EUROPEAN ECOLABEL

Project for application to Paints and Varnishes

Volume 5

RESULTS OF THE EXTENSION PHASE

The Life Cycle, Analysis of eleven indoors decorative paints

(drawn up December 23, 1993)

Pilot project carried out by the
ECOBILAN COMPANY
for the Ministry of Envirownent
in France

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I. INTRODUCTION

This report corresponds to the extension phase of the work drawn by the French company ECOBILAN in the framework of the European Ecolabel for Paints and Varnishes.

This extension phase is included in the general methodology proposed by ECOBILAN and the French Ministry of Environment in the previous reports and working documents (cf. working documents n°G and 7 for instance). The following framed section is a summary of this methodology.

The methodology to determine ecolabelling criteria may be divided into five steps:

1) Products and market survey: this step aims at proposing a typology of products, with particular reference to product use, and taking account of the various aspects likely to introduce a variability into the results of the Life Cycle Inventories. In particular. it is necessary to define the functional unit to carry out the inventories.

2) Selection of specific products deemed representative of the market and of environmental issues, for carrying out Life Cycle Inventories in step 3.

3) Carrying out of life cycle inventories of the representative selected products: a materials and energy balance is made for the complete life cycle of each selected product from data collected on actual sites.

4) Interpretation of the life cycle inventories results in terms of main environmental problems, using the currently available scientific knowledge.
   This step is submitted for consideration to the various interested parties (industrialists, ecologists, consumers, public authorities, scientists) who may debate interpretation methods and consider the specific aspects of the ecological problems 4
   related to these products.

5) Definition of ecolabelling criteria and thresholds, based on the results of the life cycle inventories and their interpretation. These criteria are discussed by various interested parties. At this stage, technology and economic aspects are taken into account.

This study procedure is iterative, as the different parties concerned may request a complementary study, either to study new products or new technologies.

In case of Paints and Varnishes, the studied group is: indoors decorative paints and varnishes for walls and ceilings.

Life Cycle Inventories have been carried out first for four real paints: two water-borne paints and two solvent-borne paints.

The last step, *Determination* of *ecolabelling criteria and thresholds,* is now under process.

In the same time, industrialists asked ECOBILAN to carry out an extension of the work. Two kinds of extension can be distinguished'

- the first kind consisted in clarifying the 'darkness area' viz. validating and making more precise some data concerning the inventories already realised for the first four paints;

- the second kind consisted in obtaining information about what is meant to be more 'environmentally friendly'; the way was to enlarge the scope of the study to other products in the group, other constituents, other processes even if they only represent a small part of the European market.

  Therefore, ECOBILAN has carried out ecobalances for seven other paints.

The purpose of this report is:

- to explain the methodology used to carry out the ecobalances, completed in respect with the SETAC' methodology and guidelines;
- to give the detailed inventories for the eleven studied paints;
- to present the results and how they can be used in the determination of ecolabelling criteria.

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Society of Environmental Toxicology and Chemistry Ecobilan, as a member of the SETAC Europe board, is deeply involved in the elaboration and publication of precise methodological rules at the expert level inside the different SETAC workshops.

II. DESCRIPTION OF THE STUDIED PRODUCTS

The eleven selected products are **white decorative indoors paints for walls and ceilings.**

They are manufactured by multinational companies in Europe.

These products are representative of:

- either the European market (paints A to J),
- and/or environmental issues (paints J and K).

Due to confidentiality reasons, the paints are mentioned with letters from A to K, so that the name of the companies and the commercial name of the products are kept secret.

The main characteristics of the eleven products are presented in the following table

Paint	Aspect	Vehicle	Resin	Solvent
A	mat	water	styrene-acrylic	-
B	gloss	water	styrene-acrylic	-
C	semi-gloss	solvent	alkyd	white spirit < 5%
D	gloss	solvent	alkyd	isoparaffinic
E	mat	solvent	styrene-acrylic	isoparaffinic
F	gloss	solvent	alkyd	isoparaffnic
G	gloss	solvent	alkyd	white spirit < 1%
H	mat	solvent	limed oil	isoparaffinic
12	mat	water	linseed oil emulsion	-
J	gloss	solvent	alkyd (high solid)	white spirit < 1%
K	mat	water	styrene-acrylic (+microvoid)	-

The name given to this paint by its producer is'natural paint'.

The paints A and B are conventional water-borne paints, representative of the European market of the styrene-acrylic paints.

The paint C is conventional alkyd paint with less than 5% aromatics white spirit.

The paints D, F and G are sold with a view to being more 'environmentally friendly' than conventional alkyd paints because either they contain less aromatics with less than 1% aromatics white spirit or they contain odourless isoparlfYinic solvent. Life Cycle Inventories are necessary to support these assertions.

The paint E contains a resin called 'plioway' by its producer. It is a paint with an acrylic resin in an isoparaffinic solvent. According to the producer, its characteristics are the following:

- the isoparaffinic solvent is odourless.
- the applied paint dries quicker than a conventional solvent-borne alkyd paint,
- the paint adhesion on difficult surfaces is higher than that of a conventional water-borne acrylic paint.

The name 'natural paint' is given to the paint I by its producer. An ecobalance is necessary to identify the impact on environment of this 'natural paint'.

The high solid paint J is today a laboratory product. But its low solvent content may be of interest environmentally speaking. The inventory will eventually prove or disprove it.

The microvoid paint K is a new technology to reduce the quantity of titanium dioxide in water-borne paints. This technology consists in replacing a certain quantity of the conventional acrylic resin by the lnicrovoid resin in conventional water-borne paint. The result is then a diminution of the quantity of titanium dioxide.
The paint K composition has been obtain by a simulation (whereas the microvoid resin corresponds to a real resin) by replacing part of paint A (conventional water-borne paint) resin and titanium dioxidt<,by microvoid resin. Its composition has been calculated from that of paint A to obtain the same opacity power. The purpose is to evaluate the potential environmental advantage of this technology in comparison to a conventional water-borne paint. i
This explains that these two paints have the same quantity related to the functional unit (cf, section 111. 1) and this justifies the choice of the same paint process data for both paints (cf. section III.3.2).

III. THE METHODOLOGY OF LIFE CYCLE INVENTORY APPLIED TO PAINTS AND VARNISHES

The general methodology and the definition of the different terms such as the functional unit are given in Appendix 1. The purpose of this section is to apply this methodology to the eleven selected products and to precise:

- the functional unit,
- the studied systems and the systematic rule to define them,
- the nature and the sources of the collected data,
- the allocation rules.
- the main hypotheses.

111.1 The functional unit

The functional unit used for analysing the inventories of the paints is:

the amount of paint necessary to cover 20 m= with an opacity of 98%.

To be homogeneous, the quantities of paints relative to this functional unit have been measured according to the French standard NF 30 075.

The quantities of each paint relative to this functional unit are presented in the following table.

Paints	Quantity of paints relative to the functional unit (litres)
A	2.47
B	2.08
C	1.9
D	1.96
E	2.99
F	1.77
G	1.77
H	3.13
1	2.94
J	1.163
K	2.-17°

3 As a difference with the previous report. this figure has been calculated according to the French standard NF 30 075 and it is now homogeneous with the ten other paints.

4 This value is equal to that of paint A. Ilie explanation is given in the paragraph describing the paint K in the previous page.

111.2 The studied systems

The studied systems cover the whole life cycle of the paints from cradle (raw materials extraction) to grave (application and elimination of tjte paint).

To delimit precisely the systems, that is to say to decide whether the production of a material should be taken into account or not, *it* systematic rule has been used:

- if data are already available, the production of the material is systematically taken into account, even if the consumed quantity is low;
- if not, for each stage where the material is consumed, the decision is made according to the mass fraction x% of the material in relation to the 'total inputs' of the stage.

  The figure *Delintitation of the system* page 11 illustrates this rule. If a material represents more than x% of the 'total inputs' of the stage where it is consumed, its production is taken into account. If not, the quantity consumed is recorded but its production is not taken into account.

  The 'total inputs' at each stage is the sum of the constituents, the consumables and tile fuels.

  In this project, x equals 5%.

It is important to insist on the fact that the reason to not take into account the production of some materials is not ass arbitrary decision. On the contrary, precise rules have been chosen which have been determined by all European ecobalance experts (SETAC). Materials are thus considered negligible or not according to these rules. Moreover, verification rules have been used: they consist in checking that these materials have a low impact in terms of energy constunpfon and environmental pollution (air emissions, water releases and waste production).

The eleven systems have been delimited by the means of this systematic rule. They are presented in Appendix 11.

When considering all paints and all stages, we took into account the production of 80 to 100% of total inputs at each stage. The average is 95%.

The impact on the environment of the extraction and the production of the different sources of energy (electricity, natural gas, fuel oil, ...) is recorded. The impact due to the different means of transport (road. rail, sea) is taken into account for each material whose production is taken into account.

,y The packaging have been recorded but their production has not been taken into account in the framework of this ecolabel project. As a smatter of fact, the results of the European Ecolabel for Packaging is awaited

5 NB: The production of fuels are always taken into account because data are available.

Delimitation of the system

For each stage, we take into account the production of the inputs which represent more than X % of the total inputs of the stage.

Fuels production are systematically taken into account.

For paints and varnishes, X = 5 %.

TO TO TO TO

styrenebutyle ;nonylphenot ,aerylamid ,acrylic acid

;additivet fuels

acrylat , el

0.1 k *0.1 k* *0.01 kg* *0.008 kg* *0.01 kg* *0.015 k* *0.003 k*

44° *44%* *4.4%* *1.7%* *2.29,* *3.3°/ 0.7°*

Total input = 0.45 kg
(without water)

styren acrylic resi

111.3 The collected data: nature and sources

111.3.1 Data nature •,

The collected data are presented in Appendix I, section 1.3.

111.3.2 Data sources

Most data have been collected on **actual sites from European industrial operators corresponding to annual productions in 1991 or** 1992; this is the preferred source of data in order to be representative of the existing market in Europe. Due to confidentiality reasons, the names of the companies are kept secret. However, some characteristics can be mentioned (country, process, ...). Moreover, industrialists agreed to publish their data with sufficient transparency (cf. Appendix III where the detailed inventories are given) so that they can be used in the framework of the European Ecolabel for Paints and Varnishes.

The missing data come from public databases and the literature.

The different sources and some comments are given in Appendix III for each material whose production has been taken into account in the scope of the eleven ecobalances. To make easy the reading, the materials have been classified in alphabetical order.

Some data have been used several times, for different paints. For instance, the data about titanium dioxide production have been collected on one site. These data have been used for all the paints, even if this titanium dioxide producer is not the supplier of all paint producers. The links between the data are given below:

- the same titanium dioxide, kaolin, calcium carbonate, less than 5% aromatics white spirit for all concerned paints,
- the same styrene-acrylic resin for paints A, B and K,
- the same alkyd resin for paints C and D,
- the same paint process data (effluents, air emissions and solid waste) for paints E, F, G, H, and J (the formulations are obviously different, and the energy consumptions have been assessed for each paint),
- the same paint process data (energy, effluents, air emissions and solid waste) for paints A and K (the formulations are obviously different).

111.4 The allocation rules

In most cases, data collected on real sites,are specific data for the studied product (resin or paint, etc.). As a consequence, allocation isles have been useless.

When co-products appeared in a process and when specific data were not available (generally in case of consumables consumption), the allocation rules have been chosen with the agreement of the concerned industrialists. It was essentially mass allocation rule.

111.5 Calculation hypotheses

The main hypotheses are given below.

1) European electricity model

The data concerning the production of electricity are representative of the European situation. This choice is based on the fact that the project is a European one and the members of the ad hoc group would like to avoid any discrimination between the products due to the national electricity characteristics production system. The figures used are given in the following table. They came from UCpTE6 1990.

Origin	%	Outputs (%)
Thermal energy	46.88	
Coal	18.14	32.3
Lignite	9.84	32.3
Heavv feel oil	10.16	31
Natural gas	8.74	31.3
Nuclear energy	37.98	33
Hydraulic energy	15.14	90
Total	100	

IICPTE : Union for the Coordination of the Production and the Transport of Energy

2) Calculation of the diesel oil consumption due to road transport

The purpose is to calculate the quantity of diesel oil to transport a given real load in a truck with a given maximum capacity consuming a given quantity of diesel oil per 100 km.

The hypotheses are:

- diesel oil consumption by full tnick: 38 litres / 100 kill
- diesel oil consumption by empty truck: 2/3*38 litres / 100 kill
- linear consumption for intermediary loads

Then the quantity of diesel oil consumed to transport a quantity Q of material is: a

38/I00 * kni * (1/3*Lr/Cni + 2/3) * N and N = Q/Lr

with kin = number of kin between the production site of tile material to the site where it is used

Lr = tile real load in the tnick, including the weight of packaging and pallets

Cin = tile inaxinlum capacity of the tnick (for instance, 16 or 24 tonnes)

(1= the quantity of inaterial to be transported

N = the number of tricks necessary to transport this quantity

For an empty return, the diesel oil consumption is:

38/100 * kill * (1/3*Lr/Ciii + 2/3 + 2/3) * N

3) substituted styrene: styrene data

The impacts oil the environment of the production of a substituted styrene', one of the constituents of paint E, have been supposed similar that of styrene. This assumption has been validated by petroleum industry.

4) acrylate 1: butyl acrylate data

Tile impacts oil the environment of the production of the acrylate 18 , one of tile constituents of paint E, have been supposed similar that of butyl acrylate. This assumption has been validated by petroleum industry.

5) WS < 1%: **WS < 5% data**

Due to the lack of data concerning the production of the less than 1% aromatics white spirit, the data concerning the less than 5% aromatics white spirit have been used.

' **Due to confidentiality reason, the complete name of this constituent cannot he given. Due to confidentiality reason, the complete name of this constituent cannot be given.**

6) VOC calculation

The emissions of volatile organic compounds (VOC) after the application of the paint by consumers, expressed in mg/functional unit,, have been calculated according to the following formula:

volatile solvents contained in the paint

\+ volatiles solvents contained in the resin

\+ volatiles solvents contained in the paint additives

Solvents contained in the paint additives have been evaluated thanks to industrialists indications.

7) High solid alkyd resin

The high solid alkyd resin for paint J contains in particular sunflower fatty acid produced mainly from sunflower oil.

Due to the lack of data corresponding to sunflower oil production, the production of an other vegetal technical oil has been considered. Sensibility study has been made. The conclusion is that the small differences which could exist between the sunflower oil and the considered vegetal technical oil are negligible in relation to the whole life cycle.

The seeds production has also been taken into account. The cultivation stage (seeding, manuring, harvesting, ...) has been modelised from French statistic data corresponding to pesticides and fertilisers consumptions, fuel consumption per land surface, seeds production output, ... Fertilisers and pesticides production has been taken into account from statistic data collected by producers organisations.

8) Lithopone for paint I

Data have been collected on a German site producing lithopone from zinc sulphate solution, barium sulphate and coke. The process consists in reducing barium sulphate with coke in a rotary kiln to make barium sulphide, then mixing solutions of barium sulphide and zinc sulphate to coprecipitate lithopone. There is then a step of calcination.

The extraction of barium sulphate and the elaboration of zinc sulphate solution from zinc residues have not been taken into account.
However, the energy consumption for the extraction of barium sulphate is probably low in comparison to that consumed by the previous process of reduction and calcination. Zinc
-y residues find their origin as by-products from galvanizing plants and are then transformed into zinc sulphate solution. Data concerning galvanizing plants have been included. But no data about the production of zinc consumed by galvanizing plants in one hand and about the transformation of zinc residues into zinc sulphate solution in the other hand are available.

9) Titanium dioxide process

Titanium dioxide Ti02 can be manufactured through two different processes: sulphate process and chloride process. In this project, data have been collected on a site producing titanium dioxide with the sulphate process and `complying with European regulation requirements (especially concerning water releases and solid waste). No data concerning the chloride process were communicated to the Ecobilan company. According to titanium dioxide manufacturers, no significant differences would have been appeared in the conclusions (cf. pages 19-26) because:

- one of the two origins of environmental impacts coming from Ti02 is the production of the raw materials which are the same for both processes;

  the second origin is the energy consumption on Ti02 production site, linked with the reaction's thermodynamics which are very close to each other.

10) Tall oil for alkyd resins

For several paints (cf. systems description on pages 41-51), tall oil is one alkyd resin constituant. The process to obtain tall oil is:

- production of crude tall oil, which is a co-product of paper pulp according to the European paper industry,
- transformation of crude tall oil into tall oil.

11) Less than 1% aromatics white spirit

No specific data were available concerning the production of less than 1% aromatics white spirit. Data corresponding of the production of less than 5% aromatics white spirit have been taken into account.

12) Data concerning the paints application stage

The following hypotheses have been made concerning the application stage.

To cover 20 mz	Water-borne paints	Solvent-borne paints
Hypothesis	2 litres of water/brush	0.2 litre of solvent/brush
	1 washed brush to cover 20 m'	
Consumption	2 litres of water	0.2 litre of solvent
Release into sink	2 litres of water	0.2 litre of solvent

Water and solvent consumption for paint dilution

Due to written indication on cans, dilution have been considered for paints A and C. The following figures have been used:

To cover 20 mz	Water-borne paint A	Solvent-borne paint C
Hypothesis	0.05 litre of dilution water	0.05 litre of dilution solvent

Paint residues In cleaning water or cleaning solvent

After having painted a 20 m2 room, the painter washes a brush covered with 30 g of paint. Cleaning water or cleaning solvent thus contains 30 g of paint.

Paint residues in paint cans

A quantity of paint equal to 30% of that applied is not used and is found in discharged cans.

13) Effluents on site

When an epuration station exists on the site, the data which have been used concern the water releases after the treatment on site.

When the site effluents are discharged in the town sewers, and when an epuration station exists in the town, the effluents after the municipal treatment have been considered when possible.

Concerning the paint application stage, we must insist on the fact that data are not available concerning tile evolution of the paint discharged into sinks during the brushes cleaning. Only the paint residues have thus been recorded. It will perhaps be necessary to complete the data relative to this stage with at least BOD and COD.

IV. THE INTERPRETATION OF THE LIFE CYCLE INVENTORIES APPLIED TO PAINTS AND VARNISHES

The two ways to interpretate the inventories are described in Appendix I section II.
The effects which have been studied in this project are:

- the global warming,
- the acidification,
- the eutrophication,
- the non renewable resources depletion.

The indices are given in the Appendix.

V. THE MAIN RESULTS OF THE LIFE CYCLE ASSESSMENT OF THE ELEVEN PAINTS

The main results are given in the following table and illustrated by the following graphs.

The purpose of these presentations is:

- for important flows[9] (input or output): to identify the stage(s) which constitute the main contribution, and more precisely whether the main contribution comes from the production site (e.g. production site of the resin) or upstream steps (e.g. production of the energy or the raw materials consumed during the resin production, ...),
- for each studied environmental effect: to identify the stage(s) and the flow(s) which constitute the main contribution,
- to state the flows and effects values obtained for the eleven ecobalances.

When there are two top contributions to flows or effects:

- they are classified (I and 2) and the contribution percentages are indicated in brackets;
- they are mentioned both if their contribution is equivalent.

For each flow, the paint which presents the smallest contribution to the consumption or the release is indicated into brackets.

The flows which are not represented here can obviously be found in the detailed ecobalances (cf. Appendix Ih.

Legend: En = Energy '-

FU = Functional unit

Isopar = Isoparaffinic solvent

Res. = Resin

Styr-acrylic res. = Styrene-acrylic resin

RM = Raw materials

Ti02 = titanium dioxide

solv. = solvent

alk. res. = alkyde resin

1

9 **Important because they are often mentionned or because the consumed or released quantity is high in comparison to other flows.**

Flows	Life cycle total input/output	Paints	Main origin stage	Site/upstream step
Raw materials consumplion				
Crude oil	0.2 kg/FU	I	Transport	
(smallest contrib.:	< I kg/FU	A, B, K	Styr-acrylic res(58%)	Raw
materials				
paint I)		I	WS + Alk.res. (60%)	Raw
materials				
	1.7 kg/FU	C, D, F, G	Alk. res. + *solv.* (72%)	Raw materials
	3 kg/FU	E, H	Isopar (60%)	Raw
materials				
Natural gas	< 0.9	I	1) Lithopone (5.l%)	Site +
Energy				
(smallest contrib.:			2) Ti02 (32%)	Raw
materials				
Saint 1)	1.2-1.7 kg/FU	A, B, C, G, J, K	1) Ti02 (56-80%)	Raw
materials				
			2) Resins (19-41%)	Raw
materialsl°				
		D	1) Ti02 (62%)	Raw
materials				
			2)Alk. res.+isopar(38)	Raw
materials				
	2.2 kg/FU	F	1) Ti02 (57%)	Raw
materials				
			2)Alk. res.+isopar(42)	Raw
materials				

10 Phtalic anhydride for paints C and G; styrene and butyle acrylalc for paints A, B, and K

Energy consumption

Flows	Life cycle total input/output	Paints	Main origin stage	Site/upstream step
Electricity (smallest contrib.: paint 1)	G MJ/FU 10 M1/FU 15 MJ/FU 23 M1/FU	I *B*, J, K A, C, D, E, F, G H	Ti02 (52-88%)	Site (60%) Raw materials (40%)
Thermal energy (smallest contrib.: paint I)	40-70 MJ/FU	A, *B*, K	1) Acrylic res. (55%) 2) Ti02 (35°/~)	Raw materials" Site (50"/o)+RM (40%)
		I	Lithopone (61 %)	Site + Energy
		J	I) Alkyd res. (33°io) 2) Ti02 (29°/u)	Raw materials Site (50%)+RM (40%)
	120-160 M1/FU	C, D, F, G	1) Alkyd res. (45%) 2) Ti02 + isopar(46)	Raw materials 12 Site Ti02+RM isopar
	250 MJ/FU	E, H	1) Isopar (55%) 2) Resins (25%)	Raw materials Raw materials 13
Primary equivalent energy	68 M1/FU	1	I) Lithopone (47%) 2) Ti02 (27%)	Site + Energy Site + RM
(smallest contrib.: paint 1)	100 MJ/FU -	A, *B*, *1*, *K*	1) Ti02 (45%) 2)Resins (40%)	Site + RM Raw materials
	160-200 MJ/FU	C, D, F, G	Same profil as Thermal energy	
	300 MJ/FU	E, H		

Butyle aerylate and styrene 12 Tall oil, phtalic anydride and WS<5% for paints C and D; isopar and tall oil for paints F and G. 13 **Isoparaffinic for paint H; substituted styrene and acrylate I for paint E.**

Flows	Life cycle total input/output	Paints	Main origin stage	Site/upstream step
Water discharges				
Water (smallest contrib.: paint I)	120-450 I/FU	1	1) Ti02 (53%) 2) Lithopone (-t3%)	Raw materials Site
		J other paints	Ti02 (9G°/a) Ti02 (8G-90%)	Raw materials Raw materials
Suspended matters (smallest contrib.: paint I)	5-30 g/FU	all paints	Ti02 (>92%)	Site
COD (smallest contrib.: paint I)	5-30 g/FU	all paints	Ti02 (>75%)	Site
BOD (smallest contrib.: paint I)	< 0.25 g/FU	I. J A. K	Acrylic rcs. (95%)1°	Site + RM
		B	Paint prod. (72%)1'	
		E	1) Isopar (70%) 2) Plioway resin (27)	Raw materials Raw materialsls
	0.4 g/FU	H	Limed oil resin (82)	Raw material 16
	< 0.8 g/FU	C, D, F, G	Alkyd resins (>83%)	Raw material 16
Solid waste				
Total waste (smallest contrib.: paint 1)	2.9 kg/FU		1) Appli. (58%) 2) Ti02 (32%)	Can + paint residues Site (recovered gypsum)
	3.3-5.2 kg/FU	A, B, C, D, E, F, G, K	1) Ti02 (55-80°/a) 2) Appli. (18-38%)	Site (recovered gypsum) Can + paint residues
		J	Ti02 (78%)	Site (recovered gypsum)
	8 kg/FU	H	Ti02 (82%)	Site (recovered gypsum)

14 The lack of data pertaining to water releases for paint A may explain the fact that the main step for these I30D emissions is acrylic resin production and not paint production as for paint B.

I S Substituted styren

16 Paper pulp for tall oil

Air en?issions

Flows / Environmental effects	Life cycle total input/output	Paints "	Main origin stage	Site/upstream step
VOC (smallest contrib.: paint I)	*(1.0(101* g/FU	I	Lithoponc	Galvanizing plant
	90-270 g/FU	A. B. J. K	Paint appli (>99'Yi)	(water-borne paints)
	75(1 g/FU	C, D, F. G	Paint appli (>99%)	(solvent-borne paints)
	1500 g/FU	E, H	Paint appli (>99'%)	(solvent-borne paints (isopar))
SOX (smallest contrib.: paint J)	23-40 g/FU	A, B, C. D	1) Ti02 (55%)	Site (50%)+En+RM
			2) Resins (30°/~)	En+Raw materials [17]
		F. G. J	Ti02 (75°/,)	Site (50%)+En+RM
		K	Resift + T102 (89%)	RMres.tsit&En&RMTi02
		I	Lithopone (61 %)	Site + Energy
	55-0>(1 g/FU	H	Ti02 (75%)	Site (50%)+Ett+RM
		E	() Phoway res (48%)	RM (55%)+site
			2) Ti02 (33%)	Site (50°/a)+En+RM
C02 (smallest contrib.: paint J)	2 5(111 g/FU	J	Ti02	Rin (60%)+En+site
	3 600-7 0011 g/FU	A. B. K	same profil as SOx	
		C, D, F, G	Ti02 (64-80°/~)	Rin (60°/u)+En+site
		I	1) Lithopone (52%)	Site + Energy
			2) Ti02 (26°/~)	Rin (60%)+En+site
	9 000-11 000 g/FU	E, H	same profit as SOx	
Hydrocarbons (smallest contrib.: paint 1)	32-60 g/FU	A. B, C:. h. I=. ci, 1,.1, K	same profit as C02	
	80-90 g/FU	E, H		

17 Styrene for paints :\ and 13: energy and raw materials (WS 5°•0. WS 17-l tl'!ro. tall oil. ..) for paints C and D.

Environmental effects	Life cycle total contribution	Paints	Main origin stage	Site/upstream step	Main origin flow
Non renewable resources depletion (smallest contrib.: paint I)	0.02	I	1) Lithop. (44%)	Energy	
			2) Ti02 (31%)	RM + Energy	
	0.0-(8-0.043 reserve Years	A. B. J	1) Ti02 (50%)	RM + Energy	
			2) Res. (30-40%)	Raw materials	Crude oil
		K	I) Resins (48°/o)	Raw materials	for all paints
			2) Ti02 (40%)	RM + Energy	but 1
	0.067-(1.081 reserve _years	C. D. F. G	Ti02 + resins + solvents	RM&En Ti02 + RM resins + RM solvents	
					Natural gas
	0.132 reserve years	E, H	1) Solvent (50%)	Raw materials	for all paints
			2) Resins + Ti02	RM resins + RM&En Ti02	
Eutrophication (smallest contrib.: paint J)	0.04-0.05 equivalent phm. g	J	Resin (93%)	RM	COD
		1	Lithopone (63%)	Coke	NH4
		A. B. K	Resin (90%)	Site (50)+RM (42)	COD
		H	Resin (90%)	RM: tall oil (80%)	COD
	0.1-0.14 equivalent plio,. g	C. D. E. F. G	Resin (90%)	RM: (all oil (90%)	COD
Direct global warming (smallest contrib.: paint J)	3-12 equivalent C02 tonne	I	1) Lithop. (52"/0)	Site + Energy	C02
			2) Ti02 (27%)	RM (CO%)+En+site	
		E	I) Ti02 (41%)	RM (60%)+En+site	
			2) Resin (30%)	RM+En	
		other paints	Ti02 (>64%)	RM (6o%)+En+site	
Direct & indirect global warming (smallest contrib.: paint I)	6 rtlnivalent Ccn kg	1	1) Lithop. (59%)	Site + Energy	C02+methan
			2) Ti02 (30%)	RM (60%)+En	C02+metllan
	I 1-14 equivalent Ct)2 kg	A. B. J, K	1-) Apply (45-59%4)		VOC
			2) Ti02 (40%)	RM (6(N%)+En	C02+Inethan
	35-36 equivalent cot hg	C. D, F, G	Paint application		VOC
	60-70 equivalent Cot g	E, H	Paint application		VOC
Atmospheric acidification (smallest contrib.: paint J)	1-1.3 acid. potential" g	B	1) Ti02 (50%)	RM+site+En	SOX
			2) Actyl. res. (35)	RM (styrene)	SOX
		I	Lithopone (62%)	Energy	SOx, NOx
		J	Ti02 (69%)	RM+site+En	SOX
	1.2-1.7 acid. potential g	A	1) Ti02 (50%)	RM+site+En	SOX
			2) Acryl. res. (35)	RM (styrene)	SOX
		C. D. F, G	Ti02 (60%)	RM+site+En	SOX
		K	1) Styr-acrylic res. (38'%)	RM (styrene)	SOX
					SOX
,.„			2) Ti02 (36%)	RM+site+En	SOX
	2.5-2.7 acid. potential g	E	1) Styr-acrylic res. (43%)	RM (styrene)+site	SOX
					SOX
			2) Ti02 (29%)	RM+site+En	SOX
		H	Ti02 (65%)	RM+site+En	SOX

18 acid. potential acidification poteimal

As a consequence. the conclusions are the fo)loN%,ing ones

1. Among the studied paints, one can distinguish between three paints families in terms of environmental impacts (the following families arc classified by increasing order for environmental impacts):

   - I (linseed oil emulsion), J (high solid paint), K (microvoid water-borne paint), A and B (conventional styrene-acrylic water-borne paints),
   - C, D, F and G (more or less conventional solvent-borne paints),
   - E (plioway solvent-borne paint) and H (limed oil solvent-borne paint).

The differences between the environmental impacts of paints A, B, I, J and K are iiot relevant. However, one can notice that:

- the linseed oil emulsion I contributes less than other studied paints to numerous flows and environmental effects. due to:
  - the zero solvent content;
  - - the low Ti02 content.
- the high solid paint J is at the second position in terms of environmental impacts for numerous !lows and environmental effects. due to:
  - the higher opacity power of the paint:
  - the low Ti02 content;
  - the low solvent content.
- the impacts on the environment of the conventional styrene-acrylic paints A and B are quite similar and also quite similar to that of paint K.

The impact on the environment of the conventional alkyd paints C. D, F and G arc quite similar.

Solvem-borne paint E (plioway resin) and paint H (limed oil resin) contribute inore than other studied paints to several flows and environmental effects, due to:

- the high solvent content,
- the isoparaffinic solvent: 1 kg of isoparaffinic consumes about 1.6 times more energy than 1 kg of white spirits (less than 17-18% aromatics white spirit and less than 5% aromatics white spirit),
- the high Ti02 content for paint H.

2. Among the studied paints life cycle, many flows are directly related to:

- Ti02 content per functional unit;
- solvents content and VOC emissions per functional unit;
- resins content per functional unit.

As a matter of fact, the Ti02 production, the solvents production, the VOC emissions during paint application and the resins production are the steps in the life cycle which contribute the most to numerous flows and environmental effects.

This following table shows the Ti02 content and the VOC emissions for each paint (due to confidentiality reasons, the figures related to Ti02 have been rounded oft):

Paint	A	B	C.	D	E	F	G	H	I	J	K
Pigments (kg/FU)	0.6 Ti02	0.5 Ti02	0.6 Ti02	0.6 Ti02	0.6 Ti02	0.8 Ti02	0.8 Ti02	. 1.2 Ti02	0.2 Ti02 + 1.2 lithopone	0.5 Ti02	0.4 Ti02
VOC emissions (g/• ")[19]	133	183	744	790	1438	755	774	1627	0	202	133

Resins raw materials contribute the most to the thermal energy consumption; this is not so for titanium dioxide. As a matter of fact, the thermal energy contains the feedstock energy; so the fuels energy + feedstock is higher for resins (and petroleum raw materials) than for titanium dioxide fuels energy.

For paint 1, the lithopone production contributes more than other steps in the paint life cycle to direct global warming and atmospheric acidification.

Although transport contributes to some flows (cf. detailed ecobalances), it does not represent a main contribution to any flow except for the crude oil consumption by paint I life cycle.

19 The VOC emissions have been calculated from the composition of the paint; it includes:

- the volatile solvents added by paint manufacturers,

-the volatile solvents contained in the resin and in the additives.

- the volatile additives.

3. The extension phase made it possible to study and to identify some means to optimise Ti02 use and solvents use which have at the same time a little less environmental impacts than other studied technologies. These means are:

   - the microvoid technology for Watjer-borne paints,
   - the high solid technology for solvent-borne paints,
   - the linseed oil emulsion 1.

In comparison with paint A=". ettvtrontnental impacts of paint h are inferior to that of paint A for most studied (lows except for BODS and VOC (same VOC for both paints). Thus, microvoid paint h is a means to optimise Ti02 use within the water-borne paints.

In comparison with conventional solvent-borne paints C, D, F and G, high solid alkyd paint J has less environmental impacts due to higher opacity power, lower Ti02 content and lower solvent content. Moreover, this paint has a little less impact than all other studied paints. including water-borne paints.

The limits *of* this project concern

- the impacts on water during the application phase: how to predict what will happen to paints in terms of BOD, COD, ctc., when the consumer washes brushes with water or solvents and dumps them down the sink2,[1]

  As a matter of fact, one can regret the lack of data relative to what happens to water-borne paints on one hand and solvent-borne paints on the other hand when they are released into the municipal sewer network via the consumer's sink. Infortunately. Ecobilan was not provided with accurate data which should nonetheless be available within the paint industry or the consumer or ecologist associations.

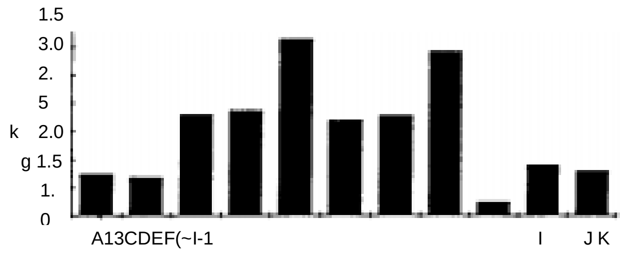
- the impacts on the environment of lithopone (one paint 1 constituant) Ilroduction, because the elaboration *of* zinc sulphate solution have not been taken into account ((Joe to the lack of data) (cf. page IG).

20 'Ihe comparison is relevant because the paint t: compmnn,n has hem obtain by a simulation replacing part of paint A resin and titanium dioxide by n,icrovoid resin (cf page 8).

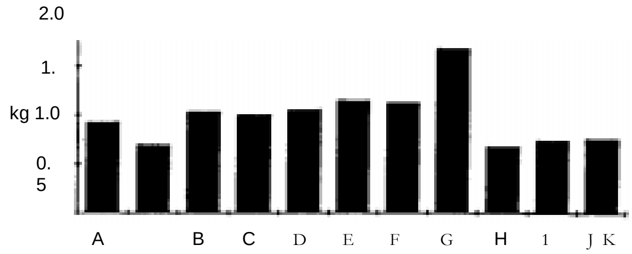
2 *1* Even if some of the consumers in certain European countries do not dump washing solvents down the sink, such a discharge still remains the case in most European countries.

Contribution of paints life cycle to consumption

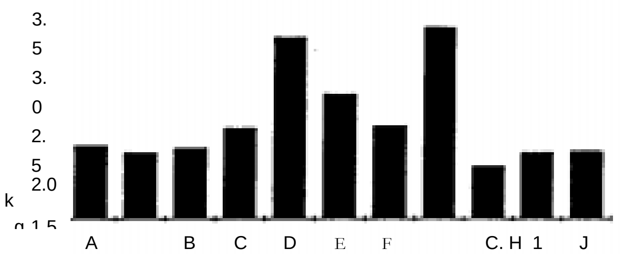
petroleum



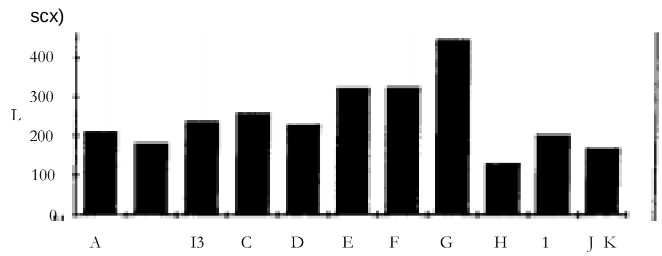
coal



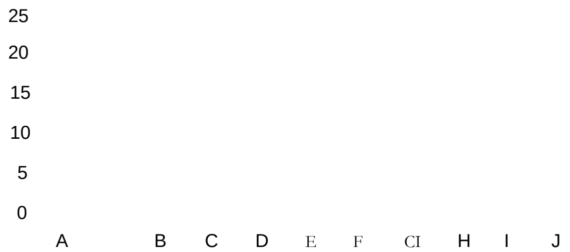
natural gas



Water consumption

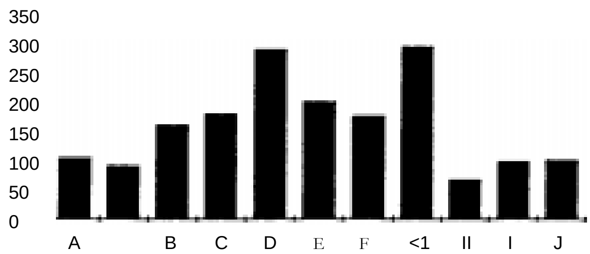


electricity

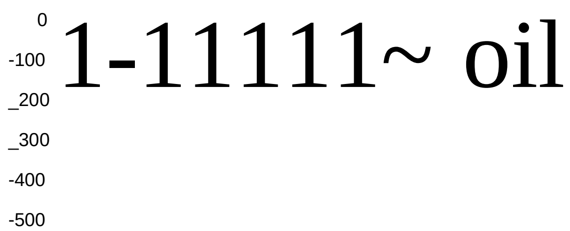


thermal energy

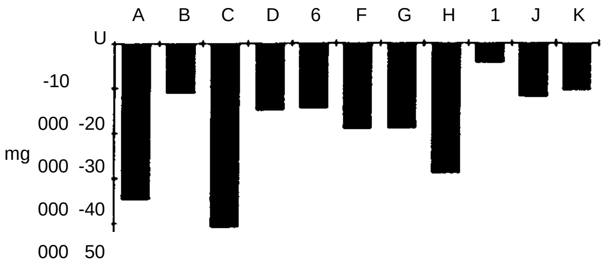
primary energy equivalent



water discharge



suspended matters

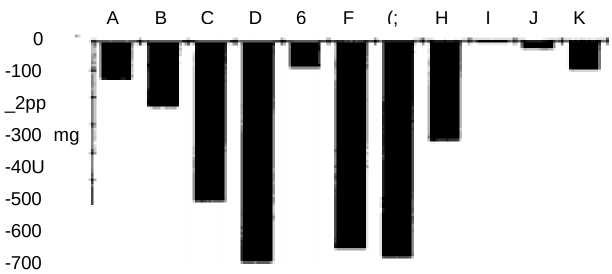


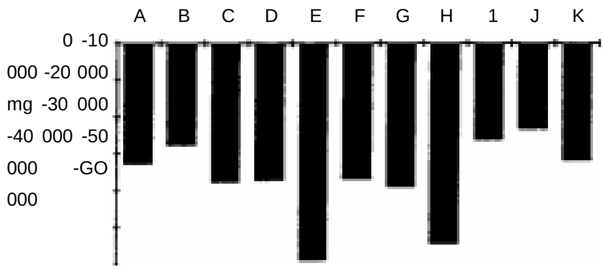
COD

A B C D E F G H I J K
. . 0
-5 000 ~ -
-mill,
1000 --0
15000
Ing _2U UOU
-25 OUU
-30 UUO
-i5 000

1

BODS

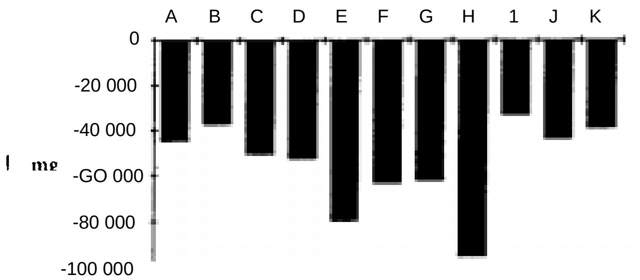




C02

ABC'UEFC;I-1 I J K
0
_ 2 000 000 itil
-4 000 000 /
mg -6 000 000
-8 000 000
-10 000 000
-12 000 000

total hydrocarbons



total VOC

ººº
000
A B (' U E 1:C. li I J K

-500 mg -I
000 -1 500
000

Waste production

Global warming (direct & indirect, 20 years)

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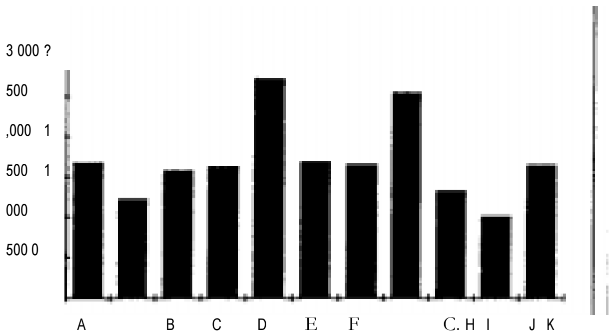
960000000
0(10
50 00040
20 000 10NN)
NIO
(1
A I3 (.' D E F (; H I J K

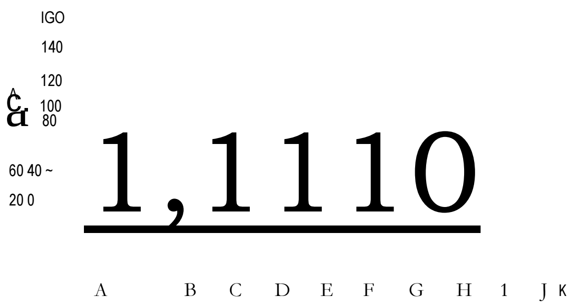
Global warming (direct, 20 years)

14 000 OW 12
00(10(N1
I(1(NNI (NIO R
(N)n 0011 G
000 WO 4
(NNI 0(N) 2
0(>n 000 0
A B C D E F G H I J K

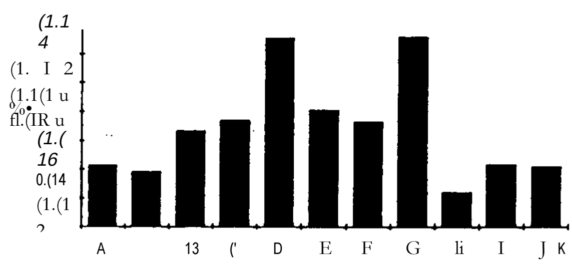
Atmospheric acidification



Eutrophication



Non renewable resources depletion



VI. ELEMENTS TO *BETAKEN INTO ACCOUNT FOR THE DETERMINATION OF ECOLABELLING CRITERIA*

The purpose of this section is to summarize the main environmental problems identified in the previous section and to identify means to reduce them related to the ecolabelling criteria.

