Below the data sources per process are described. Information on suppliers is not published in this list.

P1: Production of 2,5 mm Marmoleum/Artoleum at FORBO-KROMMENIE B.V. (in M2)
Conversion of kg linoleum in m^2 linoleum and adding packaging and the additional "general" energy use and waste production
- data sources: annex 1: flowsheet linoleum production, 2 and 4 Forbo-Krommenie B.V.
- waste = not recycled packaging and domestic waste (annex 1: flowsheet linoleum production) => ETH-848: abfall in inertstoffdeponie

P2: Other yearly use of steam and electricity at Forbo-Krommenie B.V.
General energy use not related to one specific process in Forbo-Krommenie B.V.
- data electricity: annex 5 Forbo-Krommenie B.V. =14%; – 4% to recycling (Keuken & de Koning, 1997) = 10%
- data steam: Keuken & de Koning, 1997 (=soda inst. + heating buildings)

P3: Recycling scrap linoleum
Converting scrap linoleum from trimming at Forbo-Krommenie B.V. into reusable scrap:
- data electricity: Keuken & de Koning, 1997 = 4%, total use annex 5 Forbo-Krommenie B.V., see also P2
- data emission dust/particles: annex 6 Forbo-Krommenie B.V.
- remaining data: annex 1: flowsheet linoleum production, Forbo-Krommenie B.V.
- remaining linoleum waste is incinerated

P4 & P5: Production linoleum granulate lower & upper layer
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total granulate production by Forbo-Krommenie B.V. in 1998
- data emission particles/dust and NMVOC: annex 6 Forbo-Krommenie B.V.
- data electricity: annex 5 Forbo-Krommenie B.V.
- remaining data: annex 1: flowsheet linoleum production, and 4 Forbo-Krommenie B.V.; see for calculations exel-file "berekening benodigde hoev grondstof"; In this file, the amounts needed for a certain type of linoleum are calculated based on the total inflow in 1998 (annex 1: flowsheet linoleum production) and the ratio between the materials in the final product (annex 4)

P6: Esterification of tall oil
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total tall oil production by Forbo-Krommenie B.V. in 1998
- data electricity and use of gas: annex 5 Forbo-Krommenie B.V.
- data emission dust/particles: annex 6 Forbo-Krommenie B.V.
- remaining data: annex 1 Forbo-Krommenie B.V.

P7: Production of linoleum cement (oxidation)
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total cement production by Forbo-Krommenie B.V. in 1998
- data electricity and use of gas: annex 5 Forbo-Krommenie B.V.
- data emission dust/particles and NMVOC: annex 6 Forbo-Krommenie B.V.
- data steam use: Keuken & de Koning, 1997
- remaining data: annex 1 Forbo-Krommenie B.V.
- waste (annex 1) => ETH-848: abfall in inertstoffdeponie

P8: Kalandering linoleum
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total flow of linoleum from the kalanders at Forbo-Krommenie B.V. in 1998
- data electricity use: annex 5 Forbo-Krommenie B.V.
- data emission NMVOC: annex 6 Forbo-Krommenie B.V.
- data steam use: Keuken & de Koning, 1997

- remaining: annex 1 and 4 Forbo-Krommenie B.V.; see for calculations exel-file "berekening benodigde hoev grondstof"; In this file, the amounts needed for a certain type of linoleum are calculated based on the total inflow in 1998 (annex 1) and the ratio between the materials in the final product (annex 4)
- Granulate waste and jute waste are treated together as linoleum waste. This waste is burned and treated as "linoleum waste"(although the ration between jute and granulate is somewhat higher than the ratio jute/cement in the final product (annex 4)).

P9: Production of steam at Forbo-Krommenie B.V.
Proces taking place at Forbo-Krommenie B.V.-Krommenie. Reference amount is all steam produced and used by Forbo-Krommenie B.V. (100%) in 1998. Gas input is the gas use of the steam kettles
- data gas use:
  - ammount: annex 5 Forbo-Krommenie B.V.
  - process: ETH-427: Erdgas in Industriefeuerung >100kW Euro (aggregated process production and use of gas)
- data emission NO_x: annex 6 Forbo-Krommenie B.V.

