ENVIRONMENTAL AND HEALTH DECLARATION

IN CONFORMITY WITH THE NF P 01-010 STANDARD

PERFORATED CEILING

KNAUF DANOLINE DANOTILE

NOVEMBER 2009

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

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The framework used for the presentation of the environmental and health declaration for Knauf Danoline Danotiles 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 E-06 = -4.2 x 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 6.5mm 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 (or 1200 mm) x 600mm x 6.5mm.
Other sizes are also available and are taken into consideration in this document.

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

This document has been prepared for non perforated Danotile White or Metallic with straight edges. On the basis of quantities sold, this document is valid for Danotile White and Danotile Metallic.

The tiles are placed in visible T24 or T15 suspension grids. The suspension grid is fitted with suspension hangers and finished with wall angles or shadow line trims. The grid varies from one project to another and has therefore not been taken into account in this data sheet.

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

The distribution package includes approximately 100m² 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 as the tiles are washable. The maintenance has not been taken into account in this data sheet as it depends on the requirements of the contracting authority.

Basic figures for m² of Knauf Danoline Danotile	
Per annuity	TLC total
Product: 1.05 m² of tile i.e. 133.4 g Distribution Packaging (type and quantity): Wooden pallet 1.2 g Polyethylene sheet 0.55 g Protective cardboard: 0.18 g Plaster wedges 0.23 g i.e. a total weight of the FU of: 135.5 g	Product: 1.05 m² of tile i.e. 6.668 kg Complementary products (type and quantity) for the installation: None (demountable ceiling) Distribution Packaging (type and quantity): Wooden pallet 60.3 g Polyethylene sheet 27.9 g Protective cardboard: 9 g Plaster wedges 11.6 g i.e. a total weight of the FU of: 6.776 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 Danotile has straight edges. The front side of the tiles is covered with pre-impregnated white paper, and the back side is covered with a polypropylene foil. The tiles have a washable surface and are maintained according to DTU 58-1. They are suitable for humid rooms within the food and health sectors.

Danotiles are particularly suitable for hospital rooms and other premises with high risk of infections (zone 4 according to NF EN 14698-1). Danotiles meet in fact all the relevant requirements: ISO 5, CP 10 and B10. These classifications have been achieved subsequent to specific tests at an external laboratory and in accordance with NF S 90-351 and ISO 14644-1. The details are given on page 20 regarding the contamination with microorganisms.

Knauf Danoline Danotiles are resistant to humidity of up to 95% at 25°C.

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*)

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Consumption of natural energy resources								
Wood	kg	0.00312	1.22 E-07	5.04 E-11	0	7.44 E-10	0.00312	0.156
Coal	kg	0.00614	2.27 E-05	8.80 E-09	0	1.30 E-07	0.00616	0.308
Lignite	kg	0.000113	4.68 E-05	4.60 E-10	0	6.80 E-09	0.000160	0.00801
Natural Gas	kg	0.0149	0.000145	2.22 E-07	0	3.28 E-06	0.0151	0.754
Oil	kg	0.00612	0.00606	9.44 E-06	0	0.000139	0.0123	0.616
Uranium (U)	kg	2.58 E-07	2.24 E-09	4.92 E-12	0	7.26 E-11		
Etc.								
Energy Indicators								
Total Primary Energy	MJ	1.34	0.260	0.000404	0	0.00596	1.60	80.2
Renewable Energy	MJ	0.135	9.50 E-05	1.58 E-07	0	2.32 E-06	0.135	6.74
Non Renewable Energy	MJ	1.20	0.260	0.000404	0	0.00596	1.47	73.4
Manufacturing energy	MJ	1.12	0.260	0.000404	0	0.00596	1.38	69.2
Material energy	MJ	0.220	-5.39 E-05	1.40 E-09	0	2.06 E-08	0.220	11.0
Electricity	kWh	0.0553	0.000216	2.94 E-07	0	4.34 E-06	0.0555	2.78

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)