Legend: '>' means higher (than other paints)

a

i

Flows/Effects	Main contribution stage (upstream origin or main flow)	Paints comparison	How to reduce environmental impact?
Consumptions			
Non renewable resources depletion	Ti02 + solvent + resins (flows: crude oil and natural gas)	E, H > C. D, F, G > A, B, 1, K > I	To optimise Ti02 use To limit VOC emissions To optimise resins use?
Water discharge			
:, Water, COD, suspended matters	Ti02 (site + raw materials)	H > A, B, C, D, E, F, G, J, K > I	To optimise Ti02 use
BOD	Alkyd resin (tall oil)	C, D. F. G, H > A. B, E, K > 1. 1	To optimise alkyd resin use?
Eutrophication	Resin for all paints and lithopone for paint I (flow: COD for all paints and NH4 for paint I)	C, D, E, F, G > A, B, H, I, 1, K	To optimise resin use and lithopone use ?
Air emissions			
VOC	Paint application	E, H > C, D, F, G > A, B, J, K Oforl	To limit VOC emissions
Direct global warming	Ti02 (and lithopone for paint 1) (flow: C02)	E, H > A, B, C, D, F, G, I, J, K	To optimise Ti02 use To optimise lithopone use?
Atmospheric acidification	Styrene-acrylic resin (styrene) and Ti02 (RM+site+En) Lithopone for paint I (flow: SOX)	E, H > A, B, C, D, F, G, I, J, K	To optimise Ti02 use To optimise lithopone use? Something about styrene-acrylic resin?
Solid waste			
Total waste	Ti02 (site) l Appli. for paint I	H > A, B, C, D, E, F, G, I, J, K	To optimise Ti02 use

APPENDICES

APPENDIX I: THE GENERAL METHODOLOGY FOR LIFE CYCLE ANAL YSIS

The evaluation of industrial systems is not a recent subject. The first attempts -limited to energetic aspects- to evaluate the environmental impacls of a product life cycle took place in the seventies.

A general conceptual framework for Life Cycle Assessment (or Analysis) LCA has been
A elaborated under the auspices of SETAC (Society of Environmental Toxicology and Chemistry) Europe, a scientific society active in the field of LCA in which our experts are involved. Four steps can be distinguished:

- goal definition,
- inventorv.
- impact assessment,
- improvement analysis.

The first step, *Goal definition,* consists of defining what services) or product(s) and what type of system will be studied, as well as the reason for carrying out the LCA.

The second step, *Lift Cycle Inventory (LCI) or ecobalance,* consists of precisely defining the system, collecting the data and calculating the inventory.

The third step. *Impact ascescntent,* consists of three sub-steps:

- *classification:* a mapping of items in the inventory with known environmental effects or impacts (e.g. global warming, acidification, resource depletion, etc ....).
- *characterisation:* a calculation of scientifically-based indices; each index is an estimation of the potential impact of the inventory items contributing to a given environmental effect (e.g. global warming potential, acidification potential, resource depletion index, etc ....).
- *evaluation:* the process of ranking or weighting various indices representing environmental impacts, in order to further 'aggregate' the parameters and aid decision making. Evaluation is a value based process, not a scientific one.

The fourth step, *Improventent nnal_vcis,* consists of identifying options for minimisation of environmental impacts.

The methodology for inventory analysis is well established (although some details are still ,.,, debated). It is described in the following section 1.

Impact assessment is still an open research domain, and the existing techniques are therefore subject to controversies. Few of them match the general framework for impact assessment as it was described above. They are described in the following section 11.

Improvement analysis has not yet been formalised, but can be carried out in practice directly after the inventory analysis. and or after impact assessment.

I. THE GENERAL METHODOLOGY FOR LIFE CYCLE INVENTORY

An inventory, or ecobalance. is a quantitative list of material and energy inputs and outputs for a given system. This list must be as complete and detailed as possible, subject to data availability.

1.1 The functional unit

The flows listed in the Life Cycle Inventories (LCI) are not calculated for physical quantities of the products, but on the basis of the performance of an equivalent service.

LCI means to evaluate the environmental impacts of a product which serves a given purpose. The choice of the unit relies on this purpose, and cannot merely be a unit of production (for instance mass or volume). It has instead to be a unit of use, which is called the functional unit.

The unit is the basis for the calculation of any LCI.

1.2 The delimitation of the system

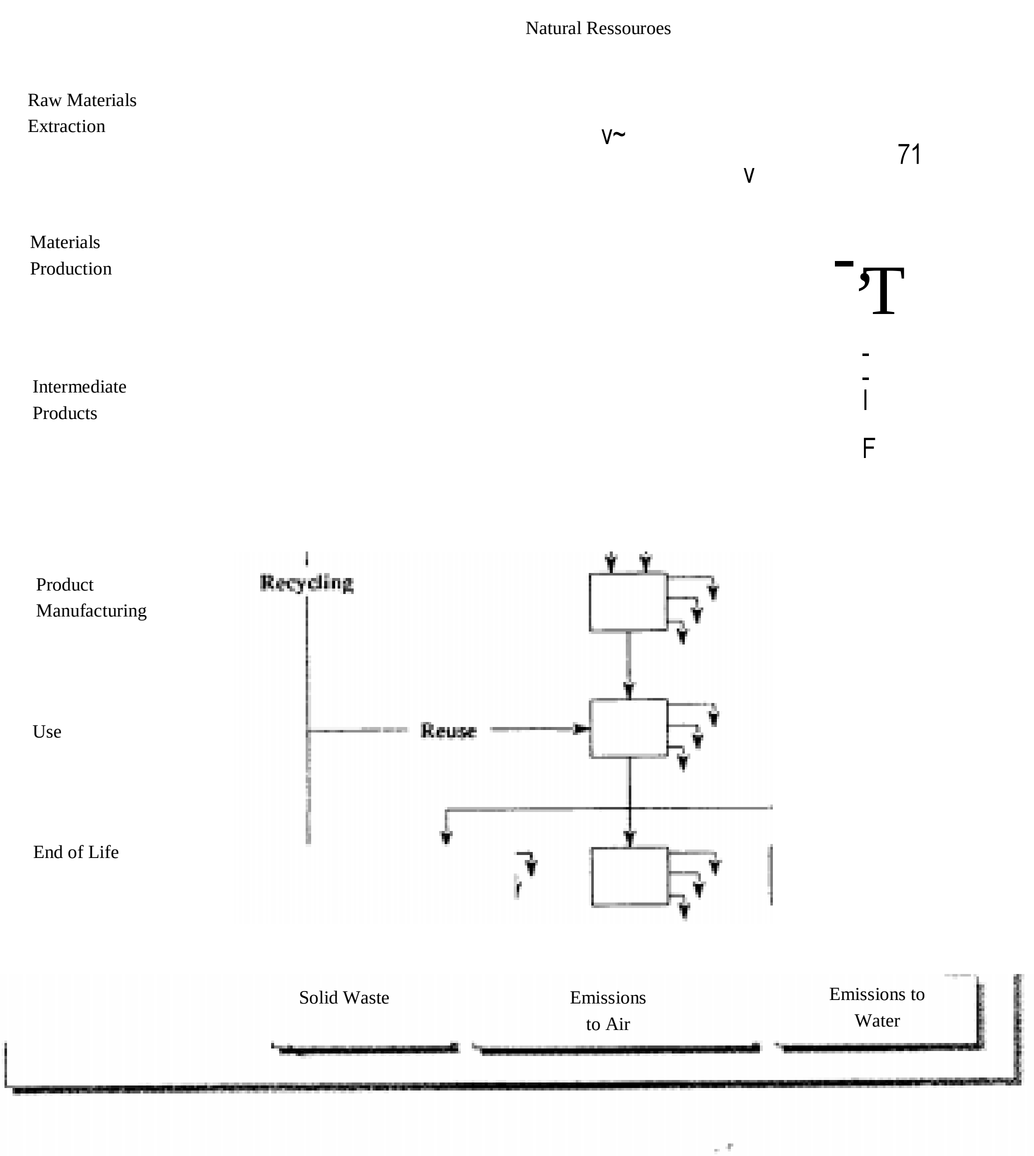
The system is an abstraction of some set of real world activities or industrial processes. Processes and activities are represented as modules; each module has its own inputs which are provided by other modules or directly by the environment of the system, and its own outputs. which arc directed to other modules or directly to the environment of the system.

When judiciously delimited, the system may encompass all processes that are directly or indirectly linked to the consumption of a **product or a service,** and that may have significant environmental impacts. In such a case, the environment of the system is very close to what is usually called the 'environment'. Ultimate flows entering the system consists of natural organic or mineral resources as well as natural energy sources, whereas those flowing out the system consist of emissions towards environmental 'sinks' such as air, water, soil, etc .... In practice, some industrial activities are not included within the system: the practitioner should nonetheless verify that the contribution of such activities to environmental inputs and outputs of the system are relatively insignificant.

Such a system encompasses all activities from the 'cradle' (the sources of natural resources necessary for the product) to the 'grave' (the end of the life of the product, often corresponding to final releases to environmental sinks).

Transport steps and energy sources production are included in the system. The figure below shows a general representation of a system for LCI.

Simplified Representation of a System for Life Cycle Inventory



1.3 The collected data

Data are collected, either from industrial operators (this should be the preferred source of data, at least for the main processes in the system), or from public databases and the literature, for every module in the system. Data can also be estimated through models and engineering calculation. The data include:

- materials inflows and outflows to and from the module (primary resources, intermediate materials and products for inputs; products, emissions released to air, water and soils, waste directed to a waste management operation for outputs);

- energy inflows and outflows.

The following figure shows (lie information that must be collected for each module.

Information recorded for each module

Air emissions

Energy inputs

Process / Operation

Water emissions

aterial inflow

Wastes

Useful products

a

1.4 The allocation rules

Industrial process may generate co-products or valorised materials. Rules have to be chosen to allocate inputs and outputs between these co-products or between the studied product and recovered materials.

II. THE INTERPRETATION OF LIFE CYCLE INVENTORY

This phase of environmental assessment rclics on-the carried out inventorN and develops two types of analysis:

identification of impact factors origins in the life cycle, analysis of flows

according to their effects on the environment.

11.1 Identification of impact factors origins in the life cycle

This identification is based on the inventory which has been carried out in the previous phase.

It brings to the fore the steps or materials which are the main contribution to the system flows.

This mode of analysis highlights means of action which may be taken to reduce environmental impacts.

Even though it may not be possible to quantify environmental impact for some flows, this mode of analysis allows for management of these (lows and indicates means of action to reduce them.

11.2 Analysis of the flows according to their effects on the environment

The purpose of this approach is to propose tools to analyse the ecobalance in terms of known environmental problems.

For instance. the environ~hental effects may be:

the increase of the global warming effect, the atmospheric acidification, the eutrophication of the waters, the depletion of resources.

This analysis is based on indices which allow to evaluate the contribution of substances to a given environmental effect.

For each effect, this mode of analysis allows to calculate the global contribution and to bring to the fore the impact factors which contribute to it as well as the steps where effect is more prominent.

These indices are closely linked to the present state of scientific knowledge when they are elaborated and have to be updated. Different indices are currently elaborated by the experts. They are the objects of a consensus which may be challenged as scientific knowledge of these effects progresses.

ECOBILAN uses indices produced or compiled by IPCC", WMO-'. RI VMZ°. VROM25 and CML'6. as well as documents distributed by the Ministry of the Environment in France. ,

11.2.1 Global Warming Effect?'

The solar radiation is re-emitted by the surface of the earth in the form of infrared radiations, which can be absorbed by substances in the atmosphere. The radiate balance determines the average temperature of the planet and allows life on earth. Thus, the environmental imbalance does not come from the existence of this effect, which is necessary to the survival of species. but front its increase, linked to the increase of the average atmospheric concentration of various substances of anthropic or natural origins-

The The unit used to measure the contribution of a material to the greenhouse **effect is the C02 mass equivalent.** The Global Warming Potential (GWP) of a substance is the potential greenhouse effect of the emission of a gram of that substance compared to one gram of C02.

The C02 equivalent varies in time according to the lifetime of the molecules. The values below have been calculated with a 20 years horizon.

Substance	CO.) equivalent (20 years) direct & indirect
CO2	I
CH4	63
N20	270
CO	7
VOC	31
NOX	30
Hvdrocarbons	31

4

IPCC published in February 1992 a new version of GWP. Working group conclusions underline the difficulties to determine a GWP which integrates both direct effects and indirect effects, viz. effects due to the creation or destruction of chemical species with direct GWP.

__ Intergovernmental Panel on Climate Change (I Inked Nation Organisation) " World Meteorological Organisation 24

National Institute of Public Health and Enviromnental Protection (The Netherlands) 25 One department ofthe National Institute of Public Health and Environmental Protection (The Netherlands) 26 Centre for Environmental Science Leiden University (The Netherlands) 27 Source: IPCC 1990 & 1992 and France (Industry Ministry)

CFC for instance are greenhouse gases and thus have a direct impact. On the other hand, they contribute to the destruction of the stratospheric ozone which is another greenhouse gas. The result of the action of the CFC on global warming thus has a positive and a negative component. . -

According to IPCC, the direct action of nitrogen oxides would also be two-fold: increase of the atmospheric content of ozone (03) and thus increase of the concentration of a greenhouse gas, and on the other hand increase of the concentration of the very reactive OH* radical species which decreases the lifetime and the concentration of the CFC and HCFC, all of them greenhouse gases.

According to the IPCC, methane, a gas with a direct global warming effect, also has an indirect effect on the warming of the planet. This indirect effect has not been precisely evaluated yet.

substance	equivalent COz (2t1 years) direct
COZ	1
N20	260
CH4	3 i

11.2.2 Atmospheric Acidificatiort28

It is the augmentation of acid substances in the low atmosphere. The unit taken for the contribution of a substances to the acidification is **the acidification potential (H+').**

substance	acidification potential (H+)
SOz	1/32
NO	1 /30
NON	1 /46
NH3	1/17
HCI	1 /36
HF	1/20
HCN	1/27
HB r	I /8 I

28 Source: VROM, 1990

11.2.3 Eutrophication29

Eutrophication steins from the introduction into aqueous environmental of nutrients, especially nitrogen and phosphorus cohipwtuds. Excess of these nutrients causes an overgro%vth of algal biomass. During the day, alga! photosynthesis consumes C02 and gives rise to a pH increase. Transparency of waters is reduced. After few weeks, algal biomass begins to decay and is metabolized by protozoa and bacteria. This results in 02 consumptions, C02 release and acidification. Introduction of nitrogenous and phosphorus compounds thus results in large fluctuations in dissolved oxygen concentrations as well as in pH.

However it should be noted that it is less relevant to apprehend eutrophication in terms of global effect than for previously described effects. Such an effect will in fact depend on local conditions. such as the rate of flow of the river into which the substance is being discharged, the vicinity of other discharge sources, etc ....

Moreover, COD is not necessary a carbon source generating bacterial proliferation. That is why the COD released by Ti02 process (emissions of Fe2i which can then be converted into Fe3+) has not be taken into account for eutrophication.

The unit considered for the contribution of a substance to eutrophication is **the phosphate equivalent.**

substance	phosphate equivalent
N	0.42
NO	p.2
NOX	0.13
N03'	0. I
NH 44	0. 3 3
P	3,06
P04 3-	I
COD	().022

29 Source : CML. Jeroen Guinee. personal communication (1992) and UNEP. 'Chemical Pollution : a global overview' (1992)

11.2.4 Non renewable resources depletion'"

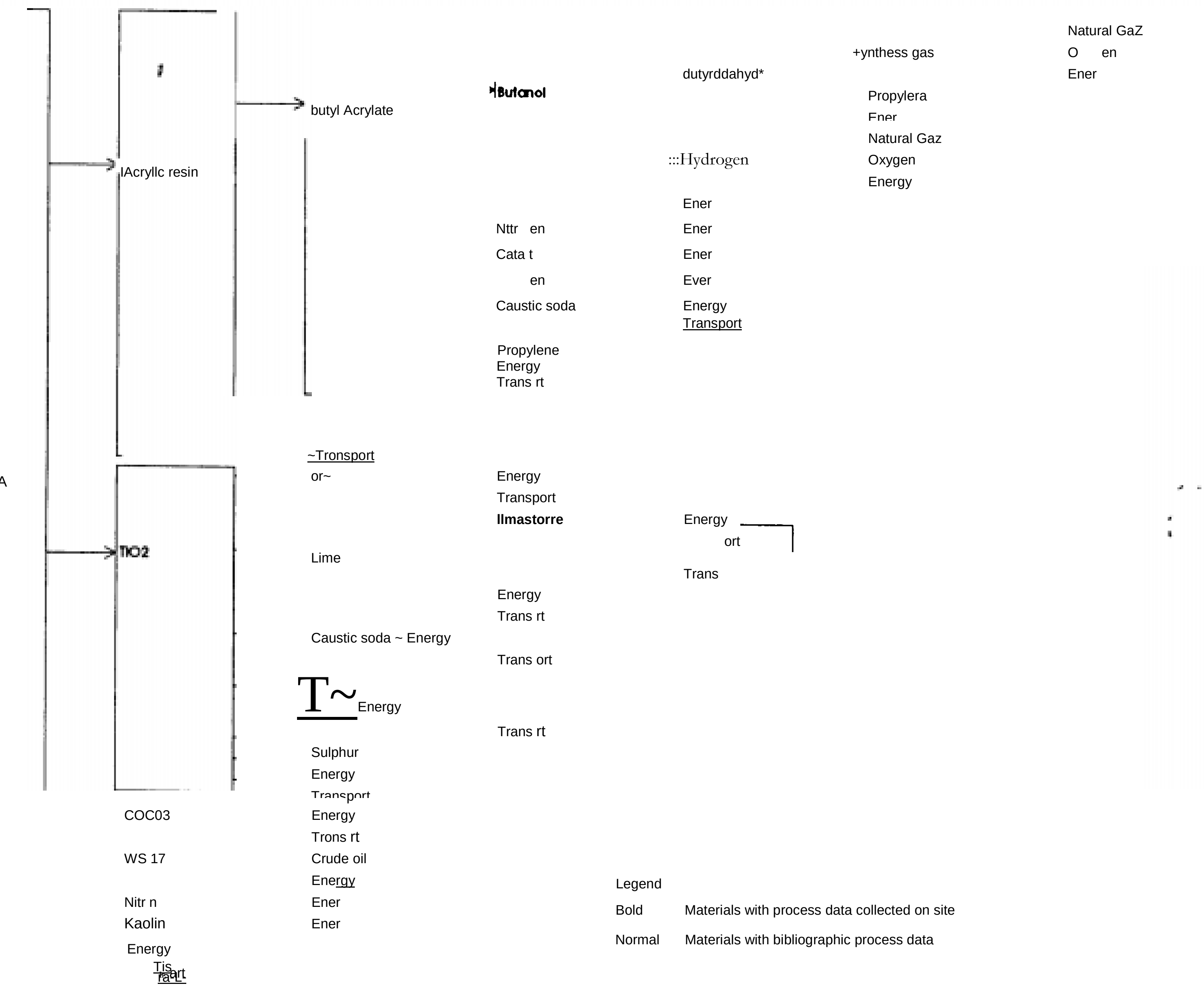
The purpose is to evaluate the contribution of the studied systems to non renewable resources depletion. Non renewable resources ar-eatydrocarbons or metallic ores. The index is the sum of consumed quantities weighted by the inverse of the years of reserve. These rescRcs arc expressed in available Years of reserve by dividing estimated known resources by present-da\ annual world consumption

It is thus considered that it is ten times less important to consume a 200 years reserve resource than a 20 years reserve one.

The following table gives the reserve years for the lion renewable resources consumed by the studied systems.

resource	Reserve (years)
crude oil	-t4
natural gas	58
coal	250
iron ore	200

30 C ML. DGEMP Industry Ministry in France and A1ines Bureau I IS,1


Natural GaZ
+ynthess gas
O en
Ener
dutyrddahyd*
Butanol
Propylera
Ener
butyl Acrylate
Natural Gaz
:::Hydrogen
Oxygen
IAcryllc resin
Energy
Ener
Nttr en
Ener
Cata t
Ener
en
Ever
Caustic soda
Energy
Transport
Propylene
Energy
Trans rt
~Tronsport
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or~
Energy
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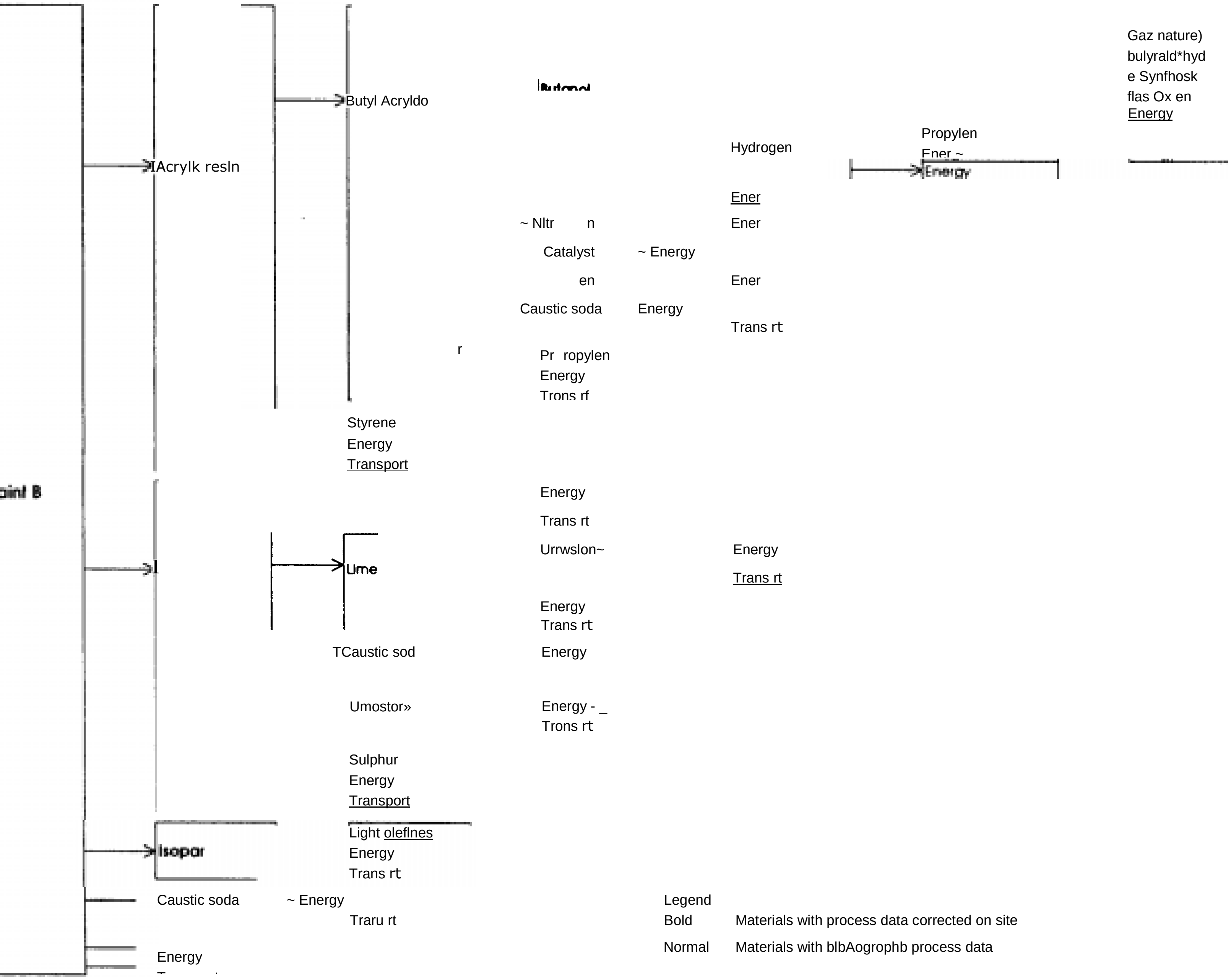
Energy
ort
TiO2
Lime
Trans
Energy
Trans rt
Caustic soda ~ Energy
Trans ort
T~ Energy
Trans rt
Sulphur
Energy
Transport
COC03
Energy
Trons rt
WS 17
Crude oil
Energy
Legend
Nitr n
Ener
Bold Materials with process data collected on site
Kaolin
Ener
Normal Materials with bibliographic process data
Energy
Tis
ra L
art


aint B
Acrylk resln
Butyl Acryldo
Butanol
Gaz nature)
bulyrald*hyd
e Synfhosk
flas Ox en
Energy
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Energy
Hydrogen
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~ Nltr n
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Caustic soda
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Styrene
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Transport
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Umostor»
Energy - _
Trons rt
Sulphur
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Transport
Light oleflnes
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Trans rt
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~ Energy
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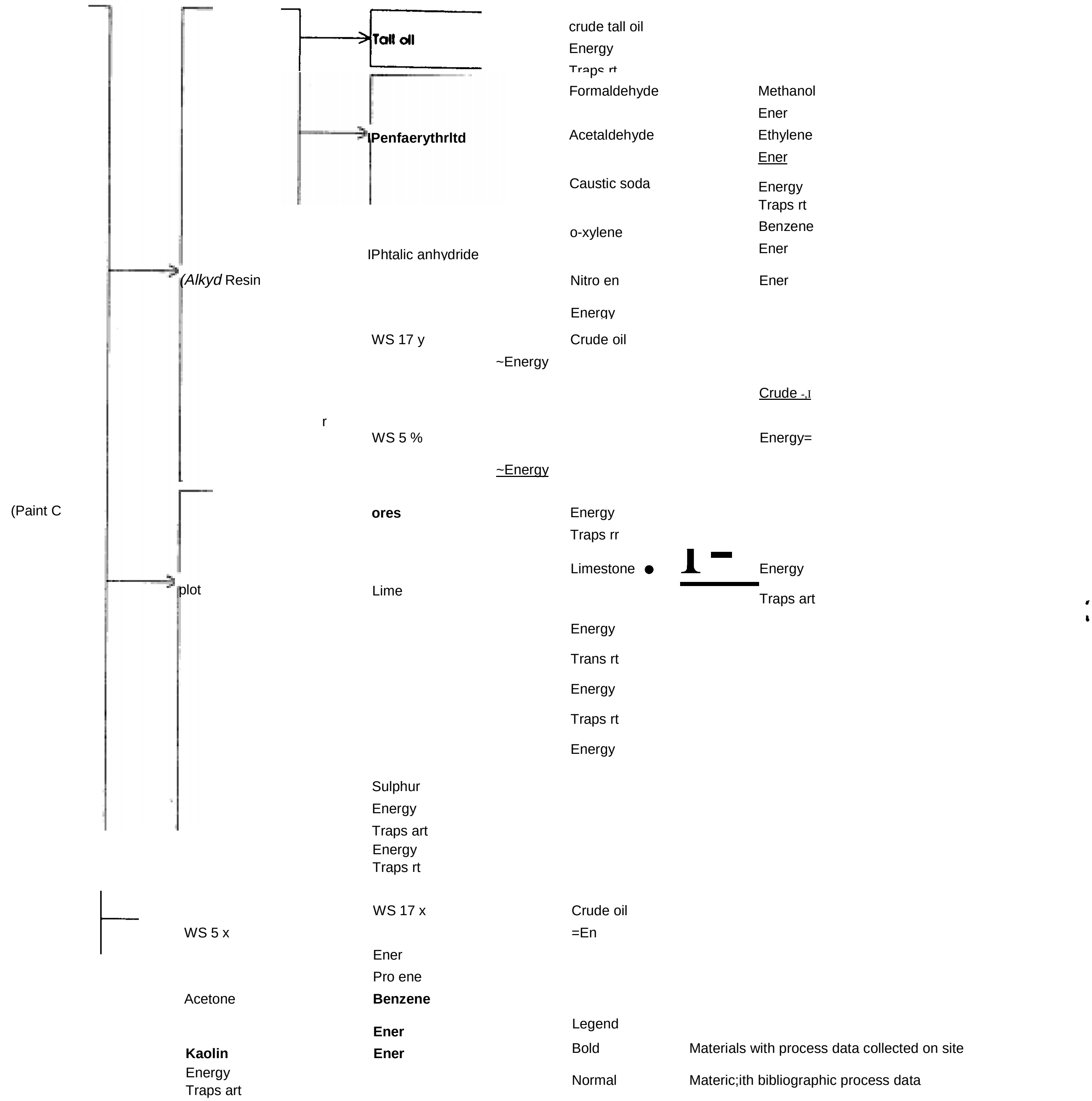
Energy
Legend
Bold Materials with process data corrected on site
Normal Materials with blbAogrophb process data



crude tall oil
Energy
Traps rt
Tall oil
Formaldehyde
Methanol
Ener
Acetaldehyde
Ethylene
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Caustic soda
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plot
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WS 17 x
Crude oil
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Kaolin
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Bold
Materials with process data collected on site
Energy
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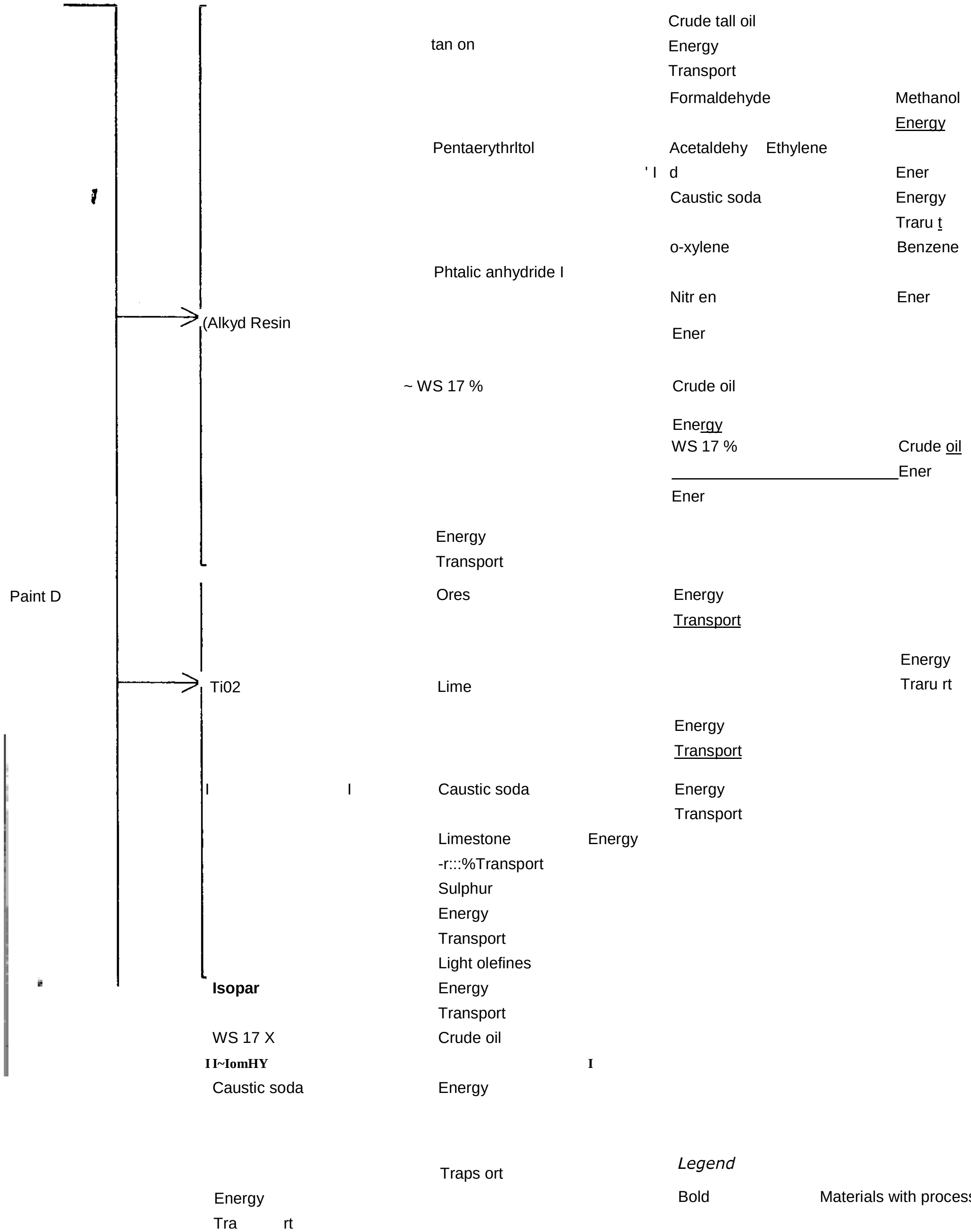
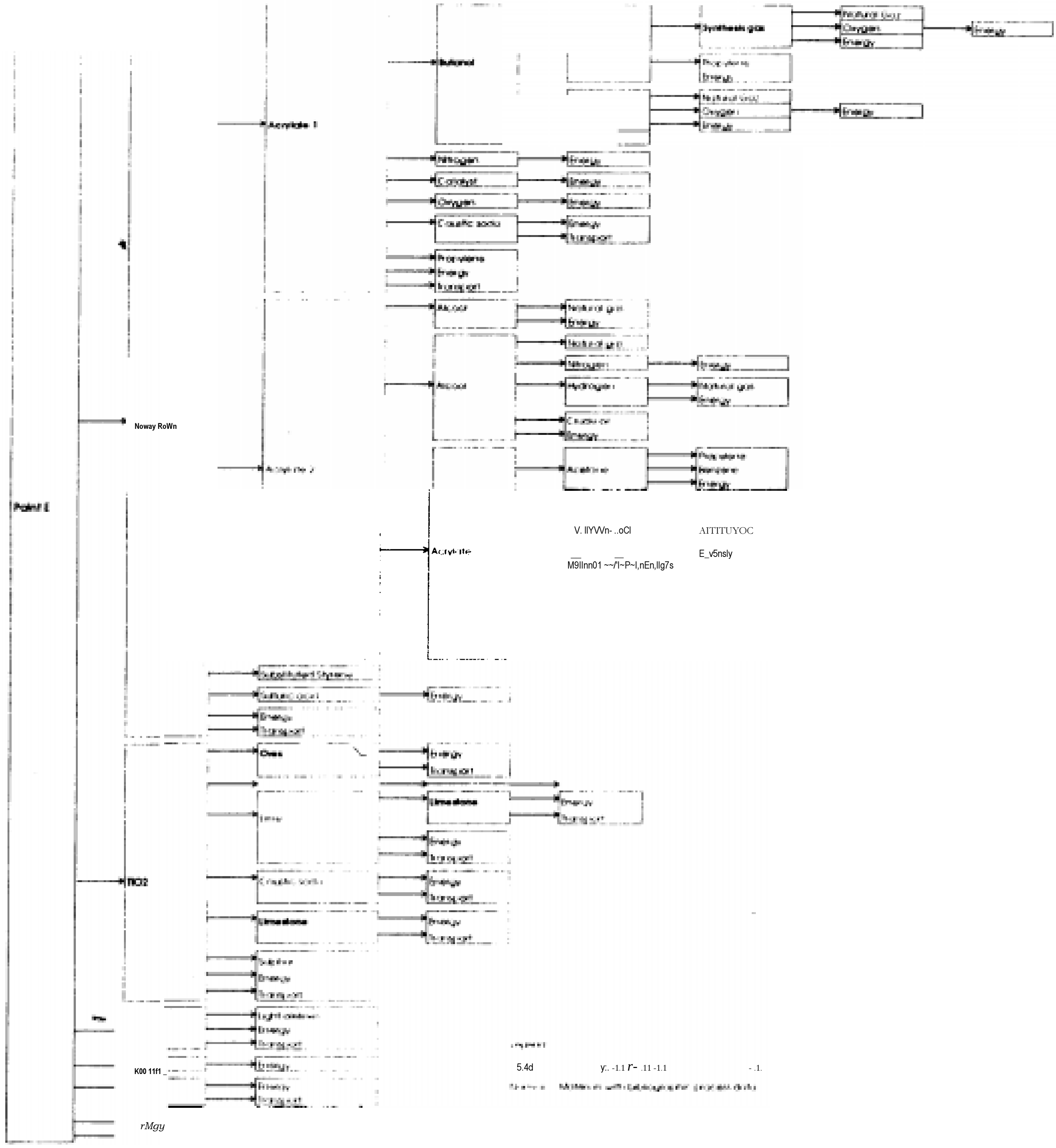
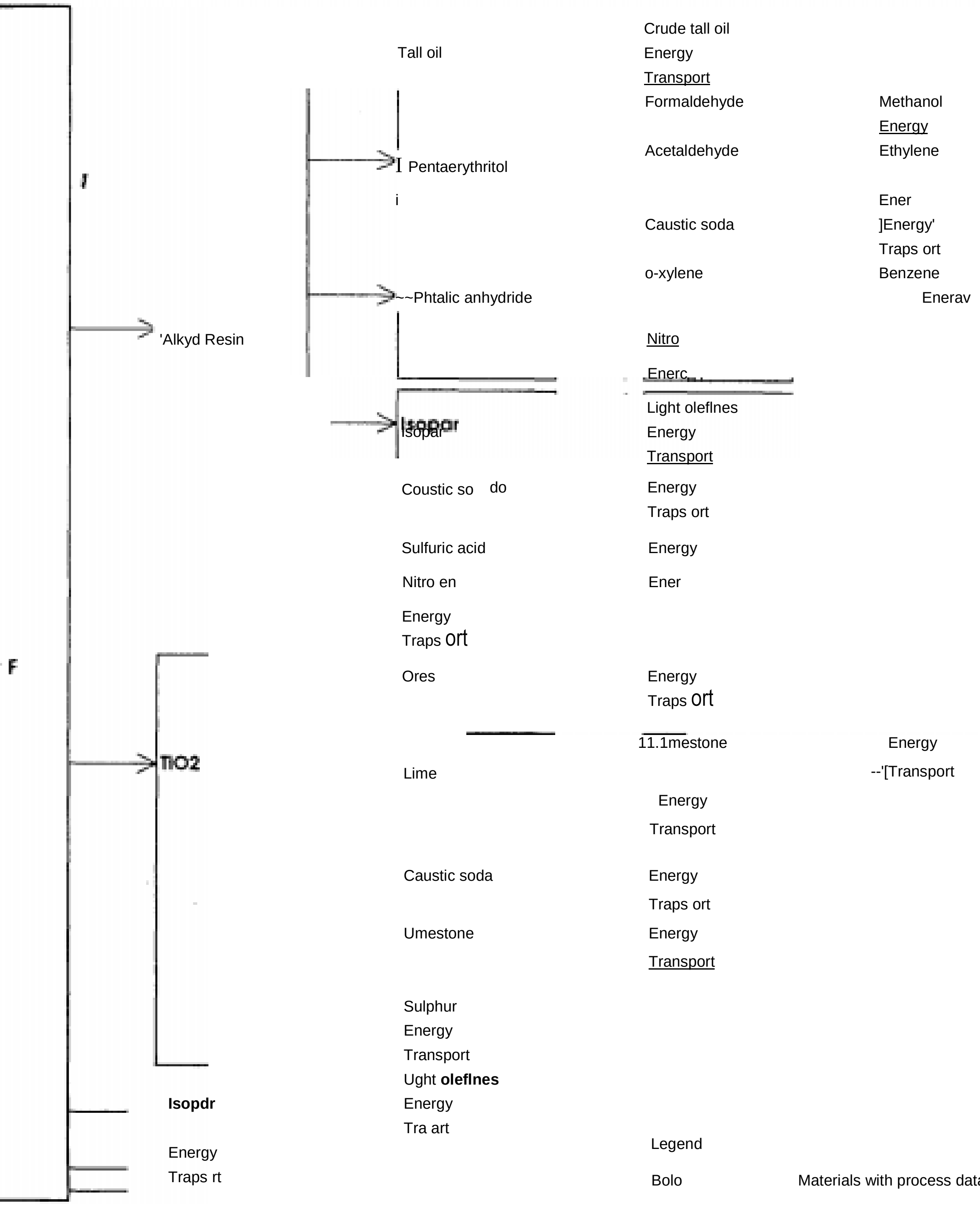


Legend

Bold	Materials with process data collected on site
Normal	Materials with bibliographic process data


Synthesis gas
Natural gas
Oxygen
Energy
Butanol
Propylene
Acrylate 1
Nitrogen
Catalyst
Oxygen
Caustic soda
Transport
Propylene
Alcool
Natural gas
Nitrogen
Hydrogen
Acrylate 2
Paint E
Acrylate
TiO2
Limestone
Lime
Caustic soda
Sulphur
Light crudes



Legend

Bolo — Materials with process data collected on site

Normal — Materials with bibliographic process data

Tall oil

Crude tall oil

Energy

Transport

Pentaerythrltol

___Formaldehyde

Methanol

Energy

' Acetaldehyde Ethylene

Energy

___Caustic soda

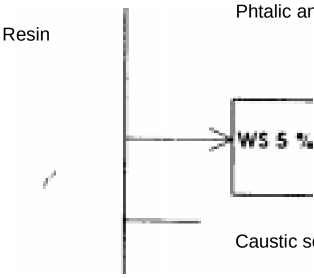
Energy

71, Transport

(Alkyd Resin

Phtalic anhydride

Energy



Nitro en

Ener

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WS 17 '/e

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Energy

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Energy

Traps ort

Sulfuric acid

Ener

~ Nitro en

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Bold Materl Nith process data collected on site

Normal Materials with t,inur,.,....... .... ,.,h;,.

