



**ENVIRONMENTAL AND HEALTH
DECLARATION
IN CONFORMITY WITH THE NF P 01-010 STANDARD**

**PERFORATED CEILING
KNAUF DANOLINE PLAZA**

NOVEMBER 2009

This statement has been laid out according to the Declarative Statement Model document approved by the AIMCC (FDE&S 2005 Version)

TABLE OF CONTENTS

READER'S GUIDE	3
DESCRIPTION OF THE PRODUCT ACCORDING TO NF P 01-010 § 4.3	4
DEFINITION OF THE FUNCTIONAL UNIT (FU).....	4
MEASUREMENTS AND FUNDAMENTAL DATA FOR CALCULATING THE FUNCTIONAL UNIT (FU).....	4
USEFUL SPECIFICATIONS NOT CONTAINED IN THE DEFINITION OF THE FUNCTIONAL UNIT.....	5
INVENTORY AND OTHER DATA ACCORDING TO NF P 01-010 § 5 AND COMMENTS CONCERNING THE ENVIRONMENTAL AND HEALTH EFFECTS OF THE PRODUCT ACCORDING TO NF P 01-010 § 4.7.2	6
CONSUMPTION OF NATURAL RESOURCES (NF P 01-010 § 5.1).....	6
<i>Consumption of natural energy resources and energy indicators (NF P 01-010 § 5.1.1)</i>	6
<i>Consumption of non energy natural resources (NF P 01-010 § 5.1.2)</i>	7
<i>Water consumption (sampling) (NF P 01-010 § 5.1.3)</i>	9
<i>Consumption of energy and materials recovered (NF P 01-010 § 5.1.4)</i>	9
EMISSIONS TO AIR, WATER AND SOIL (NF P 01-010 § 5.2).....	11
<i>Emissions into the air (NF P 01-010 § 5.2.1)</i>	11
<i>Emissions into the air (NF P 01-010 § 5.2.2)</i>	13
<i>Emissions into the soil (NF P 01-010 § 5.2.3)</i>	15
WASTE PRODUCTION (NF P 01-010 § 5.3).....	16
<i>Waste recovery (NF P 01-010 § 5.3)</i>	16
<i>Eliminated waste (NF P 01-010 § 5.3)</i>	16
TYPICAL ENVIRONMENTAL IMPACT OF CONSTRUCTION PRODUCTS ACCORDING TO NF P 01-010 § 6	18
PRODUCT CONTRIBUTION TO THE ASSESSMENT OF HEALTH RISKS AND QUALITY OF LIFE WITHIN THE BUILDINGS ACCORDING TO NF P 01-010 § 7.....	19
INFORMATION RELEVANT TO ASSESSMENT OF HEALTH RISKS (NF P 01-010 § 7.2).....	19
<i>Contribution to the sanitary quality of interior spaces (NF P 01-010 § 7.2.1)</i>	19
<i>Contribution to the quality of water (NF P 01-010 § 7.2.2)</i>	21
PRODUCT CONTRIBUTION TO THE QUALITY OF LIFE WITHIN BUILDINGS (NF P 01-010 § 7.3).....	21
<i>Product features affecting heat and humidity conditions in buildings (NF P 01-010 § 7.3.1)</i>	21
<i>Product features contributing to the acoustic comfort in buildings (NF P 01-010 § 7.3.2)</i>	21
<i>Product features contributing to the visual comfort in buildings (NF P 01-010 § 7.3.3)</i>	21
<i>Product features contributing to the olfactory comfort in buildings (NF P 01-010 § 7.3.4)</i>	21
OTHER PRODUCT FEATURES CONCERNING THE ECO-MANAGEMENT OF THE BUILDING, SAVINGS AND GLOBAL ENVIRONMENTAL POLICY	21
BUILDING ECO-MANAGEMENT.....	21
<i>Energy Management</i>	21
<i>Water management</i>	21
<i>Upkeep and maintenance</i>	21
ECONOMIC CONCERNS.....	22
OVERALL ENVIRONMENTAL POLICY.....	22
<i>Natural Resources</i>	22
<i>Emissions to air and water</i>	22
<i>Waste</i>	22
APPENDIX: DATA CHARACTERISTICS FOR THE CALCULATION OF THE LIFE CYCLE INVENTORY (LCI)	23
DEFINITION OF THE LCA (LIFE CYCLE ANALYSIS) SYSTEM.....	23
<i>Included steps and flows</i>	23
<i>Omitted flows</i>	23
<i>Rules for the establishment of boundaries</i>	23
DATA SOURCES.....	24
<i>Characterization of key data</i>	24
<i>Energy data</i>	25
<i>Non-LCI Data</i>	25
TRACEABILITY.....	25



The framework used for the presentation of the environmental and health declaration for Knauf Danoline Plaza perforated tiles is the Sanitary and Environmental Statement prepared by the AIMCC (FDE & S 2005 version).

This data sheet is an appropriate framework for the presentation of the environmental and health characteristics of construction products pursuant to the requirements of NF P 01-010 and to providing reviews and useful information in respect of the spirit of this standard as concerns sincerity and transparency (NF P 01-010 § 4.2).

Any use in whole or in part, of any information provided should at least at all times be accompanied by full references to the declaration of origin: "Full title, edition date, sender address" that can deliver a true copy.

Data producer (NF P 01-010 § 4).

The information contained in this notification is provided under the responsibility of KNAUF (Manufacturer, member of the National Union of Gypsum Industries) according to the standard NF P 01-010 § 4.6.

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Reader's guide

Example: $-4.2 \text{ E-06} = -4.2 \times 10^{-6}$

For the sake of transparency, the values shown on the inventory tables for each stage of the Life Cycle of less than 10^{-4} were retained and are displayed in light gray.

However, to facilitate the reading of this data sheet, and as proposed by the standard NF P01-010, negligible values were removed from the column "total life cycle" and replaced by blanks. The remaining values represent at least 99.9% of the total initial value.

TLC: Total Life Cycle

Description of the product according to NF P 01-010 § 4.3

Definition of the Functional Unit (FU)

Ensure the operation of one m² of acoustic and / or decorative demountable ceiling, capable of improving the quality of indoor air, in the form of 12.5mm thick rigid plasterboard during an annuity and for a total life cycle of 50 years*.