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Antimony (Sb)	kg	0.00 E+00	0	0	0	0	0	0
Silver (Ag)	kg	9.96 E-11	9.20 E-13	1.41 E-15	0	2.08 E-14		
Clay	kg	9.16 E-05	2.44 E-07	4.16 E-10	0	6.14 E-09	9.18 E-05	0.00459
Arsenic (As)	kg	0.00 E+00	0	0	0	0	0	0
Bauxite (Al_2O_3)	kg	2.56 E-06	1.77 E-07	2.76 E-10	0	4.06 E-09		
Bentonite	kg	2.13 E-06	1.79 E-08	2.74 E-11	0	4.04 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	0.000198	1.55 E-06	2.60 E-09	0	3.82 E-08	0.000200	0.0100
Sodium carbonate (Na_2CO_3)	kg	0.00 E+00	0	0	0	0	0	0
Potassium chloride (KCl)	kg	3.81 E-05	6.34 E-11	3.12 E-13	0	4.60 E-12	3.81 E-05	0.00191
Sodium chloride (NaCl)	kg	1.28 E-05	8.34 E-07	1.29 E-09	0	1.90 E-08		
Chromium (Cr)	kg	1.68 E-08	3.64 E-11	5.58 E-14	0	8.22 E-13		
Cobalt (Co)	kg	0.00 E+00	0	0	0	0	0	0
Copper (Cu)	kg	2.00 E-08	1.85 E-10	2.84 E-13	0	4.18 E-12		
Dolomite	kg	8.26 E-08	1.64 E-15	8.06 E-18	0	1.19 E-16		
Tin (Sn)	kg	0.00 E+00	0	0	0	0	0	0
Feldspar	kg	4.40 E-10	0	0	0	0		
Iron (Fe)	kg	6.89 E-05	5.86 E-07	9.26 E-10	0	1.37 E-08	6.95 E-05	0.00347
Fluorite (CaF_2)	kg	1.29 E-08	0	0	0	0		
Gravel	kg	4.12 E-06	4.47 E-06	6.86 E-09	0	1.01 E-07		
Lithium (Li)	kg	0.00 E+00	0	0	0	0	0	0
Kaolin (Al_2O_3, $2SiO_2$,$2H_2O$)	kg	0.000179	0	0	0	0	0.000179	0.00896
Magnesium (Mg)	kg	3.20 E-13	0	0	0	0		
Manganese (Mn)	kg	2.30 E-09	2.12 E-11	3.24 E-14	0	4.80 E-13		
Mercury (Hg)	kg	4.38 E-10	0	0	0	0		
Molybdenum (Mo)	kg	0.00 E+00	0	0	0	0	0	0
Nickel (Ni)	kg	1.78 E-09	1.23 E-11	1.89 E-14	0	2.78 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	1.42 E-08	5.80 E-11	8.86 E-14	0	1.31 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	
Flow							Per annuity	TLC
Rutile (TiO_2)	kg	0.00 E+00	0	0	0	0	0	0
Sand	kg	1.50 E-06	9.70 E-08	2.08 E-10	0	3.08 E-09		
Silica (SiO_2)	kg	0.000104	0	0	0	0	0.000104	0.00520
Sulphur (S)	kg	3.66 E-06	2.80 E-12	1.38 E-14	0	2.04 E-13		
Barium Sulphate ($Ba SO_4$)	kg	2.05 E-05	1.90 E-07	2.90 E-10	0	4.28 E-09	2.07 E-05	0.00104
Titanium (Ti)	kg	2.64 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	5.94 E-10	1.35 E-12	2.06 E-15	0	3.04 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	0.00179	9.92 E-06	1.54 E-08	0	2.27 E-07	0.00180	0.0902
Gypsum	kg	0.0505	3.28 E-08	5.02 E-11	0	0	0.0505	2.53

Comments concerning the consumption of non- energy natural resources

The main raw material of Knauf Danoline Danotiles 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 125 g. This represents less than 2% of the total Functional Unit of this data sheet of 6776g.

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

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Water: Lake	litre	0.00 E+00	0	0	0	0	0	0
Sea water:	litre	0.000443	1.74 E-11	8.54 E-14	0	1.26 E-12	0.000443	0.0221
Water : Ground water	litre	2.04 E-07	8.58 E-14	4.22 E-16	0	6.22 E-15		
Water : Unspecified origin	litre	0.229	0.0252	3.93 E-05	0	0.000579	0.255	12.7
Water: River	litre	0.000383	1.62 E-13	7.96 E-16	0	1.17 E-14	0.000383	0.0192
Drink water (network)	litre	0.0598	3.74 E-09	1.84 E-11	0	2.72 E-10	0.0598	2.99
Water consumed (total)	litre	0.289	0.0252	3.93 E-05	0	0.000579	0.315	15.8
Etc.	litre							

Commentary concerning water consumption (sampling):

Water consumption across the lifespan is equal to 15.8 litres, of which more that 94% is consumed at the production stage.