Crude tall oil
Tall oil Energy
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Formaldehyde Methanol
Ener
Pentoeerythrltol Acetaldehyde Ethylene
t ' I I ' IEnergy I
Caustic soda r Energy
-I ~;JTransport

Limed oil Light olefines
Isopar Energy
I Transport

Limestone Energy
Lime I h-~ITransport

Energy
-*[Transport

Caustic soda Energy
Trans ort

Sulfuric acid ~ Ener
Nitr en Ener

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Trans rt

Paint H Ores ":Energy
Trans rf

Limestone Energy
Ti02 Lime Transport

Energy
Transport

ICatAtic soda Energy
f ~ransport I
Limestone Energy
' Trans rt

Sulphur
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Transport

Light olefines
Isopor Energy
I ~Traruport I
COC03 ~~ ~Ener
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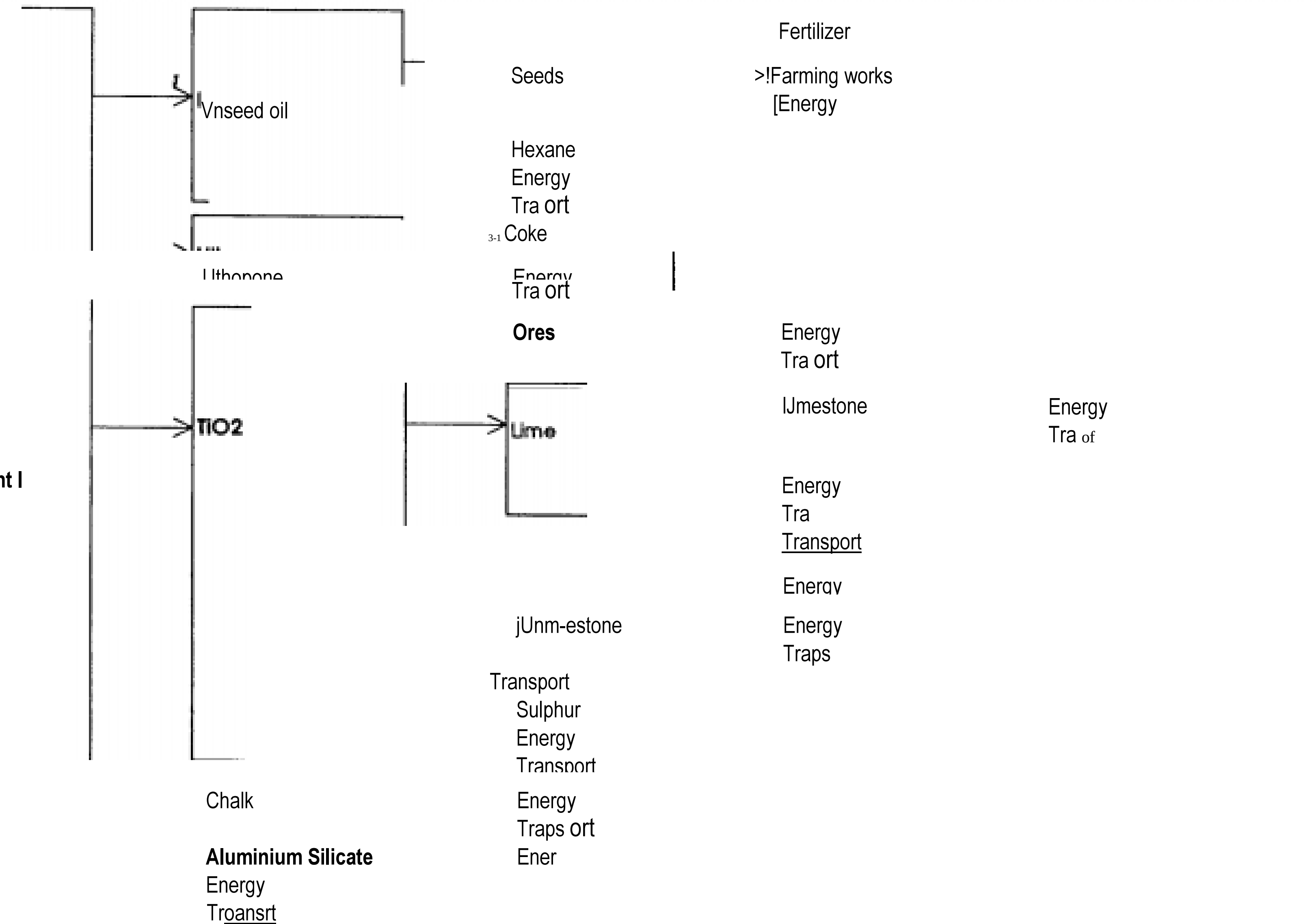
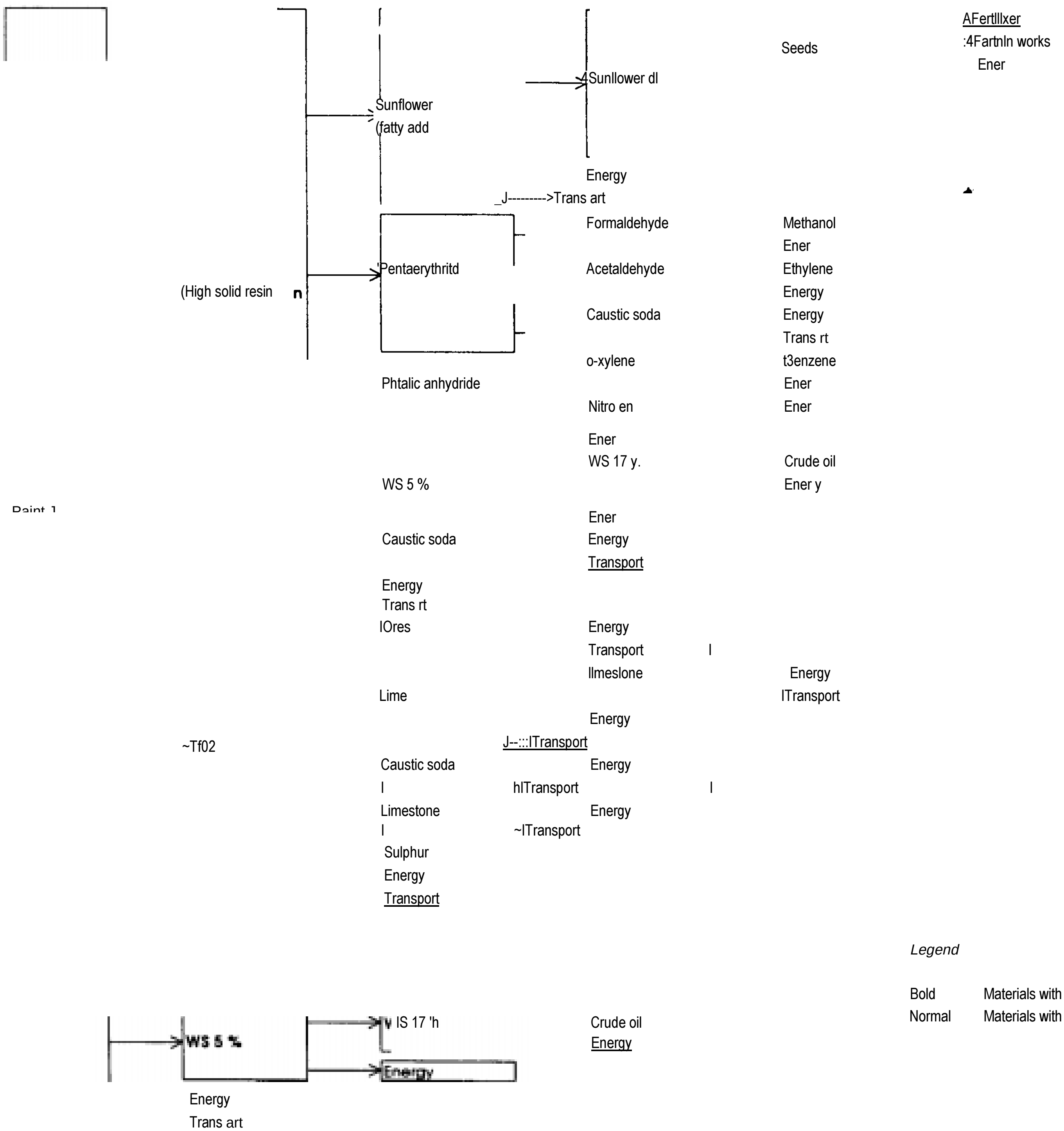


Legend

Bold	Materials with process data collected on site
Normal	Materials with bibliographic process data



Legend

Bold	Materials with process data collected on site
Normal	Materials with bibliographic process data

Styrene
Energy
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AayMc resin

--j Bulyraldohyde
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Propylene ~,
Energy
Natural Go7
k0gon
-1 Oxygen

Energy

Butyl Adylalo
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Caustic soda
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Propylene
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Microvoid Resin
Caustic soda
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t K
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Caustic soda
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llrn~ston~
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~Tronsport
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Sulphur

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Energy
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WS 17
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Ammoniac
Ener
Legend
KOOlin
Ener
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Materials with process daft acted *on* site

BPPENDIx ,(II: DATA SOUR

Material	Data source	Site country / Literature source	Comments
acetaldehyde	biblio	1FP (5)	
acetone	biblio	EFP (5)	
acrylate 1			butyl acrylate data
acrylate 2	biblio	EFP (5)	
acrylate 3	biblio	lFP (5)	
alcools	biblio	EFP (5)	
alkyd resin C (1)	site	France	
alkyd resin F	site	France	
alkyd resin G	site	France	
alkyd resin H	site	France	
aluminium silicate	site	UK	
ammoniac	biblio	EFP (5) + confidential source	
benzene	biblio	PW1vI1 & APME 1993 (4)	
butanol	site	France	
butyraldehyde	site	France	
butyl acrylate	site	France	
calcium carbonate	site	France	
catalyst	biblio		
chalk	site	France	
coke	site	France	
crude oil	biblio	BUwal 132 (3)	
cyanhydride acid	biblio	EFP (5)	
ethylene	biblio	PWMI & APME 1993 (4)	
formaldehyde	biblio	IFP (5)	
high solid resin J	site	UK	
hydrogen	biblio	EFP (5)	
isoparaffmic	site	Belgium + UK	
kaolin	site	UK	
lime	site	France	
limed oil resin	site	France	
limestone	site	France	
linseed oil			sunflower oil data
lithopone	site	Germany	
microvoid resin K	site	UK	
nitrogen	site	France	
o-xylene	biblio	EFP (5)	
olefins (light)	biblio	**PWMI & APh1E** 1993 (4)	
ore for Ti02	site	Australia	
oxygen	biblio	Bttwal 132 (3)	
paint A	site	France	
paint B	site	France	
paint C	site	France	
paint D	site	France	
paint E	site	France	
paint F	site	France	

Material (continued)	Data source	Site country / Literature source	Comments
paint G	site	France	
paint l l	site	France	
paint I	site	France +'Clennany	
paint i	site	France	
paint K	site	France	
paper pulp	biblio	Bitwal 132 (3)	sulphate process
pentaeritluitol	site + biblio	Sweden / TP (5)	
plrtalic anhydride	biblio	IFP (5)	
plioway resin E	site	France	
propylene	biblio	PWMI & APME 1993 (4)	
soda	biblio	Bilwal 132 (3)	
styrene	biblio	PWMI & APME 1993 (4)	
styrene-acrylic resin A (2)	site	France	
substituted styrene			data from styrene
sulphuric acid	biblio	Handbook of Industrial Energy	
sulphur	biblio	BUwal 132 (3)	
sunflower fatty acid	site	Germany	
sunflower oil	site	France	
sunflower seeds	site	France	
tall oil	site	Sweden	
titanium dioxide	site	France	sulphate process
white spirit < 1%			data from WS < 5%
white spirit < 5%	site	France	
white spirit 17-18%	site	France	

Energy	Data source	Site country / Literature source	Comments
electricity	biblio	Bilwal 132 (3)	European model
heavy fuel oil	biblio	BUwal 132 (3)	
light fuel oil	biblio	BUwal 132 (3)	
natural gas	biblio	Bilwal 132 (3)	
synthesis gas	site	France	

Transport	Data source	Site country / Literature source	Comments
diesel oil (road)	biblio	Bawal 132 (3)	
Wit	biblio	BUwal 132 (3)	
rail	biblio	Btiwal 132 (3)	

(1) for paint C and paint D (2) for paint A and paint B (3) Federal Swiss Office of the Environment, Forests and Landscapes (4) European Centre for the Plastics in the Environment (PWNB) and Association of Plastics Manufacturers in Europe (APME) (5) Institut Frangais du Petiole (French Insitut of Petroleum) - "Procedes de petrochimie" 1986 ("Petrochemical process")

APPENDIX IV: THE ELEVEN ECOBALANCES

For each paint are presented:

- the detailed inventory, which is a table of figures;
- graphs which illustrate the interpretation phase: the origin of the flows in the life cycle and the environmental effects analysis (cf. Appendix I - section II).

Two guides are given below for an easier reading of the documents.

Guide to read the inventories

The eleven inventories are displayed paint by paint, in an identical format as explained below.

Note that the nature of the results may surprise the reader since the information is not necessarily in the format he would expect:

- the data refer to the functional unit (cf. III.1). This quantity is shown in the box in the top left of the first page;
- some consumptions are not shown since these were replaced by a breakdown of their environmental impact factors (e.g. alkyd resin is broken into the consumption of tall oil, solvent, etc .... and into the consumption of various forms of energy and production of gaseous, liquid and solid waste);
- the letter E+3 next to a figure indicates '10 to the third'. For instance, '2.13E+3' is equivalent to '2.13*10+3" or '2130 ;
- **consumptions** are indicated by a + sign (since materials are introduced into the system under investigation) and **outputs** (waste, air emissions, water emissions) by a - sign (since waste is taken out of the system).

Each table includes the set of elementary flows measured for the paint under investigation. In theory, the concept of'elerilentary flow' or'impact factor' encompasses the following:

- the raw material available without any extraction process,
- some forms of energy obtained directly from the environment (e.g. solar and hydraulic energy)
- materials and energy disposed of into the environment.

In practice, for this project, two kinds of elementary flows were combined:

- the consumption of non-energy materials whose production or extraction is not taken into account (because they are not included in the studied system, cf. 111.2);

- in the absence of data on waste elimination sectors, releases of all types was recorded (air emissions, effluents and solid waste).

In addition, electricity and energy source materials were recorded by way of information, although these did not constitute elementary flows and their production (or extraction and/or combustion) was taken into account. It is interesting to know the value of this type of consumption in order to assess the energy-consuming or energy-conserving nature of the process under investigation.

There are several columns:

• the first column contains the name of the flows, classified under eight headings relating to consumption or waste:
  - consumption of non-energy materials;
  - consumption of packaging;
  - consumption of water;
  - consumption of energy:
    the category *Thermal Energy* records the fuels energy and the feedstock energy,
    the category *Primary Equivalent Energy* records the energy necessary to produce electricity and fuels and the feedstock energy,
    Primary Equivalent Energy is thus the sum: Thermal Energy + Electricity*yield, while electricity yield is 3.19 primary MJ/electric MJ for the European model;
  - consumption of fuels;
  - water discharge;
  - L atmospheric emissions;
  - solid waste;

• the second column contains the total of each flows for the whole life cycle;

• .... the third column contains the unit for each flow (kg, MJ, mg, ...);

• then each stage in the life cycle are represented by five columns:
  - the first and grey one is the sum of the four others;
  ....- the column *Site* contains fluxes appearing on the production site:
  .... raw materials consumption whose production has not be taken into
  .... account,
    energy consumption (electricity, all fuels, ...)
    water emissions measured on the site,
    air emissions appearing on the site,
    solid waste measured on the site;

the column *Energy production* contains the flows related to the production of energy sources (electricity, fuels, ...);
the column Raw *material production* contains the flows related to the production of the different raw materials consumed on the site;
the column *Raw material transport* contains the flows related to the transport (road, sea and rail) of the raw materials from the suppliers to the site.

Guide to read the graphs

The unit is mentioned at the top of the sheet (e.g. 'mg').

For each paint,

- the quantity of each paint corresponding to the functional unit is reminded above the graph,
- the total emission or consumption or impact is given above the graph,
- the contribution of each stage of the life cycle is represented.

The legend gives the name of the stages production stages from 2 to 7 and paint application stage for 8. The total for each paint life cycle is represented in step 1. For each stage (except the Ti02 production stage), we have represented:

the contribution of the process, the contribution of the production of the energy consumed by the stage, the contribution of the raw materials production, the contribution of transport steps during the stage.

Due to confidential reasons, only the total of these four steps have been represented for Ti02 with [redacted]

Then the results for the eleven paints are presented.

Paint A: mat water borne paint - styrene-acrylic resin

Life cycle inventory of paint A
Mat water-borne paint - Styren-acrylic resin (A)

	Valeur	Unit: SI	Extenders						Ti02
			Kaolin	Site	Energy productio	CaCO3	Site	Energy production	Ti02
	2.47	i	Functional Unit (20 m' covered with 9896 opacit						
Materials									
solvenUcoales. agent : butyl diglycol	7.51 E-2	kg							
kaolin ore	2.00E-1	kg	2.00E-1	2.00E-1					
dispersing agent : sodium polyphosphate	3.00E-2	kg							
dispersing agent : surfactant nanylphenols	2.00E-2	kg							
cellulose thickener	1.50E-2	kg							
other antifoaming agent	2.75E-2	kg							
rust preventing agent : sodium benzoate	1.50E-2	kg							
other biocides	1.25E-2	kg							
neutralizing amines	5.01E-2	kg							
nonylphenol ethaxyle sulfate	3.43E-2	kg							
acrylamid	6.79E-3	kg							
acrylic monomers: acrylic acid	1.11E-2	kg							
ammonium persulphate	3.04E-3	kg							
alkalis	7.33E-3	kg							
TBHP	1.25E-3	kg							
sodium metabisulfite / sodium sulfate	8.94E-4	kg							
SPX acticide	1.25E-3	kg							
nopco NXZ	8.94E-5	kg							
rock salt	5.68E-2	kg							4.95E-2
marble or limestone	3.20E+0	kg				1.75E+0	1.75E+0		1;45E+0
HCI	4.69E-3	kg							4:fi9E-3
TiCL4	4.37E-2	kg							4,37E-2.
trihydrated aluminium	3.38E-2	kg							3.38E-2
monoamonico phosphate	2.54E-3	kg			;'				2.54E=3'
iron (metal, ore)	9.36E-5	kg							
Zr02 compounds	3.74E-3	kg							3.74E-3
sodium silicate	2.66E-2	kg							2.66E-2
oil	4.72E-4	kg							
grease	6.30E-5	kg							
explosives	1,92E-3.	kg				1;OSE-5.	1.05E-3		8,&7E-4
ilmenite ore	8 56E 1 •	kg							8,58E-1
diverse compounds 6 catalysts	1,94E-3 ::	kg							
clay	7 36E-6	kg							
ferromanganese	3.68E-7.	kg							
bauxite	4.51E-4".	kg							
ore (Cu2S. Fe2S3)	5.09E-3:	kg							
air ~	1.75E=1	m3							

Life cycle inventory of paint A

Mat water-borne paint - Styren-acrylic resin (A)

					Extenders				Tioz
			Icaorn	Site	Energy production	C*C03	Site	Energy production	TiO2
tin can	4.18E-1	kg							
Water consumption	2.72E+2	I	5.65E-3	4.00E-3	1.64E-3	1.04E-3	6.28E-4	4.11E-4	1.BAE+2
composition	2.30E+0	I							
cleaning	1.07E+2	I							1.05E+2
cooling	9.87E+1	I							8.66E+1
boiler	2.04E+0	I							1.71E+0
unspecified water	1.43E+0	I	1.64E-3		1.64E-3	1.04E-3	6.28E-4	4.11E-4	6.34E-1
process	2.62E-1	I	4.00E-3	4.00E-3					
Energy		-							
electricity	1.32E+1	MJ	2.55E-1	2.54E-1	1.16E-3	7.91E-2	7.91E-2		8.95E+0
thermal energy	6.46E+1	MJ	3.44E-1	3.11E-1	3.28E-2	8.53E-2	8.53E-2		2.50E+1
primary energy equivalent	1.07E+2	MJ	1.16E+0	3.11E-1	8.47E-1	3.38E-1	8.61E-2	2.51E-1	5.36E+1
Fuels									
coal	4.80E-1	kg	5.29E-3		5.29E-3	1.64E-3		1.64E-3	3.90E-1
lignite	4.21E-1	kg	8:52E-3		8.52E-3	2.64E-3		2.64E-3	2.92E-1
light fuel oil	5.52E-2	kg	3.87E-4	1.04E-6	3.86E-4	2.48E-5		2.48E-5	3.77E-2
heavy fuel oil	2.12E-1	kg	2.51 E-3		2.51 E-3	9.32E-4	1.53E-4	7.80E-4	1.20E-1
natural gas	5.72E-1	kg	6.90E-3	6.77E-3	2.13E-3	5.74E-4	5.98E-6	5.68E-4	3.96E-1
diesel oil	8.62E-2	kg				1.84E-3	1.84E-3		6.46E-3
nuclear	1.46E+1	MJ	2.93E-1		2.93E-1	9.07E-2		9.07E-2	1.00E+1
hydraulic	2.16E+0	MJ	4.28E-2		4.28E-2	1.33E-2		1.33E-2	1.47E+0
other fuels	2.20E-2	MJ							
Discharge into water		-							
water discharge	-2.06E+2	I	-6.01E-1	-6.01E-1	-7.85E-4	-2.44E-4		-2.44E-4	-1.92E42
suspended matters	-1,36E+4	mg	-6.36E+1	-6.31E+1	-5.56E-1	-1.56E-2	-1.10E-2	-4.56E-3	-1.31E+4
COD	-1.46E+4	mg	-3.97E-2		-3.FE-2	-4.54E-2	-3.31E-2	-1.23E-2	-1.25E+4
BODS	-6.73E+1	mg	-1.32E-2		-1.32E-2	-1.51E-2	-1.10E-2	-4.10E-3	-7.87E-1
hydrocarbons	-1.12E+2	mg							
iammoniumhydroxide	-1.76E+1	mg	-4.88E-2		-4.88E-2	-1.51E-2		-1.51E-2	.-1.68E+0
fluorides	-5.33E+0	mg	-1.05E-1		-1.05E-1	-3.26E-2		-3.26E-2	-3:61E+0
sulphates	-5.36E+3	mg	-2.22E-2		-2.22E-2	-6.89E3		-6.89E-3	-7.63E-1
nitrates	-1.63E+0	mg	-2.49E-2		-2.49E-2	-7.71E-3		-7.71E-3	-8:54E-1
chlorides	-4.85E+1	mg	•1.34E-3		-1.34E-3	-4.15E-4		-4.15E-4	-4.59E-2
Na(ion)	-2.88&9.	mg	,421&1.	-1.21E+1	-1.73E-2	.:-5.35E-3		-5.35E-3	.-5.93E t
Fe (ion)	-5.71&4	mg	-3;02E-2	-3.00E-2	-2.03E-4	-6.31£•5		-6.31E-5	=5:71.&4
phenols	-2.07E-1	mg							
	-1:18E-2	mg							-118E•2
oils	-1.37E+2	mg	-6.72E-1		-6.72E-1	-4.31E•1.	-3.00E-1	-1.31E-1	4.82E+1
dissolved Xbstances	-4,07E+3	mg	-2:93E+1		-2.93E+1	3.20E+1	-2.33E+1	-8.75E+0	.-1.57E+3
paint residues	-3.12E+4	mg							
S	-1,45E+0	mg							
NKT	-7.73E+0	mg							
K	-2.1060	mg	-2.t0E.+0	-2.10E+0					
Ca	-5.42E+3	mg	-3.3DEi0	-3.30E+0					-5:42E+3
Mg	4:38E+4:	mg	4:44Et0:	=1.44E+0					=39E+4:
AI	1.27E+4.	mg		-6b1e4-6.01E-2					-127E+4:
P04	120E•1	mg	1;2DE-1.	-1.20E-1					
Si02	-4.6860		-4:68E0	-4.68E+0					

Life cycle inventory of paint A

Mat water-borne paint - Styren-acrylic resin (A)

.

					Extenders				**Ti02**
			Kaolin	Site	Energy production	CaC03	Site	Energy production	**Ti02**
Pb	-1.53E+1	mg	-3.00E-3	-3.00E-3					-1.53E+1
Cu	-8.40E+0	mg	-2.40E-3	-2.40E-3					-8.39E+0
Zn	-6.05E+2	mg	-1.14E-2	-1.14E-2					-6.05E+2
	-3.00E-2	mg	-3.00E-2	-3.00E-2					
Mr.	-3.36E+3	mg	-1.74E-2	-174E-2					-3.36E+3
Cr	-1.92E+0	mg	-2.40E-3	-2.40E-3					-1.92E+0
Cd	-3.25E-1	mg							-3.25E-1
Cl-	-1.69E+1	mg	-1.69E+1	-169E+1					
	2.76E-1	mo	-2'6E-1	-2'SE-1					
other nitrogen	5.68E+0	ma							
otheismetalsions	2.34E,2	mg							
Air emissions									
dusts	-5.24E+3	mg	-4.90E+1	-3.21E+1	-1.69E+1		7.76E+0	-5.23E+0	-3.86E+3
sox	3.29E+4	mg	-2.30E+2	-7.27E-2	-2.30E+2	-8.18E+1	-1.45E+1	-6.73E+1	-1.92E+4
HCL	-3.74E+2	mg	-7.40E+0		-7.40E+0	-2.29E+0		-2.29E+0	-2.54E+2
NOx	-1.88E+4	mg	-1.35E+2	-2.56E+1	-1.10E+2	-1.29E+2	-9.55E+1	-3.31E+1	-7.04E+3
N20	.7.25E+2	mg	-7.20E+0	-7.79E-1	-6.42E+0	-5.10E+0	-3.22E+0	-1.88E+0	-4.82E+2
CO	-5.13E+3	mg	-3.39E+1	-2.90E+0	-3.10E+1	-4.66E+1	-3.73E+1	-9.30E+0	-1.98E+3
C02	-5.06E+6	mg	-5.51E+4	-1.60E+4	-3.92E+4	-1.84E+4	-6.84E+3	-1.16E+4	-3.55E+6
ammoniac	3.83E+3	mg	-4.40E-2		-4.40E-2	-5.04E-2	-3.68E-2	-1.36E-2	-2.20E+0
aldehydes	1.85E+1	mg	-2.25E-1		2.25E-1	.1.43E-1	-7.36E-2	-6.97E-2	-1.12E+1
fluorides(gazeous(	2.79E-2	mg	-5.52E-4		5.52E-4	-1.71E-4		-1.71E-4	-1.89E-2
H2S	2.68E+0	mg							
other organic substances	-3.24E+1	mg	-4.07E-1		-4.07E-1	-2.37E-1	-1.10E-1	-1.26E-1	-2.02E+1
VOC , white spirit 17-18`•6	-3 85E+4	mg							
VOC butyl diglycol	-5.76E+4	mg							
other VOC	-4.07E+1	mg							
free acrylic monomers	-6.74E+2	mg							
amines	-3.83E+4	mg							
chlorine	-3.41E-2	mg							-3.16E-2
total hydrocarbons	4.49E+4	mg	-3.78E+2	-3.23E+0	-3.75E+2	-8.74E+1	-3.09E+1	-5.65E+1	-3.30E+4
methan	-9.84E+3	mg	-9.23E+1	-2.91E+0	-8.94E+1	-6.93E+0	-1.25E+0	-5.68E+0	-8.76E+3
non methanic hydrocarbons	-3.51E+4	mg	-2.86E+2	-3.24E-1	-2.86E+2	-8.05E+1	-2.96E+1	-5.08E+1	-2.43E+4
hydrogen	-4.00E+0	mg							
metals	-2.17E+0	mg							
total VOC	-1.35E+5	mg							
Waste production	-4.68E+0	kg	-4.01E-3		-4.01E-3	-1.24E-3	-2.87E-6	-1.24E-3	-2.84E+0
toxic wastes	-2.87E-2	kg							-5.66E-4
industrial wastes or post-consumer wastes	-1.90E+0	kg							
inert wastes	-3.04E-3	kg							-2.87E-1
incineration	-6.34E-5	kg							
incineration and recovery	-1.25E-1	kg							
recuperation	-2.29E+0	kg							-2.29E+0
inert minerals	-7.04E-4	kg							
unspecified wastes	-3.24E-1	k	-4.01E-3		-4.01E-3	-1.24E-3	-2.87E-6	-1.24E-3	-7.04E-4 -2.62E-1

Life cycle inventory of paint A
Mat water-borne paint - Styren-

	Acrylic resin					**Paint**					**Application**	
	Acrylic -1	Site ~	Energy	Raw material	Raw	**Paint**	Site	Energy	Raw material	Raw **material**	**Application**	Site
Materials												
solventcoales anent butyl oiglycot						7.51 E-2	-51E-2					
kaolin ore												
dispersing agent sodium polyphosphate						3.00E-2	3.00E-2					
dispersing agent surfactant nonylphenols						2.00E-2	2.00E-2					
=ellulose thickener						1.50E-2	1.50E-2					
other antifoaming agent						2.75E-2	2.75E-2					
rust preventing agent sodium benzoate						1.50E-2	1.50E-2					
other biocides						1.25E-2	1.25E-2					
neutralizing amines						5.01 E-2	5 01 E-2					
nonylphenol ethoxvle sulfate	3.43E-2	3 43E-2										
acrylamid	6.79E-3	6 79E-3										
acrylic monomers acrylic acid	111E-2	1.11E-2										
ammonium persulphate	3.04E-3	3.04E-3										
alkalis	7.33E-3	7.33E-3										
yBH P	1.25E-3	1.25E-3										
sodium metabisulfite , sodium sulfate	6.94E-4	8.94E-4										
SPX acucide	1.25E-3	1.25E-3										
nopco NXZ	8.94E-5	8 94E-5										
rock salt	7 32E-3			7 32E-3								
marr•.le or hmestone	5 68E-5			5.68E-5								
.4CI												
T,CL4												
trihydrated aluminium												
monoamonico phosphate												
iron (metal, ore)	9.36E-5			9.36E-5								
Zr02 compounds												
sodium silicate												
oil						4.72E-4	4.72E-4					
grease						6.30E-5	6.30E-5					
explosives												
ilmenite ore												
diverse compounds 8 catalysts	1.94E-3			1.94E-3								
clay	7.36E-6			7.36E-6								
ferromanganese	3.68E-7			3.68E-7								
bauxite	4.51 E-4			4.51 E-4								
ore (Cu2S. Fe2S31 •	5.09E-3			5.09E-3								
air	1.75E-1			1.75E-1						~l		
petroleum	3.93E-1		1.67E-3	3.88E-1	4.29E-3	1.04E-1		2.81E-2	5.39E-2	2.22E-2	5.79E-2	
coal	5.45E-2		8.29E-3	4.62E-2	2.85E-5	1.51E-1		1.49E-1	7.44E-4	1.34E-3	3.84E-4	
natural gas	3.92E-1		3.54E-3	3.89E-1	1.67E-5	2.52E-2		2.00E-2	4.99E-3	2.74E-4	2.25E-4	
Packaging												
cardboard						5.98E-2	5.98E-2					
paper												
polyethylene						2.15E-2	2.15E-5					

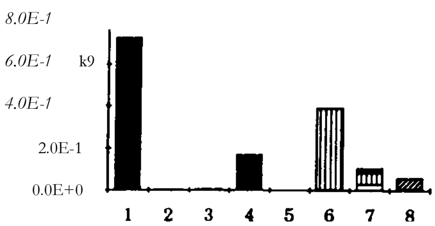
Life cycle inventory of paint A Mat water-borne paint - Styren-acrylic resin (A)	Acrylic **resin**	Site	Acrylic resin Energy productio n	Raw material production	Raw material	**Paint** :	Site	Paint Energy production	Raw material production	Raw material transport	**Applicati on**	Applicati on site
tmaterial	1,42E+1	1.16E+1	8.88E-4	2.65E+0	transpor	4.18E-1	4.18E=1	1.41E-2	2.23E-1	5.05E-3	2.06E+0	2.05E+0
in can	8.76E-1	8.76E-1	8.88E-4	1.20E-2	t	1.62E+0	1.38E+0	1.41E-2	2.19E-1	5.05E-3	5.00E-2	S.OOE-2
Water consumption	1.87E-1	1.75E-1		1.30E+0	8.35E-4	1.38E+0	1.38E+0		2.25E-3		2.005+0	2.00E+0
composition	1.18E+1	1.05E+1		3.23E-1	8.35E-4	2.19E-1			9.585•4		1.13E-2	
cleaning	3.23E-1			7.57E-1		2.25E-3						
cooling	7.59E-1			2.58E-1		2.01E-2						
boiler	2.58E-1											
unspecified water												
process												
Energy												
electricity	1,07E+0	1.50E-1	3.94E-4	9.16E-1	5.25E-4	2.85E+0	2.70E+0	8.62E+0	1.36E-2	1.34E-1	7.07E-3	
thermal energy	3.33E+1	1.05E-1	1.11E-2	3.30E+1	1.84E-1	3.31E+0			2.37E+0	9.40E-1	2.49E+0	
primary energy equivalent	3.67E+1	1.05E-1	4.90E-1	3.59E+1	1.86E-1	1.24E+1			2.42E+0	1.35E+0	2.515+0	
Fuels												
coal	2.63E-2	2.29E-3	3.12E-3	2.32E-2	3.30E-4	5.76E-2		5.62E-2	2.56E-4	1.09E-3	4,45E-3	
lignite	2.70E-2		5.02E-3	2.20E-2	1.29E-5	9.10E-2		9.05E-2	4.12E-4	6.59E-5	1.74E-4	
light fuel oil	1.60E-2		1.51E-4	1.58E-2	3.98E-3	1.07E-3		8.49E-4	2.13E-4	7.60E-6	5.36E-2	
heavy fuel oil	5.22E-2		1.48E-3	5.04E-2		3.24E-2		2.67E-2	3.62E-3	2.00E-3		
natural gas	1.44E-1		1.18E-3	1.41E-1		2.17E-2		1.95E-2	1.96E-3	2.50E-4		
diesel oil	4.17E-3		1.72E-1	1.91E-4		2.02E-2		3.11E+0	9.52E-3	2.02E-2		
nuclear	1.04E+0		2.52E-2	8.69E-1		9:12+0		4.55E-1	1.39E-3			
hydraulic	1.84E-1			1.58E-1		4:565-1						
other fuels	2.20E-2			2.20E-2								
Discharge into water												
water discharge	-	-	-4.63E-4	-4.92E-1	-2.39E-2	-2.19E-1		-8.35E-3	-2.10E-1	-7.9354	-2.00E+0	-
suspended matters	1.16E+1	1.11E+1	-1.92E-1	-1.71E+2	-7.16E-2	-		-1.56E-1	-8.08E-1	-1.23E-1	-3.22E-1	2.00E+0
COD	-	-	-2.34E-2	-7.86E+2	-2.39E-2	1.09E+0		-4.22E-1	-1.42E+1	-3.69E-1	-9.65E-1	
BODS	3.99E+2	2.29E+2	-7.79E-3	-2.18E+1		-		-1.41E-1	-5.92E-1	-1.23E-1	-3.22E-1	
hydrocarbons	-	-	-2.88E-2	-1.12E+2		1.50E+1		-5.19E-1	-2.09E-1	-4.93E-2		
ammonium hydroxide	2.01E+3	1.235+3	-6.20E-2	-1.30E+1		-8.56E-1		-1.12E+0	-2.28E+0	-1.06E-1		
fluorides	-	-	-1.31E-2	-2.82E-1		-2.09E-1		-2.36E-1	-5.09E-3	-2.25E-2		
sulphates	6.53E+1	4.35E+1	-1.46E-2	-5.36E+3		-		-2.64E-1	-1.07E-3	-2.51E-2		
nitrates	-	-1.23E-2	-7.88E-4	-4.35E-1		2.855+0		-1.42E-2	-1.20E-3	-1.36E-3		
chlorides	1.12E+2		-1.02E-2	-4.84E+1		-		-1.84E-1	-6.46E-5	-1.74E-2		
Va (ion)	-		-1.20E-4	-2.87E+3		1,23E+0		-2.16E-3	-8.35E-4	-2.06E-4		
Fe (ion)	1.30E+1			-5.44E-4		-2.60E-1			-9.83E-6			
phenols	-3.44E-i			-1.68E-1		-2.91E-1			-2.69E-2			
Hg	-					-1,56E-2						
	5,36E+3					-2.02E-						
	-4.49E-1					1.						
	-					-2.3853:						
	4.84E+1					-2.69E-2,						
	-											
	2.87E+3											
	-6,64E-4											
	-1,80E-f											
oils	-	-6.13E-1	-3.33E-1	-6.16E+1	-6.48E-1	-	-	4.49E+0	-8.72E+0	-3.35E+0	-8.74E+0	-
dissolved substances	6,26E+1		-1.70E+1	-4.57E+2	-	1;6654.1	1.19E+3	-3.00E+2	-6.76E+2	-2.60E+2	•.-648Ea2	3.005+4
paint residues	-			-8.40E-1	5.03E+1	:>1.24Et3					-3 OOEa4	
	5.24E+2					=1						
	.					19E+3						
	-											
	1.455+0											
NKT	-	-										
	7.72E+	7.72E+0										

