

# Environmental Product Declaration



In accordance with ISO 14025 and EN 15804 for:

## Ready Mixed Concrete

from

**Transgulf Readymix Concrete Co. LLC**



Programme:	The International EPD® System, <a href="http://www.environdec.com">www.environdec.com</a>
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## Programme information

<b>Programme:</b>	<p>The International EPD® System</p> <p>EPD International AB Box 210 60 SE-100 31 Stockholm Sweden</p> <p><a href="http://www.environdec.com">www.environdec.com</a> <a href="mailto:info@environdec.com">info@environdec.com</a></p>
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Product category rules (PCR): PCR 2012:01 Construction products and construction services, version 2.3 2018-11-15 and PCR 2012:01-Sub-PCR-G Concrete and concrete elements (EN 16757:2017) 2018-11-22

PCR review was conducted by: The Technical Committee of the International EPD® System.  
Chair: Massimo Marino. Contact via [info@environdec.com](mailto:info@environdec.com)

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒ EPD verification

Third party verifier: Matthias Schulz, Schulz Sustainability Consulting  
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Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

## Company information

Owner of the EPD: Transgulf Readymix Concrete Co. LLC  
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Description of the organisation:

Transgulf has always been moving through the path of continuous improvement and growth, under the shade of well structured and professional management systems, utilizing the most recent technologies and best practices within the international standards ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 integrated into one efficient coherent system, employing an elite committed team that is subject to continuous training. The result was for Transgulf to become well known of its credibility and expertise backed by the production that exceeded 12 million cubic meters of ready mix concrete.

Transgulf Readymix Concrete is GOLD AWARD winner by Dubai Municipality as one of the best performing readymix concrete companies in the Emirate of Dubai, CUSTOMER HAPPINESS CHOICE by Dubai Municipality and a CLASS (A) RANKED READYMIX CONCRETE COMPANY by Riyadh Municipality

Name and location of production site:

Transgulf Readymix Concrete Co. LLC  
P.O. Box 11314  
Jebel Ali, Dubai, UAE  
[www.tgrmcc.com](http://www.tgrmcc.com)

## Product information

Product name, description and identification:

The products under study in this report serve as the structural material, concrete, as it is used in residential, commercial and public works projects in the emirate of Dubai in the United Arab Emirates.

This EPD report is developed to assess the environmental impacts of several ready-mixed concrete products that satisfy the below specifications and standards:

- UN CPC code 375
- Dubai Municipality Circular 202: Required Combination Types for Durable & Green Reinforced or Prestressed Concrete Elements.
- Dubai Municipality Circular 225: Required Green Cement Combination for Durable and Green Reinforced or Prestressed Concrete Elements
- Dubai Municipality Standards 026:11 Technical Requirements for the Operation of Ready Mixed Concrete Plants
- ASTM C94: Standard Specification for Ready-Mixed Concrete
- ACI 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

- ACI 318: Building Code Requirements for Structural Concrete
- UNSPSC Code 30111500: Ready Mix Concrete
- CSI Master Format Division 03-30-00: Cast-in-Place Concrete

Declared Mix Range				
Product Identification	Mix Description	Aggregate Size (mm)	28-day Compressive Strength Cylinder (MPa)	28-day Compressive Strength Cube (MPa)
D11540	OPC + GGBS 40%	20	14 & 16	18 & 20
D09546	OPC + GGBS 66%	20	28	30 & 35
D09695	OPC + GGBS 66%	20	35	45
D11842	OPC + GGBS 45% +MS 5%	10	50	60
D11485	OPC + GGBS 66%	20	30 & 32	37 & 40
D11486	OPC + GGBS 50%	20	35 & 40	45 & 50
D11539	OPC + GGBS 50%	20	35 & 40	45 & 50
D09885	OPC + GGBS 50%	20	32	40
D11471	OPC + GGBS 66%	20	40	50

Tabell 1- Declared Mix Range of the products under study

Geographical scope: United Arab Emirates

## LCA information

Declared unit: 1m<sup>3</sup> of concrete.