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

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Recovered Energy	MJ	0.00 E+00	0	0	0	0	0	0
Recovered materials: Total	kg	0.0710	5.04 E-06	7.82 E-09	0	1.15 E-07	0.0710	3.55
Recovered materials: Steel	kg	1.93 E-05	5.04 E-06	7.82 E-09	0	1.15 E-07	2.45 E-05	0.00122
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	0.00964	0	0	0	0	0.00964	0.482
Recovered materials: Plastic	kg	0.00141	0	0	0	0	0.00141	0.0706
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	0.0600	0	0	0	0	0.0600	3.00
Other recovered materials:	kg	0.00 E+00	0	0	0	0	0	0

Comments concerning energy and recovered material

The main raw material inKnauf 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 Danotiles requires 3550g of recovered materials. The Functional Unit of this data sheet being 6776g, the recovered materials represent more than 50% 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 Danotiles (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)

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	**TLC**
Hydrocarbons (unspecified)	g	0.0162	4.03 E-06	6.38 E-09	0	9.40 E-08		
Hydrocarbons (unspecified, excluding methane)	g	0.0634	0.0690	0.000107	0	0.00158	0.134	6.70
PAH (unspecified)	g	6.83 E-06	8.48 E-08	1.17 E-10	0	1.73 E-09		
Methane (CH_4)	g	0.0816	0.0303	4.68 E-05	0	0.000690	0.113	5.63
Volatile organic compounds (i.e. acetone, acetate, etc.)	g	8.77 E-05	0	0	0	0		
Carbon Dioxide (CO_2)	kg	0.0609	0.0198	3.07 E-05	0	0.000453	0.0812	4.06
Carbon monoxide (CO)	g	0.0355	0.0527	7.95 E-05	0	0.00117	0.0895	4.47
Nitrogen Oxides (NOx as NO_2)	g	0.121	0.234	0.000364	0	0.00537	0.360	18.0
Nitrous Oxide	g	0.000874	0.00254	3.96 E-06	0	5.84 E-05		
Ammonia (NH_3)	g	0.00351	2.20 E-07	2.64 E-10	0	0		
Dust (unspecified)	g	0.0183	0.0135	2.10 E-05	0	0.000310	0.0321	1.61
Sulphur oxides (SOx as SO_2)	g	0.119	0.00878	1.34 E-05	0	0.000197	0.128	6.42
Hydrogen sulphide (H_2S)	g	0.000218	2.34 E-06	2.92 E-09	0	4.30 E-08		
Hydrogen cyanide (HCN)	g	1.74 E-06	1.19 E-09	6.00 E-13	0	8.84 E-12		
Phosphoric acid (H3PO4)	g	0.00 E+00	0	0	0	0	0	0
Organic chlorinated compounds (as Cl)	g	1.12 E-06	1.14 E-14	5.61 E-17	0	8.28 E-16		
Hydrochloric acid (HCl)	g	0.000844	3.13 E-05	2.24 E-08	0	3.30 E-07		
Inorganic chlorinated compounds (as Cl)	g	2.19 E-06	6.15 E-12	2.90 E-14	0	4.28 E-13		
Unspecified chlorinated compounds (Cl)	g	4.34 E-07	1.59 E-12	7.82 E-15	0	1.15 E-13		