Life cycle inventory of paint A t water-borne paint - Styren-acrylic resin (A)	Acrylic resin					Paint					Application		
	Acrylic resin	Site	Energy production	Raw material production	Raw material transport	**Paint**	Site	Energy production	Raw material production	Raw material transport	**Application**	Site	Ra mat trans
	-3.00E-2			-3.00E-2									
n													
er mtroaen	5.68E+0			-5.68E+0									
ers metals ions	-2.34E+2			-2.34E+2									
emissions													
ts	-8.15E+2	-2.31E-2	-9.96E+0	-7.89E+2	-1.68E+1	-2.72E+2		1 79E+2	-5.69E+0	-8.71E+1	-2.26E+2		-2.26
≠	-1.02E+4	7'9E-2	-1.32E+2	-1.00E+4	-3.12E+1	-2.80E+3		-231E+3	-3.01E+2	-1.88E+2	-4.21E+2		-4.21
1	-3.12E+1		-4.36E+0	-2.68E+1		-7.99E+1		-7.87E+t	-3.58E-1	-9.02E-1			
x	-6.48E+3	-8.68E+0	-6 39E+1	-6.20E+3	-2.06E+2	-2.23E+3		-1.14E+3	-3.88E+1	-1.06E+3	-2.78E+3		-2.78
O	-3.85E+1	-2.64E-1	-3.70E+0	-2.75E+1	-6.96E+0	-9.87E+1		-6.46E+1	-1.24E+0	-3.28E+1	-9.38E+1		-9.38
	-1.25E+3	-9.81E-1	-1.80E+1	-1.15E+3	-8.07E+1	-7.36E+2		-3.19E+2	-3.83E+0	-4.13E+2	-1.09E+3		-1.09
2	-,'.35E+5	-5 41E+3	2.26E+4	-6 92E+5	-1 48E+4	-4.96E+5		3.97E+5	-1.94E+4	-7.97E+4	-1.99E+5		-1.99
moniac	-5.15E-1		-2.59E-2	-4.10E-1	-7.95E-2	-9.45E-1		4 68E-1	-6.67E-2	-4.10E-1	-3.83E+3	-3.83E+3	-1.07
ehydes	-147E+0		-1.32E-1	1.17E+0	-1.59E-1	-3.36E+0		2.39E+0	-1.40E-1	-8.32E-1	-2.14E+0		-2.14
rides (gazeous;	=1.80E-3		-3.25E-4	-1.48E-3		-6.45E-3		-5.87E-3	-2.67E-5	-5.58E-4			
S	-2.68E+0			-2.68E+0									
er organic substances	-2.59E+0		-2.40E-1	2.11E+0	-2.39E-1	-5.79E+0		-4.32E+0	-2.13E-1	-1.25E+0	-3.22E+0		-3.22
C : white spirit 17-18°•=						-8.07E+2	-8.07,U+2				-3.77E+4	-3.77E+4	
C : butyl diglycol						-8.07E+2	-8.07E+2				-5.68E+4	-5.68E+4	
er VOC	-4.07E+1			-4.07E+1									
e acrylic monomers	-4.46E+0	-4.46E+0									-6.70E+2	-6.70E+2	
nes											-3.83E+4	-3.83E+4	
orine	-2.50E-3			-2.50E-3									
l hydrocarbons	-7.83E+3	-1.09E+0	-1.73E+2	-7.59E+3	-6.67E+1	-2.71E+3		-1.94E+3	-3.98E+2	-3.70E+2	-8.99E+2		-8.99
han	-4.47E+2	-9.85E-1	-3.49E+1	-4.09E+2	-2.70E+0	-4.96E+2		-1.95E+2	-2.86E+2	-1.55E+1	-3.64E+1		-3.64
methanic hydrocarbons	-7.39E+3	-1.10E-1	-1.38E+2	-7.18E+3	-6.40E+1	-2.21E+3		-1.74E+3	-1.12E+2	-3.54E+2	-8.63E+2		-8.63
rogen	-4.00E+0			-4.00E+0									
als	-2.17E+0			-2.17E+0									
l VOC	-4.51E+1	-4.46E+0		-4.07E+1		-1.61E+3	-1.61E+3				-1.33E+5	-1.33E+5	
ste production	-6.59E-2	-4.29E-2	-2.36E-3	-2.06E-2	-6.20E-6	-1.97E-1	-1.53E-1	-4.24E-2	-2.84E-4	-7.70E-4	-1.57E+0	-1.57E+0	-8.3
c wastes v	-2.40E-2	-2.37E-2		-3.94E-4		-4.08E-3	-4.07E-3		-1.47E-5				
ustrial wastes or post-consumer wastes	-2.57E-2	-1.93E-2		-6.44E-3		-2.37E-2	-2.37E-2			/1	-1.57E+0	-1.57E+0	
t wastes	-3.04E-3			-3.04E-3									
neration	-3.30E-5			-3.30E-5		-3.04E-5			-3.04E-5				
neration and recovery						-1.25E-1	-1.25E-1						
uperation	-7.68E-5			-7.68E-5		-8.91E-6			-8.91E-6				
t minerals													
pecified wastes	-1.30E-2		-2.36E-3	-1.06E-2	-6.20E-6	-4.34E-2		-4.24E-2	-2.30E-4	-7.70E-4	-8.36E-5		-8.3

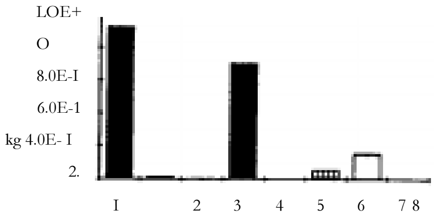
PAINT A : CONSUMPTIONS

Mat water-borne paint - Styren-acrylic resin (A)
2.47 I Functional Unit (20 n12 covered with 98% opacity)

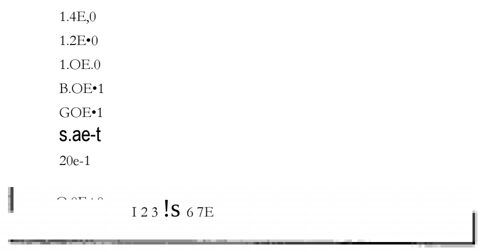
petroleum 7.3E-1 kg



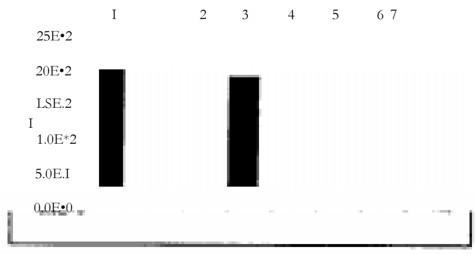
coal 9.3 E-1 kg



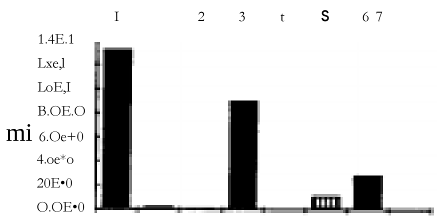
natural gas 1.3E+0 kg



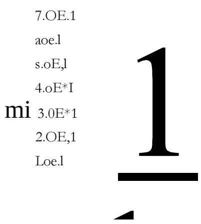
Water consumption
2.1E+2 I



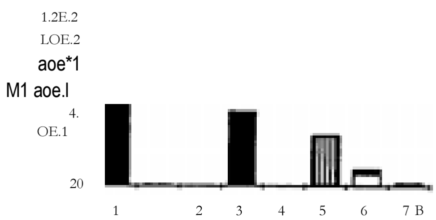
electricity 1.3E+1 MJ



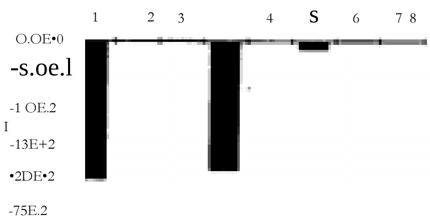
thermal energy
6 5E+1 M i



primary energy equivalent
1.1E+2 MJ



water discharge
-2.1E+2 1



Legend

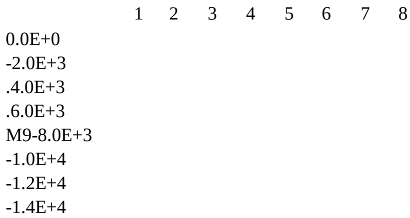
Site	1= TOTAL	5=
Energy	2 = Kaolin	6 = Acrylic resin
Raw material	3 = CaC03	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

PAINT A : DISCHARGES

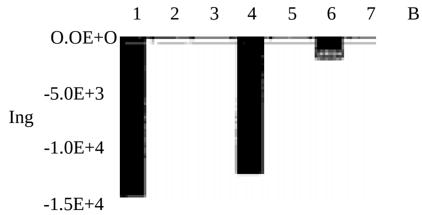
Mat water-borne paint - Styren-acrylic resin (A)

Functional Unit (20 m2 covered with 98% opacity)

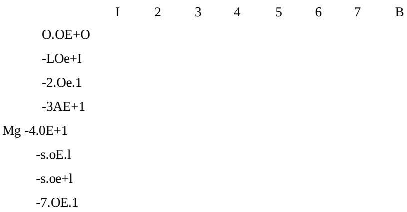
suspended matters -1.4E+4 mg



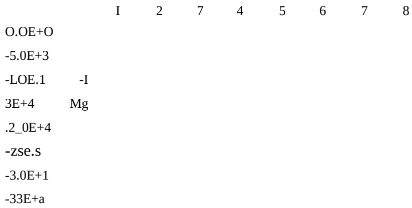
COD -1.5E+4 mg



BODS -6.7E+1 mg



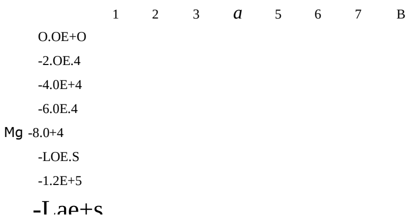
SOX -3.3E+4 mg



C02 -5.1E+6mg

total hydrocarbons -4.5E+4 mg

total VOC -1.4E+5 mg



Waste production -4.7E+0 kg

Legend

Site	1=TOTAL	5=
O Energy	2 = Kaolin	6 = Acrylic resin
Raw material	3 = CaC03	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

Paint B: gloss water-bornti paint - styrene-acrylic resin

g.cycle inventory of paint B
s water-borne paint - Styren-acrylic resin (A)

			Ti02	Acrylic resin					Paint					A lication	
			Ti02	Acrylic resin	Site	Energy productio n	Raw material production	Raw material transport	Paint	Site	Energy productio n	Raw material (productio	Raw material transport	Application -	Site
	Valeur	Unite SI													
	2.08	I	Functional Unit (20 mt covered with 9896 opacity)												
		-													
nt . butyl diglycol	5.65E-2	kg							5.65E-2	5.65E-2					
nt: 2,2.4 trimethyl	6.55E-2	kg							6.55E-2	6.55E-2					
nt : monopropylene	5.48E-2	kg							5.48E-2	5.48E-2					
d neutralizing amine	1.97E-2	kg							1.97E-2	1.97E-2					
urfactant 2.4,7,9-	6.13E-3	kg							6.13E-3	6.13E-3					
d PH regulator	3.13E-2	kg							3.13E-2	3.13E-2					
ane polymer	2.68E-2	kg							2.68E-2	2.68E-2					
: modified polysiloxan	5.48E-3	kg							5.48E-3	5.48E-3					
hiazolin-3 one	6.45E-4	kg							6.45E-4	6.45E-4					
an copolymer	3.23E-3	kg							3.23E-3	3.23E-3					
le sulfate	3.50E-2	kg		3.50E-2	3.50E-2										
	6.93E-3	kg		6.93E-3	6.93E-3										
crylic acid	1.13E-2	kg		1.13E-2	1.13E-2										
hate	3.10E-3	kg		3.10E-3	3.10E-3										
	7.48E-3	kg		7.48E-3	7.48E-3										
	1.28E-3	kg		1.28E-3	1.28E-3										
e / sodium-sulfate	9.12E-4	kg		9.12E-4	9.12E-4										
	1.28E-3	kg		1.28E-3	1.28E-3										
	9.12E-5	kg		9.12E-5	9.12E-5										
	1.14E-1	kg	4.09E-2	7.46E-3			7.46E-3		6-fi0.E- .2			6.60E-2			
e	1.19E+0	kg	1.19E+0	5.80E-5			5.80E-5		6.26E-6			6.26E-6			
	3.88E-3	kg	3.88E-3												
	3.61E-2	kg	3.61E-2												
um	2.80E-2	kg	2.80E-2												
phate	2.10E-3	kg	2.10E-3												
	1.08E-4	kg		9.55E-5			9.55E-5		1.25E-5			1.25E-5			
	3.09E-3	kg	3.09E-3												
	2.20E-2	kg	2.20E-2												
	1.23E-1	kg							1.23E-1	1.23E-1					
	1.91E-2	kg							1.918-2	1.91E-2					
	7.17E-4	kg	7.17E-4												
	7.08E-1	kg	7.08E-1												
8 catalysts	2.00E-3	kg		1.98E-3			1.98E-3		1.90E-5			1.90E-5			
	8.76E-6	kg		7.51E-6			7.51E-6		1.25E-6			1.25E-6			
	4.38E-7	kg		3.76E-7			3.76E-7		6,26E-8			6.26E-8			
	4.79E-4	kg		4.60E-4			4.60E-4		1.68E-5			1.88E-5			
	5.19E-3	kg		5.19E-3			5.19E-3								
	1.78E-1	m3		1.78E-1			1.78E-1								
	6.74E-1	kg	1.39E-1	4.01E-1		1.70E-3	3.95E-1	4.38E-3	**9.51E-2**		4.81E-3	7.91E-2	1.11E-2	*5E-2	
	6.91E-1	kg	5.81E-1	5.56E-2		8.46E-3	4.71E-2	2.90E-5	5.39E-2		2.55E-2	2.83E-2	7.37E-5	2.55E-4	
	1.17E+0	kg	7.23E-1	4.00E-1		3.61 E-3	3.97E-1	1.70E-5	4.95E-2		3.42E-3	4.60E-2	4.32E-5	1.50E-4	
		-													
	8.20E-3	kg							8.20E-3	8.20E-3					
	1.44E-2	k	1.44E-2												

T

of paint B			Ti02			Acrylic resin				Paint				Applicatio n
- Styren-			Ti02	**Acrylic**	Site	Energy	Raw	Raw	**Paint**	Site	Energy	Raw	Raw	**Applicatio n**	Site
resin (A)				resin		productio n	material	material			productio n	material	material		
							production	transport				production	transport		
	2.55E-2	kg	3.59E-3						2.19E-2	2.19E-2					
	5.47E-3	kg							5.47E-3	5.47E-3					
	3.53E-1	kg							3.53E-1	3.53E-1					
	1.80E+2	I	161E+2	1.45E+1	1.18E+1	9.06E-4	270E+0	8.52E-4	3.25E+0	2.32E+0	2.41E-3	9.26E-1	2.16E-3	2.01E+0	2.00E+0
	2.38E+0	I		8.94E-1	8.94E-1				1.48E+0	1.48E+0					
	9.01E+1	I	8.70E+1	1.91E-1	1.79E-1		1.23E-2		8.39E-1	8.39E-1				2.00E+0	2.00E+0
	8.38E+1	I	7.16E+1	1.20E+1	1.07E+1		1.32E+0		1.27E-1			1.27E-1			
	1.75E+0	I	1.42E+0	3.29E-1			3.29E-1		3.04E-3			3.04E-3			
	2.11E+0	I	5.24E-1	7.74E-1		9.06E-4	7.72E-1	8.52E-4	8.00E-1		2.41E-3	7.95E-1	2.16E-3	7.49E-3	
	2.63E-1	I		2.63E-1			2.63E-1								
		-													
	9.47E+0	MJ	7.40E+0	1.09E+0	1.53E-1	4.02E-4	9.34E-1	5.35E-4	9.77E-1	4.62E-1		5.13E-1	1.36E-3	4.71E-3	
	6.18E+1	MJ	2.07E+1	3.40E+1	1.08E-1	1.13E-2	3.37E+1	1.88E-1	5.413E+0			5.00E+0	4.78E-1	1:6515±0	
valent	9.20E+1	Mi	4.43E+1	3.74E+1	1.08E-1	5.00E-1	3.66E+1	1.90E-1	8.59E+0 .		1.47E+0	6.63E+0	4.82E-1	1,67E+0	
		-													
	3.70E-1	kg	3.22E-1	2.68E-2		3.18E-3	2.36E-2		2.11E-2		9.61E-3	1.15E-2			
	3.01E-1	kg	2.41E-1	2.75E-2		5.12E-3	2.24E-2		3.18E-2		1.55E-2	1.63E-2			
	4.78E-2	kg	3.12E-2	1.63E-2		1.54E-4	1.61E-2		3.20E-4		1.45E-4	1.75E-4			
	1.79E-1	kg	9.92E-2	5,33E-2		1,51E-3	5.14E-2	3.37E-4	2.37E-2		4.57E-3	1.83E-2	8.55E-4	2:9815-3	
	4.91E-1	kg	3.28E-1	1.47E-1	2.34E-3	1.21E-3	1.44E-1	1.32E-5	1.6$E-2		3.33E-3	1.31E-2	3.35E-5	1,18E-4	
	5.56E-2	kg	5.34E-3	4.25E-3			1.95E-4	4.06E-3	1.03E-2			1.73E-5	1.03E-2	3.57E-2	
	1.05E+1	MJ	8.29E+0	1.06E+0		1.76E-1	8.86E-1		tAttt0		5.32E-1	5.75E-1			
	1.56E+0	MJ	1.21E+0	1.87E-1		2.57E-2	1.62E-1		1.6 :515=1		7.78E-2	8.76E-2			
	2.25E-2	MJ		2.25E-2			2.25E-2								
	3.19E-3	kg							3.19E-3.			3.19E-3			
r		-													
	-1.73E+2	I	-1.59E+2	-1.19E+1	-1.13E+1	-4.72E-4	-5.02E-1		- 8:7115=1	-8.39E-1	-1.43E-3	-3.11E-2		-2.pQE+O	-2.00E+0
	-1.1315+4	mg	- 1.0815+ 4	-4.08E+2	-2.33E+2	-1.96E-1	-1.74E+2	-2.43E-2	-4.9oEs1	-3.52E+1	-2.67E-2	-1.27E+1	-6.18E-2	-3.14E=1	
	-1.2815+4	mg	- 1.0415+ 4	-2.05E+3	-1.25E+3	-2.38E-2	-8.02E+2	-7.30E-2	- 3:4915±2 :	-3.35E+2	-7.21E-2	-1.31E+1	-1.85E-1	**-6:4215•1**	
	-2,38E+2	mg	-6.51E-1	-6.66E+1	-4.44E+1	-7.95E-3	-2.22E+1	-2.43E-2	-1.701542	- 1.68E+~ ?	-2.40E-2	-2.48E+0	-6.18E-2	•2.:1415-1	
	-1,20&2	mg		-1.14E+2.			-1.14E+2		-6.02ED	-2.26E+0		-3.75E+0			
le	-1.53E+1	mg	-1.39E+0	-1.33E+1		-2.93E-2	-1.32E+1		-8VE,f		-8.87E-2	-5.63E-1			
	-3.73E+0	mg	-2.99E+0	-3.51E-1		-6.33E-2	-2.87E-1		-3.93E-1		-1.91E-1	-2.02E-1			
	-5,47E+3	mg	-6.31E-1	-5.47E+3		-1.34E-2	-5.47E+3		-8.30E-2		-4.04E-2	-4.26E-2			
	-1,32E+0	mg	-7.06E-1	-4.58E-1		-1.49E-2	-4.43E-1		-1.55E-1		-4.52E-2	-1.10E-1			
	-5.26E+1	mg	-3.80E-2	-4.94E+1		-8.04E-4	-4.94E+1		-3,13E+0		-2.43E-3	-3.13E+0			
	-2.93E+3	mg	-4.90E-1	-2.93E+3		-1.04E-2	-2.93E+3		-6.45E-2		-3.14E-2	-3.31 E-2			
	-4,72E+4	mg	-4.72E+4	-6.7815-4		-1.22E-4	-5.55E-4		- 3.2715+0	-3.27E+0	-3.70E-4	-3.90E-4			
	-3.30E-1	mg		-1.84E-1	-1.25E-2		-1.71E-1		-1.46E-1	-8.39E-2		-6.26E-2			
	-9.78E-3	mg	-9.78E-3												
	-1.21E+2	mg	-3.99E+1	-6.38E+1		-3.40E-1	-6.28E+1	-6.61E-1	-1.17E+1		-7.67E-1	-9.30E+0	-1.68E+0	-5.82E+0	
s	-2.80E+3	mg	1.30E+3	-5.34E+2		-1.73E+1	-4.66E+2	-5.13E+1	-5.21E+2		-5.13E+1	-3.40E+2	-1.30E+2	-4.51E+2	
	-3.0015+4	mg	f												

e cycle inventory of paint B water-borne paint - Styren- acrylic resin (A)			Ti02	Ac lic resin					Paint					Application	
			Ti02	Acrylic resin	Site	Energy productio	Raw material production	Raw material transport	Paint	Site	Energy production	Raw material production	Raw material transport	Application	Site
	-1.33E+1	mg	-1.26E+1	-3.06E-2			-3.06E-2		-6.71E-1	-1.68E-1		-5.03E-1			
	-6.97E+0	mg	-6.94E+0						-3.35E-2	-3.35E-2					
	-5.00E+2	mg	-5.00E+2						-3.52E-1	-3.52E-1					
	-2.77E+3	mg	-2.77E+3						-7.21E-1	-7.21E-1					
	-1.75E+0	mg	-1.58E+0						-1.68E-1	-1.68E-1					
	-2.77E-1	mg	-2.69E-1						-8.39E-3	-8.39E-3					
	-8.39E-2	mg							-8.39E-2	-8.39E-2					
	-2.52E-2	mg							-2.52E-2	-2.52E-2					
	-5.87E-2	mg							-5.87E-2	-5.87E-2					
	-6.42E+0	mg		-5.80E+0			-5.80E+0		-6.26E-1			-6.26E-1			
	-2.54E+2	mg		-2.39E+2			-2.39E+2		-1.56E+1			-1.56E+1			
		-													
	-4.34E+3	mg	-3.19E+3	-8.32E+2	-2.36E-2	-1.02E+1	-8.04E+2	-1.71E+1	-1.69Er2.		-3.07E+1	-9.51E+1	-4.35E+1	: -1.51E+2	
	-2.79E+4	mg	-1.59E+4	-1.04E+4	-7.95E-2	-1.35E+2	-1.02E+4	-3.19E+1	-1.41Ea3		-3.95E+2	-9.33E+2	-8.09E+1	.,-2;80F4	
	-2.70E+2	mg	-2.10E+2	-3.18E+1		-4.45E+0	-2.74E+1		-2.82E+1		-1.34E+1	-1.48E+1			
	-1.57E+4	mg	-5,82E+3	-6.61E+3	-8.86E+0	-6.52E+1	-6.32E+3	-2.10E+2	141E3:		-1.94E+2	-6.85E+2	-5.34E+2	:: '18SEi.3.:	
	-5.48E+2	mg	-3.98E+2	-3.92E+1	-2.69E-1	-3.77E+0	-2.81E+1	-7.10E+0	-4.79EO:		-1.10E+1	-1.89E+1	-1.80E+1	. 4;24Es1	
	-3.99E+3	mg	-1.64E+3	-1.27E+3	-1.00E+0	-1.84E+1	-1.17E+3	-8.23E+1	-3.55E+2		-5.45E+1	-9.15E+1	-2.09E+2	-7:24Ea2	
	-4.09E+6	mg	-2.94E+6	-7.50E+5	-5.52E+3	-2.31 E+4	-7.06E+5	-1.51E+4	-2.75E+5		-6.79E+4	-1.69E+5	-3.83E+4	:•:•1,33E+5	
	-3.74E+0	mg	-1.82E+0	-5.26E-1		-2.64E-2	-4.18E-1	-8.11E-2	-611E•1.		-8.00E-2	-3.95E-1	-2.06E-1	:::;-7;.14E-1	
	-1.40E+1	mg	-9.23E+0	-1.49E+0		-1.35E-1	-1.20E+0	-1.62E-1	.-1, .67Et0.		-4.09E-1	-1.05E+0	-4.12E-1	-I:43En0:	
	-1.96E-2	mg	-1.57E-2	-1.84E.3		-3.32E-4	-1.51E-3		-2OSE•3.		-1.00E-3	-1.06E-3			
	-3.08E+0	mg		-2.73E+0			-2.73E+0		-3.44E•1			-3.44E-1			
nces	-2.46E+1	mg	-1.67E+1	-2.64E+0		-2.44E-1	-2.15E+0	-2.43E-1	-3.13E+0		-7.40E-1	-1.78E+0	-6.18E-1	-2.14E+Q	
	-4.30E+4	mg							-5.65E+1	-5.65fF+1				-4.30E+4	-4.30E+4
	-4.77E+4	mg							-6.26E+1	-6.26E+1				-4.76E+4	-4.76E+4
pentamediol-1,3	-4.99E+4	mg							-6.55E+1	-6.55E+1				-4.99E+4	-4.99E+4
e glycol	-4.18E+4	mg							-5.48E+1	-5.48E+1				-4.17E+4	-4.17E+4
	-4.15E+1	mg		-4.15E+1			-4,15E+1								
rs	-6.86E+2	mg		-4.55E+0	-4.55E+0									-6.81E+2	-6.81E+2
	-7.06E-2	mg	-2.62E-2	-2.55E-3			-2.55E-3		-4.19E-2			-4.19E-2			
	-3.74E+4	mg	-2.73E+4	-7.99E+3	-1.12E+0	-1.76E+2	-7.74E+3	-6.81E+1	-1.45E+3		-3.31E+2	-9.48E+2	-1.73E+2	-5.99E+2	
	-7.80E+3	mg	-7.24E+3	-4.56E+2	-1.01E+0	-3.56E+1	-4.17E+2	-2.76E+0	-8.49E+1		-3.33E+1	4.45E+1	-7.00E+0	-2.43E+1	
carbons	-2.96E+4	mg	-2.01 E+4	-7.53E+3	-1.12E-1	-1.41E+2	-7.33E+3	-6.53E+t	-1.37E+3		-2.98E+2	-9.03E+2	-1.66E+2	-5.74E+2	
	-4.OBE+O	mg		-4.08E+0			-4.08E+0								
	-2.28E+o	mg		-2.21E+0			-2.21E+0		-6.26E-2			-6.26E-2			
	-1.83E+5	mg		-4.60E+1	-4.55E+0		-4.15E+1		-2.39E+2	-2.39E+2				-1.83E+5	-1.83E+5
	-3.59E+0	kg	-2185E+0	-6.72E-2	-4.38E-2	-2.41E-3	-2.10E-2	-6.33E-6	-8.27E-2	-6.51E-2	-7.26E-3	-1.04E-2	-1.61E-5	-1.09E+0	-1.09E+0
	-5.79E-2	kg	-4.68E-4	-2.45E-2	-2.41E-2		-4.02E-4		-3.29E-2	-3.28E-2		-5.54E-5			
post-consumer wastes	-1.39E+0	kg	-2.37E-1	-2.62E-2	-1.97E-2		-6.57E-3		-3.25E-2	-3.23E-2		-2.47E-4		-1.09E+0	-1.09E+0
	-3.40E-3	kg		-3.10E-3			-3.10E-3		-2.94E-4			-2.94E-4			
	-3.37E-5	kg		-3.37E-5			-3.37E-5								
	-1.90E+0	kg	-1.90E+0	-7.83E-5			-7.83E-5								
	-5.82E-4	kg	-5.82E-4												
	-2.47E-1	k	-2.17E-1	-1.33E-2		-2.41E-3	-1.08E-2	-6.33E-6	-1.71E-2		-7.26E-3	-9.79E-3	-1.61E-5	-5.57E-5	

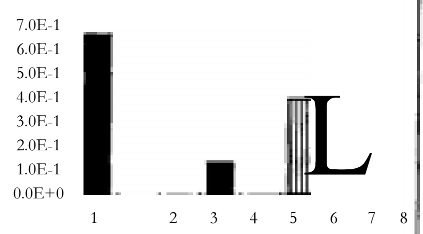
PAINT B : CONSUMPTIONS

(:loss water-borne paint - Styren-acrylic resin (A)

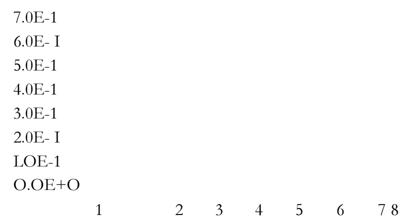
2.08 I

Functional Unit (20 m2 covered with 98% opacity)

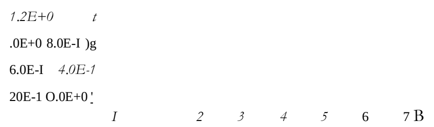
petroleum 6.7E-1 kg,



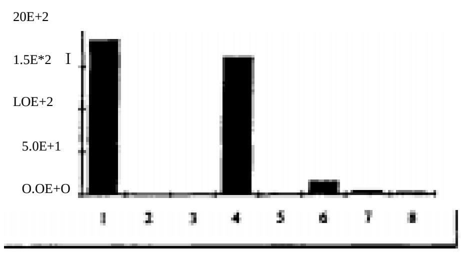
coal 6.9E-1 kg



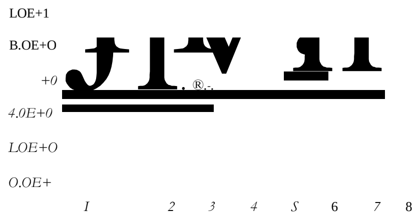
natural gas 1.2E+0 kg



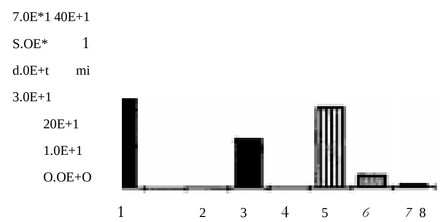
Water consumption 1.8E+2 1



electricity

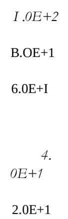


thermal energy 6.2E+1 M,1

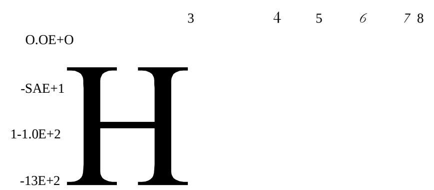


primary energy equivalent 9.2E+1.

M, 1



water discharge -1.7E+2 1



Legend

Site

Energy

Raw material

Transport

1= TOTAL

2 =

3 =

4 = Ti02 (total)

ti = Acrylic resin

7 = Paint

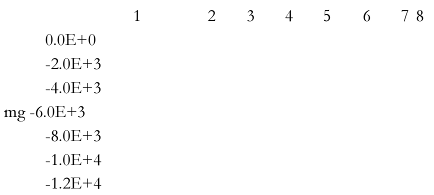
8 = Application

PAINT B : DISCHARGES

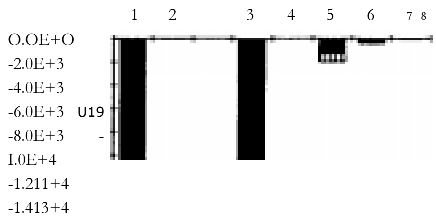
('.loss water-borne paint - ltyren-acrylic resin (A)

2.08 I Functional Unit (20 m2 covered with 98°!0 opacity)

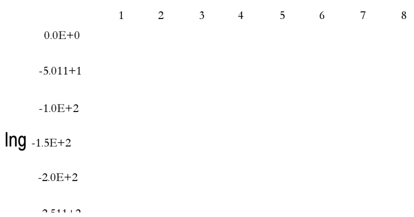
suspended matters -1.1E+4 mg



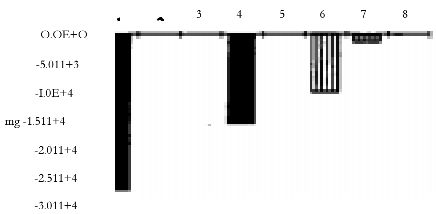
COD -1.3E+4 mg



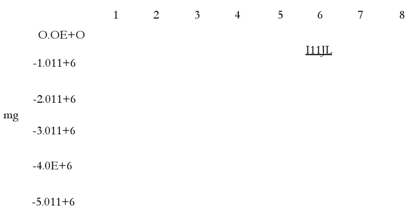
BOD5 -2.4E+2 mg



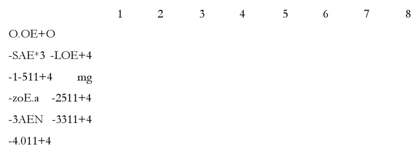
SOX -2.8E+4 mg



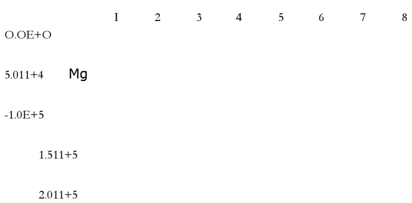
C02 -4.1E+6mg



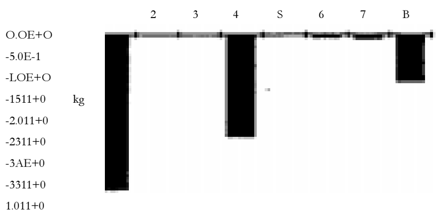
total hydrocarbons -3.7E+4 mg



total VOC -1.8E+5 mg



Waste production -3.6E+0 kg



Legend

Site	Energy	1 = TOTAL	5=
Raw material		3 =	6 = Acrylic resin
Transport		4 = Ti02 (total)	7 = Paint
			8 = Application

Paint C: *semi-gloss solvent-borne paint - alkyd resin - WS<5%*

Life cycle inventory of paint C
Semi-gloss solvent-borne paint -
Alkyd resin (C) - Isoparaffinic

Valour Units Sl

1.90 I Functional Unit (20 m: covered with 98% opacity)

			Extenders							Solvent			
			Kaolle :	Site	Energy production	ZaCOI:	Site	Energy production	T.KYI	1IV8sx::: solvent::	Site	Energy productio	Haw materia . producti
Materials		-											
xylene	3.48E-2	kg											
cleaning solvent : methyl isobutyl ketone	1.18E-2	kg											
cleaning solvent: toluene	1.18E-2	kg											
kaolin ore	7.70E-1	kg	7.70E-1	7.70E-1									
soya lecithins (dispersing agent . ...)	2.05E-2	kg											
siccative : Pb/Zn/Co/Ca/Zr complex	6.84E-2	kg											
anti skinning forming agent : methyl ethyl	1.03E-2	kg											
sodium metabisulfite / sodium sulfate	8.15E-3	kg											
glycerin	5.18E-2	kg											
maleic anhydride	3.85E-3	kg											
phenyl triphosphate	8.23E-4	kg											
wolfamid 500	1.18E-2	kg											
rock salt	7.92E-2	kg							5.25E-2				
marble or limestone	1.74E+0	kg				2.05E-1	2.05E-1		1.53E+0				
HCI	6.77E-3	kg							4.98E-3				
caustic soda	5.41E-3	kg											
iCL4	4.63E-2	kg							4.63E-2				
rihydraoud aluminium	3.59E-2	kg							3,59E-2				
wood	9.75E-1	kg											
monoamonico phosphate	2.70E-3	kg							2.70E-3				
iron (metal, ore)	3.43E-5	kg											
Zr02 compounds	3.97E-3	kg							3.97E-3				
sodium silicate	2.83E-2	kg							2.83E-2				
oil	3.23E-4	kg											
grease	5.44E-5	kg											
explosives	1.04E-3	kg				1.23E-4	1.23E-4		9.20E-4				
ilmenite ore	9.09E-1	kg							9.08E-1				
clay	4,39E-6	kg											
ferromanganese	2.20E-7	kg											
bauxite	5.05E-5.	kg											
air	7.70E-3	m3											
petroleum	1.79E+o	kg	1.14E-2		1.14E-2	3.29E-4	2.33E-4	9.61E-5	1,78E-1,.	4.89E-1		1.46E-3	4.87E
coal	1.03E+0	kg	5.42E-2		5.42E-2	5.12E-4	1.54E-6	5.10E-4	7.45E-1	. 1.14E-2		5.03E-3	6.42E
natural gas	1.26E+0	kg	3.48E-2		3.48E-2	6.92E-5	9.06E-7	6.83E-5	9,27E-1	.2.97E-2		1.26E-2	1.71E
Packaging		-											
cardboard	4.63E-2	kg											
paper	2.39E-2	kg	3.85E-3	3.85E-3		1.64E-3	1.64E-3		1.84E•2.				
polyethylene	2.32E-2	kg	1.54E-3	1.54E-3		4.11E-4	4.11E-4		4.6tE:3:.				
tin can	3.23E-1	kg											
Water consumption	2.38E+2	1	2.17E-2	1.54E-2	6.32E-3	,1.2.2(: 74	7.36E-5	4.815		2- 06E+2:::2 :28W	2.84E-1	9.94E-4	2.00E
cleaning	1,12Ea2 :	I							112E+2				
cooling	9 97E41:	1							4:196+.1		227E42.84 E-1		1.99E
boiler	121 E44, :.	I							1;82Et0				
unspecified water	1E+3:	I	8.32'5-9:		6.32E-3	'1.3ZE.4	7.36E	4.81 E5	.;g;9a•1	81,93'		9.94E-4	7.43E
process	~.44E+V :	I	1.54E-2	1.54E-2									