Products' Densities	
Product Identification	Density(kg/m3)
D11540	2,493.0
D09546	2,485.0
D09695	2,489.0
D11842	2,461.5
D11485	2,480.5
D11486	2,506.0
D11539	2,490.0
D09885	2,490.5
D11471	2,496.0

Time representativeness:

The collected primary data from Transgulf Readymix Concrete Co. LLC related to their manufacturing process covered one year, from September 2018 till September 2019.

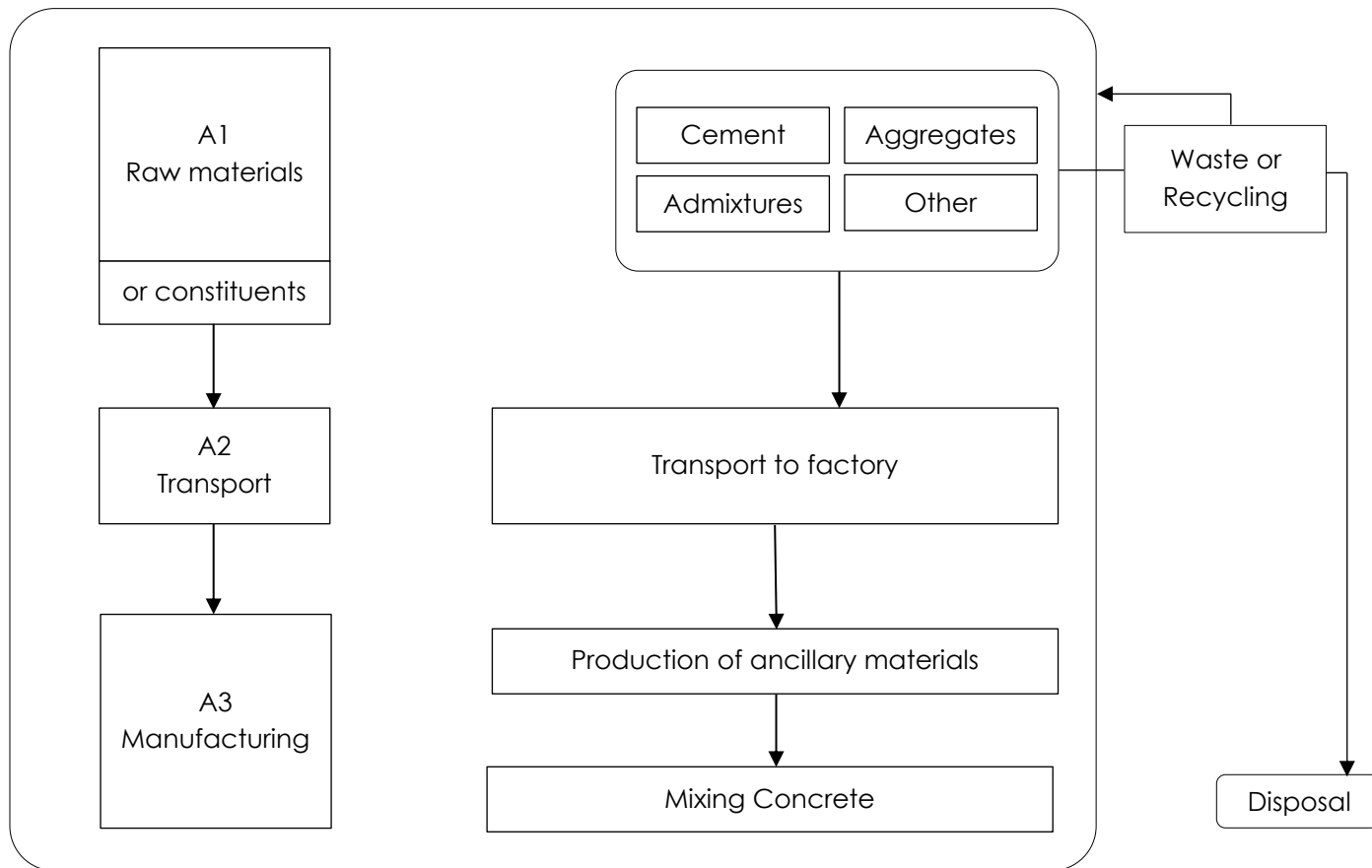
Background LCI data was specific LCI GaBi TS dataset documentation for the software-system and databases (some of which are developed specifically for UAE and available upon demand) and it spanned from the year 2011 till 2018.