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	**TLC**
Fluorinated organic compounds (in F)	g	5.49 E-07	1.23 E-06	1.92 E-09	0	2.84 E-08		
Inorganic fluorinated compounds (in F)	g	9.04 E-05	1.81 E-06	1.83 E-09	0	2.70 E-08		
Halogenated compounds (unspecified)	g	1.99 E-05	1.54 E-07	3.27 E-11	0	4.83 E-10		
Unspecified fluorinated compounds (as F)	g	0.00 E+00	0	0	0	0	0	0
Metals (unspecified)	g	0.000244	2.56 E-05	1.25 E-08	0	1.85 E-07		
Antimony and its compounds (as Sb)	g	4.94 E-07	3.02 E-08	2.56 E-13	0	3.78 E-12		
Arsenic and its compounds (as As)	g	2.22 E-06	1.05 E-07	1.42 E-10	0	2.10 E-09		
Cadmium and its compounds (as Cd)	g	1.06 E-06	5.06 E-07	7.86 E-10	0	1.16 E-08		
Chromium and its compounds (as Cr)	g	1.18 E-06	1.47 E-07	1.78 E-10	0	2.64 E-09		
Cobalt and its compounds (as Co)	g	7.94 E-07	2.50 E-07	3.48 E-10	0	5.14 E-09		
Copper and its compounds (as Cu)	g	1.71 E-06	3.62 E-07	5.26 E-10	0	7.76 E-09		
Tin and its compounds (as Sn)	g	7.76 E-09	1.50 E-09	8.36 E-14	0	1.23 E-12		
Manganese and its compounds (as Mn)	g	3.05 E-06	5.10 E-08	4.26 E-11	0	6.30 E-10		
Mercury and its compounds (as Hg)	g	1.85 E-06	1.30 E-08	1.80 E-11	0	2.64 E-10		
Nickel and its compounds (as Ni)	g	2.48 E-05	4.51 E-06	6.98 E-09	0	1.03 E-07		
Lead and its compounds (as Pb)	g	4.12 E-06	1.69 E-06	2.56 E-09	0	3.78 E-08		
Selenium and its compounds (as Se)	g	6.60 E-07	1.07 E-07	1.44 E-10	0	2.12 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	8.11 E-05	0.000761	1.19 E-06	0	1.75 E-05		
Vanadium and its compounds (V)	g	7.92 E-05	1.80 E-05	2.78 E-08	0	4.10 E-07		
Silicon and its compounds (as Si)	g	0.000205	4.78 E-05	2.04 E-09	0	3.00 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 99%, carbon dioxide.

Other emissions superior to 1g and totalling less than 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 4.09 kg of CO2 emitted throughout the TLC are mainly emitted during the production stage (75%), of which 53% are directly related to the production site and during transport (24%).

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

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
COD (Chemical Oxygen Demand)	g	0.0216	0.000895	0.00440	0	0.0648	0.0918	4.59
BOD5 (Biochemical Oxygen Demand at 5 days)	g	0.00420	2.71 E-05	0.00105	0	0.0156	0.0208	1.04
Suspended solids (SS)	g	0.0196	0.000151	0.00123	0	0.0182	0.0391	1.96
Cyanide (CN-)	g	3.25 E-06	1.30 E-06	1.99 E-09	0	2.94 E-08		
AOX (halogenated absorbable organic compounds)	g	4.13 E-05	1.26 E-06	3.52 E-05	0	0.000519	0.000596	0.0298
Hydrocarbons (unspecified)	g	0.00935	0.00918	0.000369	0	0.00545	0.0243	1.22
Nitrogen compounds (N)	g	0.000598	0.000837	0.00106	0	0.0156	0.0181	0.903
Phosphorus compounds (P)	g	0.00441	2.49 E-06	3.88 E-09	0	5.71 E-08	0.00441	0.221
Fluorinated organic compounds (in F)	g	0.0122	6.31 E-06	0.000527	0	0.00778	0.0205	1.02
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	3.28 E-06	1.40 E-08	2.14 E-11	0	3.17 E-10		
Inorganic chlorinated compounds (as Cl)	g	0.278	0.308	0.000479	0	0.00707	0.593	29.7
Unspecified chlorinated compounds (Cl)	g	0.000599	5.45 E-06	8.34 E-09	0	1.23 E-07	0.000605	0.0302
PAH (unspecified)	g	3.34 E-06	7.74 E-06	1.21 E-08	0	1.78 E-07		
Metals (unspecified)	g	0.00627	0.00515	0.000711	0	0.0105	0.0226	1.13