Life cycle inventory of paint C Semi-gloss solvent-borne paint - Alkyd resin (C) - Isoparaffinic			Kaolin	Site	Extenders Energy productio	CaGp3	Site	Energy production	Tjpy : :	::WS 5% solvent	Site	Solvent Energy production	Raw mater *produc*
Energy		_											
electricity	1.47E+1	MJ	9.82E-1	9.78E-1	4.48E-3	9.27E-3	9.27E-3		9.50E+0	2.08E-1	8.92E-2	1.94E-3	1.17E
thermal energy	1.18E+2	MJ	1.32E+0	1.20E+0	1.26E-1	1.00E-2	1.00E-2		2.65E+1	2.07E+1	5.18E-1	5.46E-2	2.02E-
primary energy equivalent	1.65E+2	MJ	4.46E+0	1.20E+0	3.26E+0	3.96E-2	1.01E-2	2.95E-2	5.68E+1	2.14E+1	5.18E-1	3.45E-1	2.05E-
Fuels													
coal	5.24E-1	kg	2.03E-2		2.03E-2	1.92E-4		1.92E-4	4.13E-1	4.14E-3		1.85E-3	2.29E
lignite	4.79E-1	kg	3.27E-2		3.27E-2	3.10E-4		3.10E-4	3.10E-1	6.67E-3		2.99E-3	3.68E
light fuel oil	5.00E-2	kg	1.49E-3	3.99E-6	1.49E-3	2.90E-6		2.90E-6	4.00E-2	1.26E-3		5.38E-4	7.24E
heavy fuel oil	4.27E-1	kg	9.67E-3		9.67E-3	1.09E-4	1.79E-5	9.14E-5	1.27E-1	.3.36E-2		8.82E-4	3.28E
natural gas	5.55E-1	kg	3.42E-2	2.60E-2	8.20E-3	6.73E-5	7.01E-7	6.66E-5	4.20E-1	2.92E-2	1.13E-2	1.14E-3	1.68E
diesel oil	8.13E-2	kg				2.16E-4	2.16E-4		6.86E				
nuclear	1.64E+1	MJ	1.13E+0		1.13E+0	1.06E-2		1.06E-2	1.06E+1	1.87E-1		1.03E-1	8.46E
hydraulic	2.41E+0	MJ	1.64E-1		1.64E-1	1.55E-3		1.55E-3	1.55E+0	2.74E-2		1.50E-2	1.24E
Discharge into water													
water discharge	-2.36E+2	1	-2,31E+0	-2.31E+0	-3.02E-3	-2,86E=5		-2.86E-5		- 2.94&2. - 2.IBE+0 .	-2.84E-1	-2.76E-4	-1.90E-
suspended matters	-1.43E+4	mg	-2.45E+2	-2.43E+2	-2.14E+0	-1.83E-3	-1.29E-3	-5.34E-4	-1.39&1	-1.37E+1	-7.56E+0	-9.06E-1	-5.20E-
COD	-1.78E+4	mg	-1.53E-1		-1.53E-1	-5,32E-3.	-3.88E-3	-1.44E-3	-1.33F,	,r4:•1.34E+2	-8.20E+1	-1.39E-2	-5.23E-
BODS	-5.78E+2	mg	-5.09E-2		-5.09E-2	-1:77E=3	-1.29E-3	-4.81E-4	-8;35E-1	.-2.98E±1	-2.44E+1	-4.64E-3	-5.37E-
hydrocarbons	-3.22E+1	mg								-8.45E+0	-7.56E+0		-1.89E-
ammonium hydroxide	-3.74E+0	mg	-1,88E-1		-1.88E-1	-1.77E-3		-1.77E-3	-1:78E+0	--3.82E-2		-1.71E-2	-2.11E
fluorides	-5.96E+0	mg	-4.05E-1		-4.05E-1	=3.83E-3		-3.83E-3	-3:83E(0	-8.24E-2		-3.69E-2	-4.55E
sulphates	-1.59E+1	mg	-8.54E-2		-8.54E-2	-8.08E-4		-8.08E-4	-8.10E-1	-1.74E-2		-7.79E-3	-9.61E
nitrates	-1.60E+0	mg	-9.56E-2		-9.56E-2	-9.04E-4		-9.04E-4	-9.06E-1	-1,95E-2		-8.72E-3	-1.07E
chlorides	-1.92E+1	mg	-5.14E-3		-5.14E-3	-4.86E-5		-4.86E-5	-4.87E-2	-1.05E-3		-4.69E-4	-5.78E
Na (ion)	-4.74E+t	mg	-4.65E+1	-4.64E+1	-6.64E-2	-6.27E-4		-6.27E-4	-6.29E-1	-1.35E-2		-6.06E-3	-7.46E
Fe (ion)	-6.05E+4	mg	-1.16E-1	-1.16E-1	-7.82E-4	-7.39E-6		-7.39E-6	-6.05E+4	-1.59E-4		-7.13E-5	-8.79E
phenols	-6.06E-1	mg								-2.44E-1			-2.44E
Hg	-1.27E-2	mg							1.25E 2				
AOx	-1.95E+0	mg											
oils	-3.07E+2	mg	-2.59E+0		-2.59E+0	-5,05E-2	-3.51E-2	-1.53E-2	-5.12E+1	-7.86E+1		-5.65E-1	-7.80E-
dissolved substances	-1.97E+4	mg	-		-	-	-	-	-	-		-	-

Life cycle inventory of paint C Semi-gloss solvent-borne paint - Alkyd resin (C) - Isoparaffinic		
Cu		
Zn		
B		
Mn		
Cr		
Cd		
Cl-		
F		
other nitrogen		
others metals ions		
fiber		
Air emissions		
dust		
SO_x		
H_2SO_4		
HCL		
NO_x		
N_2O		
CO		
CO_2		
ammoniac		
aldehydes		
fluorides (gazeous)		
H_2S		
		Extenders Solvent Kaolin Site

e cycle inventory of paint C i-gloss solvent-borne paint - yd resin (C) - (SOpereffInIC	Alkyd resin Alkyd resin	Site	Energy production	Raw material production	Raw material	Paint Pain	Site	Energy production	Raw material production	Raw material transport	Application Application	Site	Dilution	Raw
	3.48E-2	3.48E-2												
lvent : methyl isobutyl ketone						1.18E-2	1.18E-2							
lvent : toluene														
						1.18E-2	1.18E-2							
ne (dispersing agent,)						2.05E-2	2.05E-2							
Pb/Zn/Co/Ca/Zr complex						6.84E-2	6.84E-2							
g forming agent : methyl ethyl						1.03E-2	1.03E-2							
tabisulfite / sodium sulfate	8.15E-3			8.15E-3										
	5.18E-2	5.18E-2												
ydride	3.85E•3	3.85E-3												
hosphate	8.23E-4	8.23E-4												
00	1.18E-2	1.18E-2												
	2.66E-2			2.66E-2		5.52E-5			5.52E-5					
mestone	3.44E-3			3.44E-3		1.00E-6			1.00E-6					
	1.79E-3			1.79E-3										
da	5.41 E-3			5.41E-3										
aluminium														
	9.75E-1			9.75E-1										
ico phosphate														
, ore)	3.27E-5			3.27E-5		1.58E-6			1.58E-6					
ounds														
cate														
						3.23E-4	3.23E-4							
	1.14E-5	1.14E-5				4.30E.5.	4.30E-5							
e														
	4.20E-6			4.20E-6		1		88E-71.88E-7						
anese	2.10E-7			2.tOE-7		9.39E4.			9.39E-9					
	4.82E-5			,4.82E-5		2.33E-6			2.33E-6					
	7.70E-3			7.70E-3										
	7.84E-1		1.22E-1	6.28E-1	3.39E-2	3991= 2::		6.36E-2	7.59E-3	7.74E 3	250E 1		2.09E-1	4
	1.16E•1		7.49E-2	4.07E-2	2.25E-4		1;03E- 1:1.02E-1		6.22E-4	5.13E 5	9023:.		2.76E•3	2
	2.34E-1		1.16E-2	2.22E-1	1.32E-4	2.37E 2:		1.38E-2	9.86E-3	3.01E 5	7-50E3 .		7.34E-3	1
						4.63E-2	4.63E-2							
	~r													
ne						t 87E Z	1.67E-2				~r			
						~.., ::.	3.23E-1							
umption	2.89E+1		2.80E-2	2.88E+1	6.59E-3	. 1 X54	4.55E-2	1.83E-2	3.94E-2	1.50E 3	$ E_1.,':		8.58E-1	
														7
							55E•,.2:4. 55E-2							
	4.66124			4.66E+0										
	-828E-1			-6.28E-1		zIE'.					g. E 1 .'		B.SSE-i	
water	2.34Ex1 :		2.80E-2	2.34E+1	6.58E-3	9 5 $		1.83E-2	2.41E-2 1.53E-2		1			

Life cycle inventory of paint C	Alkyd resin					Paint					Application		
Semi-gloss solvent-borne paint - Alkyd resin (C) - ISOperaffiniC	Alkyd ~sln	Site	Energy production	Raw material production	Raw material transport	Paint. :	Site	Energy production	Raw material production	Raw material, transport	Application	Site	Dilu solv
Energy													
lectricity	2.11E+0	1.34E+0	1.34E-2	7.48E-1	4.14E-3	1.87E+0	1.85E+0	5.42E-3	1.15E-2	9.46E-4	5.52E-2		5.0
hermal energy	5.61E+1	4.15E+0	3.92E-1	5.02E+1	1.43E+0	2.93E+0	1.68E+0	1.59E-1	7.56E-1	3.32E-1	1.04E+1		8.6
rimary energy equivalent	6.30E+1	4.15E+0	4.72E+0	5.27E+1	1.45E+0	8.68E+0	1.68E+0	6.07E+0	7.93E-1	3.35E-1	1.06E+1		8.8
Fuels													
oal	4.64E-2		2.80E-2	1.85E-2		3.88E-2		3.84E-2	3.50E-4		9.83E-4		9.8
gnite	6.62E-2		4.50E-2	2.12E-2		6.22E-2		6.19E-2	2.48E-4		1.58E-3		1.5
ght fuel oil	6.28E-3		4.75E-4	5.80E-3		6.63E-4		5.80E-4	8.23E-5		3.11E-4		3.1
eavy fuel oil	1.75E-1	9.11E-2	2.16E-2	4.88E-2	1.40E-2	6.40E-2	4.11E-2	2.17E-2	4.33E-4	7.84E-4	1.72E-2		1.4
atural gas	4.65E-2	1.18E-3	1.01E-2	3.51E-2	1.02E-4	1.68E-2		1.35E-2	3.35E-3	2.33E-5	7.34E-3		7.2
iesel oil	2.99E-2	8.61E-3		1.32E-3	2.00E-2	6.98E-3				6.98E-3	3.73E-2		
uclear	2.28E+0		1.55E+0	7.32E-1		2.14E+0		2.13E+0	1.05E-2		3.84E!-2		3.6
ydraulic	3.42E-1		2.26E-1	1.16E-1		3,13E-1		3.11E-1	2.07E-3		5:31 E3.		5.3
Discharge into water													
water discharge	-2.66E+1	-6.36E-2	-4.15E-3	-2.66E+1		-5:12E-2	-4.55E-2	-5.71 E-3	-2.29E-5		=8.17E-1 `		-8.1
uspended matters	-1.39E+2		-7.70E-1	-1.38E+2	-1.88E-1	-1.93E+0		-3.53E-1	-1.53E+0	-4.30E-2	-2AGE+0		-2.2
OD	-4.34 E+3		-2.00E+0	-4.34E+3	-5.65E-1	-3.04E+0		-1.03E+0	-1.88E+0	-1.29E-1	4,32Ei1,		-2.2
BOD5,	-5.44E+2		-6.68E-1	-5.44E+2	-1.88E-1	-6.07E-1		-3.43E-1	-2.22E-1	-4.30E-2	•2.63E+0:		-2.3
ydrocarbons	-2.12E+1			-2.12E+t		-7.18E-1			-7.18E-1		-0.13E-1		-8.1
mmonium hydroxide	-1.32E+0		-2.58E-1	-1.06E+0		-4.03E-1		-3.55E-1	-4.84E-2		-9.07E-3		-9.0
luorides	-8.46E-1		-5.56E-1	-2.90E-1		:7.68E-1		-7.65E-1	-3.07E-3		:4.96E-2		-1.9
ulphates	-1.48E+1		-1.17E-1	-1.47E+1		-1.62E-1		-1.62E-1	-6.48E-4		-4:13E=3		-4.1
itrates	-3.80E-1		-1.31E-1	-2.49E-1		=1.91E-1		-1.81E-1	-1.01E-2		• .-~.62E~9 :		-4.6
hlorides	-1.84E+1		-7.07E-3	-1.84E+1		;7.22E-1:		-9.72E-3	-7.13E-1		-z:48E-4.		-2.4
a(ion)	-1.35E-1		-9.13E-2	-4.35E-2		.1.26&1		-1.25E-1	-5.03E-4		-321.E5:		-3.2
e (ion)	-1.59E-3		-1.08E-3	-5.13E-4		w1:48&3		r -1.48E-3	-5.93E-6		-3.78E•5		-3.7
henols	-2:54E-1			-2.54E-1		-3.32E-			-3.32E-3		.J,t>,SE•1:		-1.0
g	-1.95E-4			-1.95E-4									
AOx	-1.95E+0			-1.95E+0									
ils	-1.24E+2		-1.85E+1	-9.99E+1	-5.12E+0	1.19E+5		-9.76E+0	-1.02E+0	-1.17E+0	3 96co		-3.3
issolved substances	-7.84E+3		-1.42E+3	-6.03E+3	-3.97E+2	-=B.23Ef2		-7.27E+2	-5.86E+0	-9.06E+1	:3;IOE43		-2.6
ylene	-1.30E+3	-1.30E+3											
oil'	-3.26E+2	-3.26E+2											
ontaminated solvents : methyl isobutyl						-1.18E•2	-1.18E-2						
ontaminated solvents : toluene							:.1:18E- 2:-1.18E-2						
ontaminated solvents : acetone						118E-2	-1.18E-2						
leaning solvents : white spirit 17 - 1894											': t	55Et,5:.- 1.56E+5	
austic soda						-1.56E+8	-1.59E+3						
aint residues	,t,					-9.22E1.2:	-9.22E+2				-3.OOE*.4	-3.00E+4	
S						-1.66E 2			-1.66E-2				
NKT	-1.63E+1			-1.63E+1									
K													
Ca													
Mg													
Al													
P04													
Si02													
Pb	-1.95E-1			-1.95E-1									

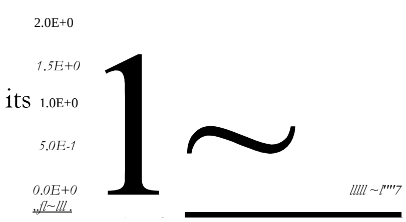
e cycle inventory of paint C			Al d resin					Paint				Applicati on	
i-gloss solvent-borne paint - yd resin (C) - Isoparaffinic	Alkyd resin	Site	Energy production	Raw material production	Raw material transport	Paint	Site	Energy production	Raw material production	Raw material transport	Application	Site	Dilution solvent
gen	-2.10E+0			-2.10E+0		-9.39E-2			-9.39E-2				
als,on•;	=' 42E+t			7 42E+1		-2 85E+0			-2.85E+0				
	-4.88E+1			.4.88E+1									
ns													
	1.94E+3	8D3E+1	1 71E+2	1.64E+3	11~E.2	-2.06E+2	-3.61E+1	1.32E+2	8.65E+0	-2.99E+1	-1.80E+2		2.20E+1
	-9.56E+3	-249E+3	1.53E+3	4,83E+3	-7.01E+2	-2.95E+3	-1.11E+3	-1.74E+3	-4.14E+1	-6.38E+1	-1.44E+3		-1.15E+3
	1.85E+1			-1.85E+1									
	-6.37E+1		-3.91E+1	-2.46E+1		-5.41E+1		-5.38E+1	-3.40E-1		-1.38E+0		-1.38E+0
	-5.35E+3	6.82E+2	-7.54E+2	-2.81E+3	-1.10E+3	-1.58E+3	-2.92E+2	-8.54E+2	-7.18E+1	-3.63E+2	-2.08E+3		-1.46E+2
	1.73E+2	-6.16E+1	-3.70E+1	-3.14E+t	-4.26E+1	-8.42E+1	-2.53E+1	-4.61E+1	-4.70E-1	-1.23E+1	-6.95E+1		-4.24E+0
	-8.68E+2	-2.87E+1	-1.84E+2	-2.39E+2	-4.16E+2	-3.87E+2	-1.03E+1	-2.28E+2	-6.87E+0	-1.42E+2	-7.71E+2		-1.31E+1
	-1.01E+6	-3.21E+5	-2.27E+5	-3.45E+5	-1.17E+5	-4.54E+5	-1.31E+5	-2.84E+5	-1.23E+4	-2.67E+4	-2.12E+5		-7.28E+4
	-3.74E+0		-2.23E+0	-8.84E-1	-6.28E-1	-1.29E+0		-1.14E+0	-1.28E-3	-1.43E-1	-1.01E+0		-2.60E-1
	-8.57E+0		-5.17E+0	-2.14E+0	-1.26E+0	-3.57E+0		-3.28E+0	-6.55E-3	-2.87E-1	-2.04E+0		-5.45E-1
azeousl	-4.31E-3		-2.92E-3	-1.39E-3		-4.03E-3		-4.01E-3	-1.61E-5		-1.02E-4		
	-1.09E+1			-t.G9E+1		-6.36E-2			-6.36E-2				-1.02E-4
s	-1.32E+2			-1.32E+2									
nic substances	-1.34E+1		-8.13E+0	-3.43E+0	-1.88E+0	-5.87E+0		-5.42E+0	-1.52E-2	-4.30E-1	-3.07E+0		
sprnt17-18%	-1.19E+3	-1.15E+3		-4.37E+1									-8.30E-1
e spirit < 5%	-3.30E+3	-2.76E+3		-5.39E+2							-1.71E+5	-1.71E+5	
						-5.00E+3	-5.00E+3				-5.39E+5	-5.39E+5	
ne													
ed emissions	-2.93E-3			-2.93E-3							-2.65E+4	-2.65E+4	
	-1.77E-2			-1.77E-2									
carbons	-7.28E+3	-3.42E+1	-1.67E+3	-5.15E+3	-4.15E+2	-1.87E+3	-1.36E+1	-1.60E+3	-1.33E+2	-1.18E+2	-1.85E+3		-1.23E+3
	-2.42E+3	-5.06E-1	-1.27E+2	-2.28E+3	-1.58E+1	-1.65E+2		-1.41E+2	-1.98E+1	-4.78E+0	-1.02E+3		-9.93E+2
nlc hydrocarbons	-4.86E+3	-3.37E+1	-1.55E+3	-2.88E+3	-3.99E+2	-1.70E+3	-1.36E+1	-1.46E+3	-1.14E+2	-1.14E+2	-8.33E+2		-2.32E+2
yl ethyl cetoxime													
phate											-7.83E+3	-7.83E+3	
	-2.93E+0			-2.93E+0									
	-2.10E-1			-2.10E-1		-9.39E-3			-9.39E-3				
	-4.49E+3	-3.91E+3		-5.83E+2		-5.00E+3	-5.00E+3						
duction	-7.81E-2	-5.57E-3	-2.13E-2	-5.12E-2	-4.90E-5	-1.21E-1	-9.13E-2	-2.91E-2			-7.44E+5	-7.44E+5	
									-2.11E-4	-1.12E-5	-1.11E+0	-1.11E+0	-1.06E-3
	-2*0E-4			-2.50E-4		-2.79E-3	-2.79E-3				-5.72E-5		-5.72E-5
astes or post-consumer wastes	-6.35E-3	-5.46E-3		-8.90E-4		-7.80E-2	-7.79E-2		-3.85E-5		-111E+0	-1.11E+0	
s	-1.90E-2			-1.90E-2		-5.00E-5							
n	-6.04E-4			-6.04E-4					-5.00E-5				
n and recovery											-1.18E-4		-1.18E-4
						-1.05E-2	-1.05E-2						
on	-7.60E-5			-7.60E-5									
als											-3.47E-5		-3.47E-5
l wastes	-5.18E-2	-1.09E-4	-2.13E-2	-3.04E-2	-4.90E-5	-2.93E-2	-4.93E-5	-2.91 E-2	-1.23E-4	-1.12E-5	-9.05E-4		
													-8.47E-4

PAINT C : CONSUMPTIONS

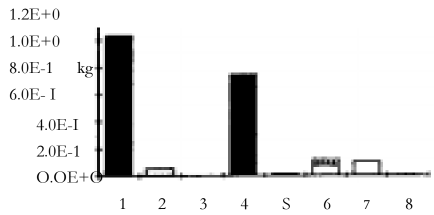
Semi-gloss solvent-borne paint - Alkyd resin (C) - Isoparaffinic

Functional Unit (20 m' covered with 98% opacity)

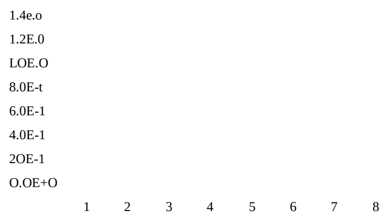
petroleum 1.8E+0 kg



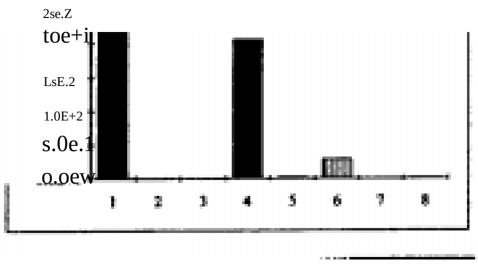
coal 1.0E+0 kg



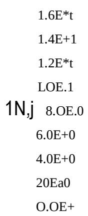
natural gas 1,3E+0 kg



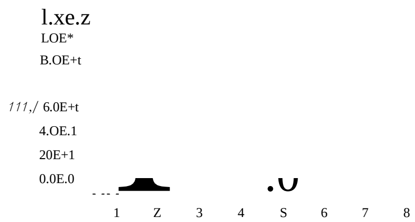
Water consumption 2.4E+2 1



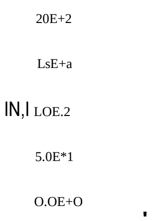
electricity 1.5E+1 MJ



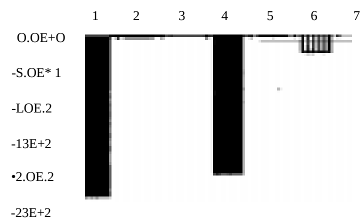
thermal energy 1.2E+2 MJ



primary energy equivalent 1.7E+2 MJ



water discharge -2.4 E+2 1



Legend

Site

0 Energy

Raw material

Transport

1=TOTAL
2 = Kaolin
3 = CaC03
4 = Ti02 (total)

5 = WS 5°6 solvent
6 = Alkyd resin
7 = Paint
8 = Application

PAINT C : DISCHARGES

Semi-gloss solvent-borne paint - Alkyd resin (C) - Isoparaffinic

1 90 1

Functional Unit (20 m2 covered with 98% opacity)

suspended matters -1.4E+4 mg

1 2 3 4 5 6 7 8

0.0E+0

-5.0E+3

tng

-1.0E+4

1.5E+1

COD -1.8E+4 mg

1 2 3 . 4 5 6 7 8

O.OE+O

-5.0E+3 and

-1.0E+4

-1.5E+4

-2.0E+4

BODS -5.8E+2 mg

1 2 3 4 5 6 7 8

O.OE+O

-LOE+2

-2.0E+2

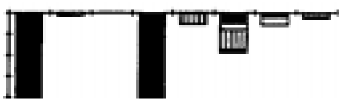
and -3.0E+2

-4.0E+2

-S.OE+2

-6.0E+2

SOX -3.8E+4 mg



C02 -5.9E+6mg

1 2 3 4 S 6 7 8

O.OE+O

-LOE+6

-2AE+6

mg -3.0E+6

1.0E+6

-SAE+6

-6.0E+6

total hydrocarbons -5.1E+4 mg

1 2 3 t 5 6 7 8

O.OE+O -1

AE+4 -2.0E+4

mg -3DEN

.4.0E+1

-3.OEN

fiAE+4

total VOC -7.5E+5 mg

1 2 3 4 5 6 7

O.OE+O

-1.0E+3

-2AE+5

-3.0E+5

mg **-4.0E+3**

-5.0E*3

-6.0E+5

-7AE+3

-B.OE+S

Waste production -4.3E+0 kg

8 2 3 4 5 6 7 8

O.OE+O

_1.0B+0

-2.OEa0

-3AE+0

-4.0E+0

-S.OE+O

Legend

Site	*1= TOTAL*	5 = WS 5°k solvent
Energy	2 = Kaolin	6 = Alkyd resin
Raw materiab	3 = CaC03	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

Paint D: *gloss solvent-borne faint - alkyd resin - isoparaffinic*

4

Life cycle inventory of paint D
GI oss solvent-borne paint -
AI d resin C - Iso araffinic

	Valour	Unit6 Sl	Ti02	Solvent					Alkyd rosin				
			Ti	IrparaNi : „,o '.ow.nc	Site	Energy produooo	Raw material produorio	Raw material transport	Alkyd raiR :	:Site	Energy production	Raw malarial production	Ra mate trans
	1.96	I	Functionnal Unit (20nO oowrod with 9B% opacity)										
Materials													
solvent: ethanol	4.4DE3::	kg											
xylene	4~40E-2.	kg							4?.SEi2:	4.23E-2			
solvent: butanol	1.7 81; 3'	kg											
other cleaning solvents	T:40C4	kg											
Soya kcithine (dispersing agent,)	4 f11= 3,'	kg											
thickener : clay organic derivative	8.22-3 .	kg											
antifoaming agent: silicone free	1:47E•3:::	kg											
siccative : Pb/Zn/Co/Ca/Zr dry complex	3.05G.2	kg											
anti skinning forming agent : methyl ethyl	8.22E3'	kg											
film tensioner : modified polyether dimethyl-	3.52E-3	kg											
sodium metabisulfite / sodium sulfate	9.89E-3	kg							9 $W3:.:			9.89E-3	
glycerin	ti.29E•2.	k9								828Er28. 29E-2			
malefic anhydride	468E-3. .	kg							4	88ES:4.8 8E-3			
phenyl triphosphate	1OOE O: :	kg							1 OOE:3::	1.00E-3			
wolfamid 500	t 14!» ~ ::	kg							3	i41»:~1. 44E-2			
rock salt	;g7F I	kg	561E 2	.:~T9E 3.'.			2.79E-3		3.239i~: •			3.23E-2	
marble or limestone	1.64E+0 .	kg	1,64E+0	: A;64E- 5 :			4.64E-5		4 t~:			4.17E-3	
HG	~,49E-3::	kg	5:92E 3						2.17&4v:			2.17E-3	
caustic soda	$:58E=3 :::	kg							$ 5$E.3:;			6.58E-3	
TiCl.4	4:95E4:	kg	4.95E•2.										
trihydraLed aluminium	9.83E-2	kg	3.83E•2	.									
wood	1.18E+0	kg							tt1$Ef0			1.18E+0	
monoamonico phosphate	2.88E-3	kg	2.88E-3'										
iron (mewl, ore)	t.33E-4	kg		9.29E•5			9.29E-r5 '		3.87E-5			3.97E-5	
Zr02 compounds	4,24E3	kg	4.24E-3										
sodium silicate	3.02E-2	kg	3.02E-2'										
oil	1.16E71	kg											
grease	1.80E•2	kg							1.38E•5	1.38E-5			
explosives	9.83E-4	kg	9.83E-4										
ilmenite ore	9.70E-t	kg	9.70E-1										
diverse compounds 8 catalysts	t.4tE-4	kg		1.41E-4	1.41E-4								
clay	t.44E-5	kg		9.29E-6			9.29E-6		5;t0E-6			5.10E-6	
ferromanganese	7.20E-7	kg		4.64E-7			4.64E-7		2.55E-7			2.55E-7	
bauxite	t.98E-4	kg		1.39E•4			1.39E-4		S.BSE-5			5.85E-5	
air	9.35E-3	m3							9.35E-3.			9.35E-3	
petroleum	**1.86E+0**	kg	1.91E•t	4.83E-1		5.68E-2	4.25E-1	9.87E-4	9.52E-t		1.48E-1	7.63E-1	4.12
I ~	1:OOEaO. :	kg	7;96E t :	.:2.Q9£- 2::		1.27E-2	8.24E-3	ti.52E-6	:1;41Er1		9.10E-2	4.94E-2	2.73
natural gas	1.BOE?0	kg	9.91E t	9;14E 1.		3.53E-3	3.10E-1	3.83E-6	284Ec1::		1.4tf-2	2.70E-1	1.60
Packaging													
cardboard	7;73E:3::	kg											
paper	1.97E-2	kg	1:97E=2										

Life cycle inventory of paint D			Ti02	Solvent					Alkyd resin				
Gloss solvent-borne paint -.:.:			Ti02::.:.	ISO piuallf so~ent::	site	Energy production	Raw material productio	Raw material transport	>_;LU.ky4:: nslt	Site	Energy production	Raw material production	Raw material transport
Alkyd resin C - Iso araffinie													
Water consumption	2:$96+,2:	I	2:206+2	1:48f+ Q	9.69E-1	1.18E-2	4.95E-1	1.91E-4		3511:3.40 6-2		3.50E+1	8.01E-3
cleaning	*1.20Ei2*	I	1.19E+2										
cooling	1 06E+2	I	9.$2E+t	:9:466 1::	9.46E-1				3*fi~r,.¢:'			5.666+0	
boiler	ImefiO	I	1;94E+Q	:2.266= .	2.26E-2				3'.63.6:1::.			-7.63E-1	
unspecified water	3:026+1:	I	7:166 1	:a.¢7>5 1		1.18E-2	4.95E-1	1.91E-4	2:84a:1		3.40E-2	2.84E+1	8.01 E-3
process	1.736+0	I							T:?'3ExQ'			t.73E+0	
Energy		-											
electricity	139E+1	MJ	1.01E+1	4 66E	12.22E-1	6.92E-3	1.76E-1	1.20E-4	'1.566.4	1.63E+0	1.62E-2	9.09E-1	5.03E-3
thermal energy	1.40Ea.	MJ	2.84Eay	:3*.ti+t:2. 296+0		2.03E-1	3.16E+1	4.05E-2	6 82Ef:	5.04E+0	4.77E-1	s.09E+1	1.746+0
primary energy equivalent	185Ea2	MJ	6:076+1	:.3:54E- r1:	2.29E+0	9.34E-1	3.21E*1	4.09E-2	x:66Ea1>	5.04+0	5.746+0	6.40E+1	1.766+0
Fuels		-											
coal	5:276:.1	kg	4;426 1	a 296.2::		4.63E-3	8.24E-3		!*	i'r1E:2'3.4 0E-2		2.24E-2	
lignite	4.4461	kg	3:316-1	.:745)x:3::;		7.45E-3				$04E:~y5. 47E-2		2.57E-2	
light fuel oil	S, i0E=2 .	kg	4:27& 2	:f 41E-d':		1.41E			762E-3		5.77E-4	7.05E-3	
heavy fuel oil	4;116-1.'	kg	1:366•1	: 3926:2:	6.186-3	6.38E-3	1.97E-2	9.87E-4	213E-1.	1.11E-t	2.62E-2	5.92E-2	1.706-2
natural gas	5,88E-1	kg	4.49E-1	7.06E-2 ,	t.58E-3	1.84E-3	6.71 E-2	2.95E-6	:.656-2.:	1.43E-3	1.22E-2	4.27E-2	1.246-4
diesel oil	8:936-2	kg	7.33E-3.	.					3.64E-?. :	1.05E-2		1.60E-3	2.43E-2
nuclear	1.5312+1	MJ	1.14E+1.	:3.646-1:		2.56E-1	1.05E-1		•2.77&0		1.88E+0	8.89E-1	
hydraulic	2.28E+0	MJ	t:666+0	T.92E-2		3.74E-2	4.18E-2		4.16£=1'		2.75E-1	1.41E-1	
industrial gas	2.37E-2	kg		2.37E4	2.37E-2								
Discharge into water		-											
water discharge	-2.51E+2	I	•2.186+2	*-2.20E-1*	-2.19E-t	-6.87E-4			-3;246+1:	-7.73E-2	-5.04E-3	-3.23E+1	
suspended matters	-1.51 E+4	mg	-1.48614.	::g:33611:		-4.41E-1	-9.29E+1	-5.46E-3	-1:696+2		-9.35E-1	-1.68E+2	-2.28E-1
COD	-1.986+4	mg	~1;42E4	'-9.38611:		-9.41E-1	-9.29E+1	-1.64E-2	5.276+3.		-2.43E+0	-5.27E+3	-6.86E-1
BOD5	-7.98E+2	mg	•8.926-1	-1.66E+1		-3.14E-1	-1.63E+t	-5.46E-3	-6.61Ec2		-8.11E-1	-6.60E+2	-2.28E-1
hydrocarbons	-5:596+1	mg		>2:T9Et1			-2.79E+1		-2.58E+1.			-2.58E+1	
ammonium hydroxide	-7.18E+0	mg	-1.9060	-3:536+0		-4.27E-2	-3.48E+0		-1.61E+0		-3.13E-1	-1.29E+0	
fluorides	-5.536+0	mg	-4.10E+0	-6:216-2		-9.21E-2			-1 036+0		-6.76E-1	-3.52E-1	
sulphates	-1.89E+1	mg	-8.65E-1	-1.94E-2		-1.94E-2			-1.BOE+1		-1.43E-1	-1.78E+1	
nitrates	-1.99E+0	mg		-9.66E- 1:.:- 4:8612-1		-2.17E-2	-4.64E-1		-4.62E-1		-1.60E-1	-3.02E-1	
chlorides	-4.576+1	mg	-5.20E-2	-2.32E+1		-1.17E-3	-2.326+1		-2.24E+1		-8.59E-3	-2.24E+1	
Na(ion)	-9.02E-1	mg	-6:726.1	.-1.5tE-2		-1.51E-2			-1.64E-1		-1.11E-1	-5.28E-2	
Fe (ion)	-6.476+4	mg	-6.476+4	-1.786-4		-1.78E-4			-1.93E-3		-1.31E-3	-6.23E-4	
phenols	-9.18E-1	mg		-4.64E-1			-4.64E-1		-3.08E-1			-3.08E-1	
Hg	-:1,366-2.	mg	-1-34E	2:::-					=2.376:4			-2.37E-4	
AOx	-2.37Ea4	mg							-2:37E4 .			-2.37E+0	
oils	-2.956+2.:	mg	3.47E+1	-5.29E+1		-8.63E+0	-4.41E+1	-1.49E-1	-1.506+2		-2.25E+t	-1.21E+2	-6.22E+0
,dissolved substances	-1.516+4	mg	=1.76643	:-8:71Ea2		-6.64E+2	-1.95E+2	-1.15E+1	-8.536+3		-1.726+3	-7.32E+3	J.83E+2
'xylene	-1.58E+3	mg							-1.58E+3	-1.58E+3			
'oil'	-3.96E+2	mg							-3.96E+2	-3.96E+2			
cleaning solvents: white spirit 17 - 186/6	-1.566+5	mg											
other cleaning solvents	-7.406+4	mg									f		
paint residues	-3.006+4	mg											
S	-2.326+0	mg		-2,326`0			-2.326+0						
NKT	-1.96611.	mg							198611:.			-1.98E+1	
Ca	-6.14Ek3	rng	-6146+3::										
Mg	-2.706+4::	mg	2706+4										

Life cycle inventory of paint D Gloss solvent-borne paint - Alkyd resin C - Iso araffinic			Tio2			Solvent					Alkyd resin		
			Ti02	Isoparaffinic solvent,	Site	Energy productio	Raw material production	Raw material transport	Alkyd resin	Site	Energy production	Raw material production	Raw mate trans
Zn	-6.86E+2	mg	-6.85E+2										
Mn	-3.80E+3	mg	-3.80E+3										
Cr	-2.29E+0	mg	-2.17E+0										
Cd	-3.75E-1	mg	-3.69E-1										
N'	-5,87E-2	mg											
Ag	-1.76E-2	mg											
Co	-4.11 E-2	mg											
other nitrogen	-7.20E+0	mg		-4.64E+0			-4.64E+0		-2.55E+0'			-2.55E+0	
others metals ions	-2.06E+2	mg		-1.16E+2			-1.16E+2		-9.01E+1			-9.01E+1	
fiber	-5.92E+1	mg							-5.92E+1			-5.92E+1	
Air emissions													
dusts	-7.41E+3	mg	-4.38E+3	-4.05E+2	-5.70E+0	-2.58E+1	-3.72E+2	-2.06E+0	-2.36E+3	-9.75E+1	-1.35E+2	-1.99E+3	-1.34
SOX	-3.75E+4	mg	-2.17E+4	-2.02E+3	3.25E+1	-3.87E+2	-1.63E+3	-4.35E+t	-1.16E+4	-3.02E+3	-1.86E+3	-5.87E+3	-8.51
H2S04	-2.25E+1	mg							-2.25E+1			-2.25E+1	
HCL	-3.98E+2	mg	-2-87F+2	-1.11E+1		-6.47E+0	-4.64E+0		-7.74E+1		-4.75E+1	-2.99E+1	
NOx	-2.04E+4	mg	-7.98E+3	-3.06E+3	-7.43E+1	-1.90E+2	-2.79E+3	-4.89E+0	-6.49E+3	-8.28E+2	-9.16E+2	-3.41E+3	-1.34
N20	-8.76E+2	mg	-5.46E+2	-1.51E+1	-6.72E+0	-7.81E+0		-6.04E-1	-2.10E+2	-7.49E+1	-4.49E+1	-3.82E+1	-5.17
CO	-4.56E+3	mg	-2.24E+3	-2.38E+2	-1.24E+1	-3.92E+1	-1.86E+2	-7.86E-1	-1.05E+3	-3.48E+1	-2.23E+2	-2.90E+2	-5.05
C02	-6.13E+6	mg	-4.03E+6	-5.20E+5	-1.21E+5	-4.77E+4	-3.48E+5	-3.42E+3	-1.23E+6	-3.90E+5	-2.75E+5	-4.19E+5	-1.42
ammoniac	-9.47E+0	mg	-2.49E+0	-1.06E+0		-1.05E+0		-1.82E-2	-4.54E+0		-2.70E+0	-1.07E+0	-7.62
aldehydes	-2.85E+1	mg	-1.27E+1	-2.25E+0		-2.21E+0		-3.64E-2	-1.04E+1		-6.29E+0	-2.60E+0	-1.52
fluorides tgazeous)	-2.88E-2	mg	-2.15E-2	-4.83E-4		-4.83E-4			-5.23E-3		-3.54E-3	-1.69E-3	
H2S	-1-58E+t	mg		-2.55E+0			-2.55E+0		-1.33E+1			-1.33E+1	
mercaptans	-1.60E+2	mg							-1.60E+2			-1.60E+2	
other organic substances	-4.80E+1	mg	-2.29E+1	-3.90E+0		-3.38E+0	-4.64E-t	-5.46E-2	-1.63E+1		-9.88E+0	-4.16E+0	-2.29
VOC . white spirit 17-18°%0	-1.45E+5	mg							-1.45E+3	-1.39E+3		-5.31E+1	
VOC . white spirit < 5 %	*-2.51E+5*	mg							-4.01E+3	-3.35E+3		-6.55E+2	
VOC : xylene	-3.35E+4	mg											
VOC . isoparaffinic	-3.54E+5	mg											
VOC : ethanol	-3.36E+3	mg											
VOC butanol	-1.34E+3	mg											
other VOC	-2.22E+2	mg											
non specified emissions	-3.55E-3	mg							-3.55E-3			-3.55E-3	
chlorine	-8.67E-2	mg	-3.59E-2						-2.15E-2			-2.15E-2	
total hydrocarbons	-5.27E+4	mg	-3.75E+4	-4.05E+3	-1.41E+1	-5.46E+2	-3.48E+3	-6.36E+0	-8.84E+3	-4.16E+1	-2.03E+3	-6.26E+3	-5.04
methan	-1.38E+4	mg	-9.92E+3	-5.28E+1	-1.09E+1	-4.18E+1		-1.74E-1	-2.94E+3	-6.14E-1	-1.55E+2	-2.77E+3	-1.92
non methanrc hydrocarbons	-3.89E+4	mg	-2.75E+4	-4.00E+3	-3.25E+0	-5.04E+2	-3.48E+3	-6.19E+0	-5.90E+3	-4.10E+1	-1.88E+3	-3.49E+3	-4.85
VOC : methyl ethyl cetoxime	-8.06E+3	mg											
sodium sulphate	-3.55E+0	mg							-3.55E+0			-3.55E+0	
metals	-7.20E-1	mg		-4.64E-1			-4.64E-t		-2.55E-1			-2.55E-1	
total VOC	-7.96E+5	mg							-5.45E+3	-4.75E+3		-7.08E+2	
Waste production f	-4.38E+0	kg	-3.22E+0	-7.92E-3	-3.25E-4	-3.58E-3	-4.02E-3	-1.42E-6	-9.48E-2	-6.76E-3	-2.54?E-2	-6.22E-2	-5.95
toxic wastes	-5.94E-3	kg	-6.41E-4	-3.25E-4	-3.25E-4				-3.04E-4			-3.04E-4	
industrial wastes or post-consumer wastes	-1.37E+0	kg	-3.25E-1	-1.83E-3			-1.83E-3		-7.71E-3	-6.63E-3		-1.08E-3	
inert wastes	-2.53E-2	kg		-2.18E-3			-2.18E-3		-2.31E-2			-2.31E-2	
incineration	-8.32E-4	kg							-7.34E-4			-7.34E-4	
recuperation	-2.60E+0	kg	-2.60E+0						-9.23E-5			-9.23E-5	
inert minerals	-7.98E-4	kg	-7.98E-4										
unspecified waates	-3.77E-1	k	-2.97E-1	-3.58E-3		-3.58E-3		-1.42E-6	-6.29E-2	-1.33E-4	-2.58E-2	-3.69E-2	-5.95

