friendly products, which give important contribution to all major green rating systems for eco-sustainable buildings such as LEED and BREEAM.

Furthermore, Mapei has developed a sales and technical service network with offices all over the world and offers an efficient Technical Assistance Service that is valued by architects, engineers, contractors and owners.

The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR Environdec (version 2.3, 2018-11-15) under EN 15804:2014 and to have more comprehension about the environmental impacts related to **Redisit**, **Redirep 25 RSF** and **Redirep 45 RSF** manufactured in Mapei AS located in Sagstua (Norway), during the year 2018, including packaging of the finished products.

Target audiences of the study are customers and other parties with an interest in the environmental impacts of Redisit, Redirep 25 RSF and Redirep 45 RSF.

This analysis shall not support comparative assertions intended to be disclosed to the public.

2. PRODUCT DESCRIPTION

Redisit is used as an anticorrosive coating on steel rebars and as bonding agent between old and new concrete/mortar.

Redirep 25 RSF is a dry mortar for repair of concrete substrates. It has very good bonding properties. The mortar has rapid setting times and low shrinkage.

Redirep 45 RSF is a dry mortar for repairing concrete substrates. It is frost-resistant and has very good adhesive properties. The mortar sets quickly with low shrinkage.

Redisit, Redirep 25 RSF and **Redirep 45 RSF** meet the requirements defined by EN 1504-9 ("Products and systems for protection and repair of concrete structures - Definitions and requirements, quality control and evaluation of conformity. General principles for the use of products and systems").

Redisit meets also the requirements of EN 1504-7 ("Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. Reinforcement corrosion protection").

Redirep 25 RSF and **Redirep 45 RSF** meet the minimum requirements claimed by 1504-3 ("Structural and non-structural repai") for mortars of class R2.

Redisit is supplied in 20 kg multiply bags, **Redirep 25 RSF** and **Redirep 45 RSF** are supplied in 25 kg multiply bags.

3. CONTENT DECLARATION

The main components and ancillary materials of **Redisit**, **Redirep 25 RSF** and **Redirep 45 RSF** are the following:

Table 1: Composition

Materials	Percentage (%)
Binders (inorganic and organic)	< 55
Fillers	< 70
Recycled content	< 5
Other (Additives & Packaging)	< 3

The products contain neither carcinogenic substances nor substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency, in a concentration higher than 0,1 % (by unit weight).

4. DECLARED UNIT AND REFERENCE SERVICE LIFE

The declared unit is 1 kg of powder (packaging included).
Packaging materials include:

- Multiply bags (paper/PE/paper)
- Wooden pallet
- LDPE used as wrapping material

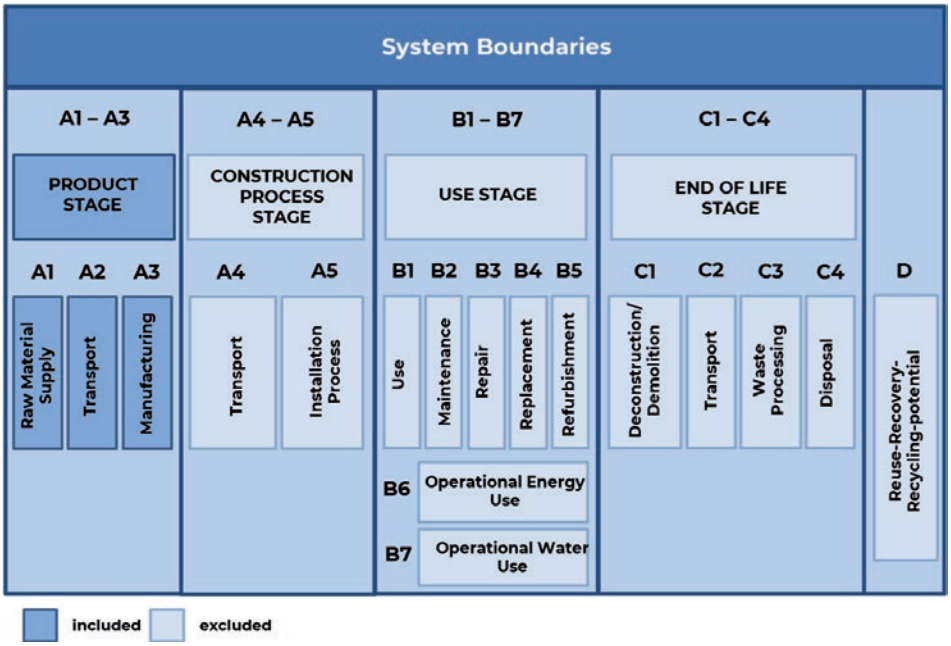
Due to the selected system boundary, the reference service life of the products is not specified.