P10: Electricity use at Forbo-Krommenie B.V.
Reference amount is all electricity used by Forbo-Krommenie B.V. (100%) in 1998. Input is electricity from the Dutch net.
- data electricity use:
  - amount: annex 5 Forbo-Krommenie B.V.
  - ETH-99: Strom Mittelspannung - Bezug in NL Import

P11: Drying of 2,5 mm Marmoleum/Artoleum
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total amount of linoleum from the drying chambers at Forbo-Krommenie B.V. in 1998
- data electricity and use of gas: annex 5 Forbo-Krommenie B.V.
- data steam use: Keuken & de Koning, 1997
- data emission NMVOC: annex 6 Forbo-Krommenie B.V.
- remaining data: annex 1 Forbo-Krommenie B.V.

P12: Trimming of 2,5 mm Marmoleum/Artoleum
Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total amount of trimmed linoleum at Forbo-Krommenie B.V. in 1998
- data electricity use: annex 5 Forbo-Krommenie B.V.
- data steam use: Keuken & de Koning, 1997
- data emission NMVOC: annex 6 Forbo-Krommenie B.V. databronnen:
- data lacquer: annex 1 and 4 Forbo-Krommenie B.V.; see for calculations exel-file "berekening benodigde hoev grondstof"; In this file, the amounts needed for a certain type of linoleum are calculated based on the total inflow in 1998 (annex 1) and the ratio between the materials in the final product (annex 4)
- remaining data: annex 1 Forbo-Krommenie B.V.
- waste = remaining lacquer => ETH-849: abfall in reststoffdeponie

P13: Production + transport to Forbo-Krommenie B.V. of wood flour (milling)
Milling and transportation from the mill to Forbo-Krommenie B.V.. Reference amount is 1 kg wood flower
- ratio between suppliers to Forbo-Krommenie B.V. known
- all data received from suppliers via Forbo-Krommenie B.V.
- data use of electricity:
  - amount: weighted average suppliers
  - process: ETH-102: Strom Mittelspannung - Bezug in UCPTE
- data transportation distance: weighted average distance from plant suppliers to Forbo-Krommenie B.V.
- ratio raw wood/wood reminders: information from one supplier only

P14 & P15: Sawing of raw wood
- ratio between suppliers to Forbo-Krommenie B.V. known

- allocation between wood remainders and production wood is based on data on economic value provided by Forbo-Krommenie B.V. (value produced wood remainders = 15%)
- all data received from suppliers via Forbo-Krommenie B.V.
- data electricity use: data form one supplier only
- ratio use production wood/wood remainders: data from one supplier only

P16: Forestry (production of wood)+ transport to mill
Production of wood + transportation to the sawmill
- ratio between suppliers to Forbo-Krommenie B.V. known
- all data received from suppliers via Forbo-Krommenie B.V.
- no fertiliser use (although one supplier mentions the use of P)
- data for use of diesel: date from one supplier only
- transportation distance forest to mill: weighted average suppliers

P17: Production of linseed oil and transport to Forbo-Krommenie B.V.
- ratio between suppliers to Forbo-Krommenie B.V. known
- allocation between linseed oil and linseed expellers is based on data on economic value provided by one supplier (price) and all suppliers (amount produced, all give the same produced amount per kg linseed; value produced inseed oil = 57%)
- all data received from suppliers via Forbo-Krommenie B.V.
- data use of gas:
    - amount: data from the largest provider for Forbo-Krommenie B.V.. In this case not the weighted average is chosen because the energy type of other supplier(s) is not known.
    - process: ETH-427: Erdgas in Industriefeuerung >100kW Euro (aggregated process production and use of gas)
- the amount linseed oil produced from 1 kg linseed: weighted average suppliers. All give the same amounts for linseed oil and expellers
- transport by inland freighter is based on a weighted average of suppliers of the transportation distance from plant to Forbo-Krommenie B.V. (=184.5e-3 tkm x 0.33) + the transportation distance from the harbour to the plant (= 154e-3 tkm).

P18: Growing of linseed
Worse case scenario for pesticide emissions: assumption all mentioned pesticides are used and all in the maximal dose.
- suppliers to Forbo-Krommenie B.V. known, ratio not known
- all data received from suppliers via Forbo-Krommenie B.V.
- transportation of seed by truck in India, by sea freighter and by inland freighter in Europa is based on the average distances of suppliers; transport by truck can also partly be done by train (Linora has a transportation distance in Europe of 0 km by inland freighter because they are situated in the harbour)
    - use of diesel: average suppliers (0.429 MJ & 1.74 MJ).
    - use of N- and P-fertiliser: average suppliersl
    - use of fertiliser S: one supplier (not accounted for, treated as datagap (S is not mentioned by other supplier(s)
- use of pesticides: herbicides: one supplier, insecticides: another supplier
    The amount used is the maximal amount in the worse case scenario (in P113 the best estimate for pesticide use is used, based on the assumption that on 20% of the fields one herbicide and one pesticide is used (based on e-mail supplier). The total amount used is seen as an emission. Division of the emissions over water/air/soil based on the MJP-G emission evaluation.
- emissions of NH3 and N2O to air are based on the assumption that 1 % of the applied fertiliser evaporates as NH3 and 1% as N2O to air (Välimaa & Stadig, 1998). The weights are adapted to the molecular weight of the substances. The emission of N to soil is based on the difference between the dose of N-fertiliser and the estimated amount harvested in the linseed minus the amount emitted to air.