* The estimated total life span is 50 years since this is the current average life span of a building, whereas the intrinsic life span of the product would, we estimate, be higher.

Measurements and fundamental data for calculating the functional unit (FU)

The tiles have the following standard sizes: 600mm x 600mm x 12.5mm.
Other sizes are also available and are taken into consideration in this document.

Knauf Danoline ceiling products have various types of finishing and edges.

The number and pattern of the perforation is determined by the type of the perforation. An average perforation percentage is calculated on the basis of quantities sold of each variation of the ceiling tiles in question. Thus, the document has been prepared for the **following 4 ceiling tiles:**

Knauf Danoline Plaza with Globe, Quadril, Micro and Tangent perforations.

These tiles can be painted in a wide range of colours from the factory. However, for this document the standard white paint (RAL 9003 matt) has been chosen.

The tiles are placed in T15 or T24 suspension systems. The frame varies from one project to another and has therefore not been taken into account on this data sheet.

As this is a demountable ceiling, the fitting of the tiles requires no additional products.

The distribution package includes approximately 52m² of tiles:

- a wooden pallet
- polyethylene film
- protective cardboard corners
- plaster wedges

The waste rate during the installation of the tiles is 5%.

No replacement tiles are needed during the life cycle of the product. Maintenance is feasible as required by the contracting authority and the type of activity taking place in the room where the tiles are installed. This maintenance can consist in simple cleaning or re-painting with a roller. These operations are not taken into account in this data sheet.

Basic figures for m² of Knauf Danoline Plaza perforated tiles

Per annuity

TLC total

Product: 1.05 m² of tile i.e. 170.3 g

Distribution Packaging (type and quantity):

Wooden pallet 3.9 g

Polyethylene sheet 1 g

Protective cardboard: 0.8 g

Plaster wedges 1.3 g

i.e. a total weight of the FU of: 177.4 g

Product: 1.05 m² of tile i.e. 8.516 kg

Complementary products (type and quantity) for the installation:

None (demountable ceiling)

Distribution Packaging (type and quantity):

Wooden pallet 195 g

Polyethylene sheet 50 g

Protective cardboard: 40 g

Plaster wedges 69 g

i.e. a total weight of the FU of: 8.869 kg

Useful specifications not contained in the definition of the functional unit

Knauf Danoline plasterboards are in conformity with the EN 520 standard.

Knauf Danoline Plaza tiles have straight edges. They are available with four different perforation types: Globe, Quadril, Micro and Tangent, and several perforation patterns within these perforation types. The tiles are backed with a cellulose fibre acoustic felt that provides excellent sound absorption and protection against dust.

Knauf Danoline Plaza tiles are particularly suitable for rooms requiring visual and acoustic comfort.

Inventory and other data according to NF P 01-010 § 5 and comments concerning the environmental and health effects of the product according to NF P 01-010 § 4.7.2

The inventory of life cycle data presented below has been calculated for the functional unit defined in 1.1 and 1.2

A reading guide for the tables is available on page 3.

Consumption of natural resources (NF P 01-010 § 5.1)

Consumption of natural energy resources and energy indicators (NF P 01-010 § 5.1.1)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Consumption of natural energy resources								
Wood	kg	0.00892	1.22 E-07	8.52 E-11	0	9.90 E-10	0.00892	0.446
Coal	kg	0.00739	2.27 E-05	1.49 E-08	0	1.73 E-07	0.00741	0.370
Lignite	kg	0.000563	4.68 E-05	7.78 E-10	0	9.02 E-09	0.000609	0.0305
Natural Gas	kg	0.0152	0.000145	3.76 E-07	0	4.36 E-06	0.0154	0.770
Oil	kg	0.00557	0.00606	1.59 E-05	0	0.000185	0.0118	0.591
Uranium (U)	kg	2.38 E-07	2.24 E-09	8.30 E-12	0	9.64 E-11		
Etc.								
Energy Indicators								
Total Primary Energy	MJ	1.47	0.260	0.000683	0	0.00793	1.74	87.1
Renewable Energy	MJ	0.208	9.50 E-05	2.66 E-07	0	3.09 E-06	0.208	10.4
Non Renewable Energy	MJ	1.27	0.260	0.000683	0	0.00793	1.53	76.7
Manufacturing energy	MJ	1.31	0.260	0.000683	0	0.00793	1.58	79.0
Material energy	MJ	0.162	-5.39 E-05	2.36 E-09	0	2.74 E-08	0.162	8.09
Electricity	kWh	0.0628	0.000216	4.96 E-07	0	5.76 E-06	0.0630	3.15

Commentary concerning the consumption of natural energy resources and energy indicators

The main energy resource consumed is natural gas, mainly used during the production stage.

Wood, coal, lignite, a portion of the oil and a portion of the natural gas consumed to produce energy (electricity) and some raw materials such as the pallets used for packaging. The production of Knauf Danoline products does not directly require the use of coal, lignite, or oil.

The energy indicators must be used with caution because they add up energies of different origins having different environmental impacts (attention should preferably be paid to elementary flows).