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Aluminium and its compounds (as Al)	g	0.000185	3.21 E-06	5.38 E-09	0	7.94 E-08		
Arsenic and its compounds (as As)	g	2.13 E-06	2.50 E-07	3.92 E-10	0	5.78 E-09		
Cadmium and its compounds (as Cd)	g	6.16 E-07	4.18 E-07	6.50 E-10	0	9.60 E-09		
Chromium and its compounds (as Cr)	g	2.77 E-06	2.54 E-08	3.88 E-11	0	5.74 E-10		
Copper and its compounds (as Cu)	g	2.74 E-06	8.50 E-07	1.32 E-09	0	1.95 E-08		
Tin and its compounds (as Sn)	g	8.68 E-10	1.49 E-11	3.46 E-14	0	5.10 E-13		
Iron and its compounds (as Fe)	g	0.000305	0.000149	1.16 E-07	0	1.71 E-06	0.000456	0.0228
Mercury and its compounds (as Hg)	g	1.70 E-06	2.48 E-09	3.86 E-12	0	5.70 E-11		
Nickel and its compounds (as Ni)	g	3.11 E-06	1.45 E-06	2.26 E-09	0	3.32 E-08		
Lead and its compounds (as Pb)	g	6.20 E-06	3.06 E-07	5.04 E-10	0	7.42 E-09		
Zinc and its compounds (as Zn)	g	7.91 E-06	2.52 E-06	3.94 E-09	0	5.80 E-08		
Water released	Litre	0.0449	0.00121	1.60 E-06	0	2.36 E-05	0.0461	2.31
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 70% of the chemical oxygen demand and more than 74% of the 5 day Biochemical Oxygen Demand.

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

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Arsenic and its compounds (as As)	g	1.05 E-07	9.68 E-10	1.48 E-12	0	2.18 E-11		
Biocides[a]	g	0.00 E+00	0	0	0	0	0	0
Cadmium and its compounds (as Cd)	g	4.74 E-11	4.38 E-13	6.70 E-16	0	9.88 E-15		
Chromium and its compounds (as Cr)	g	1.31 E-06	1.21 E-08	1.85 E-11	0	2.74 E-10	1.32 E-06	6.61 E-05
Copper and its compounds (as Cu)	g	2.40 E-10	2.22 E-12	3.40 E-15	0	5.02 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	0.000523	4.83 E-06	7.40 E-09	0	1.09 E-07	0.000528	0.0264
Lead and its compounds (as Pb)	g	1.10 E-09	1.02 E-11	1.55 E-14	0	2.30 E-13		
Mercury and its compounds (as Hg)	g	8.72 E-12	8.06 E-14	1.23 E-16	0	1.82 E-15		
Nickel and its compounds (as Ni)	g	3.62 E-10	3.34 E-12	5.10 E-15	0	7.52 E-14		
Zinc and its compounds (as Zn)	g	3.93 E-06	3.64 E-08	5.56 E-11	0	8.20 E-10	3.97 E-06	0.000199
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)

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Recovered Energy	MJ	0.00 E+00	0	0	0	0	0	0
Recovered materials: Total	kg	0.00974	1.16 E-07	1.64 E-10	0	2.41 E-09	0.00974	0.487
Recovered materials: Steel	kg	1.35 E-07	1.42 E-09	3.72 E-12	0	5.48 E-11	1.37 E-07	6.84 E-06
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	0.00277	0	0	0	0	0.00277	0.138
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	0.00697	1.14 E-07	1.60 E-10	0	2.36 E-09	0.00697	0.349
Etc.	...							

Eliminated waste (NF P 01-010 § 5.3)

	Units	Production	Transport	Installation	Period of use	End of use	Total useful life	
Flow							Per annuity	TLC
Hazardous Waste	kg	0.00126	8.55 E-06	1.02 E-08	0	1.50 E-07	0.00127	0.0634
Non-hazardous waste	kg	0.00395	4.53 E-06	0.0165	0	0.122	0.142	7.12
Inert waste	kg	0.00222	1.78 E-05	1.96 E-08	0	2.90 E-07	0.00223	0.112
Radioactive Waste	kg	2.37 E-06	4.23 E-06	6.61 E-09	0	9.74 E-08		
Etc.	kg							