P19: Transport, spinning and weaving of jute
Including all transportation of yarn and jute in India and Europe
- ratio between suppliers to Forbo-Krommenie B.V. known

- all data received from suppliers via Forbo-Krommenie B.V.
- data use of electricity for spinning: one supplier (these are the only data on spinning): 1.44 MJ
- data use of electricity for weaving: weighted average all suppliers who gave realistic information on this: 1MJ, unrealistic high value for electricity use was not used
- data use of gas for weaving: one supplier
- data use of oil for weaving: not known, therefore not included (some suppliers mention the use of oil but give no, or unrealistic high values)
- Transportation per sea freighter India-Rotterdam: one supplier (other companies give no data for transportation from India to Europe)
- Transportation in India per truck: one supplier 425 km (other companies give no data for transportation in India)
- Transportation in Europe per truck: 375 km (based on a weighted average of the transportation distances given by all suppliers
- re-usable jute waste 2%: two suppliers (both give the same value)
- other waste 1,5%: one supplier (based on a total waste of 3,5% of which 2% is re-usable, see before) => ETH-848: abfall in inertstoffdeponie
- use of starch, oil and salt: one supplier (this supplier gave besides answer to our questions also their environmental report, therefore there data are more complete than those of the other companies)

P20: Transport raw rosin from plantation, extraction and transport to Forbo-Krommenie B.V.
- all data received from suppliers via Forbo-Krommenie B.V.
- Ratio for suppliers not known, therefore unweighted averages are used
- allocation between linseed oil and linseed expellers is based on data on economic value provided by suppliers (both give approx. the same economic value: value produced gum rosin= 91%)
- transportation in Indonesia by truck: average of the figures of suppliers (very rough estimation
- transportation Amsterdam – Krommenie: 20 km
- average distance Indonesia – Amsterdam by sea freighter: summary data Forbo-Krommenie B.V. 1997 (1999 data not reliable)
- production of rosin and terpentine, input of raw rosin: twol suppliers 1999 (both give the same figures)
- use middle fuel oil: one supplier

P21: Mining of limestone
- data from only one supplier available (via Forbo-Krommenie B.V.)
- data sources: only use diesel:
- *alternative possibility: ETH, not tried because of lack of time*

P22: Grinding + transport of limestone
- data source: all data from one supplier (via Forbo-Krommenie B.V.)
- assumption: emission from particles are due to grinding
- waste => ETH-848: abfall in inertstoffdeponie
- assumption oil = middle fuel oil

P23 & 24: Transport of tall oil and paper
Based on the location of the only supplier for tall oil
- transport by truck, 125 km Rotterdam- Krommenie: estimation
- transport by sea freighter: supplier, 1999 (via Forbo-Krommenie B.V.)
- transport by train, supplier – harbour: supplier, 1999 (via Forbo-Krommenie B.V.)
- data on the production process of paper (and tall oil) from ETH (ETH-184), data from supplier seem not complete

P25, P26 & P27: Production of TiO$_2$
- data sources:
    - P25: PE Germany, these data are most complete because they are aggregated data including mining, transportation, energy use etc.
    - P26: sulphate process:
        - all data received from suppliers via Forbo-Krommenie B.V. (ratio known)
        - sulfuric acid and Ti-ore: weighted average suppliers

- use of gas, emissions NO_x, heavy metals & Tio_2: main supplier
- transport by truck & solid waste: one supplier
- transport Ti-ore very rough estimation (based on ore from Norway)
- P27, chloride process: data from one supplier (via Forbo-Krommenie B.V.)
- waste => ETH-848: abfall in inertstoffdeponie

P28: Burning Linoleum
- the production of usefull energy is substituted by electricity (ETH-99: Strom Mittelspannung - Bezug in NL Import).
- The exchange rate is assumed 0.4 MJ/MJ
- waste => ETH-848: abfall in inertstoffdeponie
- assumption: transportation distance to incinerator: 100 km.