Consumption of non energy natural resources (NF P 01-010 § 5.1.2)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Antimony (Sb)	kg	0.00 E+00	0	0	0	0	0	0
Silver (Ag)	kg	9.88 E-11	9.20 E-13	2.38 E-15	0	2.76 E-14		
Clay	kg	0.000453	2.44 E-07	7.02 E-10	0	8.16 E-09	0.000453	0.0227
Arsenic (As)	kg	0.00 E+00	0	0	0	0	0	0
Bauxite (Al ₂ O ₃)	kg	1.44 E-06	1.77 E-07	4.66 E-10	0	5.40 E-09		
Bentonite	kg	2.00 E-06	1.79 E-08	4.62 E-11	0	5.38 E-10		
Bismuth (Bi)	kg	0.00 E+00	0	0	0	0	0	0
Boron (B)	kg	0.00 E+00	0	0	0	0	0	0
Cadmium (Cd)	kg	0.00 E+00	0	0	0	0	0	0
Limestone	kg	0.000786	1.55 E-06	4.38 E-09	0	5.08 E-08	0.000788	0.0394
Sodium carbonate (Na ₂ CO ₃)	kg	0.00 E+00	0	0	0	0	0	0
Potassium chloride (KCl)	kg	9.48 E-05	6.34 E-11	5.26 E-13	0	6.12 E-12	9.48 E-05	0.00474
Sodium chloride (NaCl)	kg	0.000702	8.34 E-07	2.18 E-09	0	2.52 E-08	0.000703	0.0352
Chromium (Cr)	kg	1.29 E-08	3.64 E-11	9.42 E-14	0	1.09 E-12		
Cobalt (Co)	kg	0.00 E+00	0	0	0	0	0	0
Copper (Cu)	kg	1.99 E-08	1.85 E-10	4.78 E-13	0	5.56 E-12		
Dolomite	kg	3.94 E-08	1.64 E-15	1.36 E-17	0	1.58 E-16		
Tin (Sn)	kg	0.00 E+00	0	0	0	0	0	0
Feldspar	kg	5.28 E-10	0	0	0	0		
Iron (Fe)	kg	0.000220	5.86 E-07	1.57 E-09	0	1.82 E-08	0.000221	0.0110
Fluorite (CaF ₂)	kg	6.96 E-09	0	0	0	0		
Gravel	kg	0.000483	4.47 E-06	1.16 E-08	0	1.35 E-07	0.000487	0.0244
Lithium (Li)	kg	0.00 E+00	0	0	0	0	0	0
Kaolin (Al ₂ O ₃ , 2SiO ₂ , 2H ₂ O)	kg	3.51 E-05	0	0	0	0	3.51 E-05	0.00176
Magnesium (Mg)	kg	6.26 E-14	0	0	0	0		
Manganese (Mn)	kg	2.28 E-09	2.12 E-11	5.48 E-14	0	6.36 E-13		
Mercury (Hg)	kg	1.94 E-11	0	0	0	0		
Molybdenum (Mo)	kg	0.00 E+00	0	0	0	0	0	0
Nickel (Ni)	kg	1.86 E-09	1.23 E-11	3.18 E-14	0	3.70 E-13		
Gold (Au)	kg	0.00 E+00	0	0	0	0	0	0
Palladium (Pd)	kg	0.00 E+00	0	0	0	0	0	0
Platinum (Pt)	kg	0.00 E+00	0	0	0	0	0	0
Lead (Pb)	kg	1.12 E-08	5.80 E-11	1.50 E-13	0	1.74 E-12		
Rhodium (Rh)	kg	0.00 E+00	0	0	0	0	0	0

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Flow								
Rutile (TiO ₂)	kg	0.000554	0	0	0	0	0.000554	0.0277
Sand	kg	0.00118	9.70 E-08	3.52 E-10	0	4.10 E-09	0.00118	0.0590
Silica (SiO ₂)	kg	2.03 E-05	0	0	0	0	2.03 E-05	0.00102
Sulphur (S)	kg	1.56 E-05	2.80 E-12	2.32 E-14	0	2.70 E-13		
Barium Sulphate (Ba SO ₄)	kg	2.06 E-05	1.90 E-07	4.90 E-10	0	5.68 E-09	2.08 E-05	0.00104
Titanium (Ti)	kg	4.22 E-10	0	0	0	0		
Tungsten (W)	kg	0.00 E+00	0	0	0	0	0	0
Vanadium (V)	kg	0.00 E+00	0	0	0	0	0	0
Zinc (Zn)	kg	6.76 E-10	1.35 E-12	3.48 E-15	0	4.04 E-14		
Zirconium (Zr)	kg	0.00 E+00	0	0	0	0	0	0
Other plant raw materials	kg	0.00 E+00	0	0	0	0	0	0
Other animal raw materials	kg	0.00 E+00	0	0	0	0	0	0
Other intermediate products (total)	kg	0.00316	9.92 E-06	2.60 E-08	0	3.02 E-07	0.00317	0.158
Gypsum	kg	0.0787	3.28 E-08	8.48 E-11	0	0	0.0787	3.93

Comments concerning the consumption of non- energy natural resources

The main raw material of Knauf Danoline Plaza tiles is gypsum. The gypsum used is either of natural origin or derived from a recycling process. In fact, both desulphurisation and recycled gypsum (internal and external recycling) are used and appear in the table for recovered materials. (See section 2.1.4).

In total, recycled gypsum represents approx. 55% of the total consumption of gypsum.

Furthermore, according to the American Office of Surface Mining, given the size of the deposits of natural gypsum in the world, gypsum is not considered as a non-renewable resource.

The total non-energy resources consumed are low as they total 386 g. This represents less than 4.5 % of the total Functional Unit of this data sheet of 8869g.

Water consumption (sampling) (NF P 01-010 § 5.1.3)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Water: Lake	litre	0.00 E+00	0	0	0	0	0	0
Sea water:	litre	0.000201	1.74 E-11	1.44 E-13	0	1.67 E-12	0.000201	0.0101
Water : Ground water	litre	3.94 E-07	8.58 E-14	7.12 E-16	0	8.28 E-15		
Water : Unspecified origin	litre	0.375	0.0252	6.63 E-05	0	0.000770	0.401	20.0
Water: River	litre	0.0157	1.62 E-13	1.34 E-15	0	1.56 E-14	0.0157	0.783
Drink water (network)	litre	0.0998	3.74 E-09	3.12 E-11	0	3.62 E-10	0.0998	4.99
Water consumed (total)	litre	0.490	0.0252	6.63 E-05	0	0.000770	0.517	25.8
Etc.	litre							

Commentary concerning water consumption (sampling):

Water consumption across the lifespan is equal to 25.8 litres, 94% of which is consumed at the production stage.

Consumption of energy and materials recovered (NF P 01-010 § 5.1.4)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Recovered Energy	MJ	0.00 E+00	0	0	0	0	0	0
Recovered materials: Total	kg	0.105	5.04 E-06	1.32 E-08	0	1.53 E-07	0.105	5.24
Recovered materials: Steel	kg	8.41 E-05	5.04 E-06	1.32 E-08	0	1.53 E-07	8.93 E-05	0.00447
Recovered materials: Aluminium	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Metal (unspecified)	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Paper-Cardboard	kg	0.0112	0	0	0	0	0.0112	0.559
Recovered materials: Plastic	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Cullet	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Biomass	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Mineral	kg	0.00 E+00	0	0	0	0	0	0

Recovered materials: Recycled Gypsum (CaSO4.2H2O)	kg	0.0936	0	0	0	0	0.0936	4.68
Other recovered materials:	kg	0.00 E+00	0	0	0	0	0	0

Comments concerning energy and recovered material:

The main raw material in Knauf Danoline products is recycled gypsum.