Database(s) and LCA software used:

GaBi version 9.1.0.53.

GaBi 8.7 database, SP 38

System diagram:



Several products, ready-mixed concrete products, are under study, where their environmental impacts are declared.

Ready-mixed concrete products are defined by mix designs or mixture compositions where each mixture composition defines the cost, impacts and performance of the concrete and ultimately defines its application. There are more than hundreds possible ready-mixed concrete mix designs (products).

The mix design must achieve a specified minimum compressive strength at the age of 28days. The compressive strength is affected by the amount of Portland cement, ground granulated blast furnace slag, silica fume, aggregates and admixtures.

The materials are weighed on conveyor belts and then they are dispatched in a mixer in a specific order. After mixing the materials, the freshly mixed concrete is transferred to a truck mixer to be delivered in its plastic state to the client (the construction site).

The variables among the studied products are:

- 28 day compressive strength: 20 MPa Cube, 30 MPa Cube, 40 MPa Cube, 45 MPa Cube, 50 MPa Cube, and 60 MPa cube were considered
- Ground Granulated Blastfurnace Slag (GGBS): quantities vary
- Silica Fume: quantities vary
- Admixture: quantities vary
- Aggregates: quantities vary

Description of system boundaries:

Cradle-to-gate

Building Lifecycle Information																
Product Stage A1-A3			Construction Process Stage A4-A5		Use Stage B1-B7							End of Life Stage C1-C4				Benefits and Loads Beyond the System Boundary
Raw Material Supply	Transport	Manufacturing	Transport	Construction & Installation Process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-construction & Demolition	Transport	Waste Processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D

- **A1 Raw Material Supply-upstream Processes:** Extraction, handling and processing of the materials (including fuels) used in the production of concrete
- **A2 Transportation:** Transportation of these materials from the supplier to the 'gate' of the concrete producer.
- **A3 Manufacturing- core processes:** The energy used to store, move, batch and mix the concrete and operate the facility of the concrete producer. Moreover it includes the water re-used for washing as well as waste processing.

Excluded lifecycle stages:

Life cycle stages A4-A5, B1-B7, C1-C4 and D are excluded from the LCA. The below life cycle processes are excluded from this study as per the governing sub-category PCR section 7.1.7:

- o Production, manufacture and construction of capital goods and infrastructure.
- o Production and manufacture of production equipment, delivery vehicles and laboratory equipment.
- o Personnel- related activities (travel, furniture, office supplies).

- Energy and water use related to company management and sales activities, which may be located either within the factory site or at another location.
- Water used for curing concrete when it is casted

More information:

LCA and EPD Practitioner: Grey Matters Consultancy

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*Grey Matters* •  
Consultancy

### **Cut-off Criteria:**

The cut-off criteria for all the flows considered within the system boundary conform to ISO 14044:2006 4.2.3.3 and 4.3.3.4.

Application for the criteria for exclusions of inputs and outputs were applied as per the below:

- All inputs and outputs to the processes for which data is available were included in the calculation. No core processes were excluded.
- Particular care was taken to include materials and energy flows known to have the potential to cause significant emissions into air, water and soil related to the environmental indicators of the governing PCR (such as Portland cement).

### **Allocation:**

Allocation was made as per the governing PCR and as per ISO 14044 clause 4.3.4. The only product under study is ready-mixed concrete.

The product category rules for this EPD recognize fly ash, silica fume and slag as co-products of iron manufacturing. Hence they carry a small environmental burden (as indicated in the respective GaBi background processes) and additionally take into account the treatment and transportation required to use as a concrete material input.