5. SYSTEM BOUNDARIES AND ADDITIONAL TECHNICAL INFORMATION

The approach is “cradle to gate”. The following modules have been considered:

- A1 – A3 (Product stage): extraction and transport of raw materials, packaging included, production process.

Table 2: System boundaries



A brief description of production process, is the following:

Figure 1: Production process detail - © Photo Halvor Gudim

The production process starts from raw materials, that are purchased from external and intercompany suppliers and stored in the plant. Bulk raw materials are stored in specific silos and added automatically in the production mixer, according to the formula of the product. Other raw materials, supplied in bags, big bags or tanks, are stored in the warehouse and added automatically or manually in the mixer. The production is a discontinuous process, in which all the components are mechanically mixed in batches. The semi-finished product is then packaged, put on wooden pallets and stored in the finished products warehouse. The quality of final products is controlled before the sale.

6. CUT-OFF RULES AND ALLOCATION

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA, information modules and any additional information are intended to support an efficient calculation procedure. They are not applied in order to hide data.

The procedure of exclusion of inputs and outputs is the following:

- All inputs and outputs to a unit process, for which data are available, are included in the calculation
- Cut-off criteria, where applied, are described in Table 3.

Input flows are covered for the whole formula.

Table 3: Cut-off criteria

Process excluded from study	Cut-off criteria	Quantified contribution from process
A3: production (auxiliary materials)	less than 10^{-5} kg/kg of finished product	Sensibility study demonstrates a contribute lower than 0,5%
A3: waste and particle emission	less than 10^{-5} kg/kg of finished product	Sensibility study demonstrates a contribute lower than 0,5%

For the allocation procedure and principles, consider the Table 4.

Table 4: Allocation procedure and principles

Module	Allocation Principle
A1	All data are referred to 1 kg of product • A1: electricity is allocated to the mortar plant
A3	All data are referred to 1 kg of packaged product • A3-wastes: all data are allocated to the mortar plant

7. ENVIRONMENTAL PERFORMANCE AND INTERPRETATION

GWP_{100}
Global Warming Potential refers to the emission/presence of GHGs (greenhouse gases) in the atmosphere (mainly CO_2, N_2O, CH_4) which contribute to the increase in the temperature of the planet.

AP
Acidification Potential refers to the emission of specific acidifying substances (i.e. NOx, SOx) in the air. These substances decrease the pH of the rainfall with predictable damages to the ecosystem.

EP
Eutrophication Potential refers to the nutrient enrichment of flowing water, which determines unbalance in aquatic ecosystems and causes the death of the aquatic fauna.

ODP
Ozone Depletion Potential refers to the degradation of the stratospheric layer of the ozone involved in blocking the UV component of sunrays. Depletion is due to particularly reactive components that originate from chlorofluorocarbon (CFC) or chlorofluoromethanes (CFM).

POCP
The Photochemical Ozone Creation Potential is the ozone formation in low atmosphere. This is quite common in the cities where a great amount of pollutants (like VOC and NOx) are emitted every day (industrial emissions and vehicles). It is mainly diffused during the summertime.

ADP_e (elements)
Abiotic Depletion Potential elements refers to the depletion of the mineral resources.

ADP_f (fossil fuel)
Abiotic Depletion Potential fossil fuel refers to the depletion of the fossil fuel resources.

The following tables show environmental impacts for the products considered according to CML methodology (2001 – Jan. 2016 ver. 4.7). All the results are referred to the declared unit (see § 4).

Redisit

Table 5: ***Redisit*** *- Environmental categories referred to the declared unit*

Environmental Category	Unit	A1 – A3
GWP_{100}	(kg CO_2 eq.)	5,13E-01
ADPe (element)	(kg Sb eq.)	3,18E-07
ADPf (fossil)	(MJ)	4,19E+00
AP	(kg SO_2 eq.)	6,19E-04
EP	(kg $(PO_4)^{3-}$eq.)	3,08E-04
ODP	(kg R-11 eq.)	5,26E-09
POCP	(kg ethylene eq.)	6,56E-05

GWP_{100}: Global Warming Potential; **ADPe**: Abiotic Depletion Potential (elements); **EP**: Eutrophication Potential; **AP**: Acidification Potential; **POCP**: Photochemical Ozone Creation Potential; **ODP**: Ozone Depletion Potential; **ADPf**: Abiotic Depletion Potential (fossil)