By nature, gypsum (or calcium sulphate) is infinitely recyclable. Recycled gypsum not only comes from the internal recycling process at our plant but also from gypsum board recycling company, operating on large scale in Denmark, as well as from coal fired power plants. The power plants are equipped with desulphurisation systems which in a simple way generate gypsum crystals and protect the environment.

On the other hand, it is imperative not to confuse FGD gypsum and phosphogypsum. This distinction is explained in Chapter 4.1.1

Furthermore, the cardboard used for the surface of Knauf Danoline products is made from recycled paper/cardboard. It is thus the second largest source of recovered materials.

From the above table, the manufacture of Knauf Danoline Plaza tiles requires 5240g of recovered materials. The Functional Unit of this data sheet being 8869g, the recovered materials represent nearly 60% of the Functional Unit.

Emissions to air, water and soil (NF P 01-010 § 5.2)

The following inventory table as all the other tables in chapter 2 displays information concerning the impact from all stages related to the implementation of 1m² of Knauf Danoline Plaza tiles (see the definition of Functional Unit on this page). For example, the manufacture of the raw materials that we purchase, the use of polyethylene film or the destruction of the tiles at the end of the life cycle of the building are taken into account.

It therefore in no way concerns emissions into the air that might emanate from our product. Such emissions are measured during testing of the ISO 16000 standards by an independent laboratory. The results of these tests are explained in Chapter 4.

Emissions into the air (NF P 01-010 § 5.2.1)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Hydrocarbons (unspecified)	g	0.00428	4.03 E-06	1.08 E-08	0	1.25 E-07		
Hydrocarbons (unspecified, excluding methane)	g	0.0608	0.0690	0.000181	0	0.00211	0.132	6.60
PAH (unspecified)	g	6.21 E-06	8.48 E-08	1.98 E-10	0	2.29 E-09		
Methane (CH ₄)	g	0.0778	0.0303	7.90 E-05	0	0.000918	0.109	5.45
Volatile organic compounds (i.e. acetone, acetate, etc.)	g	0.0570	0	0	0	0	0.0570	2.85
Carbon Dioxide (CO ₂)	kg	0.0706	0.0198	5.19 E-05	0	0.000603	0.0910	4.55
Carbon monoxide (CO)	g	0.0554	0.0527	0.000134	0	0.00156	0.110	5.49
Nitrogen Oxides (NO _x as NO ₂)	g	0.163	0.234	0.000615	0	0.00714	0.405	20.2
Nitrous Oxide	g	0.00135	0.00254	6.69 E-06	0	7.77 E-05		
Ammonia (NH ₃)	g	0.00753	2.20 E-07	4.46 E-10	0	0		
Dust (unspecified)	g	0.0298	0.0135	3.55 E-05	0	0.000413	0.0438	2.19
Sulphur oxides (SO _x as SO ₂)	g	0.153	0.00878	2.26 E-05	0	0.000262	0.162	8.11
Hydrogen sulphide (H ₂ S)	g	0.000214	2.34 E-06	4.94 E-09	0	5.72 E-08		
Hydrogen cyanide (HCN)	g	1.15 E-06	1.19 E-09	1.01 E-12	0	1.18 E-11		
Phosphoric acid (H ₃ PO ₄)	g	0.00 E+00	0	0	0	0	0	0
Organic chlorinated compounds (as Cl)	g	8.23 E-07	1.14 E-14	9.47 E-17	0	1.10 E-15		
Hydrochloric acid (HCl)	g	0.00104	3.13 E-05	3.78 E-08	0	4.38 E-07		
Inorganic chlorinated compounds (as Cl)	g	2.13 E-06	6.15 E-12	4.89 E-14	0	5.68 E-13		
Unspecified chlorinated compounds (Cl)	g	8.12 E-07	1.59 E-12	1.32 E-14	0	1.53 E-13		

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Fluorinated organic compounds (in F)	g	4.57 E-07	1.23 E-06	3.24 E-09	0	3.76 E-08		
Inorganic fluorinated compounds (in F)	g	5.32 E-05	1.81 E-06	3.10 E-09	0	3.60 E-08		
Halogenated compounds (unspecified)	g	9.90 E-06	1.54 E-07	5.54 E-11	0	6.44 E-10		
Unspecified fluorinated compounds (as F)	g	0.00 E+00	0	0	0	0	0	0
Metals (unspecified)	g	0.000164	2.56 E-05	2.11 E-08	0	2.45 E-07		
Antimony and its compounds (as Sb)	g	5.82 E-07	3.02 E-08	4.32 E-13	0	5.02 E-12		
Arsenic and its compounds (as As)	g	8.86 E-07	1.05 E-07	2.40 E-10	0	2.78 E-09		
Cadmium and its compounds (as Cd)	g	9.16 E-07	5.06 E-07	1.33 E-09	0	1.54 E-08		
Chromium and its compounds (as Cr)	g	6.10 E-07	1.47 E-07	3.02 E-10	0	3.50 E-09		
Cobalt and its compounds (as Co)	g	6.34 E-07	2.50 E-07	5.88 E-10	0	6.84 E-09		
Copper and its compounds (as Cu)	g	1.45 E-06	3.62 E-07	8.88 E-10	0	1.03 E-08		
Tin and its compounds (as Sn)	g	5.16 E-09	1.50 E-09	1.41 E-13	0	1.64 E-12		
Manganese and its compounds (as Mn)	g	2.95 E-06	5.10 E-08	7.20 E-11	0	8.36 E-10		
Mercury and its compounds (as Hg)	g	1.51 E-06	1.30 E-08	3.04 E-11	0	3.52 E-10		
Nickel and its compounds (as Ni)	g	2.74 E-05	4.51 E-06	1.18 E-08	0	1.37 E-07		
Lead and its compounds (as Pb)	g	2.89 E-06	1.69 E-06	4.34 E-09	0	5.04 E-08		
Selenium and its compounds (as Se)	g	5.22 E-07	1.07 E-07	2.44 E-10	0	2.82 E-09		
Tellurium and its compounds (as Te)	g	0.00 E+00	0	0	0	0	0	0
Zinc and its compounds (as Zn)	g	0.000114	0.000761	2.00 E-06	0	2.33 E-05		
Vanadium and its compounds (V)	g	7.90 E-05	1.80 E-05	4.70 E-08	0	5.46 E-07		
Silicon and its compounds (as Si)	g	0.000148	4.78 E-05	3.44 E-09	0	4.00 E-08		
Etc.	g							

^a PAH: Polycyclic aromatic hydrocarbons

NOTE: Regarding radioactive emissions, this table should be completed as soon as the transposition of the Euratom European Directive concerning radioactive emissions is published.