P29: production of starch
- data source: Spin 1994
- *data not complete: date concerning the use of raw materials (potatos cereals) are lacking*
- *note the amounts of water emissions (sulphate as S, salt as CL⁻, etc.)*
- *data concerning waste are a rough estimation (mostly terra and slug)*

P30, 31, 120, 121 & 122: production lacquer, adhesives and maintenance products
- data sources: one supplier (via Forbo-Krommenie B.V.)
- data concerning the production of raw materials (additives, thickeners, solvents and wax-dispersions) are not available.
- assumtion 1 l product = 1 kg

chemical waste => ETH-849: abfall in reststoffdeponie

P32, 33, 34 & 37: Production of fertiliser
- aggregated data including transport
- data: Davis & Hagland, 1999
- assumption: emissions resulting from the use of energy carriers are included in Davis & Hagland, interventions related to the production of these energy carriers are not included, Therefor the related ETH-processes are added.
  energy content of diesel, oil and cole are from BINAS, weight oil and diesel from ETH.
- waste:
  - radioactive waste => ETH-631:radioactiver abfall in depot C
  - hazardous waste => abfall in reactor deponie (50% ETH-884: Kunststoffe in Reaktordeponie & 50% ETH-870: Holz in Reaktordeponie)
  - industrial waste => ETH-848: Abfaelle in Inertstoffdeponie
  - solid waste => ETH-848: Abfaelle in Inertstoffdeponie

P35: Linoleum installation (2,5 mm)
Inputs and outputs related to installation of linoleum
- assumption: 6% of the linoleum is wasted during installation (see Potting & Blok, 1993)
- waste = 6% linoleum + packaging + marmoweld (small fraction) => not burned but landfilled: ETH-848: Abfaelle in Inertstoffdeponie
- assumption: transportation distance = 100 km in NL (=0.29 tkm)
- use of adhesives and other product from suppliers (via Forbo-Krommenie B.V.)

P36: The use and maintenance of 1m2 linoleum for 20 years
- Maintenance and use of products is based on information from Forbo-Krommenie B.V.
- all linoleum is considered to be burned after 20 years

P38 –83 & 85: ETH-processes
datasource: ETH 1996
Transportation by truck is assumed to take place with 40t trucks

P84: Production of raw gum resin
Empty process, according to Forbo-Krommenie B.V., the harvesting of raw gum rosin is done mainly by hand.

P86 & P87: production of tall oil (and paper)
- allocation between those two products based on data on economic value provided by Forbo-Krommenie B.V.
- value produced tall oil= 1%

P88 –P90: Production of DouPol, InterClean & DuoClean
- data sources: one supplier (via Forbo-Krommenie B.V.)
- chemical waste = ETH-849: Abfaelle in Reststoffdeponie

P91: Translation NMVOC based on the emissions during stationary combustion
- data source: Hauschild & Wenzel (1998)

P92: growing of linseed (best estimate)
- See P18 for data
- assumption 20% of the fields one herbicide and one pesticide is used.

P93 –P96: Production of detergents
- Selection of three detergents
- Data from Stalmans *et al.* (1995)

P97-P103, P60, P137 & P141: Maintenance options for linoleum
- data for P97-P103: Forbo-Krommenie B.V.
- data for P137-P141: Forbo-Krommenie B.V.-Forshaga, Fax 9 July 1999.

P104: Production of Marmoweld
- data source: one supplier (via Forbo-Krommenie B.V.)
- chemical waste => ETH-849: Abfaelle in Reststoffdeponie

P105-P108: Production of ingredients for maintenance products, adhesive etc.
- data source:one supplier (via Forbo-Krommenie B.V.)
- chemical waste = ETH-849: Abfaelle in Reststoffdeponie
- solid waste = ETH-848: Abfaelle in Inertstoffdeponie

P109: Production of yarn
Empty process, according to Forbo-Krommenie B.V., the growing and harvesting of yarn is done mainly by hand

P110-P129: copies of ETH processes and NMVOC translation
These are needed to split the total system into four different stages: production of raw materials, production of linoleum at Forbo-Krommenie B.V., use and maintenance, disposal

P130: Translation NMVOC based on the emissions during solvent use
- data source: Hauschild & Wenzel (1998)
- used as an estimation for the emission of NMVOC at Forbo-Krommenie B.V.