### **Limitations:**

- This EPD does not report all the environmental impacts due to manufacturing of the product, but rather reports the environmental impacts for those categories with established life cycle assessment based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction.
- This EPD reports the results of an LCA for “cradle-to-gate” analysis. Thus, declarations themselves are not comparative assertions, defined as an environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. An EPD does not make any statements that the product covered by the EPD is better or worse than any other product.
- In order to assess the local impacts of product manufacturing, additional analysis is required.
- Life Cycle Impact Assessment results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
- This EPD was created using industry-average data for upstream materials. Variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel type used.
- EPDs of concrete mixtures may not be comparable if they do not comply with this standard and data from this EPD. The data cannot be used to compare between concrete mixes, construction products or concrete mixtures used in different concrete products unless the data is integrated



into a comprehensive LCA. For example, precast concrete, concrete masonry units and site cast concrete all have different manufacturing processes whose impacts are attributed to different LCA stages. This precludes direct comparison between mixtures used in these different products unless all life cycle phases are included.

### Data Quality:

This EPD is developed based on foreground LCI data that was provided from the production facility of “Transgulf Readymix Concrete Co. LLC” that is under study. The data provided was for the 12 months from September 2018 to September 2019.

Upstream material and energy resources that were used were sourced from various industry-average datasets and literature.

Below tables describe each LCI data source that is used for the three modules A1, A2 and A3.

LCI Database for Raw Material -A1-			
Material (unit)	LCI Data Source	Geography	Year
Portland Cement (kg)	GaBi Process “AE: Cement (CEM I 42.5) Portland cement”	AE	2017
Slag Cement (kg)	GaBi Process “AE: BF slag incl. grinding”	AE	2017
Natural Aggregate (kg) <i>fine</i>	GaBi Process “EU-28: Gravel 2/32”	EU	2017
Crushed Aggregate (kg) <i>fine and coarse</i>	GaBi Process “DE: Crushed Stone 16/32”	DE	2017
Superplasticizing Admixture (kg)	GaBi Process “DE: Concrete admixtures – Plasticizer and superplasticizer - Deutsche Bauchemie e.V. (DBC) (A1-A3)”	DE	2011
Batch Water (Kg)	GaBi Process “AE: Desalinated sea water technology mix (Dubai)”	AE	2018

LCI Database for Transportation –A2-			
Material (unit)	LCI Data Source	Geography	Year
Transportation by land	GaBi Process “Truck-trailer, Euro 4, 34 - 40t gross weight / 27t payload capacity”	GLO	2017
Transportation by sea	GaBi Process “Container ship, 27500 dwt payload capacity, ocean going”	GLO	2017
Diesel and Gasoline (l)	GaBi Process “EU-28: Diesel mix at refinery”	EU	2014
Heavy Fuel Oil (l)	GaBi Process “EU-28: Heavy fuel oil at refinery (1.0wt.% S)”	EU	2014

LCI Database for Manufacturing –A3-			
Material (unit)	LCI Data Source	Geography	Year



Diesel and Gasoline (l)	GaBi Process "EU-28: Diesel mix at refinery"	EU	2014
UAE Electricity Grid Mix	GaBi Process "AE- Electricity grid mix"	AE	2014
Water (Kg)	GaBi Process "AE: Desalinated sea water technology mix (Dubai)"	AE	2018
Oil and Lubricants (l)	GaBi Process "EU-28: Lubricants at refinery"	EU	2014
Non-Hazardous Solid Waste (kg)	GaBi Process "DE- Inert matter (Construction waste) on landfill"	DE	2017

Data quality requirements are applied and reported as required in the ISO 14044:2006. This LCA and resulting EPD were developed using industry average data for upstream materials. Data quality is evaluated on the basis of its technical representativeness, temporal representativeness, geographical representativeness, completeness, and reliability.

The LCI data are assessed on the basis of the six data quality indicators listed below. Each indicator is interpreted with respect to its context and key determining data parameters are discussed to provide clarity as to how the overall quality of each indicator is assessed and stated.