Comments relating to air emissions:

Emissions to air are mainly, more than 98%, carbon dioxide.

Other emissions superior to 1g and totalling only 50g for the life cycle of the product are the following:
Nitrogen oxides, carbon monoxide, sulphur oxides, methane, hydrocarbons, dust, volatile organic compounds.

Some emissions of nitrogen oxides and air emissions in general associated with the stages of distribution and end of life are due solely to the production and combustion of diesel fuel consumed for transportation.

Carbon Dioxide (CO2)

The 4.55 kg of CO2 emitted throughout the TLC are mainly emitted during the production stage (77%), of which 52% are directly related to the production site and during transport (22%).

Emissions into the air (NF P 01-010 § 5.2.2)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
COD (Chemical Oxygen Demand)	g	0.112	0.000895	0.00742	0	0.0862	0.206	10.3
BOD5 (Biochemical Oxygen Demand at 5 days)	g	0.0305	2.71 E-05	0.00178	0	0.0207	0.0530	2.65
Suspended solids (SS)	g	0.0194	0.000151	0.00208	0	0.0241	0.0457	2.29
Cyanide (CN-)	g	2.23 E-06	1.30 E-06	3.36 E-09	0	3.90 E-08		
AOX (halogenated absorbable organic compounds)	g	0.000178	1.26 E-06	5.94 E-05	0	0.000689	0.000928	0.0464
Hydrocarbons (unspecified)	g	0.00769	0.00918	0.000624	0	0.00724	0.0247	1.24
Nitrogen compounds (N)	g	0.000611	0.000837	0.00178	0	0.0207	0.0239	1.20
Phosphorus compounds (P)	g	0.00933	2.49 E-06	6.56 E-09	0	7.61 E-08	0.00933	0.467
Fluorinated organic compounds (in F)	g	0.0259	6.31 E-06	0.000890	0	0.0103	0.0372	1.86
Inorganic fluorinated compounds (in F)	g	0.00 E+00	0	0	0	0	0	0
Unspecified fluorinated compounds (as F)	g	0.00 E+00	0	0	0	0	0	0
Chlorinated organic compounds (as Cl)	g	5.98 E-06	1.40 E-08	3.63 E-11	0	4.20 E-10		
Inorganic chlorinated compounds (as Cl)	g	0.422	0.308	0.000809	0	0.00940	0.740	37.0
Unspecified chlorinated compounds (Cl)	g	0.000624	5.45 E-06	1.41 E-08	0	1.64 E-07	0.000630	0.0315
PAH (unspecified)	g	2.70 E-06	7.74 E-06	2.04 E-08	0	2.36 E-07		
Metals (unspecified)	g	0.0166	0.00515	0.00120	0	0.0139	0.0368	1.84

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Aluminium and its compounds (as Al)	g	0.000211	3.21 E-06	9.08 E-09	0	1.05 E-07	0.000215	0.0107
Arsenic and its compounds (as As)	g	1.59 E-06	2.50 E-07	6.60 E-10	0	7.68 E-09		
Cadmium and its compounds (as Cd)	g	1.65 E-07	4.18 E-07	1.10 E-09	0	1.28 E-08		
Chromium and its compounds (as Cr)	g	2.81 E-06	2.54 E-08	6.56 E-11	0	7.62 E-10		
Copper and its compounds (as Cu)	g	2.23 E-06	8.50 E-07	2.24 E-09	0	2.60 E-08		
Tin and its compounds (as Sn)	g	7.68 E-10	1.49 E-11	5.84 E-14	0	6.78 E-13		
Iron and its compounds (as Fe)	g	0.000330	0.000149	1.96 E-07	0	2.28 E-06	0.000481	0.0241
Mercury and its compounds (as Hg)	g	1.12 E-06	2.48 E-09	6.52 E-12	0	7.58 E-11		
Nickel and its compounds (as Ni)	g	2.54 E-06	1.45 E-06	3.80 E-09	0	4.42 E-08		
Lead and its compounds (as Pb)	g	5.61 E-06	3.06 E-07	8.50 E-10	0	9.86 E-09		
Zinc and its compounds (as Zn)	g	7.39 E-06	2.52 E-06	6.64 E-09	0	7.72 E-08		
Water released	Litre	0.115	0.00121	2.70 E-06	0	3.14 E-05	0.116	5.80
Etc.	g							

Comments on emissions to water:

Releases to water that are related to Knauf Danoline product cycles are low due to lack of industrial effluents on site.

The main emissions are related to the end of product life stage and the manufacture of the paint. Indeed these last two together account for over 91% of the chemical oxygen demand and 93% of the 5 day Biochemical Oxygen Demand.

Emissions into the soil (NF P 01-010 § 5.2.3)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Arsenic and its compounds (as As)	g	1.04 E-07	9.68 E-10	2.50 E-12	0	2.90 E-11		
Biocides ^a	g	0.00 E+00	0	0	0	0	0	0
Cadmium and its compounds (as Cd)	g	4.70 E-11	4.38 E-13	1.13 E-15	0	1.31 E-14		
Chromium and its compounds (as Cr)	g	1.30 E-06	1.21 E-08	3.12 E-11	0	3.64 E-10	1.31 E-06	6.57 E-05
Copper and its compounds (as Cu)	g	2.38 E-10	2.22 E-12	5.74 E-15	0	6.66 E-14		
Tin and its compounds (as Sn)	g	0.00 E+00	0	0	0	0	0	0
Iron and its compounds (as Fe)	g	0.000673	4.83 E-06	1.25 E-08	0	1.45 E-07	0.000678	0.0339
Lead and its compounds (as Pb)	g	1.09 E-09	1.02 E-11	2.62 E-14	0	3.04 E-13		
Mercury and its compounds (as Hg)	g	8.66 E-12	8.06 E-14	2.08 E-16	0	2.42 E-15		
Nickel and its compounds (as Ni)	g	3.58 E-10	3.34 E-12	8.62 E-15	0	1.00 E-13		
Zinc and its compounds (as Zn)	g	3.91 E-06	3.64 E-08	9.38 E-11	0	1.09 E-09	3.95 E-06	0.000197
Heavy metals (unspecified)	g	0.00 E+00	0	0	0	0	0	0
Etc.	g							

^a Biocides: e.g. pesticides, herbicides, fungicides, insecticides, bactericides, etc.