P131: SWEDISH SCENARIO: The use and maintenance of 1m2 2,0 mm linoleum for 20 years and the disposal
Differences with P36 based on the Swedisch maintenance (information Forbo-Krommenie B.V.-Forshaga, Fax 9 July 1999) and the difference in weight between 2, 5 mm and 2,0 mm linoleum

P132: SWEDISH SCENARIO: linoleum installation (2,0 mm)
Difference with P35 are due to the transportation distance and the difference in weight between 2, 5 mm and 2,0 mm linoleum
- assumption transportation to Sweden: 1000 km by freighter and 1000 km by truck

P133-P136: SWEDISH SCENARIO:
Difference with P1, P8, P11 and P12 are due to the difference in weight and relative composition between 2, 5 mm and 2,0 mm linoleum see annex 4 and see for calculations exel-file "berekening benodigde hoev grondstof"

P142-P148: Scenario Cork- linoleum
Difference with P4, P5, P8, P11, P12, P35 & P36 are due to the difference in weight and relative composition between 2, 5 mm and Cork-linoleum see annex 4 and see for calculations exel-file."berekening benodigde hoev grondstof"

P149: Seaving cork
Reference flow is total amount of cork sieved in 1998 at Forbo-Krommenie B.V.
- data electricity use: annex 5 Forbo-Krommenie B.V.
- data emission dust: annex 6 Forbo-Krommenie B.V.

P150: transportation of cork to mill, milling and transportation to Forbo-Krommenie B.V. of cork granulate
- data from the main supplier
- Note: cork granulate is a by-product of corks used for bottles etc. However nothing is known of the production of this main product.
- Data on energy use from supplier (via Forbo-Krommenie B.V.)
  It is assumed that the energy mentioned by supplier used for drying is all used for the production of the granulate and not for corks, as these are not mentioned by the suppliers and the cork granulate is explicitly mentioned as the product by supplier.
- The transportation of the cork granulate to the Portuguese harbour and to Forbo-Krommenie B.V. is based on the average values from all suppliers (via Forbo-Krommenie B.V.). + 60 km for transportation in the Netherlands (estimation)
- The transportation from the woods to the mill is "allocated" based on mass (assuming that 1 kg cork from the woods results in corks and cork granulate without much waste), as economic values of corks and cork-granulate is not known. Distance between the woods and the mill is based on the average data from all suppliers (via Forbo-Krommenie B.V.).

P151-P153: SCENARIO USA
- an assumption is made about the extra transportation distance per boat and truck

P154-P162: SCENARIO NO TALL OIL
Production of linoleum cement (oxidation) without tall oil. Process taking place at Forbo-Krommenie B.V.-Krommenie. The reference amount is de total cement production by Forbo-Krommenie B.V. in 1998
- data on ratio linseed oil / resin: annex 4 and 4a Forbo-Krommenie B.V.
- data electricity and use of gas: annex 5 Forbo-Krommenie B.V.
- data emission dust/particles and NMVOC: annex 6 Forbo-Krommenie B.V.
- data steam use: Keuken & de Koning, 1997
- remaining data: annex 1 Forbo-Krommenie B.V.

P163-P164: Dutch 2.0 mm
- data from the production of 2.0 mm (Swedish scenario) combined with installation, use and, maintenance in the Netherlands

P164-P166: Production of Yellow and Red pigment
- Aggregated data on the production of two pigments, data from CE

P167: Production of organic chemical
- Transportation by truck based on the assumption that the distance from production site to user is 100 km
- other data from ETH: production of organic chemical

P168: Production of capital goods
- estimation of the yearly investments in capital goods of Forbo-Krommenie B.V. of the yearly production in fl.
- emissions and environmental inputs per 1e6 $ from Carnegie Mellon. internet-site
- hazardous waste: => abfall in reactor deponie (50% ETH-884: Kunststoffe in Reaktordeponie & 50% ETH-870: Holz in Reaktordeponie)
- conversion $ => fl. based on the values of 25/4/2000

Annex 1 Forbo-Krommenie B.V.: Flowsheet linoleum production 1998
Annex 2 Forbo-Krommenie B.V.: mass balance linoleum production
Annex 4 Forbo-Krommenie B.V.: composition linoleum 2.0 mm, 2.5 mm, linoleum without tall oil, cork-linoleum and bulletin board
Annex 5 Forbo-Krommenie B.V.: Energy use Forbo-Krommenie B.V.: 1998
Annex 6 Forbo-Krommenie B.V.: Emissions to air Forbo-Krommenie B.V. 1998