- *Technical representativeness*
- *Temporal representativeness*
- *Geographical representativeness*
- *Completeness*
- *Precision*
- *Consistency*

### Representativeness:

- Technological coverage is typical or average. Secondary data from databases that were used for this assessment, were technologically comparable to that of primary data.
- The collected primary data from Transgulf Readymix Concrete Co. LLC related to their manufacturing process covered the year 2019. Background LCI data was specific LCI GaBi TS dataset documentation for the software-system and databases (some of which are developed specifically for UAE and available upon demand). The temporal representativeness of the background spans from 2011 to 2018.
- Geographically, the coverage for cement, water, granulated blastfurnace slag as well as ready-mix concrete plant operations was the United Arab Emirates; other upstream and background processes were based on global average data. For some inputs best available datasets were chosen from EU or even Germany if no UAE datasets were available.

### Completeness:

All relevant, precise processes, plus inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared ready-mixed concrete products. The relevant background materials and processes were taken from the Gabi database; LCI databases and modeled in GaBi Professional software. Efforts were made to ensure that all data used was as complete as reasonably possible.

### Precision:

The participating company, through measurement and calculation, collected primary data on their annual production of RMC products. For accuracy, the LCA team validated these plant gate-to-gate input and output data.

### Consistency:

To ensure consistency, the LCI modeling of the input and output LCI data for the declared products used the same modeling structure across the respective product systems, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the GaBi LCI database were used across all RMC product systems LCI modeling.

## Content declaration

### Product

#### D11540

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	6.0%
Supplementary Cementitious Material	Kg	4.0%
Aggregates	Kg	84.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D09546

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	5.0%
Supplementary Cementitious Material	Kg	10.0%
Aggregates	Kg	78.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D09695

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	6.0%
Supplementary Cementitious Material	Kg	11.0%
Aggregates	Kg	77.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D11842

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	9.0%
Supplementary Cementitious Material	Kg	9.0%
Aggregates	Kg	75.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D11485

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	5.5%
Supplementary Cementitious Material	Kg	10.6%
Aggregates	Kg	77.6%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D11486

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	8.0%
Supplementary Cementitious Material	Kg	8.0%
Aggregates	Kg	78.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D11539

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	8.5%
Supplementary Cementitious Material	Kg	8.5%
Aggregates	Kg	77.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D09885

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	8.0%
Supplementary Cementitious Material	Kg	8.0%
Aggregates	Kg	78.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

#### D11471

Materials / chemical substances	[Unit]	approximate%
Cement	Kg	6.0%
Supplementary Cementitious Material	Kg	12.0%
Aggregates	Kg	76.0%
Admixtures	Kg	0.2%
Water	Kg	6.0%

For construction product EPDs compliant with EN 15804, the content declaration shall list, as a minimum, substances contained in the products that are listed in the “Candidate List of Substances of Very High Concern for Authorization” when their content exceeds the limits for registration with the European Chemicals Agency.

There are no substances contained in the product that are listed in the “Candidate List of Substances of Very High Concern for Authorization” whose content exceeds the limits for registration with the European Chemicals Agency.”

### Packaging:

The ready-mixed concrete is delivered in its plastic state directly to the construction site. It is loaded from the central mixer into the transit mixers to be dispatched to the client within a period of two hours.

### Recycled material:

Provenience of recycled materials (pre-consumer or post-consumer) in the product:

Pre-consumer materials:

- Granulated blastfurnace Slag: the slag from iron producing blastfurnaces that is rapidly quenched in water and then ground into a powder. It is used as a supplementary cementitious material.
- Silica Fume: a byproduct of producing silicon metal or ferrosilicon alloys. It is used as a supplementary cementitious material. Concrete containing **silica fume** can have very high strength and can be very durable.