Comments on soil emissions:

Emissions into the soil are insignificant. They are approximately 0.03g over the 50 years of the total lifespan of the tiles.

Waste production (NF P 01-010 § 5.3)
Waste recovery (NF P 01-010 § 5.3)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Recovered Energy	MJ	0.00 E+00	0	0	0	0	0	0
Recovered materials: Total	kg	0.0382	1.16 E-07	2.76 E-10	0	3.21 E-09	0.0382	1.91
Recovered materials: Steel	kg	0.000146	1.42 E-09	6.28 E-12	0	7.28 E-11	0.000146	0.007307
Recovered materials: Aluminium	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Metal (unspecified)	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Paper-Cardboard	kg	0.00268	0	0	0	0	0.00268	0.134
Recovered materials: Plastic	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Cullet	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Biomass	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Mineral	kg	0.00 E+00	0	0	0	0	0	0
Recovered materials: Unspecified: Gypsum	kg	0.0354	1.14 E-07	2.70 E-10	0	3.14 E-09	0.0354	1.77
Etc.	...							

Eliminated waste (NF P 01-010 § 5.3)

Flow	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
							Per annuity	TLC
Hazardous Waste	kg	0.00240	8.55 E-06	1.71 E-08	0	1.99 E-07	0.00241	0.121
Non-hazardous waste	kg	0.00670	4.53 E-06	0.0279	0	0.162	0.197	9.84
Inert waste	kg	0.00620	1.78 E-05	3.31 E-08	0	3.85 E-07	0.00621	0.311
Radioactive Waste	kg	1.99 E-06	4.23 E-06	1.11 E-08	0	1.29 E-07		
Etc.	kg							

Comments regarding production and arrangements for waste management

Waste production

The end of use phase alone accounts for over 82% of the waste previously calculated.

Indeed, although gypsum is recyclable, is it necessary that collection and selective sorting channels be operational. In Denmark, where Knauf Danoline tiles are produced, significant quantities of gypsum are recycled thanks to the setting up of permanent recycling systems. Recycling is possible as the finished products have the same chemical nature as the raw material: gypsum.

Waste management organisation

Under the European directive concerning waste disposal, waste material coming from the production of Knauf Danoline Plaza tiles can be stored in class II landfills in specific compartments.

Typical environmental impact of construction products according to NF P 01-010 § 6

This impact has been provided or calculated as specified in § 6.1 of the NF P01-010 standard, from data in § 2 and the unit of reference by annuity as defined in § 1.1 and 1.2 of this data sheet, as well as for the TLC (Total Life Cycle).

N°	Environmental impact	Indicator value for the functional unit		Indicator value for all the TLC	
1	Consumption of energy resources				
	Total Primary Energy	1.74	MJ/UF	87.1	MJ
	Renewable Energy	0.208	MJ/UF	10.4	MJ
	Non Renewable Energy	1.53	MJ/UF	76.7	MJ
2	Depletion of resources (ADP)	0.000629	kg antimony equivalent (Sb)/UF	0.0315	kg antimony equivalent (Sb)
3	Total water consumption	0.517	litre/UF	25.8	litre
4	Solid Waste				
	Waste recovery (total)	0.0382	kg/UF	1.91	kg
	Waste disposal:				
	Hazardous Waste	0.00241	kg/UF	0.121	kg
	Non-hazardous waste	0.197	kg/UF	9.84	kg
	Inert waste	0.00621	kg/UF	0.311	kg
	Radioactive Waste	6.36 E-06	kg/UF	0.000318	kg
5	Climate Change	0.0946	kg equivalent CO ₂ /UF	4.73	kg equivalent CO ₂
6	Air Acidification	0.000461	kg equivalent SO ₂ /UF	0.0230	kg equivalent SO ₂
7	Air pollution	5.86	m ³ /UF	293	m ³
8	Water pollution	0.0561	m ³ /UF	2.80	m ³
9	Destruction of the stratospheric ozone layer	0	kg CFC equivalent R11/UF	0	kg CFC equivalent R11
10	Photochemical ozone formation	0.0000545	kg ethylene equivalent/UF	0.00273	kg ethylene equivalent
Other indicator (not within the NF P01-010 standard)					
11	Eutrophication	0.0173	g equivalent PO ₄ ²⁻ /UF	0.867	g equivalent PO ₄ ²⁻ /UF

We recommend you retain the values of each indicator, calculated for the entire TLC, so as to avoid including TLC defined without justification and to apply the values obtained on the actual duration of your project.

* The estimated typical life span is 50 years since this is the current average life span of a building, whereas the intrinsic life span of the product would, we estimate, be higher.

Product contribution to the assessment of health risks and quality of life within the buildings according to NF P 01-010 § 7

Product Contribution		Relevant paragraph	Expression (value measurements, calculations ...)
In the evaluation of risks Health Risks	Sanitary quality of interior spaces	§ 4.1.1	
	Quality of water	§ 4.1.2	
To the quality of life	Hydrothermal comfort	§ 4.2.1	
	Acoustic comfort	§ 4.2.2	
	Visual Comfort	§ 4.2.3	
	Olfactory comfort	§ 4.2.4	

Information relevant to assessment of health risks (NF P 01-010 § 7.2)

Contribution to the sanitary quality of interior spaces (NF P 01-010 § 7.2.1)

Knauf Danoline Plaza gypsum tiles are used to form a demountable acoustic and / or decorative ceiling.