Life cycle inventory of paint D Gloss solvent-borne paint -	Paint					Application			
	Paint	Site	Energy production	Raw material production	**Raw material** transport	**Application**	Site	Dilution solvent	Raw material
materials									
solvent ethanol	4.40E-3	4.40E-3							
xylene	1.76E-3	1.76E-3							
solvent : butanol	1.76E-3	1.76E-3							
other cleaning solvents	7.40E-2	7.40E-2							
soya lecithine (dispersing agent,	4.11E-3	4.11E-3							
thickener : clay organic derivative	8.22E-3	8.22E-3							
antifoaming agent : silicone free	1.47E-3	1.47E-3							
siccatwe : Pb%ZNCoiCaiZr dry complex	3.05E-2	3.05E-2							
anti skinning forming agent methyl ethyl	8.22E-3	8.22E-3							
film lensioner : Modified polycthe, dimethyl-	3.52E-3	3.52E-3							
sodium metabisulfite sodium sulfate									
glycerin			r						
malefic anhydride									
phenyl triphosphate									
wolfamid 500									
rock salt	4.59E-2			4.59E-2					
marble or limestone									
HCI									
caustic soda									
TiCL4									
trihydrated aluminium									
wood									
monoamonico phosphate									
iron (metal, ore)									
Zr02 compounds									
sodium silicate									
oil	1.16E-1	1.16E-1							
grease	1.80E-2	1.80E-2							
explosives									
drrtenite ore									
diverse compounds 8 catalysts									
clay									
ferromanganese									
bauxite									
air									
petroleum	3.36E-2		4.05E-3	1.55E-2	1.40E-2	2.03E-1		1.68E-1	3.53E-2
coal	3.95E-2		2.15E-2	1.79E-2	9.31E-5	2.44E-3		2.21E-31	2.34E-4
natural gas	5.72E-3		2.88E-3	2.79E-3	5.46E-5	6.01E-3		5.87E-3	1.37E-4
Packaging									
cardboard	7.73E-3	7.73E-3							
paper									
polyethylene	2.06E-2	2.06E-2							
colophany	5.15E-3	5.15E-3							
tin can	3.32E-1	3.32E-1							

Life cycle inventory of paint D

Gloss solvent-borne paint -

Alkyd resin C - Iso araffinic

			Paint				Applicat ion		
	Paint	Site	Energy production	Raw material production	Raw material transport	Applicati on,	Site	Dilution solvent	Raw material
Water consumption	': 12E+~	5.87E-1	2.03E-3	5.32E-1	2.73E-3	6 93E 1, :		6.87E-1	transport
cleaning	5.87E-Z	5.87E-i							6.86E-3
cooling	2,92E•2			2.32E-2		6.84E-1.		6.84E-1	
boiler									
unspecified water	5.14E-1		2.03E-3	5.09E-1	2.73E-3	9.41E-3		2.56E-3	6.86E-3
process									
Energy									
electricity	7.14E-1	3.90E-1		3.22E-1	1.72E-3	4.45E-2		4.02E-2	4.31E-3
thermal energy	1.12E+0			5.20E-1	6.03E-1	8.45E+0		6.93E+0	1.51E+0
primary energy equivalent	3.40E+0		1.24E+0	1.55E+0	6.08E-1	8.59E+0		7.06E+0	1.53E+0
Fuels									
(coal	1.49E-2		8.10E-3	6.84E-3		7.86E-4		7.86E-4	
(lignite									
	2.38E-2		1.31 E-2	1.08E-2		1.27E-3		1.27E-3	
flight fuel oil	2.40E-4		1.22E-4	1.17E-4		2.48E-4		2.49E-4	
heavy fuel oil	1.50E-2		3.85E-3	1.01E-2	1.08E-3	1.40E-2		1.13E-2	2.71 E-3
natural gas	5.57E-$		2.81E-3	2.72E-3	4.22E-5	5.88E3		5.78E-3	1.06E-4
diesel oil	1.30E-2			1.21E-5	1.30E-2	3:27E-2			3.27E-2
nuclear	8.18E-:1		4.48E-1	3.69E-1		2.91 E-2.		2.91E-2	
hydraulic	1.20E•1		6.55E-2	5.40E-2		4.25E-3 .		4.25E-3	
industrial gas									
Discharge into water									
water discharge	-6.1tE-1	-5.87E-i	-1.20E-3	-2.31E-2		-6.53E-1.		-6.53E-1	
suspended matters	- 2.49E+1	-2.47E+i	-2.25E-2	-1.30E-1	-7.80E-2	•1.99E+0		- 1.79E+0	-1.96E-1
D	- 2.36E+2	- 2.35E+2	-6.08E-2	-9.44E-1	-2.34E-1	-1,86E+1		- 1.80E+1	-5.88E-1
BOD5	- 1.18E+2	- 1.17E+2	-2.03E-2	-2.33E-1	-7.80E-2	-2.04E+0		- 1.85E+0	-1.96E-1
hydrocarbons	- 1.61E+0	- 1.59E+0		-2.20E-2		-8.51E- 1• .		-6.51E- 1	
ammonium hydroxide	•1.36E- 1'		-7.48E-2	-6.17E-2		-7.25E-3		-7.25E-3	
fluorides	=2.94E- 1		-1.61E-1	-1.33E-1		.1.56E-2		-1.56E-2	
sulphates	~.21E•2		-3.40E-2	-2.81E-2	/	-3:30E-3.		-3.30E-3	
nitrates	-6.95E-2		-3.81 E-2	-3.14E-2		-3.70E-3		-3.70E-3	
chlorides	-3.74E- 3.		-2.05E-3	-1.69E-3		- 1;H9E,y::.,		-1.99E-4	
Na (ion)	-4.83E-2		-2.65E-2	-2.18E-2		-2.57E 9:		-2.57E-3	
Fe (ion)	•2:29E +0	- 2.29E+0	-3.12E-4	-2.57E-4		-3.02E-5		-3.02E-5	
phenols	-6:16E- 2:	-5.87E-2		-2.84E-3		-8.38E-2.		-8.38E-2	
Hg									
AOx									
oils	-5.20Et0		-6.47E-1	-2.43E+0	-2.12E+0		.3:22Efi1 - 2.68E+1		-5.32E+0
dissolved substances	4.35E2		-4.32E+1	-2.27E+2	-1.64E+2	-2.52E+3.:`		- 2.10E+3	-4.13E+2

Life cycle inventory of paint D

Gloss solvent-borne paint - Alkyd resin C - Iso araffinic

Zn
Mn
Cr
Cd
Ni
Ag
Co
other nitrogen
others metals ions
fiber
Air emissions
dusts
SOX
H2S04
HCL
NOx
N20
CO
C02
ammoniac
aldehydes
fluorides (gazeous)
H2S
mercaptans
other organic substances
VOC : white spirit 17-18°•0
VOC : white spirit c 5
VOC : xylene
VOC : isoparaffinic
VOC : ethanol
VOC : butanol
other VOC
non specified emissions
chlorine
total hydrocarbons
methan
non methanic hydrocarbons
VOC : methyl ethyl cetoxime
sodium sulphate
metals
total VOC
Waste production
toxic wastes
industrial wastes or post-consumer wastes
inert wastes
incineration
recuperation
inert minerals
.unspecified wastes

Paint					**Application**			
Paint	Site	Energy production	Raw material production	Raw material transport	**Application**	Site	Dilution solvent	Raw material transport
-2.47E-1	-2.47E-1							
-5.05E-1	-5.05E-1							
-1.17E-1	-1.17E-1							
-5.87E-3	-5.87E-3							
-5.87E-2	-5.87E-2							
-1.76E-2	-1.76E-2							
-4.11 E-2	-4.11 E-2							
-1.10E+2		-2.59E+1	-2.90E+t	-5.48E+1	-1.55E+2		-1.76E+1	-1.38E+2
-9.28E+2		-3.33E+2	4.93E+2	1.02E+2	-1.18E+3		-9.19E+2	-2.57E+2
-2.07E+1		-1.13E+1	-9.35E+0		-1.10E+0		-1.10E+0	
-1.03E+3		-1.64E+2	-1.95E+2	-6.75E+2	-1.81E+3		-1.17E+2	-1.69E+3
-4.39E+1		-9.31 E+0	-1.19E+1	-2.27E+1	-6.05E+1		-3.39E+0	-5.71 E+1
-3.52E+2		-4.60E+1	-4.19E+1	-2.64E+2	-6.73E+2		-1.05E+1	-6.63E+2
-1.77E+5		-5.73E+4	-7.09E+4	-4.84E+4	-1.80E+5		-5.82E+4	-1.21E+05
-5.10E-1		-6.74E-2	-1.83E-1	-2.60E-1	-8.61 E-1		-2.08E-1	-6.53E-t
-1.40E+0		-3.44E-1	-5.40E-1	-5.20E-1	-1.74E+0		-4.36E-1	-1.31 E+0
-1.54E-3		-8.45E-4	-6.97E-4		-8.20E-5		-8.20E-5	
-2.30E+0		-6.23E-1	-9.00E-1	-7.80E-1	-2.62E+0		-6.64E-1	-1.96E+0
-1.59E+1	-1.59E+1				-1.44E+5	-1.44E+5		
					-2.47E+5	-2.47E+5		
-5.28E+0	-5.28E+0				-3.35E+4	-3.35E+4		
					-3.54E+5	-3.54E+5		
-1.32E+1	-1.32E+1				-3.34E+3	-3.34E+3		
-5.28E+0	-5.28E+0				-1.34E+3	-1.34E+3		
-2.22E+2	-2.22E+2							
-2.94E-2			-2.94E-2					
-8.12E+2		-2.79E+2	-3.15E+2	-2.18E+2	-1.53E+3		-9.80E+2	-5.48E+2
-9.00E+1		-2.81E+1	-5.31E+1	-8.84E+0	-8.17E+2		-7.94E+2	-2.22E+1
-7.22E+2		-2.51E+2	-2.62E+2	-2.09E+2	-7.12E+2		-1.86E+2	-5.26E+2
					-8.06E+3	-8.06E+3		
-2.62E+2	-2.62E+2				-7.90E+5	-7.90E+5		
-4.82E-2	-3.55E-2	-6.12E-3	-6.55E-3	-2.03E-5	-1.00E+0	-1.00E+0	-8.46E-1	-5.09E-5
-4.62E-3	-4.61E-3		-9.70E-6		-4.58E-5		-4.58E-5	
-3.09E-2	-3.09E-2				-1.00E+0	-1.00E+0		
-3.21E-6			-3.21E-6		-9.46E-5		-9.46E-5	
-9.41 E-7			-9.41 E-7		-2.78E-5		-2.78E-5	
-1.27E-2		-6.12E-3	-6.54E-3	-2.03E	-7.28E-4		-6.77E-4	-5.09E-5

PAINT D : CONSUMPTIONS

(:loss solvent-borne paint - Alkyd resin (C) - Isoparaffinic

1 06 1

Functionnal Unit (20 m2 covered with 98% opacity)

petroleum

1.9E+0 kg

2.0E+0
1.5E+0
kg 1.0E+0
S.OE-1
0.0E+0 1 2 3 4 5 6 7 8

coal

1.0E+0 kg

LOErO
8.0E-1
6.0E- I
4.0E-1
2.0E-1
O.0E+0 ~-
1 2 3 4 5 6 7 8

natural gas 1,6E+0 kg

2oe+o
LSE+O
ICS LOEsO
5.0E-1
O.0E+0 LI 2 3 6 5 6 7 8

Water consumption

2.6E+2 I

3.oe+z
25E+2
20E+2 I
1.5E+2
1.0E+2
S.Oe+1
O.OE+O

electricity

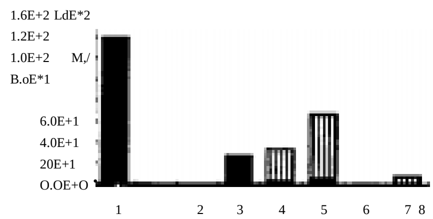
1,4E+1 M,1

1.4E+1
1.2E+1
1.0E+1
+0
+0
+0
B.OE 6.0E

h~ H.

thermal energy

1.4E+2 M,l



primary energy equivalent

1.8E+2 MJ

20E*2
1.5E+2
IN,[LOE+2
S.OE+1
aoE.o~_
t 2 3 4 5 6 7 8

water discharge

-2.5E+2 1

1 2 3 4 5 6 7 8
O.OE+O
-5.0E+1
-I AE*2
(-ISE+2'
-2.0E+2
-zsE+2 •
.3.oe+2 •

Legend

Site	1= TOTAL	5 = lsoparaffinic solvent
Energy	2=	6 = Alkyd resin
Raw material	3=	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

PAINT D : DISCHARGES

Gloss solvent-borne paint - Alkyd resin (C) - Isoparaffinic
1.96 I Functionnal Unit (20 m2 covered with 98% opacity)

suspended matters
-1.5E+4 mg

1 2 3 4 5 6 7 8

0.0E+0
-5.0E+3
ttna -1.0E+4
-1.5E+4
-2.0E+4

SOD -2.0E+4 mg

1 2 3 4. S 6 7 8

O.0E+0
-5.0E+3
nag -1.0E+4
-1.5E+4
-2.0E+4

BODS -8.0E+2 mg

1 2 3 4 5 6 7 8

O.0E+0
-1 AE+2
-2.0E+2
-3.0E*2
fns -4.0E+2
-5.0E+2
b.OE*2
-7.0E*2
-8.OEU

SOX -3.7E+4 mg

2 3 4 5 6 7 8

5.0E+3
O.0E+0
-5.0E+3
-LOE+4
-13E+1
04 -2.OEa1
-2.5E+4
-3.0E+4
-33E+4

C02 -6.1E+6mg

I 2 3 • 5 6 7 8

Mao
Wiii

O.0E+0
-LOE+6
•2.0E+6
gng -3.0E+6
-S.OE+6
.6.0E+6
-7AE+6

total hydrocarbons
-5.3E+4 mg

3a s s 7s

O.0E+0
-1.0E+4
-2.0E+4 mg
-3AE+4
4.0E+1
-S.OE+4
-6.0E+1

total VOC -8.0E+5 mg

1 2 3 4 5 6 7 8

O.0E+0
-1.0E+5
-2.0E+5
-3.0E+5 mp
-4.0E+5
-SAE+S
6.0E+5
-7.0E+5
-6AE+5

Waste production
-4.4E+0 kg

I 2 34s s 7a

O.0E+0
-1.OE,0
-2.0E+0
-3.0E+0
-4AE+O
-S.OE+O

Legend

Site	1 = TOTAL	5 = Isoparaffinic solvent
Energy	2=	6 = Alkyd resin
Raw material	3=	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

Life cycle inventory of paint E Mat solvent-borne paint - Plioway resin - ISOparaffinic			Extenders						Ti02	Solvent				
			Kaolin	Site	Energy productio n	CaC03	Site	Energy productio n	Tf02	Isoparaffi We solvent	Site	Energy productio n	Raw material productio	Ra[w] mate[rial] trans[port]
	Valour	Units SI												
	2.99	I	Functional Unit (20 m, oovanod with 98% opacity)											
Materials														
kaolin ore	5.97E-t	kg	5.97E-1	5.97E-1										
Soya tecithine (dispersing agent. ,)	1.32E-2	kg												
sodium metabisulfite / sodium sulfate	1.95E-3	kg												
rock salt	6.89E-2	kg							S.U9E•2. :	::1::19(=•Z			1.t3E-2	
marble or limestone	2.38E+0	kg				8,96E-t	8.96E-t		1.49E+0:	:.1 88(;:4			1.88E-4	
HCA	4.83E-3	kg							4.83E-3.	::				
TiCL4	4.49E-7:	kg							4.49E 2	.::				
trihydraosd aluminium	3.48•2	kg							9;48E 2					
potassium sulfate / other potassium	6.29E-2	kg												
monoamonico phosphate	2.62E-3	kg							2;62 ~g:;:					
iron (metal, ore)	5.10E-4	kg								,9T6E-4			3.76E	
1r02 compounds	3.85E-3	kg							3gsiry:::					
sodium silicate	2.74E-2	kg							z7•.C:2:.	.:				
explosives	1.43E-3	kg				5.37E:4	5.37E-4		8.92E-4	.:				
monmorillonite/bentone	4.88E-2	kg												
ilmenite ore	8.81E-1	kg							gg~ 1					
diverse compounds 8 catalysts	5.11 E-3	kg								5:12-4	5.72E			
clay	4.79E:5.:	k9								,9:18E-3.			3.76E-5	
ferromanganese	y d0E.g:kg							,		38t:-fi::			1.88E-6	
bauxite	1 27ir 3	kg								iS:¢iE-#.:			5.6dE-4	
ore (Cu2S. Fe2S3)	1 2gE1'	kg												
plasfifying	6.98F.7-2:."	kg								....				
air	7 88•2:	m3												
petroleum	3 14E+V :	kg	8 83>R. 3:		8.83E-3	t •t3~:g:::	1.02E-3	4.19E-4	t ?3~ t .	t88E+G'		2.30E-1	1.72E+0	4.00I
coal	1 a5E±0	kg	4 206-2;		4.20E-2	2 23-9:	g.73E-6	2.22E 3	T:~3~	tC .:4~-?		5.t2E-2	3.34E-2	2.64I
natural gas	3 23Ef0'.•	kg	2 7Q)r:2.		2.70E-2	3	0,2g-4'3.95E-6	2.98E-4	:8,99.1	.;:27!»+D.		1.43E-2	1.26E+0	1.SSI
Packaging														
cardboard	3 26E3.	kg												
Paper	280E-2:	kg	298)w-3.	2.98E-3			7~g~.$7 .t6E-3		139.8::					
polyethylene	2 09E-Z:	k9	t t9&3:	1.19E-3		~ 79i~ 9:;	1.79E-3		4~7~5					
tin can	S.t6E 1::.	kg												
WataroonaumpUon v	. 229Et2::	I	t68)~.,x	1.19E-2	4.90E-3	53tE:4.	3.2tE-4	2.t0E-4	3:OQ~+2,	.3881ht0	3.92E+0	4.78E-2	2.00E+0	7.75I

Life cycle inventory of paint E Mat solvent-borne paint - Plioway resin - Isopati effinlc			Kaolin	Site	**Extender** Energy production	C&C03 ::	Site	Energy productio n	**Ti02** Ti02.	**Isoparatti** oia:.• - .::...:::.adt.	Site	**Solvent** Energy production	Raw material productio	Raw material transport
Energy		-												
electricity	1.53E+t	MJ	7,6115•1	7.58E-1	3.47E-3	4:0415-2	4.04E-2		0.21E+0	t $415+0;.	9.0115-1	2.80E-2	7.15E-1	4.86E-4
thermal energy	2.51E+2	MJ	1.03EtC	9.28E-1	9.79E-2	**4;36&2**	4.36E-2		2:5715+1	.:; 38E+z:	8.26E+0	8.22E-1	1.28E+2	1.64E-1
primary energy equivalent	3.OOEt2	MJ	3.456+0	9.28E-t	2.53E+0	1;7315-I :	4.40E-2	1.29E 1	: 5:51.15+ 1.:	: 4;43184:	9.26E+0	3.79E+0	1.30E+2	1.66E-1
Fuels		-												
coal	5.50E-1.	kg	t 5$15-z		1.58E-2	8s$E-4::		8.38E-d	4.01E 1	5,21.2		1.87E-2	3.34E-2	
lignite	4 6515.1	kg	254E 2:		2.54E-2	f 35.E	$:1.3515	3	3:pQ1519	Q,~!».~ :		3.02E-2		
light fuel oil	6 90E-2:	kg	1 15E 3:	3.09E-6	1.15E-3	? 2715•5		1.27E 5	3;$81~ $	. 3$15»4 ::		5.73E-4		
heavy fuel oil	5 27E-1'	kg	7 50E 3		7.50E-3	4 7715-4 .:	7.81E-5	3.99E-4	1.23E 1	: t 3515-1	2.51 E-2	2.58E-2	7.96E-2	4.00E-3
natural gas	1.36EfO	kg	Q,65E-2	2.02E-2	6.36E-3	2~.0dE-4::	3.06E-6	2.91E-4	4:Q~1	:286-1	6.41E-3	7.44E-3	2.72E-1	1.20E-5
diesel oil	1.20E-1	kg				9;4015-4':	9.40E-4		6.65 3					
nuclear	1.65E+1 .	MJ	8.7215.1		8.72E-1	4;6415-2		4.64E-2	.1.:0315+ 1.	t;4¢E+4		1.04E+0	4.23E-1	
hydraulic	2.571510	MJ	' 1,27E-1		1.27E-1	6:7$15-3:		6.78E-3	.1:5115+ 0.:	::31-a:		1.52E-1	1.69E-1	
other fuels	3.59E-2	MJ												
industrial gas	9.61E-2	kg												
Discharge into water										$ $115-.;:	9.61 E-2			
water discharge	•2.0615+2	I	-1,79154	-1.79E+0	-2.34E-3	1:2515- 4::		-1.25E-4	t,98,E+2	:$ 91 :1:	-8.88E-1	-2.78E-3		
suspended matters	-14615±4.	mg	190152	-1.88E+2	-1.66E+0		7*97-3- 5.64E-3	-2.33E-3	-1.35 15+4	A78Et2:		-1.79E+0	-3.76E+2	-2.21E-2
D	-1 671'- ,f!1':	m9	1 '(815 1::		•1.1815-1		4-1.69E-2	-6.29E 3	. ;;29F„*4	3~Qi)r:		-3.81 E+0	-3.76E+2	-6.64E-2
BOD5	-9.60FA	mg	3 94E 2:		-3.94E-2	7 74!3	•5.6415-3	-2.10E 3	:$ iQ~ 1.	An 44		- 1.2715+0	-6.59E+1	-2.21 E-2
hydrocarbons	;- 6.7pEr$::::		═══			══>═			::::: :::::.::.	.:••.; . ,.: :: •f.f,			1.13E+2	
ammonium hydroxide	„.:.:: :4:2pE*1:::	m0	-1'46 1 15		-1.16E-1	════	7*74- 7.74E-3		•:. 7 1.		.2'•aR- 1.73E-t		-	
fluorides	576E+0.'	mp	314151;.		-3.14E-t	187152:		-1.67E 2	3:7315+0	:373.1::		•3.7315-1	-1.41E+1	
sulphates	-1.5515+4::	mg	-6.62E-2.;		-6.62E-2	:3:52153.		-3.52E 3	7;$„515~ •3,.	:7$T~:~'		-7.87E-2		
nitrates	:3.76154	mg	7.41 15~2		-7.41E-2	.3;9415.3:			- 3.94153* 78~,-1:	:~1,97)rt 0:		-8.81E-2	-1.88E+0	
chlorides	A.70E+2	mg	399153:		-3.99E-3	21.215-4::		-2.12E-4	4-3	.:941>;:h 1.:		-4.74E-3	-9.41E+1	
Na (ion)	-1.28E*3	mg	-360E#1:	-3.60E+1	-5.15E-2	2*34153.		-2~74E-3	.:8:101:.1 .	.:-6.12i.~:		-6.12E-2		
Fe (ion)	-5.8715	mg	9 01E	2-8.95E-2	-6.06E-4	3.,t 5::		-3.22E 5	.5;$7151. 4	:.'1.$3154:		-7.21E-4		
phenols	•2.1,315+0	mg												
H9	=122152,	Mg							1;?.~E2	1;8815r4 .:			-1.88E+0	
oils	:4 41 Ea2:	mg	$1x)15+0,		-2.00E+0	1::	-1.53E-1	-6.69E 2	4 9615+1	,'1,141x+ 2:		-3.50E+1	-1.79E+2	-6.02E-1
dissolved substances	1.1315+4	mg	$7315+1		8.73E+t	641	1.19E+1	4.47E+0	f:69E+3:	3.f15		3.69E+3	7.00E+2	4.67E+1

Life cycle inventory of paint E Mat solvent-borne paint - Plloway resin - Isoparaffinic			Kaolin		Extenders				Ti02	Solvent				
			Kaolin	Site	Energy production	CaC03	Site	Energy production	Ti02	**Isoparaffinic solvent**	Site	Energy production	Raw material production	Raw material transport
Cd	-3.35E-1	mg							-3.35E-1					
Cl-	-5.05E+1	mg	-5.05E+1	-5.05E+1										
	-8.24E-1	mg	-8.24E-t	-8.24E-1										
other nitrogen	-2.72E+1	mg								-1.88E+1			-1.88E+1	
others metals ions	-8.38E+2	mg								-4.70E+2			-4.70E+2	
Air emissions														
dusts	-7.76E+3	mg	-1.46E+2	-9.57E+1	-5.05E+1	-6.64E+0	-3.97E+0	-2.68E+0	-3.97E+3	-1.64E+3	-2.31E+1	-1.05E+2	-1.51E+3	-8.35E+0
SOX	-5.93E+4	mg	-6.87E+2	-2.17E-1	-6.87E+2	-4.18E+1	-7.39E+0	-3.44E+1	-1.97E+4	-8.20E+3	1.32E+2	-1.57E+3	-6.59E+3	-1.76E+2
HCL	-4.35E+2	mg	-2.21E+1		-2.21E+t	-1.17E+0		-1.17E+0	-2.61E+2	-4.50E+1		-2.62E+1	-1.88E+1	
NOx	-3.93E+4	mg	-4.04E+2	-7.65E+1	-3.27E+2	-6.57E+1	-4.88E+1	-1.69E+1	-7.24E+3	-1.24E+4	-3.01E+2	-7.69E+2	-1.13E+4	-1.98E+1
N20	-1.02E+3	mg	-2.15E+1	-2.32E+0	-1.91E+t	-2.61E+0	-1.65E+0	-9.63E-1	-4.96E+2	-6.13E+1	-2.72E+1	-3.16E+1		-2.45E+0
CO	-6.99E+3	mg	-1.01E+2	-8.64E+0	-9.25E+1	-2.38E+1	-1.91E+1	-4.76E+0	-2.04E+3	-9.65E+2	-5.01E+1	-1.59E+2	-7.53E+2	-3.18E+0
C02	-9.18E+6	mg	-1.64E+5	-4.76E+4	-1.17E+5	-9.42E+3	-3.50E+3	-5.92E+3	-3.65E+6	-2.11E+6	-4.89E+5	-1.93E+5	-1.41E+6	-1.38E+4
ammoniac	-1.25E+1	mg	-1.31E-1		-1.31E-1	-2.58E-2	-1.88E-2	-6.97E-3	-2.26E+0	rt.31E+0		-4.23E+0		-7.38E-2
aldehydes	-3.47E+1	mg	-6.70E-1		-6.70E-1	-7.32E-2	-3.76E-2	-3.56E-2	-1.15E+1	-9.10E+0		-8.95E+0		-1.48E-1
fluorides (gazeous)	-3.02E-2	mg	-1.64E-3		-1.64E-3	-8.75E-5		-8.75E-5	-1.95E-2	-1.95E-3		-1.95E-3		
H2S	-1.37E+1	mg								-1.03E+1			-1.03E+1	
other organic substances	-5.89E+1	mg	-1.21E+0		-1.21E+0	-1.21E-1	-5.64E-2	-6.45E-2	-2.08E+1	-1.58E+1		-1.37E+1	-1.88E+0	-2.21E-1
VOC : tsoparaffinic	-1.44E+6	mg												
other VOC	-1.76E+1	mg												
chlorine	-3.36E-2	mg							-3.26E-2					
total hydrocarbons	-8.00E+4	mg	-1.13E+3	-9.64E+0	-1.12E+3	-4.47E+t	-1.58E+1	-2,89E+1	-3.40E+4	-1.64E+4	-5.72E+1	-2.21E+3	-1.41 E+4	-2.58E+1
methan	-1.57E+4	mg	-2.75E+2	-8.67E+0	-2.66E+2	-3.55E+0	-6.39E-1	-2.91E+0	-9.01E+3	-214E+2	-4.41E+1	-1.69E+2		-7.06E-1
non methanic hydrocarbons	-6.43E+4	mg	-8.53E+2	-9.66E-1	-8.52E+2	-4.11E+1	-1.51E+1	-2.60E+1	-2.50E+4	-1.62E+4	-1.32E+1	-2.04E+3	-1.41E+4	-2.51E+1
hydrogen	-6.52E+0	mg												
VOC : acrylates	-1.63E+3	mg												
VOC : styrene or styrene monomere	-1.63E+3	mg												
metals	-5.33E+0	mg								-1.88E+0			-1.88E+0	
total VOC	-1.44E+6	mg												
Waste production	-4.64E+0	kg	-1.20E-2		-1.20E-2	-6.34E-4	-1.47E-6	-6.33E-4	-2.93E+0	-3.21E-2	-1.32E-3	-1.45E-2	-1.63E-2	-5.75E-6
toxic wastes	-6.40E-3	kg							-5.82E-4	-1.32E-3	-1.32E-3			
industrial wastes or post-consumer	-1.88E+0	kg							-2.95E-1	-7.43E-3			-7.43E-3	
inert wastes	-1.34E-2	kg								-8.84E-3			-8.84E-3	
incineration	-1.09E-4	kg												
rt	-3.51E-2	kg												
incineration and recovery														
recuperation	-2.36E+0	kg							-2.36E+0					
inert minerals	-7.24E-4	kg							-7.24E-4					
unspecified wastes	-3.50E-1	k	-1.20E-2		-t.20E-2	-6.34E-4	-1.47E-6	-6.33E-4	-2.70E-1	-1.45E-2		-1,45E-2		-5.75E-6

Life cycle inventory of paint E **Mat solvent-borne paint -** **PlIOWa resin - ISO arBfflniC** Y P	**Pliowa resin** Pfioway Site Energy Raw material Raw **resin** production production material transport					**Paint** **Paint** Site Energy Raw material production transport				**Application** **Application** Site WS17- Raw 18 % malarial dansport			
Materials													
kaolin ore													
soya IecUhme (dispersing agent .)													
						1.32E-2	1.32E-2						
sodium metabisul(Ue / sodium sulfate	1.95E-3	1.95E-3											
rock salt	6.72E-3			6.72E-3									
marble or limestone	8.42E-5			8.42E-5									
HCI													
TiCL4													
trthydrated aluminium													
potassium sulfate ı other potassium	6.29E-2	6.29E-2											
rponoamonico phosphate													
iwn (metal, ore)	1.34E-4			1.34E-4									
Zr02 compounds													
sodium silicate													
explosives													
monmonllonUe'bentone													
						4.98E-2	4.98E-2						
ilmenrte ore													
diverse compounds 8 catalysts	4.54E-3	3.70E-3		8.40E-4									
clay	1.03E-5			t.03E-5									
ferromanganese	5.14E-7			5.14E-7									
bauxite	7.06E-4			7.06E-4									
ore (Cu2S, Fe2s3)	1.28E-t			t.28E-1									
plaslilying													
						6.98E-2	6.98E-2						
air	7.88E-2			7.88E-2									
petroleum	7.06E-t		t.67E-1	5.21E-t	1.78E-2	6.68E-2		5.46E-3	6.13E-2	2.25E-1			
coal	7.64E-1		t.16E-i	4.76E-2	t.t8E-4	2.94E-2		2.90E-2	4.07E-4			t.68E-1	5.72
natural gas	t.02E+0		3.86E-1	6.36E-t	6.90E-5	4.12E-3				2.59E-3		2.2tE-3	3.79
Packaging								3.88E-3	2.39E-4	6.09E-3		5.87E-3	2.23
cardboard	3.26E-3	3.26E-3											
paper													
polyethylene	6.27E-3	6.27E-3				7.t6E-3	7.16E-3						
tin can													
						5.16E-1	5.t6E-1						
Water consumption	2.20E+7	t.27E+1	5.41E+0	3.90E+0	3.45E-3	t.d7E-2		2.74E-3					
cleaning									7.t9E-2	6.98E-1		687E-1	t.t1
	.07E+0	**1.07E+0**		5.22E-3									
cooling	7.77E+0	7.02E+0		7.49E-t							~		
boiler	7.65E+0	1.25E+0	5.36E+0	1.04E+0						6.84E-1		6.84E-1	
unspecified water	1.19E+0		5.22E-2	**1.13E+0**	3.45E-3	1.47E-2		2.74E-3	1.19E-2				
process	4.30E+0	3.32E+0		g.77E-1						1.37E-2		2.56E-3	1.1

Life cycle inventory of paint E **Mat solvent-bome paint -** **Plioway resin - Isoparaffinic1~**	**Phowa resin**					**Paint**				**Application**			
	Plioway.	Site	Energy production	Raw material production	Raw material transport	Paul.	Site	Energy production	Raw material transport	Application -	Site	WS17-18%	r tr
Energy													
electricity	3.11E+0	2.04E+0	7.59E-2	9.95E-1	2.17E-3	5.33E-1;	5.25E-1		7.50E 3	4 72E , ;		4.02E-2	6
thermal energy	7.42E+1	4.90E+0	1.82E+1	5.03E+1	7.37E 1	. 263Et0'.			2.63E+0	*3g.40;';		6.93E+0	2
primary energy equivalent	8.4.1&1	4.90E+0	2.50E+1	5.35E+1	7.44E 1	4 33E4.:		1.67E+0	2.66E+0	9 54Eto		7.06E+0	2
Fuels													
coal	6,g0E.Z.;.		4.23E-2	2.67E-2		1.Q~ 2::		1.09E-2		;7.96E.;		7.86E	
lignite	8.89E .2.		6.82E-2	2.07E-2		17$E	21.76E-2			;:1,273.:;		1.27E-3	
light fuel oil	2.81E•2		1.65E-2	1.16E-2		1.85E4 :-		1.65E		2AOE.4 :. :.		2.49E-4	
heavy fuel oil	2.35E•1.	1.19E-1	3.01E-2	7.14E-2	1.41E2	.':1iQE2::		5.19E-3	5.81 E3	14.7.2 :		1.13E-2	4
natural gas	8.29E-t		3.80E-1	2.49E-1	5.33E 5	I. .471 E4 3:		3.79E-3	1.85E-4	$.>i,5';;:		5.78E-3	1
diesel oil	4.16E-3	4.39E-4		8.27E-5	3.64E-3	;5.$Z(*•::::			5.57E-2	:•:.$p:'			S
nuclear	3.22E+Q		2.34E+0	8.77E-t		&~iE1:.		6.04E-i		x,91,::::;		2.91E-2	
hydraulic	5.73E-1		3.42E-1	1.71E-1		883E-2::		8.83E-2		',;2$3: :.		4.25E-3	
other fuels	3.59E-2			3.59E-2									
industrial gas													
Discharge into water													
water discharge	-5.49E+0	-4.39E+0	-6.29E-3	-1.10E+0		=t f>2E-$		-1.62E-3		.6 53F•1; :'		-6.53E-1	
suspended matters	-5.91E+2	-3.16E+2	-2.88E+1	-2.46E+2	-9.85E-2	.-371E-1		-3.03E-2	-3.41E 1	:xAIE+V.		-1.79E+0	-
D	-3,40Et3	-2.22E+3	-2.47E+0	-1.18E+3	-2.96E-1	.=1 10E+t)		-8.19E-2	-1.02E+0	. ?1:90E++1,'.		-1.80E+1	-
BOD5	-2.55E+t		.8.23E-1	-2.46E+1	-9.85E-2	:.3.68E=1		-2.73E-2	-3.41E-1	2.i6Eta		-1.85E+0	-
hydrocarbons	-7.66E+2.	-5.90E+2		-1.76E+2						-6;51E-1 :		-6.51E-1	
ammonium hydroxide	-266E+t		-3.91E-1	-2.62E+1		-_A.OIE- .4.		-1.01E-1		7.25E-$		-7.25E-3	
fluorides	-1.10E+0		-8.43E-1	-2.60E-1		-21TE-1		-2.17E-1		•1.56E-2:		-1.56E-2	
sulphates	-1.54E+4	-8.78E+3	-1.78E-1	-6.67E+3		-4.59E-2		-4.59E-2		-3.30E-3		-3.30E-3	
nitrates	-7.74E-1		-1.99E-1	-5.75E-1		-5:13 E•2		-5.13E-2		-3.70E-3 .		-3.70E-3	
chlorides	-7.56E+1		-1.07E-2	-7.56E+1		•2.76E=3[1)]		-2.76E-3		-1.99E-4		-1.99E-4	
Na (ion)	-1.24E+3		-1.38E-1	-1.24E+3		-3.56E-2		-3.56E-2		-2.57E-3		-2.57E-3	
Fe (ion)	-2.13E-3		-1.63E-3	-5.03E-4		-4.20E-4		-4.20E-4		-3.02E-5		-3.02E-5	
phenols	-1.61E-t			-1.61E-1						-8.38E-2		-8.38E-2	
Hg													
oils	-1.29E+2		-3.58E+1	-9.04E+1	-2.68E+0	-1.01E+1		-8.72E-1	-9.26E+0	-3.55E+1		-2.68E+1	-8
dissolved substances	-2.45E+3		-1.80E+3	-4.42E+2	-2.08E+2	-7.77E+2		-5.83E+1	-7.18E+2	-2.77E+3		-2.10E+3	-6
cleaning solvents: white spirit 17 - 18%										-1.56E+5	-1.56E+5		
paint residues										-3.00E+4	-3.00E+4		
S	-8.05E-1			-8.05E-1									
K													
Ca													
Mg													
AI													
P04													
Si02													
Pb	-1.30E-2			-1.30E-2									
Cu													
Zn													
B													
Mn													
Cr													

v

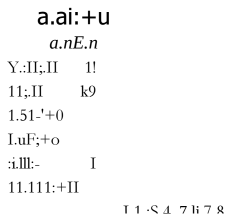
Life cycle inventory of paint E
Mat solvent-borne paint. Plioway
Plioway resin - Isoparaffinic