Post-consumer materials:

- Recycled water used for washing trucks

## Environmental performance

### Potential environmental impact: D11540

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.193E+002	1.950E+001	1.122E+001	2.500E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	9.892E-010	3.251E-015	1.438E-013	9.894E-010
Acidification potential (AP)	kg SO <sub>2</sub> eq.	3.988E-001	7.990E-002	3.970E-002	5.184E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	4.096E-002	2.000E-002	7.062E-003	6.804E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	3.546E-002	-2.951E-002	-1.289E-004	5.820E-003
Abiotic depletion potential – Elements	kg Sb eq.	8.353E-006	1.399E-006	1.103E-006	1.086E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.392E+003	2.668E+002	2.995E+002	1.959E+003

### Potential environmental impact: D09546

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.018E+002	1.882E+001	1.122E+001	2.319E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.272E-009	3.138E-015	1.438E-013	1.272E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	5.717E-001	7.710E-002	3.970E-002	6.885E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	4.788E-002	1.930E-002	7.062E-003	7.426E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	4.121E-002	-2.848E-002	-1.289E-004	1.260E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.349E-006	1.350E-006	1.103E-006	1.080E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.498E+003	2.574E+002	2.995E+002	2.055E+003

### Potential environmental impact: D09695

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.218E+002	1.865E+001	1.122E+001	2.517E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.554E-009	3.109E-015	1.438E-013	1.554E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.288E-001	7.641E-002	3.970E-002	7.449E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.264E-002	1.912E-002	7.062E-003	7.884E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	4.541E-002	-2.823E-002	-1.289E-004	1.705E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.478E-006	1.338E-006	1.103E-006	1.092E-005

Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.642E+003	2.551E+002	2.995E+002	2.197E+003
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### Potential environmental impact: D11842

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	3.118E+002	2.165E+001	1.122E+001	3.447E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.721E-007	3.445E-015	1.438E-013	1.721E-007
Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.407E-001	1.853E-001	3.970E-002	8.657E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	6.045E-002	3.035E-002	7.062E-003	9.788E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	5.514E-002	-2.138E-002	-1.289E-004	3.363E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.503E-006	1.382E-006	1.103E-006	1.099E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	2.029E+003	2.911E+002	2.995E+002	2.619E+003

### Potential environmental impact: D11485

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.116E+002	1.861E+001	1.122E+001	2.414E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.413E-009	3.103E-015	1.438E-013	1.413E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.000E-001	7.624E-002	3.970E-002	7.160E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.022E-002	1.908E-002	7.062E-003	7.639E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	4.330E-002	-2.816E-002	-1.289E-004	1.501E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.328E-006	1.335E-006	1.103E-006	1.077E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.568E+003	2.546E+002	2.995E+002	2.122E+003

### Potential environmental impact: D11486

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.870E+002	1.879E+001	1.122E+001	3.171E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.554E-009	3.133E-015	1.438E-013	1.554E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.090E-001	7.698E-002	3.970E-002	7.257E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.681E-002	1.927E-002	7.062E-003	8.316E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	5.048E-002	-2.844E-002	-1.289E-004	2.192E-002

Abiotic depletion potential – Elements	kg Sb eq.	8.583E-006	1.348E-006	1.103E-006	1.103E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.868E+003	2.570E+002	2.995E+002	2.425E+003

### Potential environmental impact: D11539

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.929E+002	1.853E+001	1.122E+001	3.227E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.554E-009	3.090E-015	1.438E-013	1.554E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.222E-001	7.593E-002	3.970E-002	7.379E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.782E-002	1.900E-002	7.062E-003	8.390E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	5.160E-002	-2.805E-002	-1.289E-004	2.342E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.490E-006	1.330E-006	1.103E-006	1.092E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.901E+003	2.535E+002	2.995E+002	2.454E+003

### Potential environmental impact: D09885

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.798E+002	1.866E+001	1.122E+001	3.097E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.413E-009	3.111E-015	1.438E-013	1.413E-009
Acidification potential (AP)	kg SO <sub>2</sub> eq.	5.941E-001	7.646E-002	3.970E-002	7.102E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.522E-002	1.913E-002	7.062E-003	8.144E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	4.923E-002	-2.824E-002	-1.289E-004	2.085E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.450E-006	1.339E-006	1.103E-006	1.089E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.818E+003	2.553E+002	2.995E+002	2.373E+003