Inevitable pollutant discharge to which handlers may be exposed

There is no pollutant discharge to which handlers may be exposed.

Tile installation must be done in accordance with the rules of DTU 58-1.

It should be noted that the use of a box cutter for the cutting of certain tiles does not generate dust.

Volatile organic compounds and aldehydes

Different samples of gypsum have been analyzed for VOC and aldehyde discharge in a test chamber by CSTB in 2004 and 2006 and by the FCBA in 2006 and 2007 in accordance with NF ISO 16000-3, NF ISO 16000-6 and NF EN ISO 16000-9.

Specific tests for Knauf Danoline products have also been undertaken by "the Danish Technological Institute" in accordance with the above mentioned standards. This laboratory based in Denmark has a DANAK accreditation (Danish Accreditation and Metrology Fund, a member of ILAC International Laboratory Accreditation Cooperation).

All results show that total VOC discharge in indoor air for 28 days is less than 1000 µg/m³.

In the absence of a current regulatory threshold, this reference has been used for the various protocols.

Moreover, each volatile organic compound, taken individually, has a discharge level that is lower than its specific limit defined in these protocols.

In any event, the potential risks associated with these discharges can be evaluated as part of a completed and furnished building, and with reference to those thresholds established by regulatory authorities.

Radioactive substances

The radioactivity of a product arises from the methods used in its manufacture and in particular as concerns the products used in its manufacture. Due to natural radioactivity, all building materials of mineral origin have a certain level of radioactivity, however minimal it may be.

Knauf Danoline products are mainly composed of natural gypsum, FGD gypsum and gypsum recycled from plasterboards. The FGD gypsum comes from a simple treatment of waste gases at power plants. This process is now compulsory in Germany in order to protect the environment.

Gypsum has a low activity concentration index I. Gypsum has the lowest radioactivity among all the construction materials.

Origin of gypsum	Laboratories ^(2 and 3)	Bq/kg			I(*)
		²²⁶ Ra	²³² Th	⁴⁰ K	
Natural gypsum	Report 112	10	10	80	0.11
	IRES (FR)	11 - 19	<3 - 4.7	22 - 146	< 0.04 – 0.14
	INTRON (NL)	6.1	1.7	27	0.04
	SCK-CEN (BE)	9.6 - 13	3.9 - <7	<30 - <40	< 0.08
FGD Gypsum	INTRON (NL)	3.8 - 5.8	<2	<5 - <6	< 0.03

⁽¹⁾The activity concentration index I combines the activity of radionuclides to reflect their respective energies:
 $I = [CRa226 / 300 \text{ Bqkg}^{-1}] + [CTh232 / 200 \text{ Bqkg}^{-1}] + [CK40 / 3000 \text{ Bqkg}^{-1}]$

The average natural radioactivity of the earth's crust ⁽²⁾ may serve as a benchmark to assess the level of radioactivity in our tiles:

²²⁶Ra : 40 Bqkg⁻¹

²³²Th : 40 Bqkg⁻¹

⁴⁰K : 400 Bqkg⁻¹

Index I = 0.47

Taking into account how materials are used in building the index I is correlated to dose levels ⁽²⁾:

Dose levels	0.3 mSv.a ⁻¹	1 mSv.a ⁻¹
Structural shell materials (e.g. concrete)	I ≤ 0.5	I ≤ 1
Covering materials (e.g. tiles, panels, etc.)	I ≤ 2	I ≤ 6

The Knauf Danoline Plaza tiles therefore have an index I that is lower than the required index to satisfy the strictest test level, namely: 0.3 mSv.a⁻¹. In addition, the tiles are in compliance with the strictest levels for structural shell materials.

Caution: There is absolutely no link between the FGD gypsum and phosphogypsum which is a by-product of phosphoric acid manufacturing.

Data quality:

(1) "Improvement of the life cycle assessment methodology for dwellings"; Arjen Meijer, IOS Press BV, Amsterdam 2006

(2) Report 112 of the EC "Radiological Protection Principles Concerning the Natural Radioactivity of Building Materials", 1999

(3) Laboratory SERF (France); Laboratory SCK-CEN (Belgium); Report INTRON R95373: Radioactivity of common building materials, 1996 (in Dutch)

Development of microorganisms

At the time of writing this record, there is no standardized method for measuring the growth of microorganisms in construction products. A fortiori there exist no regulatory values.

The development of microorganisms is primarily due to excess moisture and inadequate ventilation, according to the characteristics the indoor air; mould can grow on any material.

Under normal conditions of use and design of buildings, no development of microorganisms on the surface of Knauf Danoline Plaza tiles has been observed.

Note that a building occupied under normal conditions is a unit that is not over-occupied and one that is, in particular, well ventilated. Please refer to your country's legislation concerning the ventilation requirements in buildings.

Fibres

During manufacturing, less than 1% of fibreglass filaments having a length of greater than 5mm and a diameter of greater than 10µm, is incorporated into the plaster mass. Because of their size and in terms of WHO criteria, these fibres cannot be inhaled and are classified in the "non-carcinogenic to humans" category (Group 3 of IARC classification).

By their very small proportion and their incorporation into the mass of our plasterboards, these fibres do not cause any irritation.

Contribution to the quality of water (NF P 01-010 § 7.2.2)

Not applicable as the structures composed of Knauf Danoline Plaza tiles have no connection with water quality. They are not in contact with runoff, seepage, ground water or even with surface waters.

Product contribution to the quality of life within buildings (NF P 01-010 § 7.3)

Product features affecting heat and humidity conditions in buildings (NF P 01-010 § 7.3.1)

The Knauf Danoline Plaza tiles are plasterboard and as such, have a thermal conductivity equal to 0.25 W/m°C.

Product features contributing to the acoustic comfort in buildings (NF P 01-010 § 7.3.2)

Knauf Danoline Plaza tiles have high acoustic performance. Knauf Danoline Plaza perforated tiles, the object of this data sheet, are delivered with a cellulose fibre acoustic felt, ensuring improved acoustic properties.

This performance depends on the type of perforation chosen and has been confirmed by our acoustic measurements at certified Acoustic Labs. Test reports can be acquired on demand.