	Pliowa resin							**Paint**			**Application**		
	resin	Site	Energy production	Raw material production	Raw material transport	**Paint**	Site	Energy production	**Raw material** transport	**Application**	Site	WS17-18%	m… tr
Cd													
Cl													
F													
other nitrogen	-8.40E+0			-8.40E+0									
others metals tons	-3.68E+2			-3.68E+2									
Air emissions													
dusts	-1.48E+3	-8.97E+1	-168E+2	-1.18E+3	-4.43E+1	-2.72E+2		-3.49E+l	-2.37E+2	-2.41E+2		-1.76E+1	-2
SOX	2.83E+4	-9.24E+3	2.90E+3	1.56E+4	-6.39E+2	-9.38E+2		-4.48E+2	-4.90E+2	-1.34E+3		-9.19E+2	-4
HCL	-8.90E+1		-5.92E+1	-2.98E+1		-1.53E+1		-1.53E+1		-1.10E+0		-1.10E+0	
NOx	-1.33E+4	-842E+2	-2.56E+3	-9.61C+3	-2.58E+2	-3.12E+3		-2.21E+2	-2.90E+3	-2.87E+3		-1.17E+2	-2
N20	-2.35E+2	-7.36E+t	-1.12E+2	-3.38E+1	-1.48E+1	-1.11E+2		-1.25E+1	-9.82E+1	-9.61E+1		-3.39E+0	-9
CO	-1.58E+3	-3.01E+1	-4.73E+2	-9.95E+2	-8.50E+1	-1.19E+3		-6.20E+t	-1.13E+3	-1.09E+3		-1.05E+1	-1
C02	-2.70E+6	-3.83E+5	-1.25E+6	-t.00E+6	-6.15E+4	-2.88E+5		-7.72E+4	-2.11E+5	-2.55E+5		-5.82E+4	-1
'ammoniac	-3.31E+0		-2.74E+0	-2.37E-1	-3.28E-1	-1.23E+0		-9.08E-2	-1.14E+0	-1.27E+0		-2.08E-1	-1
aldehydes	-8.05E+0		-6.58E+0	-8.07E-1	-6.57E-1	-2.,74E+0		-4.64E-1	-2.27E+0	-2.56E+0		-4.36E-1	-2
fluorides ,gazeousl	-5.78E-3		-4.42E-3	-1.36E-3		-1.14E-3		-1.14E-3		-8.20E-5		-8.20E-5	
H2S	-3.37E+0			-3.37E+0									
other organic substances	-1.30E+1		-1.04E+1	-1.54E+0	-9.85E-1	-4.25E+0		-8.40E-1	-3.41E+0	-3.84E+0		-6.64E-1	-3.18
VOC : isoparaffinic										-1.44E+6	-1.44E+6		
other VOC	-1.76E+1			-1.76E+1									
chlorine	-1.08E-3			-1.08E-3									
total hydrocarbons	-2.53E+4	-3.95E+1	-1.24E+4	-1.27E+4	-1.50E+2	-1.32E+3		-3.76E+2	-9.42E+2	-1.87E+3		-9.80E+2	-8.89
methan	-5.30E+3		-3.99E+3	-1.31E+3	-4.92E+0	-7.59E+1		-3.79E+1	-3.81E+1	-8.30E+2		-7.94E+2	-3.60
non methanic hydrocarbons	-2.00E+4	-3.95E+1	-8.41E+3	-1.14E+4	-1.45E+2	-1.24E+3		-3.39E+2	-9.04E+2	-1.04E+3		-1.86E+2	-8.53
hydrogen	-6.52E+0			-6.52E+0									
VOC : acrylates	-1.63E+3	-1.63E+3											
VOC styrene or styrene monomere	-1.63E+3	-1.63E+3											
metals	-3.45E+0			-3.45E+0									
rural VOC	-3.28E+3	-3.26E+3		-1.76E+1									
										-1.44E+fi	-1.44E+6		
	' -y ooc--<	.. - ^	q'14G-2	-2.50E-2	-2.56E-5	-4.01E-2	-3.17E-2	-8.24E-3	-8.86E-5	-1.54E+0	-1.54E+0	-8.46E-4	-6.26E-5
						ı,, ')pc-,4 ,4 2a&5				-4.59E-5		-4.58E-5	
										. r.IF+O	-1.54E+0		
inert wastes	-4.54E-3			-4,b4r.j									
incineration	-1.43E-5			-1.43E-5						-9.46E-5		-9.46E-5	
incineration and recovery	-3.51E-2	-3.51E-2											
recuperation	33E-5			-3.33E-5									
										-2.78E-5		-2.78E-5	
inert minerals													
unspecified wastes	-4.36E-2		-3.34E-2	-1.02E-2	-2.56E-5	-8.33E-3		-8.24E-3	-8.86E-5	-7.60E-4		-6.77E-4	-8.26

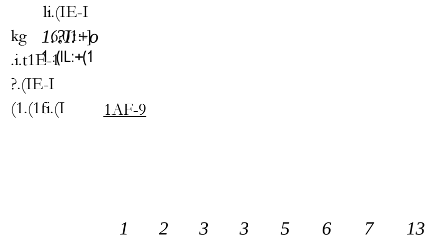
Mat solvent-lulrne paint - Pli(n%ay resin - tsoparaffinic

Functional Unit (211 m= covered with 98% opacity)

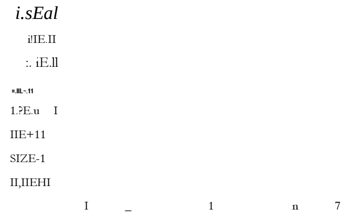
petroleum 3, I F+(1 kg



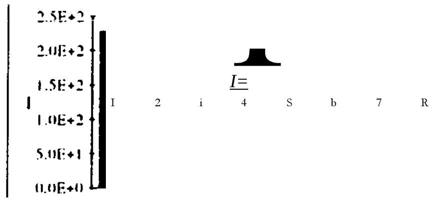
coal 1.()E+(1 kg



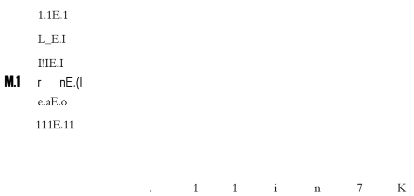
natural gas 3.2E+(1 kg



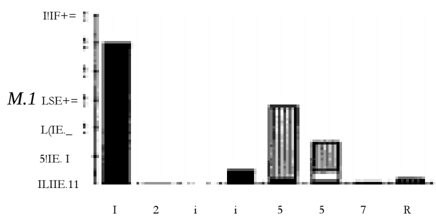
Water consumption 2.3E+2 I



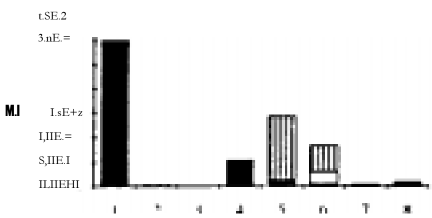
electricity 1,5E+ I MJ



thermal energy 2.5 E+2 MJ



primary energy equivalent 3.I1E+2 MJ

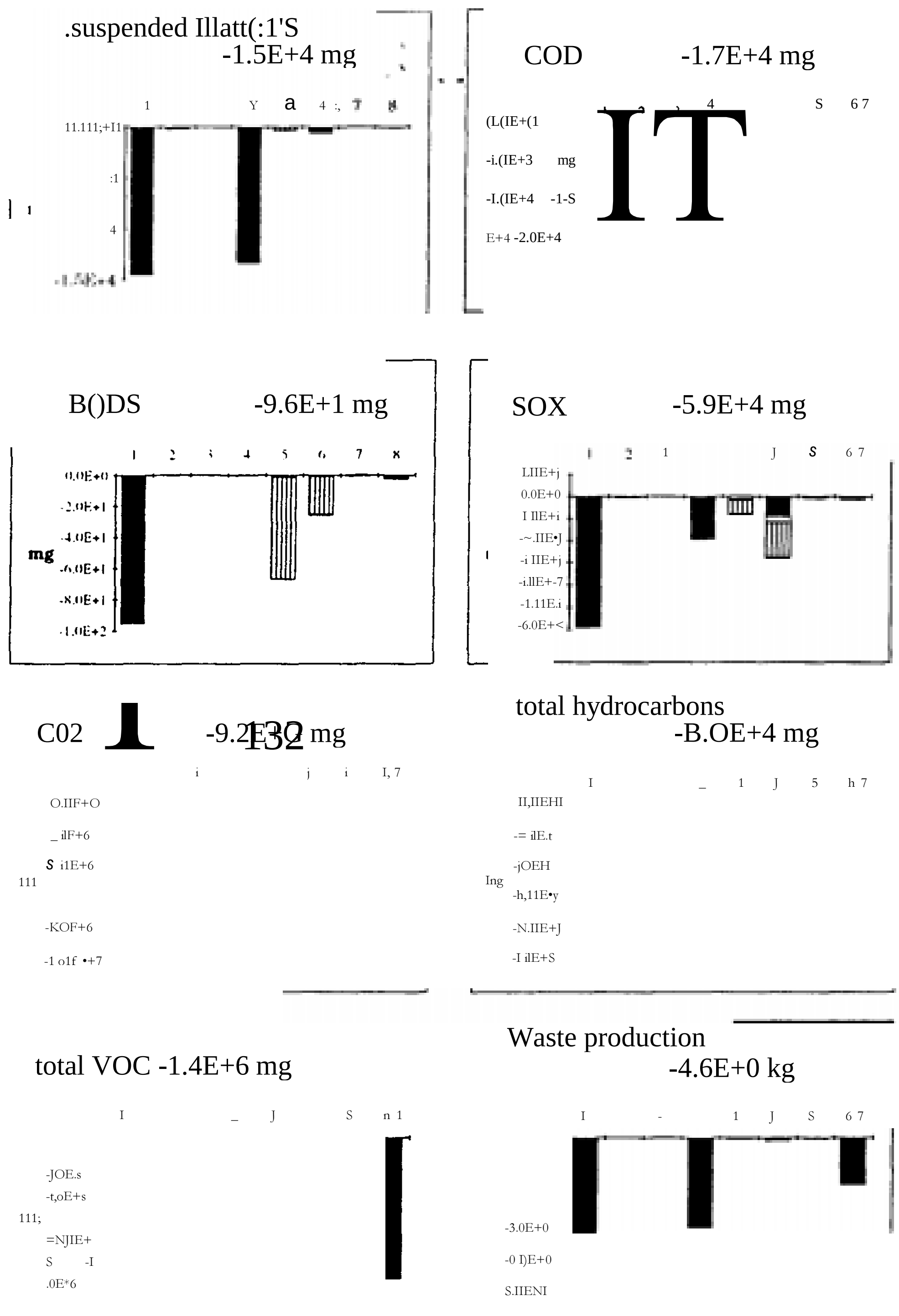


water discharge -2.1 E+2 I

Legend

bite	I = '1'()'1'AI.	5 = Isoparaffinic solvent
h:nergy	2 = Kaolin	I> = Plioway resin
Raw materials	3 = (:a(:()3	7 = **Paint**
Transport	4 = '1'i()2 (total)	fi = Application

Functional Unit (2() m= covered with 9R°l. opacity)



Legend

Site	I = '1'()TAI.	5 = Isoparaffinic solvent
Energy	2 = Kaolin	6 = Plioway resin
Raw materials	3 = CaC03	7 = Paint
Transport	4 = '1'i()2 (total)	*R = Application*

4

~r

Life cycle inventory of paint F Gloss solvent-bone paint - Alkyd resin (F) - ISOpafBffInIC Valour U 'ti SI		m	Ti02	Solvent					Alkyd resin				
			Ti02 .	IaPparatl i ^ic: solve^t	Site	Energy producti o	Raw material producti o	Raw material transpor t	Alkyd. resin	Site	Energy productio n	Raw material production	Ra mate trans
materials													
soya lecithins (dispersing agent,)	1.24E-2	kg											
siccative : Pb/Zn/Co/Ca/Zr complex	6.49E-2	kg											
anti skinning forming agent : methyl ethyl	9.27E-3	kg											
benzoic acid	9.73E-3	kg											
sodium metabisulfite / sodium sulfate	t.08£-2	kg							9.73E-3	9.73E-3			
glycerin	6.79E•3:	kg							1:081::, 2			1.08E-2	
rock salt	1.25£-t	kg	716E-2	3,74E4.					9 73E•3::	9.73E-3			i
marble or limestone	2.10E+0	kg	2.09E+0	6.24E-5			3.74E-3		4 95&2 :			4.95E-2	
							6.24E-5		4.56E•3 .			4.56E-3	
HCI	9.94E•3	kg	6.79E-3						3a5£-3:			3.15E-3	
caustic soda	7.15E-3 .	kg							7;151: -3:.,				
TiCLd	6.32E-2	kg	6:32E-2.									7.15E-3	
trihydrated aluminium	4.90E-2	kg	4.90E-2.,	,									
wood	1.29E+0	kg							1.29E +0			1.29E+0	
monoamonico phosphate	3.68E-3	kg	• 3.68E-3										
iron (metal, ore)	2.27E-4	kg		1.25E-4			1.25E-4		1.02E-4			1.02E-4	
Zr02 compounds	5.41E-3.	kg	5.41E-3										
sodium silicate	3.85E-2	kg	3;85E-2.										
explosives	5,25E-3	kg	1;25E• 3										
ilmenite ore	1.24E+0	kg	1.2412 40										
diverse compounds b catalysts	2,gg£.4:.	kg		•:1;g0E .~::1.9 0E-4									
clay									9 87E~.5.			9.87E-5	
	2.96E-5	kg		1:25E-5			1.25E-5		I,I 1E-5			1.11E-5	
ferromanganese	1:18E-6	kg		6.24E-			6.24E-		5.S6E•7				

v

Gloss solvent-borne paint - Life cycle inventory of paint F Alkyd resin (F) - IBoparaffinic			Ti02	Solvent					Alkyd resin .				
			Ti02	Isoparani ^~ solvent	site	Energy production	Raw material production	Raw material transport	Alkyd rein	Bite	Energy production	Raw material production	Ra mate trans
~Ensrpy													
lelectricity	1.52E+1	MJ	1.30E+1	5.45E-1	2.99E-1	9.29E-3	2.37E-1	1.61E-4	1.42&+0	2.66E-1	9.29E-3	1.14E+0	2.58
thermal energy	1.58Ea2	MJ	3,62E+1	4^58E+1:	3.07E+0	2.73E-1	4.24E+1	5.44E-2	6.60Ea1	2.48E+0	2.62E-1	6.23E+1	9.00
Il,primary energy equivalent	2.06E+2	MJ	7.75E+1	4.75E+t:	3.07E+0	1.26E+0	4.31E+1	5.49E-2	7.07Et1.	2.48E+0	1.14E+0	6.61E+1	9.08
Fuels		-											
coal	6,23E-i	kg	5.64&•1	.1.73&•2		6.21E-3	1.11E-2		3.58&:2:::		5.53E-3	3.03E-2	
lignite	4.81E-1	kg	4,22&•1	t 00E-2:.		1.00E-2			3.84E=2		8.90E-3	2.95E-2	
light fuel oil	6.51E-2	kg	5.46E-2:	. i 90&-4		1.90E-4			1 pOE.		2.53E-3	7.47E-3	
heavy fuel oil	2.93E-1	kg	1.74E-1	: 4.46E-2	8.32E-3	8.57E-3	2.64E-2	1.33E-3	5:48&•2		2.63E-3	4.75E-2	4.72
natural gas	8.05E-1	kg	5.74E-1	.9.48E-2	2.13E-3	2.47E-3	9.02E-2	3.97E-6	7.28E-1	5.40E-2	4.31E-3	7.00E-2	6.34
diesel oil	8.55E-2	kg	8.35E-3	.					' 1,82E-2:			1.78E-3	1.64
nuclear	1.68E.0	MJ	1.46E+1	4.84E-1		3.44E-1	1.40E-1		1:44.E4Q:		3.06E-1	1.14E+0	
hydraulic	2.52&+0	MJ	2.12&+0	1.06E-1		5.03E-2	5.62E-2		2.40E-1'		4.47E-2	1.96E-1	
industrial gas	4.84&•2:.	kg		g,16!E-2	3.19E-2				1.66&•2			1.66E-2	
Discharge into water		-											
water discharge	-3.12E+2	I	-2.78Ef2	:.-2.96E-1	-2.95E-1	-9.23E-4			-3.28E+1.	-2.44&-1	-8.21E-4	-3.27E+1	
suspended matters	-1.93&+4	IN	-1.90&+4	-1>25E+2		-5.93E-1	-1.25E+2	-7.34E-3	.-2.36&4		-4.34E+0	-2.32E+2	-1.17
COD	-2.42&+4	rng	-1.82&+4	-1.26E+2		-1.26E+0	-1.25E+2	-2.20E-2	-5:86&+3	-2.05E+2	-4.15E-2	-5.65E+3	-3.51
BODS	-7.50E+2	mg	-1:14&+tl	- 2.233E+1:		-4.21E-1	-2.18E+1	-7.34E-3	.:- 7`.24&+2: .	-2.20E+1	-1.38E-2	-7.02E+2	-1.17
hydrocarbons	-1:27&+1	mg		-374E+1,			-3.74E+1				-346Ew1:- 3.46E+1		
ammonium hydroxide	-1:08&+1	mg	-2.43E+0	-4.74&+0		-5.74E-2	-4.68E+0		3.61&+0		-5.10E-2	-3.56&+0	
fluorides	-5,996+0	mg	-5:23&+0	--1.24E-1		-1.24E-1			-5^14+=-1.		-1.10E-1	-4.04E-1	
sulphates	-2,06E+1	mg	- 1:1012+0	:-2fitE-2.		-2.61E-2			1MEr1:		-2.32E-2	-1.94E+1	
nitrates	-2.55&+11	mg	=1,24E+0	-453E-1:		-2.92E-2	-6.24E-1		-6:27&=1		-2.60E-2	-6.01E-1	
chlorides	-6.73E+1	mg	4.65E-2	::312&+1		-1.57E-3	-3.12E+1		3.66 l		-1.40E-3	-3.60E+1	
Na (ion)	-9,78E-1	mg	-8.58E 1	-:2 03E-2		-2.03E-2			7:90& 2:		-1.80E-2	-6.09E-2	
Fe (ion)	-8,26&+4	mg	4:26&.4	.=238&4		-2.39E-4			J!E-4 :		-2.13E-4	-7.18&-4	
phenols	-1.07E+Q	mg		-6 24E-1:			-6.24E-1		16^1:::			-3.67E-i	
Hg	-1.74E-2::	mg	-,1471E 2	:					, Sl.4			-2.58E-4	
AOx	-2.58E+Q	mg							2:68&.0.			-2.58E+0	
oils	-3.84E+Z.	mg	$,886+I	=x 11E+1:		-1.16E+1	-5.93E+1	-2.00E-1	2.OIEa2.	-1.32E+2	-2.44E+0	-6.916+1	-3.18
dissolved substances	-7.59 E+3	mg	-2:27&+3	=.1 17E4		-8.92E+2	-2.62E+2	-1.55E+1	1.28&43:		-3.79E+1	-9.78E+2	-2.47
cleaning solvents: white spirit 17 - 18°/.	-1.56&+5	mg											
paint residues	3;0094:; 4:74E~V.;	mg		126.0			-3.12E+0		1,ti2F:			-1.62&+0	
NICT	-2^15E+1:	mg							215&1:			-2.15E+1	
Ca	-7.84&03	mg	,7:841» +3										
Mg	3:44&;4.	mg	14Ey4.										
AI r	-1:94&04	mg	=64E+!L										
Pb	- -:' ::: , 2.x4&+1:.:	:.:.:,:.,:- :: mg	^^^:::4: 21&1•1):						>::::::::.:.; :;.': 351E 1.:			-3.54E-1	
Cu	iC,:.		1,23E	::::.::::.::. ::					::: -=				
Mn	•:::g^76E+,2 : 66E	atg	4.761:4 .	.:: :: :.:::.>:;					•:. ::::::				

Life cycle inventory of paint F

Gloss solvent-borne paint -

Alkyd resin (F) - Isoparaffinic

			Ti02	**_ Solvent**					**Alkyd resin**				
			Ti02	**Isoparaffi nic** solvent	Site	Energy production	Raw material production	Raw material transport	**Alkyd** resin	Site	Energy production	Raw material production	Ra mat trans
Air emissions													
dusts	-8.86E+3	mg	-5.59E+3	-5.44E+2	-7.66E+0	-3.47E+1	-4.99E+2	-2.77E+0	-2.44E+3	' -5.46E-1	-1.81E+t	-2.35E+3	-7.6
sox	-3.72E+4	mg	-2.78E+4	-2.72E+3	4.37E+1	-5.20E+2	-2.18E+3	-5.84E+1	-5.02E+3	-1.84E+0	-3.33E+2	-4.40E+3	-2.7
H2S04	-2.45E+1	mg							-2.45E+1			-2.45E+1	
HCL	-4.35E+2	mg	-3.67E+2	1.49E+1		8.69E+0	-6.24E+0		-4.42E+1		-7.73E+0	-3.65E+1	
NOx	-2.39E+4	mg	-1.02E+4	-4.11 E+3	-9.98E+1	-2.55E+2	-3.74E+3	-6.56E+0	-6.34E+3	-2.05E+2	-1.36E+2	-5.13E+3	-8.69
N20	-9.18E+2	mg	-6.98E+2	-2.03E+1	-9.02E+0	-1.05E+1		-8.11E-1	-8.84E+1	-6.21E+0	-9.11E+0	-4.23E+1	-3.08
CO	-5.23E+3	mg	-2.87E+3	-3.20E+2	-1.66E+t	-5.26E+1	-2.50E+2	-1.06E+0	-8.22E+2	-2.31E+1	-3.96E+1	-4.23E+2	-3.3
C02	-7.02E+6	mg	-5.14E+6	-6.99E+5	-1.62E+5	-6.40E+4	-4.68E+5	-4.59E+3	-8.62E+5	-1.27E+5	-5.35E+4	-6.08E+5	-7.2
ammoniac	-7.69E+0	mg	-3.18E+0	-1.43E+0		-1.40E+0		-2.45E-2	-1.63E+0		-4.60E-2	-1.20E+0	-3.9
aldehydes	-2.62E+1	mg	-1.62E+1	-3.02E+0		-2.97E+0		-4.89E-2	-3.93E+0		-2.35E-1	-2.92E+0	-7.8
fluorides (gazeous)	-3.12E-2	mg	-2.74E-2	-6.48E-4		-6.48E-4			-2.52E-3		-5.77E-4	-1.95E-3	
H2S	-1.95E+t	mg		-3.43E+0			-3.43E+0		-1.60E+1			-1.60E+1	
mercaptans	-1.74E+2	mg							-1.74E+2			-1.74E+2	
other organic substances	-4.57E+1	mg	-2.92E+1	-5.23E+0		-4.54E+0	-6.24E-1	-7.34E-2	-6.60E+0		-4.25E-1	-5.01E+0	-1.1
VOC : isoparaffinic	-7.23E+5	mg											
other VOC	-2.55E+4	mg											
non specified emissions	-3.86F-3	mg							-3.86F-3			-3.86E-3	
chlorine	-7.73E-2	mg	-4.58E-2						-3.15E-2			-3.15E-2	
total hydrocarbons	-6.36E+4	mg	-4.78E+4	-5.44E+3	-1.90E+1	-7.33E+2	-4.68E+3	-8.55E+0	-8.16E+3	-2.58E+1	-1.73E+3	-6.11E+3	-2.9
methan	-1.45E+4	mg	-1.27E+4	-7.09E+1	-1.46E+1	-5.61E+1		-2.34E-1	-9.35E+2	-2.32E+1	-5.86E+2	-3.14E+2	-1.18
non rnethanic hydrocarbons	-4.90E+4	mg	-3.51E+4	-5.37E+3	-4.37E+0	-6.77E+2	-4.68E+?	-8.31E+0	-7.22E+3	-2.58E+0	-1.14E+3	-5.79E+3	-2.8
acid equivalent	-1.43E-6	mg					'		-1.43E-6	-1.43E-6			
alcool equivalent	-2.17E-6	mg							-2.17E-6	-2.17E-6			
VOC : methyl ethyl cetoxime	-7.27E+3	mg											
sodium sulphate	-3.86E+0	mg							-3.86E+0			-3.86E+0	
metals	-1.18E+0	mg		-6.24E-1			-6.24E-1		-5.56E-1			-5.56E-1	
total VOC	-7.55E+5	mg											
Waste production	-5.19E+0	kg	-4.12E+0	-1.06E-2	-4.37E-4	-4.80E-3	-5.40E-3	-1.91E-6	-8.33E-2	-8.38E-3	-4-36E-3	-7.06E-2	-3.0
toxic wastes	-4.25E-3	kg	-8.19E-4	-4.37E-4	-4.37E-4				-2.35E-4			-2.35E-4	
industrial wastes or post-consumer wastes	-1.40E+0	kg	-4.15E-1	-2.46E-3			-2.46E-3		-6.94E-3	-4.67E-3		-2.27E-3	
inert wastes	-2.93E-2	kg		-2.93E-3			-2.93E-3		-2.64E-2			-2.64E-2	
incineration	-4.40E-3	kg							-4.31E-3	-3.71E-3		-6.02E-4	
recuperation	-3.32E+0	kg	-3.32E+0										
inert minerals	-1.02E-3	kg	-1.02E-3										
rr	-4.35E-1	k	-3.79E-1	-4.81E-3		-4.80E-3		-1-91E-6	-4.55E-2		-4.360-3	-4.11E-2	-3.0
unspecified wastes													

Life cycle inventory of paint F Gloss solvent-borne paint - Alkyd resin (F) - Isoparaffinic	Paint				Application			
	paint	Site	Energy production	Raw material transport	Application	Site	Dilution solvent	Raw material transport
Materials								
soya leathine tdispersing agent,)	1.24E-2	1.24E-2						
siccauve : PbrZn/Co/Ca/Zr complex	6.49E-2	6.49E-2						
anti skinning forming agent : methyl ethyl	9.27E-3	9.27E-3						
benzoic acid								
sodium metabisulfite • sodium sulfate								
glycerin								
rock salt								
marble or limestone								
HCI								
caustic soda								
TiCL4								
trihydrated aluminium								
wood								
monoamonico phosphate								
iron (metal, ore)								
Zr02 compounds								
sodium silicate								
explosives								
ilmenite ore								
diverse compounds 8 catalysts								
clay								
ferromanganese								
bauxite								
ore (Cu2S, Fe2S3)								
2-pentene	3.09E-2	3.09E-2						
air								
petroleum	3.10E-2		2.77E-3	2.82E-2	2.04E-1		1.68E-1	3.60E-2
coal	1.49E-2		1.47E-2	1.87E-4	2.44E-3		2.21E-3	2.38E-4
natural gas	2.08E-3		1.97E-3	1.10E-4	6.01E-3		5.87E-3	1.40E-4
Packaging								
paper								
polyethylene	4.33E-3	4.33E-3						
tin can	3.11E-1	3.11E-1						
uption	6.88E-3		1.39E-3	5.49E-3	6.94E-1		6.87E-1	6.98E-3
Water conscleanin g								
cooling					6.84E-1		6.84E-1	
boiler								
unspecified water	6.88E-3		1.39E-3	5.49E-3	9.55E-3		2.56E-3	6.99E-3
rocess								

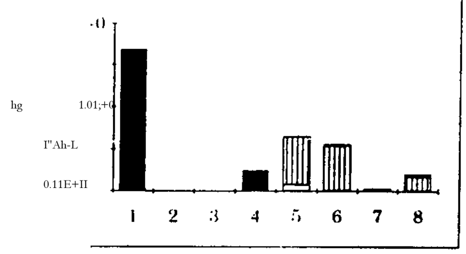
Life cycle inventory of paint F Gloss solvent-borne paint - Alkyd resin (F) - Isoparaffinic	Paint							Application
	' Pate .	site	Energy peon	Raw transport	material,Application	Site	Dilution solvent	Raw materiel transport
Energy								
electricity	2.70E-1	2.66E-1		3.45E-3	4;46E-2		4.02E-2	4.40E-3
thermal energy	1.21E+0			1.21 E+0	::B:~BE+ D: .		6.93E+0	1.54E+0
primary energy equivalent	2.07E+V		8.49E-1	1.22E+0	*10g2E4* :.		7.06E+0	1.56E+0
Fuels								
coal	6.54E•3.		5.54E-3		7.86E•4.		7.86E-4	
lignite	8.92E-3 :		8.92E-3		1.27E-3.		1.27E-3	
tight fuel oil	6:38E-5::		8.36E-5		ZAgE-4: .		2.49E-4	
heavy fuel oil	fi 35E 9-:.		2.63E-3	3.72E-3	140E•2:		1.13E-2	2.76E-3
natural gas	2 00E 9::		1.92E-3	8.50E-5	5 88E 3 :::		5.78E-3	1.08E-4
diesel oil	'246E-2.			2.46E-2	333E~2 .			3.33E-2
nuclear	3.O6E:1		3.06E-1		x:91 *E-2.* .		*2.91E-2*	
hydraulic	4:48E-2		4.48E-2		' .425E-3: :		4.25E-3	
industrial gas								
Discharge into water								
water discharge	-9.23E-d		-8.23E-4		•.-~:53E-1.		-6.53E-1	
suspended matters	-1.725•1		-1.54E-2		-1.57E- 19!)EO		-1.79E+0	-2.00E-1
	5125•1:		-4.15E-2	-4.71E-1	t 86Et:1:.		-1.80E+1	-6.00E-1
BOD5	171E,a		-1.38E-2	-1.57E-t	~t>SEO:;		-1.85E+0	-2.00E-1
hydrocarbons					-8.515:'1:.::;.		-6.51E-1	
ammonum hydroxide	• '''Z:		.1tE 2 -5 -		75E 9:.		7.25 E-3	
fluorides	1 10Jr •		-1.10E-1		1 $65.2 <		-1.56E-2	
,sulphates		-2:35.2	-2.33E-2		:-4',eE 3:::.		-3.30E-3	
nitrates	'x!:::	::2	-2.60E-2		:.:.;,'	-';>-	3.70E-3	
chlorides			1.40E_3		:3:,,.		-1.99E-4	
INa(ion)					.. 99v:			
	815•2:: .... :: :'		-1	.81E-2	3: :675		-2.57E-3	
Fe (ion)	233E-1'		-2.13E-4		3 ~~ 5		-3.02E-5	
phenols					8:365::2::.		-8.38E-2	
Hg								
AOx								
oils		~.y.10E•rtl :-4.42E-1		-4.26E+0	:.: y'~Et3 ,:		-2.68E+1	-5.435+0
dissolved substances	=360Ei:		-2.96E+1	-3.31E+2		25353	-2.10E+3	-4.21E+2
cleaning solvents: white spirit 17 - 1814					`: :1.5fiir+.5.:- 1.56E+5			
paint residues	;,::::::•:				`' 06 ;::.	-3.00+4		
NKT								
Ca								
Mg								
AI								
Pb								
Cu								
Zn								
Mn								
Cr								
Cd								

Life cycle inventory of paint F Gloss solvent-borne paint - Alkyd resin (F) - Isoparaffinic	**Paint**				**Application**			
	Paint	Site	Energy production	Raw material transport	Application	Site	Dilution solvent	Raw material transport
Air emissions								
dusts	- 1.25E+2		-1.77E+1	-1.07E+2	-1.58E+2		- 1.76E+1	- 1.41E+2
SOX	- 4.94E+2		-2.27E+2	-2.67E+2	-1.18E+3		- 9.19E+2	- 2.62E+2
H2S04								
HCL	-7.75E+J		-7.75E+0		-1.10E+0		- 1.10E+0	
NOx	- 1.40E+3		-1.12E+2	-1.29E+3	-1.85E+3		- 1.17E+2	- 1.73E+3
N20	- 5.04E+1		-6.36E+0	-4.41E+1	-6.17E+1		- 3.39E+0	- 5.83E+1
CO	- 5.32E+2		-3.14E+1	-5.01E+2	-6.87E+2		- 1.05E+1	- 6.76E+2
C02	- 1.36E+5		-3.91E+4	-9.73E+4	-1.82E+5		- 5.82E+4	- 1.24E+0 5
ammoniac	-5.69E-1		-4.61E-2	-5.23E-1	-8.74E-1		-2.08E-1	-6.66E-1
aldehydes	- 1.28E+0		-2.35E-1	-1.05E+0	-1.77E+0		-4.36E-1	- 1.33E+0
fluorides (gazeous)	-5.78E-4		-5.78E-4		-8.20E-5		-8.20E-5	
H2S								
mercaptans								
other organic substances	- 1.99E+0		-4.26E-1	-1.57E+0	-2.66E+0		-6.64E-1	- 2.00E+0
VOC : isoparaffinic					-7.23E+5	- 7.23E+5		
other VOC					-2.55E+4	- 2.55E+4		
non specified emissions								
chlorine								
total hydrocarbons	- 6.15E+2		-1.91E+2	-4.24E+2	-1.54E+3		- 9.80E+2	- 5.59E+2
methan	- 3.62E+1		-1.92E+1	-1.70E+1,)	-8.17E+2		- 7.94E+2	- 2.27E+1
non methanic hydrocarbons	- 5.78E+2		-1.72E+2	-4.07E+2	-7.22E+2		- 1.86E+2	- 5.36E+2
acid equivalent								
alcool equivalent								
VOC : methyl ethyl cetoxime					-7.27E+3	-		

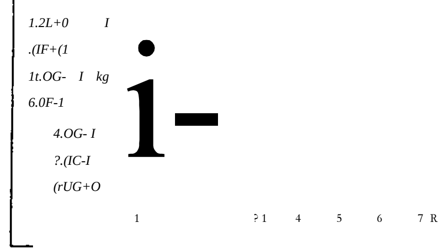
PAINT F: CONSUMPTIONS

Gloss sIlkent-borne paint - Alkyd rein (I•) - Isoparaffinic
1.77 I I: unctional Unit (20 m= covered with 98%, opacity)

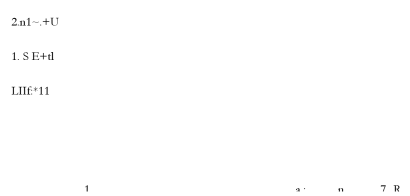
I"rulettltt 1.7E+t1 kg



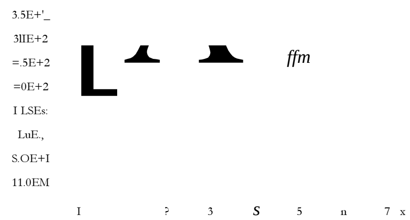
coal 1.1 E+0 k



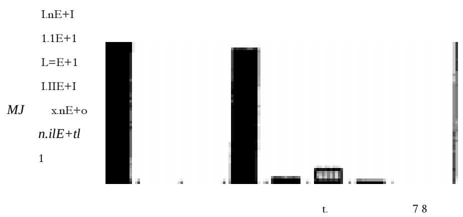
natural gas 2.2E+0 kg



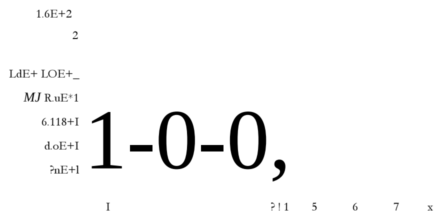
Water consumption 3.2E+2



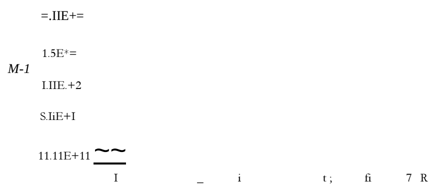
electricity



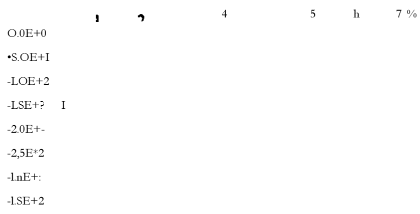
thermal energy 1.GE+2 MJ



primary energy equivalent 2. l E+2 MJ



water discharge -3.1 E+2 I



Legend

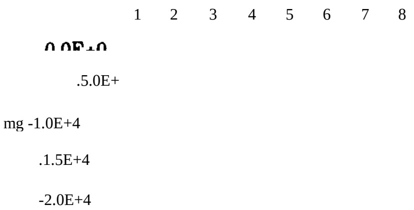
bite	1 = T()TAI,	5 = Isoparaffinic solvent
Energy	2 =	G = Alkyd resin
Raw material.	3 =	7 = Paint
'Transport	4 = Ti02 (total)	$ = Application

PAINT F : DISCHARGES

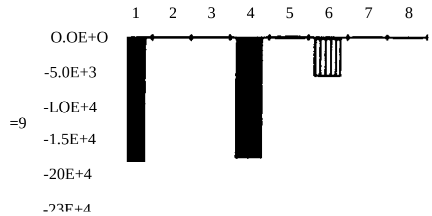
Gloss solvent-borne paint - Alkyd resin (F) - Isoparaffinic

1 77 1 Functional Unit (20 m2 covered with 98% opacity)

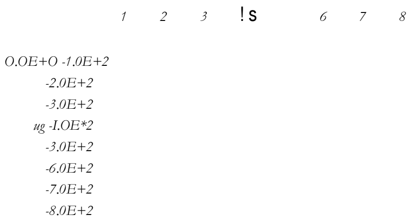
suspended matters -1.9E+4 mg



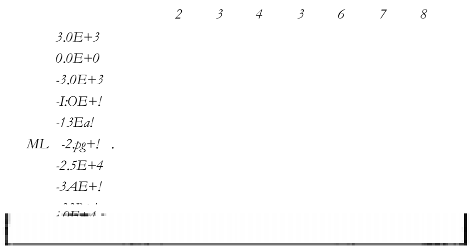
- COD -2.4E+4 mg



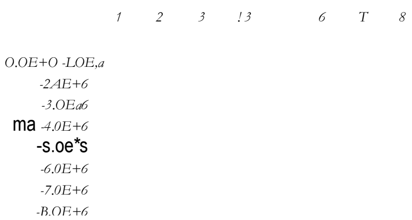
BODS -7.5E+2 mg



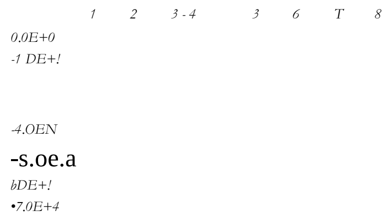
SOX -3.7E+4 mg



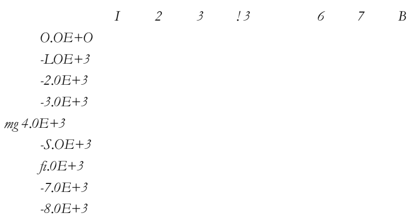
C02 -7.0E+6mg



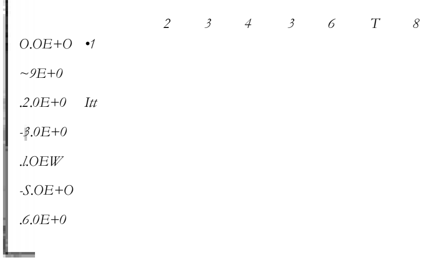
total hydrocarbons -6.4E+4 mg



total VOC -7.6E+5 mg



Waste production -5.2E+0 kg



Legend

Site	*1= TOTAL*	5 = lsoparaffinic solvent
Energy	*2=*	*6 = Alkyd* resin
Raw material	3 =	7 = Paint
Transport	*4 = Ti02* (total)	8 = Application

Paint G: gloss solvent-bore paint - alkyd resin - WS<1

-fr

Life cycle inventory of paint G
Gloss solvent borne paint

	Valour	Uniti Sl	Ti02	Solvent				Alkyd resin				
	I i:it~ l	1	::::.:::`':'	'ixX&tI *: aolwiM-	site	Energy	Raw	ax '=,==		Energy	Raw material	Raw
			'Funo&onat Unit (20 rtri oownd with 98% opaoityJ									
Materials	:':>											
soya lecithins (dispersing agent)	1 24r;.4::	kg										
siccative : Pb/Zn/Co/Ca/Zr complex	7 42E 2 ":	kg										
anti skinning forming agent: methyl ethyl	9 27E$:	kg										
benzoic acid	9 73E.S: :	kg						g;73E y:	9.73E-3			
sodium metabisulfite / sodium sulfate	1 08E.2:'::	kg						1:;ag ~2 :			1.p8E_2	
glycerin	9.73E-3.	kg						9:T3E9::	9.73E-3			
rock salt	1.19E.1.	kg	T.16E-2					4,7SE2:			4.75E-2	
marble or limestone	2.t0EfQ:	kg	2.09E +0	.				4.5SE3:			4.53E-3	
HCI	9.94E-5	kg	6.T9E-3					3.15E•3			3.15E-3	
caustic soda	7,15E-3	kg						7.15E•3			7.15E-3	
TiCL4	6.32E-2	kg	'fi:32E-2									
trihydralsd aluminium	4.90E•2	kg	4.90E:2:									
wood	1,29E+0	kg						t<29Et0:			1.29E+0	
monoamonico phosphate	9 68E.3;:.:	k9	3.68E•3 .	.								
iron (metal, ore)	3 68E 5:::	kg						3,68E:5			3.68E-5	
Zr02 compounds	' S 41 E 8:'	kg	5 41 E=3									
sodium silicate	3 86E 4	kg	3 t36E:2									
explosives	126E•3:.	kg	126E•9									
ilrtwnite ore	1.241E4.4 1:	kg	1 24E+0									
clay	463E- fi.:kg							483E4. ::			4.63E-6	
ferromanganese	2 91 E•7.: .	kg						2.31 E- 7:			2.31 E-7	
bauxite	5,43E•5	kg						5;43E4			5.43E-5	
ore (Cu2S, Fe2S3)	1.38E 3	kg								1:.38E- 3:1.38E-3		
air	157E•2:	m3						1:57E 2:			t.57E-2	
petroleum	1.77E+0.	kg	243E1:	309Ea		2.12E-3	7.07E-1	:5;78E.1 ::		5.31E-3	5.51E-1	2.11E-2
coal	1.12E+0	kg	1.02E+0	. 1.66E•2		7.30E-3	9.31 E-3	7.03E 2		1.52E-2	5.50E-2	1.40E-4
natural pas	1.64EiV.	kg	1.27E+0	4 31E-2		1.83E-2	2.48E-2	~3 :22E- 7::		5.92E-2	2.63E-1	8.20E-5
Packaging												
cardboard		kg										