### Potential environmental impact: D11471

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	2.259E+002	1.865E+001	1.122E+001	2.558E+002
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.554E-009	3.110E-015	1.438E-013	1.554E-009



Acidification potential (AP)	kg SO <sub>2</sub> eq.	6.426E-001	7.642E-002	3.970E-002	7.587E-001
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	5.357E-002	1.913E-002	7.062E-003	7.978E-002
Photochemical ozone creation potential (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	4.636E-002	-2.823E-002	-1.289E-004	1.800E-002
Abiotic depletion potential – Elements	kg Sb eq.	8.502E-006	1.338E-006	1.103E-006	1.094E-005
Abiotic depletion potential – Fossil resources	MJ, net calorific value	1.670E+003	2.552E+002	2.995E+002	2.225E+003

### Use of resources: D11540

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.327E+002	1.553E+001	1.362E+001	1.619E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.327E+002	1.553E+001	1.362E+001	1.619E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.454E+003	2.677E+002	3.011E+002	2.023E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.454E+003	2.677E+002	3.011E+002	2.023E+003
Secondary material		kg	104	0	0	104
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	1.793E-001	2.625E-002	2.361E-002	2.291E-001

### Use of resources: D09546

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.286E+002	1.499E+001	1.362E+001	1.572E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.286E+002	1.499E+001	1.362E+001	1.572E+002
Primary energy resources –	Use as energy carrier	MJ, net calorific value	1.559E+003	2.583E+002	3.011E+002	2.119E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0

Non-renewable	TOTAL	MJ, net calorific value	1.559E+003	2.583E+002	3.011E+002	2.119E+003
Secondary material		kg	251	0	0	251
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	1.857E-001	2.534E-002	2.361E-002	2.346E-001

### Use of resources: D09695

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.287E+002	1.485E+001	1.362E+001	1.572E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.287E+002	1.485E+001	1.362E+001	1.572E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.705E+003	2.560E+002	3.011E+002	2.262E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.705E+003	2.560E+002	3.011E+002	2.262E+003
Secondary material		kg	277	0	0	277
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	1.959E-001	2.511E-002	2.361E-002	2.446E-001

### Use of resources: D11842

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.274E+002	1.452E+001	1.362E+001	1.556E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.274E+002	1.452E+001	1.362E+001	1.556E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	2.090E+003	2.921E+002	3.011E+002	2.683E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	2.090E+003	2.921E+002	3.011E+002	2.683E+003
Secondary material		kg	226	0	0	226

Renewable secondary fuels	MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Net use of fresh water	m <sup>3</sup>	3.136E-001	2.457E-002	2.361E-002	3.618E-001

### Use of resources: D11485

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.272E+002	1.482E+001	1.362E+001	1.556E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.272E+002	1.482E+001	1.362E+001	1.556E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.629E+003	2.555E+002	3.011E+002	2.186E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.629E+003	2.555E+002	3.011E+002	2.186E+003
Secondary material		kg	264	0	0	264
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	1.895E-001	2.505E-002	2.361E-002	2.381E-001

### Use of resources: D11486

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.303E+002	1.496E+001	1.362E+001	1.588E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.303E+002	1.496E+001	1.362E+001	1.588E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.931E+003	2.579E+002	3.011E+002	2.490E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.931E+003	2.579E+002	3.011E+002	2.490E+003
Secondary material		kg	205	0	0	205
Renewable secondary fuels		MJ, net calorific value	0	0	0	0

Non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Net use of fresh water	m <sup>3</sup>	2.055E-001	2.530E-002	2.361E-002	2.545E-001

### Use of resources: D11539

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.283E+002	1.476E+001	1.362E+001	1.567E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.283E+002	1.476E+001	1.362E+001	1.567E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.963E+003	2.544E+002	3.011E+002	2.518E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.963E+003	2.544E+002	3.011E+002	2.518E+003
Secondary material		kg	210	0	0	210
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	2.052E-001	2.495E-002	2.361E-002	2.538E-001