*Table 6: **Redisit** – Other environmental indicators referred to the declared unit*

Environmental Indicator	Unit	A1-A3
RPEE	MJ	7,15E-01
RPEM	MJ	-
TPE	MJ	7,15E-01
NRPE	MJ	4,28E+00
NRPM	MJ	-
TRPE	MJ	4,28E+00
SM	kg	4,88E-02
RSF	MJ	-
NRSF	MJ	-
W	m^3	2,29E-03

RPEE Renewable primary energy as energy carrier; **RPEM** Renewable primary energy as material utilisation; **TPE** Total use of renewable primary energy sources; **NRPE** Non-renewable primary energy as energy carrier; N**RPM** Non-renewable primary energy as material utilization; **TRPE** Total use of non-renewable primary energy sources; **SM** Use of secondary materials; **RSF** Renewable secondary fuels; **NRSF** Non-renewable secondary fuels; **W** Net use of fresh water

*Table 7: **Redisit** – Waste production & other output flows referred to the declared unit*

Output flow	Unit	A1-A3
NHW	kg	0,00E+00
HW	kg	6,61E-03
RW	kg	0,00E+00
Components for re-use	kg	-
Materials for recycling	kg	4,93E-04
Materials for energy recovery	kg	-
Exported energy	MJ	-

HW Hazardous waste disposed; **NHW** Non Hazardous waste disposed; **RW** Radioactive waste disposed

Redirep 25 RSF

Table 8: ***Redirep 25 RSF*** *- Environmental categories referred to the declared unit*

Environmental Category	Unit	A1 – A3
GWP_{100}	(kg CO_2 eq.)	2,31E-01
ADPe (element)	(kg Sb eq.)	4,90E-07
ADPf (fossil)	(MJ)	2,06E+00
AP	(kg SO_2 eq.)	5,09E-04
EP	(kg $(PO_4)^{3-}$eq.)	1,22E-04
ODP	(kg R-11 eq.)	1,22E-09
POCP	(kg ethylene eq.)	2,73E-05

GWP_{100}: Global Warming Potential; **ADPe**: Abiotic Depletion Potential (elements); **EP**: Eutrophication Potential; **AP**: Acidification Potential; **POCP**: Photochemical Ozone Creation Potential; **ODP**: Ozone Depletion Potential; **ADPf**: Abiotic Depletion Potential (fossil)

*Table 9: **Redirep 25 RSF** – Other environmental indicators referred to the declared unit*

Environmental Indicator	Unit	A1-A3
RPEE	MJ	7,29E-01
RPEM	MJ	-
TPE	MJ	7,29E-01
NRPE	MJ	2,20E+00
NRPM	MJ	-
TRPE	MJ	2,20E+00
SM	kg	1,38E-02
RSF	MJ	-
NRSF	MJ	-
W	m^3	1,78E-03

RPEE Renewable primary energy as energy carrier; **RPEM** Renewable primary energy as material utilisation; **TPE** Total use of renewable primary energy sources; **NRPE** Non-renewable primary energy as energy carrier; N**RPM** Non-renewable primary energy as material utilization; **TRPE** Total use of non-renewable primary energy sources; **SM** Use of secondary materials; **RSF** Renewable secondary fuels; **NRSF** Non-renewable secondary fuels; **W** Net use of fresh water

*Table 10: **Redirep 25 RSF** – Waste production & other output flows referred to the declared unit*

Output flow	Unit	A1-A3
NHW	kg	0,00E+00
HW	kg	6,60E-03
RW	kg	0,00E+00
Components for re-use	kg	-
Materials for recycling	kg	4,93E-04
Materials for energy recovery	kg	-
Exported energy	MJ	-

HW Hazardous waste disposed; **NHW** Non Hazardous waste disposed; **RW** Radioactive waste disposed

Redirep 45 RSF

Table 11: ***Redirep 45 RSF*** *- Environmental categories referred to the declared unit*

Environmental Category	Unit	A1 – A3
GWP_{100}	(kg CO_2 eq.)	2,86E-01
ADPe (element)	(kg Sb eq.)	6,88E-07
ADPf (fossil)	(MJ)	2,21E+00
AP	(kg SO_2 eq.)	6,36E-04
EP	(kg $(PO_4)^{3-}$eq.)	1,37E-04
ODP	(kg R-11 eq.)	1,04E-09
POCP	(kg ethylene eq.)	3,09E-05