Product features contributing to the visual comfort in buildings (NF P 01-010 § 7.3.3)

The perforation types and patterns available for Knauf Danoline product range have been specifically designed to associate the previous cited acoustic performance with indisputable visual comfort.

Light reflectance tests have been carried out by the Delta Lys & Optik laboratory in accordance with DIN 5036 Part 3. This laboratory based in Denmark has a DANAK accreditation (Danish Accreditation and Metrology Fund, a member of ILAC International Laboratory Accreditation Cooperation).

The results from the reports referenced L101601-2800 and 10483-393 indicate that reflectance is greater than 70%. This reflectance contributes to visual comfort.

Product features contributing to the olfactory comfort in buildings (NF P 01-010 § 7.3.4)

Knauf Danoline products, like any plasterboard, do not emit any odour when dry.

Other product features concerning the eco-management of the building, savings and global environmental policy

Building eco-management

Energy Management

Knauf Danoline Plaza tiles are not insulating products. Their thermal conductivity is 0.25 W/m°C.

Water management

Not applicable

Upkeep and maintenance

Maintenance of the tiles can be undertaken as required by the client. This maintenance may consist in cleaning the tiles with a vacuum cleaner or a damp cloth moistened with mild detergent if the tiles have become soiled, or in the case of

re-painting with a roller.

Economic Concerns

Not applicable

Overall Environmental Policy

Natural Resources

As specified earlier (see chapter 2.1.4), nearly 60% of the resources consumed are recycled materials. In fact, the amount of recovered materials is 5240g, compared to the 8869g Functional Unit of this data sheet.

The main natural resource consumed is gypsum, which is not considered as a non-renewable resource. The consumption of non energy resources is low – 386g or less than 4.5% of the Functional Unit.

Emissions to air and water

Not applicable

Waste

Plasterboard tiles are recyclable and are recycled on a large scale in Denmark. Indeed, the implementation of a professional recycling system in this sector has made it possible to establish a selective collection of waste gypsum. Thus tens of thousands of tons of gypsum are recycled annually and therefore minimize both the need for gypsum and the production of waste.

Appendix: Data characteristics for the calculation of the Life Cycle Inventory (LCI)

This appendix is from the report accompanying the statement (cf. Introduction)

Definition of the LCA (Life cycle analysis) system

Description of flows considered in the lifecycle of the product.

Included steps and flows

The modelling of Knauf Danoline Plaza tiles life cycles of has been conducted by means of TEAM™ software developed by the Ecobilan SA company. In accordance with Chapter 4.1 of the NF P 01-010 standard, the choice of modelling consists in the 5 steps described below. The data used reflects a breakdown in m² according to the size and perforation type of the tile concerned in this document.

Stages of the life cycle of the tiles

Production:

It is similar to that of conventional plasterboard and is shown below, except the additional steps of perforation, machining and the application of products specific to Knauf Danoline products, such as the acoustic felt and painting. This step takes into account the extraction, production and transportation of the raw materials, the production of energy consumed on site, manufacturing and transportation of plasterboards and then the manufacture and packaging of Knauf Danoline Plaza tiles.

Distribution:

This step details the transport of the tiles from the final production sites to the work areas, possibly passing through a commercial subsidiary and a dealer. It also takes into account the extraction and refining of oil for fuel consumed during transportation.

Installation:

In particular, all waste produced on the worksite has been taken into account.
 Period of use: Maintenance is feasible as required by the contracting authority and the type of activity taking place in the room where the tiles are installed. This maintenance can consist in simple cleaning or re-painting with a roller. These operations are not taken into account in this data sheet.

End of use:

The modelling of the end of life includes not only the stage of disposal of the product at the end of its useful life, but also the transport of waste from the place of installation to the place of final disposal.

Omitted flows

The NF P01-010 standard allows for the omission of the following flows from the system:

- The lighting, heating and cleaning of the workshops
- The administrative department,
- Employee transportation,
- The manufacture of production tools and transportation systems (machines, trucks, etc... ..).

Rules for the establishment of boundaries

The NF P01-010 standard has set the cut-off point at 98%, i.e. over 98% of the products related to functional unit described must be taken into account. The cut-off rule does not apply in the case of substances classified as very toxic (T), toxic (T) or environmentally hazardous by order of April 20, 1994, in accordance with NF P 01-010 §.

The present data sheet meets the above requirements; the percentage of products taken into account is over 98.6%. Products not included in the tables of results are related to some very specific flows such as unspecified corn or

biomass.

Data Sources

Characterization of key data

Manufacturing

Year: 2008

Geographical representation: The data covers the Knauf Danoline tiles manufactured at Knauf factory in Hobro, Denmark.

Technological representativeness: The production sites are representative of the technology used in Europe.

Source: data is taken from the sites and has been collected either through analysis of data from the enterprise resource planning system SAP, or through questionnaires completed during a visit to each site.

Transport

Year: 2009

Geographical representation: The distance travelled by the tiles includes transport to the construction sites in France, this routing taking into account different possible scenarios, namely the delivery from the production site to commercial entities based in France, then flow directly to the sites or via a subsidiary.

Technological representativeness: Road transport has been modelled in accordance with the standard.

Source: Sites.

Installation

Year: 2009

Geographical area: France

Source: Knauf

End of use

Year: 2005

Geographical area: France

Source: French legislation (maximum allowable levels of effluents in waste storage centres)

Energy data

To be filled in if the data used is different from that contained in the specifications document AFNOR FD P 01-015.

Electric Model

The modelling of electricity production of has been compiled from data supplied by the International Energy Agency. The data used for this model are provided below.

Source: IEA Statistics 2004 Electricity Information

For example:

Table 1: Origin of electricity in France 2002

	Quantity in GWh	%
Nuclear	436.76	78%
Natural Gas	23.50	4%
Heavy fuel oil (HFO)	4.52	1%
Coal	25.12	5%
Lignite	0.00	0%
Process gas	0.00	0%
Hydraulics	65.89	12%
Tidal power plant	0.54	0%
Wind farm	0.27	0%
Geothermal	0.00	0%
Solar	0.01	0%
Renewable Fuel	3.52	0.5%
Imported electricity	3.00	0.5%
Distribution loss	32.20	5.8%

Non-LCI Data

Data from the Gypsum Industries (SNIP) and following the tests undertaken by each member within the KNAUF Group.

Traceability

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