Comments regarding production and arrangements for waste management

Waste production
The end of use phase alone accounts for over 85% 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 (see chapter 2.1.4). 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 Danotiles 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	1.60	MJ/UF	80.2	MJ
	Renewable Energy	0.135	MJ/UF	6.74	MJ
	Non Renewable Energy	1.47	MJ/UF	73.4	MJ
2	Depletion of resources (ADP)	0.000614	kg antimony equivalent (Sb)/UF	0.0307	kg antimony equivalent (Sb)
3	Total water consumption	0.315	litre/UF	15.8	litre
4	Solid Waste				
	Waste recovery (total)	0.00974	kg/UF	0.487	kg
	Waste disposal:				
	Hazardous Waste	0.00127	kg/UF	0.0634	kg
	Non-hazardous waste	0.142	kg/UF	7.12	kg
	Inert waste	0.00223	kg/UF	0.112	kg
	Radioactive Waste	6.70 E-06	kg/UF	0.000335	kg
5	Climate Change	0.0842	kg equivalent CO2/UF	4.21	kg equivalent CO2
6	Air Acidification	0.000388	kg equivalent SO2/UF	0.0194	kg equivalent SO2
7	Air pollution	4.72	$m^{3/}$UF	236	m^3
8	Water pollution	0.0372	m^3/UF	1.86	m^3
9	Destruction of the stratospheric ozone layer	0	kg CFC equivalent R11/UF	0	kg CFC equivalent R11
10	Photochemical ozone formation	0.0000601	kg ethylene equivalent /UF	0.00301	kg ethylene equivalent
	Other indicator (not within the NF P01-010 standard)				
11	Eutrophication	0.00911	g equivalent PO_4^{2-}/UF	0.456	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 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.

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	Sanitary quality of interior spaces	§ 4.1.1	
Health Risks	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 Danotiles 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 gyspum and gyspum recycled from plasterboards. The FGD gyspum 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

(*)The activity concentration index I combines the activity of radionuclides to reflect their respective energies:
I = [CRa226 / 300 Bqkg^{-1}] + [CTh232 / 200 Bqkg^{-1}] + [CK40 / 3000 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:
^{226}Ra : 40 Bqkg^{-1}
^{232}Th : 40 Bqkg^{-1}
^{40}K : 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 Danotiles 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
Danotiles have been tested by the Céra-Labo laboratory in France. According to the reports 903034 Knauf/1 and 903034 Knauf/2, Danotiles achieve following classifications:

- ISO 5 according to ISO 14644-1 (or Class 100 according to US FS 209 D) defining the maximum number of particles allowed following the size and the class of the particle.
- CP 10 according to NF S 90-351 defining the kinetic class of the particular decontamination.
- B10 according to NF S 90-351 defining the class of bacteriological cleanness.

These results are considered excellent as Danotiles meet the acceptance criteria for use in hospital environments and high infection risk zones (zone 4 according to NF EN 14698-1). Our tiles are therefore suitable for neonatal units, sterile operating rooms or high security microbiological labs.

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. However, the determination of the class for bacteriological cleanness is a satisfactory response.

In fact, the tiles have been contaminated with microorganisms in large quantities. After 3 to 7 days of incubation according to the bacteria strain used, the remaining microorganisms are counted as number of units forming colony per m³ of air.

Our tiles have been exposed to 5 different bacteria strains: Acinobacter baumannii, Baciillus Cereus, Streptococcus pneumoniae, Escherichia Coli, Staphylococcus aureus.

The classification B10 means that at the end of the test less than 10 units forming colony per m³ of air existed. As mentioned, this result is considered excellent as it constitutes one of the criteria necessary to meet the requirements for the high risk infection zones (zone 4).

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 Danotiles 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 Danotiles are plasterboard and as such, have a thermal conductivity equal to 0.25 W.m-1.K-1.

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

The acoustic properties of Knauf Danoline Danotiles have not been measured.

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

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 equals 77.7%. 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 Danotiles are not insulating products. Their thermal conductivity is 0.25 Wm-1.K-1.

Water management

Not applicable

Upkeep and maintenance

Knauf Danoline Danotiles are designed as washable ceiling tiles. They can therefore be cleaned with frequencies set by the client, and with high pressure cleaner (up to 80 bars with a distance of 30 cm and with an angle of min. 30°).

Economic Concerns

Not applicable

Overall Environmental Policy

Natural Resources

As specified earlier (see chapter 2.1.4), more than 50% of the resources consumed are recycled materials. In fact, the amount of recovered materials is 3550g, compared to the 6776g 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 – 125g or less than 2% 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 Danotiles 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. 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 Danotiles.

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:
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. Danotiles are designed as washable ceiling tiles. 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 98.8%. 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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