GWP_{100}: Global Warming Potential; **ADPe**: Abiotic Depletion Potential (elements); **EP**: Eutrophication Potential; **AP**: Acidification Potential; **POCP**: Photochemical Ozone Creation Potential; **ODP**: Ozone Depletion Potential; **ADPf**: Abiotic Depletion Potential (fossil)

Table 12: ***Redirep 45 RSF*** *– Other environmental indicators referred to the declared unit*

Environmental Indicator	Unit	A1-A3
RPEE	MJ	7,65E-01
RPEM	MJ	-
TPE	MJ	7,65E-01
NRPE	MJ	2,36E+00
NRPM	MJ	-
TRPE	MJ	2,36E+00
SM	kg	1,85E-02
RSF	MJ	-
NRSF	MJ	-
W	m^3	2,06E-03

RPEE Renewable primary energy as energy carrier; **RPEM** Renewable primary energy as material utilisation; **TPE** Total use of renewable primary energy sources; **NRPE** Non-renewable primary energy as energy carrier; N**RPM** Non-renewable primary energy as material utilization; **TRPE** Total use of non-renewable primary energy sources; **SM** Use of secondary materials; **RSF** Renewable secondary fuels; **NRSF** Non-renewable secondary fuels; **W** Net use of fresh water

Table 13: ***Redirep 45 RSF*** *– Waste production & other output flows referred to the declared unit*

Output flow	Unit	A1-A3
NHW	kg	0,00E+00
HW	kg	6,60E-03
RW	kg	0,00E+00
Components for re-use	kg	-
Materials for recycling	kg	4,93E-04
Materials for energy recovery	kg	-
Exported energy	MJ	-

HW Hazardous waste disposed; **NHW** Non Hazardous waste disposed; **RW** Radioactive waste disposed

Tables from Table 5 to Table 13 show absolute results for all the environmental categories considered. Calculations point out module **A1** has the highest contribution for most environmental indicators (i.e. relative contribution in ODP is up to 99%).

Raw materials extraction and processing show the most relevant environmental load considering the whole life cycle of the finished product. In particular, the hydraulic binder has the strongest influence on the results.

The **module A2** (raw materials transport) gives a negative contribution to POCP due to NO and NO_2 emission factors (for more details, see the methodology used: HBEFA -Handbook Emission Factors for Road Transport).

The specific amounts of **recycled material** are shown in Table 6, Table 9 and Table 12, as **SM** (Secondary Material) indicator.

The following tables show the percentage contribution of the modules considered in the system boundary to the environmental impacts.

*Table 14: Environmental Impact as percentage – **Redisit***

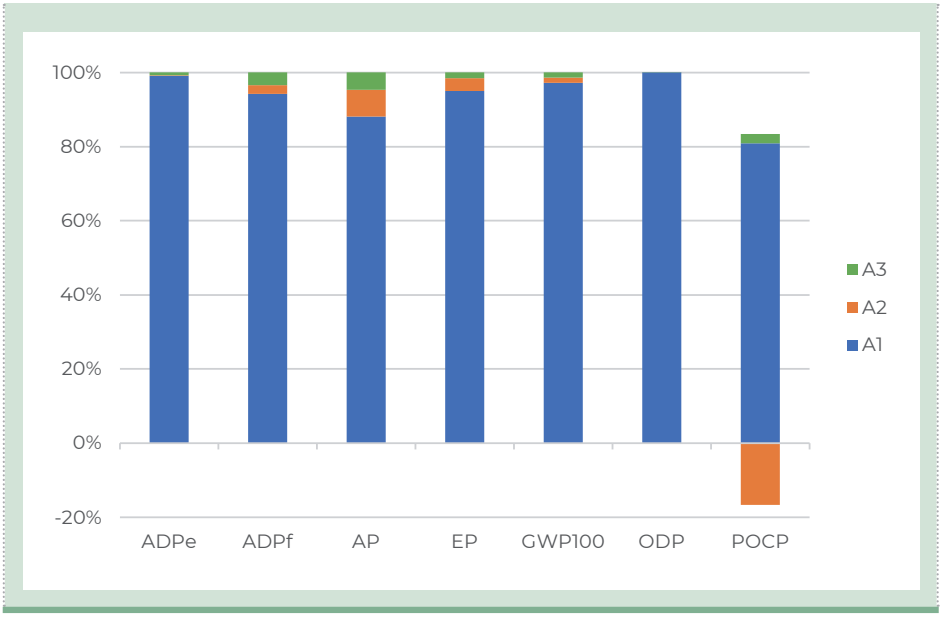


Table 15: Environmental Impact as percentage – ***Redirep 25 RSF and Redirep 45 RSF***