### Use of resources: D09885

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.287E+002	1.486E+001	1.362E+001	1.572E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.287E+002	1.486E+001	1.362E+001	1.572E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.880E+003	2.562E+002	3.011E+002	2.437E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.880E+003	2.562E+002	3.011E+002	2.437E+003
Secondary material		kg	200	0	0	200
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	2.001E-001	2.512E-002	2.361E-002	2.488E-001

### Use of resources: D11471

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.288E+002	1.485E+001	1.362E+001	1.573E+002
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.288E+002	1.485E+001	1.362E+001	1.573E+002
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.733E+003	2.561E+002	3.011E+002	2.290E+003
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	1.733E+003	2.561E+002	3.011E+002	2.290E+003
Secondary material		kg	284	0	0	284
Renewable secondary fuels		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0
Net use of fresh water		m <sup>3</sup>	1.971E-001	2.511E-002	2.361E-002	2.458E-001

### Waste production and output flows

#### Waste production: D11540

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.016E-002	1.495E-005	9.346E-006	1.018E-002
Non-hazardous waste disposed	kg	1.594E+001	2.176E-002	1.422E+002	1.582E+002
Radioactive waste disposed	kg	2.458E-002	3.632E-004	6.328E-004	2.557E-002

#### Waste production: D09546

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.305E-002	1.443E-005	9.346E-006	1.308E-002
Non-hazardous waste disposed	kg	1.380E+001	2.100E-002	1.422E+002	1.561E+002
Radioactive waste disposed	kg	2.427E-002	3.505E-004	6.328E-004	2.525E-002

#### Waste production: D09695

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.596E-002	1.430E-005	9.346E-006	1.598E-002

Non-hazardous waste disposed	kg	1.343E+001	2.081E-002	1.422E+002	1.557E+002
Radioactive waste disposed	kg	2.477E-002	3.474E-004	6.328E-004	2.575E-002

**Waste production: D11842**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.741E-002	1.386E-005	9.346E-006	1.743E-002
Non-hazardous waste disposed	kg	1.364E+001	2.044E-002	1.422E+002	1.559E+002
Radioactive waste disposed	kg	2.469E-002	3.893E-004	6.328E-004	2.571E-002

**Waste production: D11485**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.451E-002	1.427E-005	9.346E-006	1.453E-002
Non-hazardous waste disposed	kg	1.424E+001	2.077E-002	1.422E+002	1.565E+002
Radioactive waste disposed	kg	2.428E-002	3.466E-004	6.328E-004	2.526E-002

**Waste production: D11486**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.596E-002	1.441E-005	9.346E-006	1.598E-002
Non-hazardous waste disposed	kg	1.443E+001	2.097E-002	1.422E+002	1.567E+002
Radioactive waste disposed	kg	2.500E-002	3.500E-004	6.328E-004	2.598E-002

**Waste production: D11539**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.596E-002	1.421E-005	9.346E-006	1.598E-002
Non-hazardous waste disposed	kg	1.444E+001	2.068E-002	1.422E+002	1.567E+002
Radioactive waste disposed	kg	2.465E-002	3.452E-004	6.328E-004	2.563E-002

**Waste production: D09885**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.451E-002	1.431E-005	9.346E-006	1.453E-002
Non-hazardous waste disposed	kg	1.441E+001	2.083E-002	1.422E+002	1.567E+002
Radioactive waste disposed	kg	2.448E-002	3.476E-004	6.328E-004	2.546E-002

**Waste production: D11471**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	1.596E-002	1.430E-005	9.346E-006	1.598E-002

Non-hazardous waste disposed	kg	1.323E+001	2.081E-002	1.422E+002	1.555E+002
Radioactive waste disposed	kg	2.477E-002	3.474E-004	6.328E-004	2.575E-002

#### Output flows: D11540

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

#### Output flows: D09546

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

#### Output flows: D09695

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

#### Output flows: D11842

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

#### Output flows: D11485

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0



**Output flows: D11486**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

**Output flows: D11539**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

**Output flows: D09885**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

**Output flows: D11471**

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

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