More details about electrical mix used in this EPD, is shown below:

	Data source	Amount	Unit
Electricity grid mix (NO) – 2016	GaBi database	0,0287	kg CO_2-eqv/kWh

8. DATA QUALITY

Table 16: Data quality

Dataset & Geographical reference	Database (source)	Temporary reference
A1-A3		
PTL binder	EPD: NEPD-1539-528-NO	2018
Fillers (EU)	GaBi Database	2018
Electricity grid mix (NO)	GaBi Database	2016
Additives & Packaging components (EU)	GaBi Database; EPD IBU EFCA; PlasticsEurope	2005 – 2018
A2		
Truck transport (euro 3, 27-ton payload – GLO)	GaBi Database	2018
Oceanic ship (27500 DWT - GLO)	GaBi Database	2018
Light Train (Gross Ton Weight 500 Tons - GLO)	GaBi Database	2018
Diesel for transport (EU)	GaBi Database	2016
Heavy Fuel Oil (EU)	GaBi Database	2016
Electricity mix (EU)	GaBi Database	2016

All data included in table above refer to a period between 2005 and 2018; the most relevant ones are specific from supplier, while the others (i.e. transport and minor contribution dataset), come from European and global databases.

All dataset are not more than 10 years old according to EN 15804 § 6.3.7 "Data quality requirements". The only exception is represented by one raw material used for one packaging component production, coming from PlasticsEurope database.

Primary data concern the year 2018 and represent the whole annual production.

9. REQUISITE EVIDENCE

9.1 Recycled Content

Redisit contains about 5% of recycled material.

10. VERIFICATION AND REGISTRATION

EPD of construction products may not be comparable if they do not comply with EN 15804.
Environmental product declarations within the same product category from different programs may not be comparable.

CEN standard EN15804 served as the core PCR	
PCR:	PCR 2012:01 Construction products and Construction services, Version 2.3, 2018-11-15
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino Contact via **info@environdec.com**
Independent verification of the declaration and data, according to ISO 14025	☒ EPD Process Certification (Internal) ☐ EPD Verification (external)
Third party verifier:	Certiquality S.r.l. Number of accreditation: 003H rev5
Accredited or approved by:	Accredia
Procedure for follow-up of data during EPD validity involves third-party verifier	☒ Yes ☐ No

11. REFERENCES

- EN 1504-3: PRODUCTS AND SYSTEMS FOR THE PROTECTION AND REPAIR OF CONCRETE STRUCTURES – DEFINITIONS, REQUIREMENTS, QUALITY CONTROL AND EVALUATION OF CONFORMITY – STRUCTURAL AND NON-STRUCTURAL REPAIR
- EN 1504-7: PRODUCTS AND SYSTEMS FOR THE PROTECTION AND REPAIR OF CONCRETE STRUCTURES – DEFINITIONS, REQUIREMENTS, QUALITY CONTROL AND EVALUATION OF CONFORMITY – REINFORCEMENT CORROSION PROTECTION

- EN 1504-9: PRODUCTS AND SYSTEMS FOR PROTECTION AND REPAIR OF CONCRETE STRUCTURES – DEFINITIONS, REQUIREMENTS, QUALITY CONTROL AND EVALUATION OF CONFORMITY – GENERAL PRINCIPLES FOR THE USE OF PRODUCTS AND SYSTEMS
- EN 15804: SUSTAINABILITY OF CONSTRUCTION WORKS - ENVIRONMENTAL PRODUCT DECLARATIONS - CORE RULES FOR THE PRODUCT CATEGORY OF CONSTRUCTION PRODUCTS
- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 3.0
- HBEFA - HANDBOOK EMISSION FACTORS FOR ROAD TRANSPORT
- ISO 14025 ENVIRONMENTAL LABELS AND DECLARATIONS - TYPE III ENVIRONMENTAL DECLARATIONS - PRINCIPLES AND PROCEDURES
- ISO 14044 ENVIRONMENTAL MANAGEMENT – LIFE CYCLE ASSESSMENT – REQUIREMENTS AND GUIDELINES
- PCR 2012:01; "PRODUCT GROUP CLASSIFICATION: MULTIPLE UN CPC CODES CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES"; VERSION 2.3

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