P

Life cycle inventory of paint G
Gloss solvent-borne paint -
p

Alkyd resin - WS < 1 %

			T102	Solvent				Alkyd resin				
				T02 :1% solr~M:	Site	Energy productio	Raw material producti on	Alkyd hero :	:Site	Energy production	Raw material production	Raw material transpor
Energy		-										
electricity	1 49E+:1: .	MJ	1 30E;1	3 02E-t :	1.29E-1	2.81 E-3	1.70E-1	1 2&E+0•	2.66E-1	9.29E-3	1.01E+0	2.58E-3
thermal energy	1.34E+2 :	MJ	3.62E+1	3 QE+f:	7.52E-1	7.93E-2	2.93E+1	5 73E+.1:.	2.49E+0	2.62E-1	5.37E+1	9.00E-1
primary energy equivalent	1.81 E+2	MJ	7.76E41	3 tl£+l	7.52E-1	5.01E-1	2.98E+1	616(*+1	2.49E+0	1.14E+0	5.70E+1	9.08E-1
Fwia		-										
coal	6.06E-1	kg	5.64E-1	6,0. BE 3		2.69E-3	3.32E-3	2.98E 2		5.53E-3	2.43E-2	
lignite	4.80E-1	kg	4.22E-1	'9.681-3		4.34E-3	5.35E-3	3.81E-2:		8.91E-3	2.92E-2	
light fuel oil	6,76E-2	kg	5461:2	1.89E=3:		7.81E-4	1.05E-3	1 0$E 2:		2.53E-3	8.29E-3	
heavy fuel oil	3.00E-1	kg	1 741•1	4 88,•2		1.28E-3	4.76E-2	.5 621-2;:		2.63E-3	4.881•2	4.72E-3
natural gas	7.24E-l .	kg	5 74Es1	d 24E 2:	1.63E-2	1.66E-3	2.44E-2	. '1 p0E 1:::	5.40E-2	4.32E-3	4.21E-2	6.35E-5
diesel oil	9,24E-2	kg	9.36E-3					1 821:2.::			1.78E-3	1.64E-2
nuclear	1.64E+1:.	MJ	1.45E+1	2 72E 1::.		1.49E-1	1.23E-1	t 9314		3.06E-1	1.02E+0	
hydraulic	2.42E+0	MJ	2,12Ea1) •	:3.971-2		2.18E-2	1.79E-2	2.051•1.		4.47E-2	1.60E-1	
Discharge into water												
water discharge	-3.16E+2	1	-2.78E+2	-3:17EtV	-4.13E-1	-4.00E-4	-2.76E+0	-3.44E+1	-2.44E-1	-8.22E-4	-3.41E+1	
suspended matters	-1.921+4	mg	-f.90E+d	-1,98E+i.	-1.10E+1	-1.31E+0	-7.55E+0	•1.811+2 :		-4.31E+0	-1.76E+2	-1.17E-1
COD	-2.43E+d	ring	•1.82Et4	-1:951+2	-1.19E+2	-2.02E-2	-7.60E+1	•5.8914.3	-2.05E+2	-4.15E-2	-5.69E+3	-3.52E-1
BOD5	-7.81E+2	mg	-1.14E+0	:- 4.33E+1.	-3.55E+1	-6.73E-3	-7.79E+0	.-7.35&2	-2.20E+1	-1.38E-2	-7.13E+2	-1.17E-1
hydrocarbons	-3:84Et4	mg		.1.37Et1	-1.10E+1		-2.75E+0	-2:20Et1'			-2.20E+1	
ammonium hydroxide	-3.721+0	ring	-2.43E+0	-5.55E-2		-2.49E-2	-3.06E-2	-1.18E+0		-5.10E-2	-1.13E+0	
fluorides	-5.99E+0	mg	-5.23E+0	-1.20E-1		-5.36E-2	-6.60E-2	-5.10E-1		-1.10E-1	-4.00E-1	
sulphates	-2.06E+1	mg	-1.10E+0	.-2.531•2		-1.13E-2	-1.39E-2	-1.94E+1		-2.32E-2	-1.94E+1	
nitrates	-1.601+0	mg	-1.24E+0	-2.83E-2		-1.27E-2	-1.56E-2	-3.02E-t		-2.60E-2	-2.76E-1	
chlorides	-1.98E+1	mg	-6,65E-2	-1:521-3		-6.81E-4	-8.39E-4	-1.98E+1		-1.40E-3	-1.98E+1	
Na (ion)	-9.77E-:1	mg	-13.581-1.	.-1:961-2		-8.79E-3	-1.08E-2	-7.83E-2		-1.81E-2	-6.03E-2	
Fe (ion)	-8.261+4	mg	•8.26Ea4	- 2.31E=4.		-1.04E-4	-1.?8E-4	-9.23E-4		-2.13E-4	-7.10E-4	
phenols	-6.58E-1	mg		-3.54E-1			-3:541-1	-2.20E-1			-2.20E-1	
H9	-1.74E-2	mg	-1.71E-2					-2.58E-4			-2.58E-4	
AN	-2.58E+0	ring						-2.58E+0			-2.58E+0	
oils	-4.49E+2	mg	-6.98E+1	-1.14E+2		-8.20E-1	-1.13E+2	-2.27E+2	-1.32E+2	-2.44E+0	-8.95E+1	-3.18E+(
dissolved substances	-1.93E+4	mg	-2.27E+3	-8.90E+3		-1.69E+1	-8.88E+3	-5.13E+3		-3.79E+1	-4.84E+3	-2.47E+2
cleaning solvents: white spirit 17 - 18%	-1.56E+5	mg										
paint residues	-3.001+4	mg										
NKT	-2.15E+1	mg						-2.15E+1			-2.15E+1	
Ca	-7.841+3	mg	•7.841+3									
Mg	-3.441+4	ring	•3.441+4	.								
Al	-1.841+4	mg	•1.841+4									
Pb	-2.241+1	m8	-?.21,11.1:	∴.				-3.55E-1			-3.55E-1	
Cu	-1.22Et1.	mg	122141									

Life cycle inventory of paint G			Ti02			Solvent				Alkyd resin		
Gloss solvent-borne paint - Alkyd resin F - WS < 1 %			Ti02	WS < 1% **solvent**	Site	Energy production	Raw material production	Alkyd **resin**	Site	Energy production	Raw material production	Raw materia… transpo…t
Air emissions		-										
dusts	-8.19E+3	mg	-5.59E+3	-8.33E+1	-1.65E-1	-8.73E+0	-7.44E+1	-2.20E+3	-5.46E-1	-1.81E+1	-2.11E+3	-7.64E+…
sox	-3.93E+4	mg	-2.78E+4	-4.10E+3	-7.29E+1	-1.43E+2	-3.88E+3	-5.66E+3	-1.84E+0	-3.33E+2	-5.05E+3	-2.77E+…
H2S04	-2.45E+1	mg						-2.45E+1			-2.45E+1	
HCL	-4.25E+2	mg	-3.67E+2	-8.41E+0		-3.77E+0	-4.65E+0	-4.07E+1		-7.74E+0	-3.30E+1	
NOx	-1.89E+4	mg	-1.02E+4	-6.17E+2	-6.19E+1	-6.17E+1	-4.93E+2	-4.52E+9	-2.05E+2	-1.36E+2	-3.31E+3	-8.69E+…
N20	-9.30E+2	mg	-6.98E+2	•2.01E+1	-1.88E+0	-3.93E+0	-1.43E+1	-8.80E+1	-6.21E+0	-9.11E+0	-4.18E+1	-3.08E+…
CO	-4.99E+3	mg	-2.87E+3	-6.91E+1	-6.99E+0	-1.78E+1	-4.43E+1	-6,91E+2	-2.31E+1	-3.96E+1	-2.92E+2	-3.36E+…
C02	-6.45E+6	mg	-5.14E+6	-3.08E+5	-3.86E+4	-2.34E+4	-2.46E+5	-6;53E+5	-1.28E+5	-5.36E+4	-3.99E+5	-7.28E+…
ammoniac	-7.01E+0	mg	-3:18E+0	-8.99E-1		-2.24E-2	-8.77E-1	-1.34E+0		-4.60E-2	-9.08E-1	-3.91E-…
aldehydes	-2.48E+1	mg	-1.62E+1	-1.95E+0		-1.14E-1	-1.84E+0	-3.35E+0		-2.35E-1	-2.33E+0	-7.81E-…
fluorides (gazeous)	-3.12E-2	mg	-2.74E-2	-6.27E-4		-2.81E-4	-3.46E-4	-2.50E-3		-5.77E-4	-1.93E-3	
H2S	-1.43E+1	mg						-1.43E+1			-1.43E+1	
mercaptans	-1.74E+2	mg						-1.74E+2			-1.74E+2	
other organic substances	-4.27E+1	mg				-2.07E-				-4.25E-1	-3.80E+0	

Life cycle inventory of paint G
Gloss solvent-borne paint -
Alkyd resin F - WS < 1 %

	Paint				Application			
	Paint	Site I-	Energy production	Raw material transport	Application	Site	Dilution solvent	Raw material
Materials								
soya lecithine (dispersing agent .)	1.24E-2	1.24E-2						
siccative : Pb/Zn/Co/Ca/Zr complex	7.42E-2	7.42E-2						
anti skinning forming agent : methyl ethyl	9:27E-3	9.27E-3						
benzoic acid								
sodium metabisulfite / sodium sulfate								
glycerin								
rock salt								
marble or limestone								
HCI								
caustic soda								
TCL4								
trihydrated aluminium								
wood								
monoamonico phosphate								
iron (metal, ore)								
Zr02 compounds								
sodium silicate								
explosives								
ilmenite ore								
clay								
ferromanganese								
bauxite								
ore (Cu2S, Fe2S3)								
air								
petroleum	3.85E-2		2.77E-3	3.57E-2	2.04E-1		1.68E-1	3.60E-2
coal	1.49E-2		1.47E-2	2.37E-4	2.44E-3		2.21E-3	2.39E-4
natural gas	2.11E-3		1.97E-3	1.39E-4	6.01E-3		5.87E-3	1.40E-4
Packaging								
cardboard								
paper								
polyethylene	4.33E-3	4.33E-3						
tin can	3.11E-1	3.11E-1						
Water consumption	8.33E-3		1.39E-3	6.94E-3	6.94E-1		6.87E-1	7.00E-3
cleaning i								
cooling					6.84E-1		6.84E-1	
boiler								
unspecified water	8.33E-3		1.39E-3	6.94E-3	9.55E-3		2.56E-3	7.00E-3
rocess								

Life cycle inventory of paint G	Paint				Application			
Gloss solvent-borne paint - Alkyd resin - WS < 1 %	Paint -:.	Site	Energy production	Raw material transport	Application.	Site	Dilution solvent	Raw malarial transport
Energy	;::							
electricity	2.71E-1	2.66E-1		4.36E-3	AA~E-2.		4.02E-2	4.40E-3
thermal energy	1.53E+0			1.53E+0	::::.848E~G .		6.93E+0	1.55E+0
primary energy equivalent	2.39E+0		8.50E-1	1.54E+0	sa2E± o		7.06E+0	1.56E+0
Fuels								
coal	5.54E-3		&54E-3		7:86E-4		7.86E-4	
lignite	8.92E-3		8.92E-3		1.27E-3		1.27E-3	
light fuel oil	8.36E.5		8.36E-5		2,491:-4		2.49E-4	
heavy fuel oil	6.92E-3		2.63E-3	4.29E-3	1.40E-2		1.13E-2	2.77E-3
natural gas	2.03E-3		1.92E-3	1.07E-4	5.66E-3		5.78E-3	1.08E-4
diesel oil	3:1SE-2			3.15E-2	333E 2			3.33E-2
nuclear	3.07E-1		3.07E-1		2.9.1E.2		2.91E-2	
hydraulic	4.48E-2		4.48E-2		4.25E-3		4.25E-3	
Discharge into water								
water discharge	-8.23E-4		-8.23E-4		-853E-1		-6.53E-1	
suspended matters	-2.14E-1		-1.54E-2	-1.98E-1	-:1.99E4G;		-1.79E+0	-2.00E-1
COD	-6.37E-1		-4.15E-2	-5.95E-1	.:.1.B6E+.I- 1.80E+1			-6.00E-1
BOD5	.2,12E-t		-1.38E-2	-1.98E-1	'2:05124:		-1.85E+0	-2.00E-1
hydrocarbons					•'-651:12::		-6.51E-1	
ammonium hydroxide	-5.11E-2		-5.11E-2		T:25-y::`,		-7.25E-3	
fluorides	-t.tOE•t.		-1.10E-1		156•2:		.1.56E-2	
sulphates	-2.33E-2		-2.33E-2		-3:9012-3'		-3.30E-3	
nitrates	^2.8012-2		-2.60E-2		•-3;703:		-3.70E-3	
chlorides	-1:4012-3		-1.40E-3		-1;9912-4		-1.99E-4	
Na (ion)	-1.81E-2		-1.81E-2		•2.5712-3		-2.57E-3	
Fe (ion)	-2.13E-4		-2.13E-4		-3.02E-5		-3.02E-5	
phenols					-8.38E-2		-8.38E-2	
Hg								
AOx								
oils	-5.83E+0		-4.42E-1	-5.39E+0	-3.23E+1		-2.68E+1	-5.43E+0
dissolved substances	-4.48E+2		-2.96E+1	-4.18E+2	. •2.5312+3		-2.10E+3	-4.21E+2
cleaning solvents : white spirit 17 - 18%					-1.56E+5	-1.56E+5		
paint residues					-3.0012+4	-3.0012+4		
NKT								
Ca								
Mg								
Al								
Pb								
Cu								
Zn								
Mn								
Cr								
Cd								
other nitrogen								
others metals ions								
fiber								

Life cycle inventory of paint G

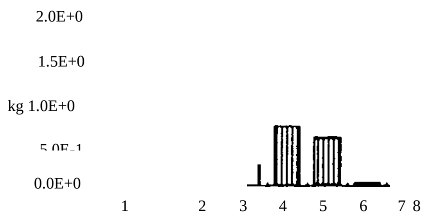
Gloss solvent-borne paint - Alkyd resin F - WS < 1 %

			Paint			Application		
	Paint	Site	Energy production	Raw material transport	**Application**	Site	Dilution solvent	Raw material transport
Air omissions								
dusts	-1.54E+2		-1.77E+1	-1.36E+2	-1.58E+2		-1.76E+1	-1.41E+2
SOX	-5.49E+2		-2.27E+2	-3.21E+2	-1.18E+3		-9.19E+2	-2.62E+2
H2S04								
HCL	-7.75E+0		-7.75E+0		-1.10E+0		-1.10E+0	
NOx	-1.76E+3		-1.12E+2	-1.64E+3	-1.85E+3		-1.17E+2	-1.73E+3
N20	-6.25E+1		-6.37E+0	-5.62E+1	-6.17E+1		-3.39E+0	-5.83E+1
CO	-6.73E+2		-3.14E+1	-6.41 E+2	-6.87E+2		-1.05E+1	-6.76E+2
C02	-1.62E+5		-3.91 E+4	-1.23E+5	-1.82E+5		-5.82E+4	-1.24E+OS
ammoniac	-7,07 E•1		-4.61E-2	-6.61E-1	-8;74E-1		-2.08E-1	-6.66E-1
aldehydes	-1.56E+0		-2.35E-1	-1.32E+0	-1.77E+17 .		-4.36E-1	-1.33E+0
fluorides (gazeous)	-5.78E-4		-5.78E-4		-8.20E-5			
H2S							-8.20E-5	
mercaptans								
other organic substances	-2.41E+0		-4.26E-1	-1.911E+0	-266E+0			
VOC : white spirit 17-18%.						.	-6.64E-1	-2.00E+0
VOC : white spirit < 5 %								

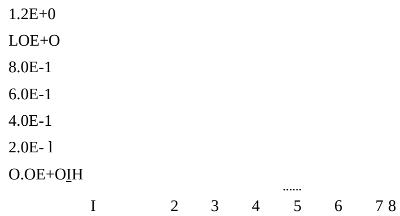
Gloss solvent-borne paint - Alkyd resin (E) - WS < 1 %

1.771 Functional Unit (20 m2 covered with 98% opacity)

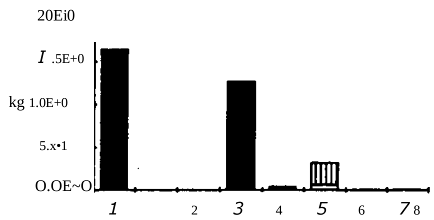
petroleum 1.8E+0 kg



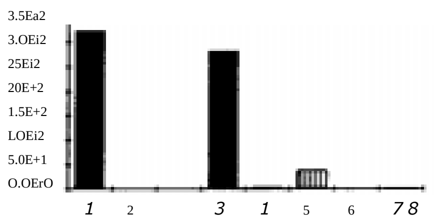
coal 1.IE+0 kg



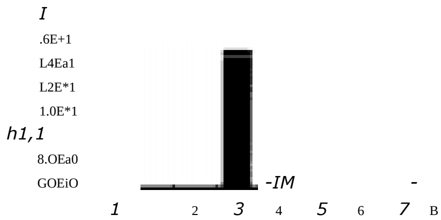
natural gas 1.6E+0 kg



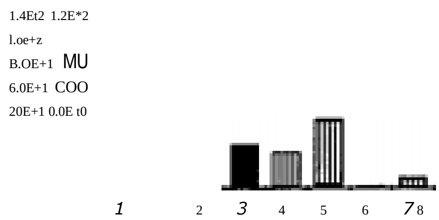
Water consumption 3.2E+2 I



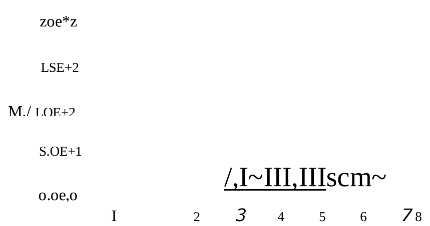
electricity 1.5E+1 MJ



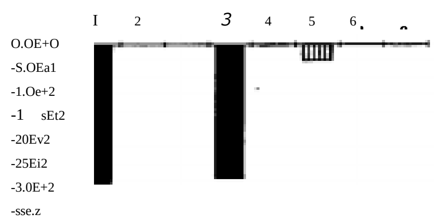
thermal energy 1.3E+2 Mj



primary energy equivalent 1.8E+2 MJ



water discharge -3.2 E+2 1



Legend

- Site Energy
- Raw material
- Transport

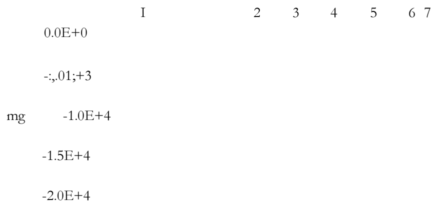
1 = Total
2 =
3 =
4 = Ti02 (total)
5 = WS < 1% solvent
6 = Alkyd resin
7 = Paint
8 = Application

PAINT G : DISCHARGES

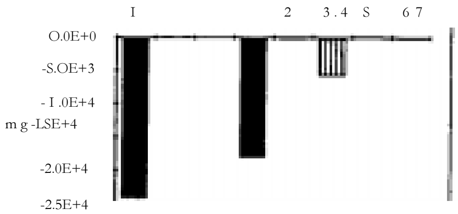
(:loss solvent-borne paint - Alkyd resin (F) - WS < 1

1 77 I Functional Unit (20 m' covered with 98%n opacity)

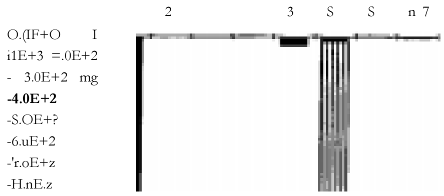
suspended matters
-1.9E+4 Ing,



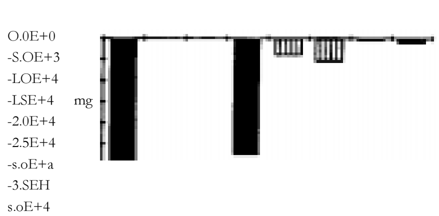
COD -2.4E+4 mg



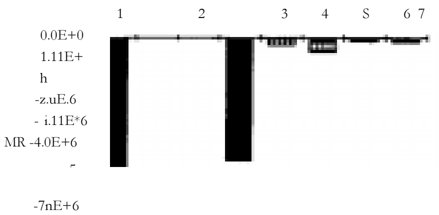
BODS -7.8E+2 mg



SOX -3.9E+4 mg

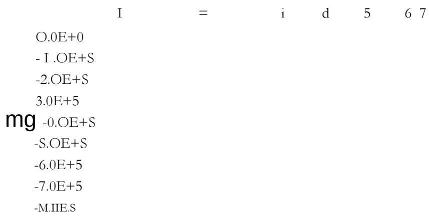


C02 -6.4E+6mg

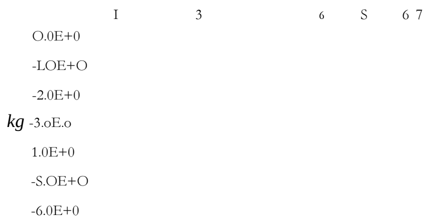


total hydrocarbons
-6.2E+4 mg

total VOC -7.8E+5 mg



Waste production
-5.2E+0 kg



Legend

	Site	1 = Total	5 = WS < 1 °k solvent
	Energy		6 = Alkyd resin
	Raw material	3 =	7 = Paint
	Transport	4 = Ti02 (total)	8 = Application

Paint H: mat solvent-borne pant - limed oil - isoparaffinic

Life cycle inventory of paint H

Mat solvent-borne paint -

	Valour	Uniti SI	Extenders			riot	solvent				
			caCaa`	site	Energy p`°d"`°°"	TIQ	bopaca~	Site-	-Energy productio	Raw IProductio n! material	Flaw material
	3.13	*I*	*Functional unit (70 no covered with 8B% opacity)*								
materials		_-									
Soya lecithins (dispersing agent .)	61tE4:	kg						,			
sodium metabisulfite / sodium sulfate	4,29E-3'	kg									
rock salt	1:29E-1	kg				1 08E i	1:02E•3			1.02E-2	
marble or limestone	4.79E+0	kg	1,59£+0'	1.59E+0		3::16E.rQ :	.:•1.:G8E-A			1.69E-4	
HCI	1 D7£=2::	kg				1 ~~2.::					
caustic soda	285£;$:.	kg									
TiCL4	9 S6E 2	kg				9:56 2					
VihydraEad aluminium	7 4i£~Z	kg				7:itE 2:::					
wood	514E.-t.:	kg					:.				
monoamonico phosphate	5.57E-3	kg				5.57E 3::.					
iron (metal, ore)	4:26E4:	kg					3.39E-4			3.39E-4	
Zr02 compounds	' 8 10E =3	kg				. 819E-3					
sodium silicate	5 83E4	kg				S 832.	.;				
explosives	2.87E 3:.	kg	9 59E4 ;	9.53E-4		1.p0E 3::					
tale:	3 87E 1.:: .	kg									
monmorilbnite/bentone	611E:3:.	kg									
ilmenite ore	1:$7E4. :	kg				y.ezEto	.				
diverse compounds 8 catalysts	6.47E	k 9					5.15E-4	5.15E-4			
clay	4.26E•5	kg					9.38E•5			3.39E-5	
ferromanganese	2.13E-6	kg					1,69E•6			1.69E	
bauxite	6.40E-4	kg					5.08E-4			5.08E-d	
era (Cu2S. Fe2S3)	7.67E•4	kg				y					
air	4.38E-3	m3									
petroleum	2.92E+0	kg	2.55E-3	1.80E-3	7.44E-4	3.68E-1.	1.76E+0		2.07E-1	1.55E+0	3.60E-3
coal	1.68E+0	kg	3.96E-3	1.19E-5	3.95E-3	**1.54E+0**	7.62E-2		4.61E-2	3.00E-2	2.38E-5
natural gas	3.41E+0	kg	5.35E-4	7.OtE-6	5.28E-4	1,.91E±0	1.14E+0		1.29E-2	1.13E+0	1.40E-5
Packaging		.									
Paper	b.1D£-2	kg	j,27E-2	t.27E-2		3.80E=2					
polyethylene	'2.06E-2.	kg	3.18£-3::	3.18E-3		8.51E-3.					
tin can	S 58E-.f	kg									
Watarconaumption	4.47E12::	I	8.42E4	5.70E-4	3.73E•4	.1.25E+2	5.386+0	3.53E+0	4.30E-2	1.80E+0	6.98E-d
leaning	2.St E+2	I				2.31 E40,					
cooling	1.96E+2	I				1	90Et2.::3. 45Et0	3.45E+0			
boiler	3:87E+0	I				9.T5E+0	8.29E•2.	8.23E-2			
unspecified water ~	1.56E*1	I	8,42E-4	5.70E-4	3.73E-4	: 1.39&0	1.85Et0		d,30E-2	1.8PE+0	6.98E-4
process	t,99E-t	I									
Energy		-									
electricity	2.23E+1.	MJ	7.17E•2	7.17E-2		1;86Et1,	.1.48E+0	8.11E-1	2.52E-2	6.43E-1	4.37E-d
thermal energy	2.35E+2:.	MJ	7.74E4	7.74E-2		5:48E+1	1:24E+2	8.33E+0	7.40E-1	1.15E+2	1.48E-1
rims area equivalent	3.06Ea2	MJ	3.06E-t	7.81E-2	2.28E-1	1:17Ef2	.1.29E+2	8.33E+0	3.41E+0	1.17E+2	1.49E-1

Life cycle inventory of paint H Mat solvent-bone paint - Limed oil - Iso araffinic				Extenders		riO2	solvent				
			cac03: ;	-Site	Energy production:	.Jrm ·	(sopa~ffi ' pie .olvent	Site	Energy production	Raw material production	Raw material transport
Fuels		-				;	:.::.:.: ::::				
coal	9 28E 1::	kg	1 49E=3:		1.49E 3	**8;539** 1	::4 699-2		1.69E-2	3.00E-2	
lignite	8.98E-1	kg	2.40E-3		2.40E-3	6.39E-1:	. 2.72E-2		2.72E-2		
light fuel oil	B 78E-02:.:	kg	2 259•05		2.25E-05	8:269•02	**5:1:6944**		5.16E-04		
heavy fuel oil	4 $pE.j:::	kg	8469! .	1.38E-4	7.07E-4	23E t	1;2tEa::	2.26E-2	2.32E-2	7.16E-2	3.60E-3
natural gas	1.249+0.	kg	5;219-4	5.42E-6	5.16E	8:689 1	' 2;579.'1:	5.77E-3	6.70E-3	2.45E-1	1.08E-5
diesel oil	•1;5312=1:	kg	1.67E-3	1.67E-3		1:429-2:					
nuclear	:2450*4:	MJ	8,239•2:		8.23E 2	21.8E+9,:	:1;31£±0		9.33E-1	3.81E-1	
hydraulic	3 70E+Q::	MJ	1.20E-2		1.20E 2	3 21:12+0	2:699 3		1.36E-1	1.52E-1	
industrial gas	1.09E-1.	kg					8.649,2	8.64E-2			
Discharge into water		-									
water discharge	-4.35E+2	I	-2.21E-4		-2.21E-4	-4.20E+2	-8.025•f	-7.99E-1	-2.50E-3		
suspended matters	-2.929+4	mg	-1.41E-2	-1.00E-2	-4.13E-3	:4.679+4	-3.40E+2		-1.61E+0	-3.39E+2	-1.99E-2
COD	-3.029+4	mg	-4.12E-2	-3.00E-2	-1.12E-2	-2.75Et4	-3.42E+2		-3.43E+0	-3.39E+2	-5.97E-2
8005	-3.63E+2	mg	-1.37E-2	-1.00E-2	-3.72E-3	-1.72E+0	-6.04E+1		-1.14E+0	-5.93E+1	-1.99E-2
hydrocarbons	-1.28E+2	mg					-1.02E+2			-1.02E+2	
ammonium hydroxide	-2.00E+1	mg	-1.37E-2		-1.37E-2	-3.67E+0	-1.29E+1-		-1.56E-1	-1.27E+1	
fluorides	-8.669+0	mg	-2.96E-2		-2.96E-2	-7.91E+0	-3.36E-1		-3.36E-1		
sulphates	-9.53E+0	mg	-6.25E-3		-6.25E-3	-1.67E+0	-7.08E-2		-7.08E-2		
nitrates	-4.17E+0	mg	-6.99E-3		-6.99E-3	-1.879+0	-1.77E+0		-7.93E-2	-1.69E+0	
chlorides	-1.07E+2	mg	-3.76E-4		-3.76E-4	.-1.01E-1	-8.47E+1		-4.26E-3	-8.46E+1	
Na (ion)	-1.42E+0	mg	-4.869-3		-4.869-3	:1.309+0	-5.50E-2		-5.50E-2		
Fe (ion)	-1.25E+5	mg	-5.72E-5		-5.72E-5	-1.25E+5	-6.48E-4		-6.48E-4		
phenols	-2.22Ei4	mg					-1.69E+0			-1.69E+0	
Hg	-2.60E-2	mg				-2.*E=2					
AOx	-1.039+0	mg									
oils	-4.559+2	mg	-3.91E-1	-2.72E-1	-1.19E-1	**o1.06&2**	-1.93E+2		-3.15E+1	-1.61E+2	-5.42E-1
dissolved substances	+1;149+.4	mg	-2.90E+1	-2.11E+1	-7.94E+0	-3.44E+3	-3.17E+3		-2.42E+3	-7.11E+2	-4.21E+1
cleaning solvents: white spirit 17 - 18 %	-1,56E+5	mg									
paint residues	-3.009+4	mg									
	-1.069+1	mg					-8.46E+0			-8.46E+0	
NKT	-8.589+0	mg									
Ca	-1.199+4	mg				-1.199+4					
Mg	-5.21 E+4	mg				-5.21 E+4					
AI	-2.789+4	mg				-2.789+4					
Pb	-3.35E+1	mg				-3.34E+1					
Cu	-1:849+1	rng				-1.841:+1:					
Zn	-1.32E+3	mg				-1.32E+3					
Mn	-7.35E+3	mg				-7,35E+9					
Cr	-4.2012+0	mg				-4.20E+0					
Cd	-7.12E-1	mg				•7.129-1					
other nitrogen	-2.13E+1	mg					-1.69E+1			-1.69E+1	
others metals ions	-5.339+.2	mg					-4.23E+2			-4.239+2	
fiber	-2.57E+1										

Life cycle inventory of paint H

Mat solvent-borne paint -

Limed oil - Iso araffinic

Air wniaaions			**C4003**	**Extenders** Site	Energy production	riot TiOZ :	Itoparalti We solvent	Site	**Solvent** Energy Production	Raw material production	Raw material transport
dusts	-1.17E+4	mg	-1.18E+1	-7.04E+0	-4.75E+0	-8.46E+3	-1.48E+3	-2.08E+1	-9.41E+1	-1.35E+3	-7.52E+0
sox	-5.47E+4	mg	-7.42E+1	-1.31E+1	-6.11E+1	-4.20E+4	38E+3 -7.	1.19E+2	-1.41E+3	-5.93E+3	-1.58E+2
H2S04	-9.76E+0	mg									
HCL	-6.30E+2	m 9	-2.08E+0		-2.08E+0	-5.55E+2	-4.05E+t		-2.36E+1	-1.69E+1	
NOx	-3.77E+4	mg	-1.17E+2	-8.66E+1	-3.00E+1	-1.54E+4	-1.11E+4	-2.71E+2	-6.92E+2	-1.02E+4	-1.78E+1
Np	-1.40E4	mg	-4.63E+0	-2.92E+0	-1.71E+0	-1;06E+3	-5.52E+1	-2.45E+1	-2.85E+1		-2.20E+0
	-8:36E+3	mg	-4.23E+1	-3.39E+1	-8.44E+0	-4.33E+3	-8.68E+2	-4.51E+1	-1.43E+2	-6.77E+2	-2.86E+0
C02	-1.10E+7	mg	-1.67E+4	-6.21E+3	-1.05E+4	-7.78E+6	-1.90E+6	-4.40E+5	-1.74E+5	-1.27E+6	-1.25E+4
ammoniac	-1.29E+t	mg	-4.57E-2	-3.34E-2	-1.24E-2	-4.81E+0	-3.88E+0		-3.81E+0		-6.64E-2
aldehydes	-4.17E+1	mg	-1.30E-1	-6.67E-2	-6.32E-2	-2.44E+1	-8.19E+0		-8.06E+0		-1.33E-1
fluorides (gazeous)	-4.53E-2	mg	-1.55E-4		-1.55E-4	-4.15E-2	-1.76E-3		-1.76E-3		
H2S	-1.69E+1	mg					-9.31E+0			-9.31E+0	
mercaptans	-6.94E+1	mg									
other organic substances	-	mg	-2.15E-	-1.00E-	-1.14E-	-	-		-	-	-1.99E-

r

Life cycle inventory of paint H Mat solvent-borne paint - Limed oil - Iso araffinic	Limed oil resin					Paint				Application		
	Limed oil resin	Site	Energy production	Raw material production	Raw material transport	Paint	Site	Energy production	Raw material transport	Application	Site	Dilution solvent
Materials												
soya lecithine (dispersing agent,)						6.11E-3	6.11E-3					
sodium metabisulfite / sodium sulfate	4,2963			4.29E-3								
rock salt	1.01E-2			1.01E-2								
marble or limestone	3.32E-2			3.32E-2								
HCI	4.67E-4			4.67E-4								
caustic soda	2.85E-3			2.85E-3								
TiCL4												
trihydrated aluminium												
wood	5.14E-1			5.14E-1								
mopoamonico phosphate												
iron (metal, ore)	8,78E-5			8.78E-5								
Zr02 compounds												
sodium silicate												
explosives	1.88E-5			1.88E-5								
talc						3.976•1	3.97E-1					
monmodllonite/bentone						6.11E=3	6.11E-3					
ilmenite ore												
diverse compounds 8 catalysts	1.32E-4			1.32E-4								
clay	8.78E-6			8.78E-6								
ferromanganese	4.39E-7			4.39E-7								
bauxite	1.32E-4			1.32E-4			~'					
ore (Cu2S, Fe2S3)	7.67E-4			7.67E-4								
air	4,38E-3			4.38E-3								
petroleum	4.76E-1		2.95E-3	4.62E-1	1.11E-2	7,47E-2		4.04E-3	7.06E-2	2.37E-1		1.68E-1
coal	3.44E-2		8.43E-3	2.59E-2	7.38E-5	2,19E-2		2.15E-2	4.68E-4	2.66E-3		2.21E-3
natural gas	3.41E-1		3.29E-2	3.08E-1	4.33E-5	3:156-3		2.87E-3	2.75E-4	6.14E-3		5.87E-3
Packaging												
paper	2.51 E-4			2.51 E-4								
polyethylene	6.27E-5			6.27E-5		7.84.E-3	7.84E-3					
tin can						5:586-1	5.58E-1					
Water consumption	1.51E+1	2.01E-1	2.18E-3	1.49E+1	2.16E-3	. T58E-2		2.03E-3	1.37E-2	7,006:1::.		6.87E-1
cleaning	9.78E-2	9.79E-2										
cooling	2.38E+0	1.03E-1		2.28E+0						$,8~E=1.:		6.84E-1
boiler ~`	3.22E-2			3.22E-2								
unspecified water	1.24E+1		2.18E-3	1.23E+1	2.16E-3	. 1.58E-2		2.03E-3	1.37E-2	1 6061•1.		2.56E-3
process	1,98E-t			1.99E-1								
Energy												
electricity	6.55E-1	1.48E-1	5.16E-3	5.00E-1	1.36E-3	-:3.996-1,	3.89E-1		8.63E-3	4.87E-2:.,		4.02E-2
thermal energy	4.29E+1	1.38E+0	1.46E-1	4.09E+1	4.75E-1	3.03E+0			3.03E+0	9 90Es0,::		6.936+0
rime energy equivalent	4.50&1	1.38E+0	6.33E-1	4.25E+1	4.80E-1	43064:		1.24E+0	3.06E+0	>1.01E+1'-		7.06E+0

Life cycle inventory of paint H

Mat solvent-borne paint -

Limed oil - Iso araffinic

			Limed oil	resin				Paint			Applicat ion		
	Limed oil resin	Site	Energy production	Raw material production	Raw material transport	Paint	Site	Energy production	Raw material transport	**Application**	Site	Dilution solvent	
Fuels													
coal	1.77E-2		3.07E-3	1.46E-2		8.09E-3		8.09E-3		7.86E-4		7.86E-4	
lignite	1.54E-2		4.95E-3	1.05E-2		1.30E-2		1.30E-2		1.27E-3		1.27E-3	
light fuel oil	4.43E-03		1.41E-03	3.02E-03		1.22E-04		1.22E-04		2.49E-04		2.49E-04	
heavy fuel oil	3.77E-2		1.46E-3	3.42E-2	2.09E-3	1.16E-2		3.85E-3	7.76E-3	1.66E-2		1.13E-2	
natural gas	1.03E-1	3.00E-2	2.40E-3	7.07E-2	3.35E-5	3.02E-3		2.80E-3	2.12E-4	5.98E-3		5.78E-3	
diesel oil	9.78E-3			7.19E-4	9.07E-3	6.30E-2			6.30E-2	6.41E-2			
nuclear	6.29E-1		1.70E-1	4.59E-1		4.48E-1		4.48E-1		2.91E-2		2.91E-2	
hydraulic	1.17E-1		2.49E-2	9.23E-2		6.54E-2		6.54E-2		4.25E-3		4.25E-3	
industrial gas	2.21 E-2			2.21 E-2									
Discharge into water													
water discharge	-1.33E+1	-9.79E-2	-4.57E-4	-1.32E+1		-1.20E-3		-1.20E-3		-6.53E-1		-6.53E-1	
suspended matters	-1.45E+2		-2.41E+0	-1.42E+2	-6.18E-2	-4.15E-1.		-2.25E-2	-3.92E-1	-2.17&0.		-1.79E+0	
GOD	-2.38E+3	-8.22E+1	-2.30E-2	-2.30E+3	-1.85E-1	-1.24E+0		-6.07E-2	-1.18E+0	-1.02E+1		-1.80E+1	
BOD5	-2.98E+2	-8.81E+0	-7.68E-3	-2.89E+2	-6.18E-2	. -4.13E-1		-2.02E-2	-3.92E-1	-2,23E+0		-1.85E+0	
hydlocarbons	-2.60E+1			-2.60E+1						-6.51E-1			
lammonium hydroxide	-3.34E+0		-2.84E-2	-3.31E+0		- 7.4715•2		-7.47E-2		-7.25E 3:		-6.51E-1	
flyorides	-2.05E-1		-6.12E-2	-1.43E-1		-1.61E-.1		-1.61E-1		-1ME-2		-7.25E-3 -1.56E-2	
sulphates	-7.75E+0		-1.29E-2	-7.74E+0		-3.40E-2		-3.40E-2		-3,30E-3'.		-3.30E-3	
nitrates	-4.78E-1		-1.44E-2	-4.64E-1		-3.80E-2		-3.80E-2		=3,70E-3::		-3.70E-3	
chlorides	-2.22E+1		-7.77E-4	-2.22E+1		-2.05E-3		-2.05E-3		-1.99E-4.		-1.99E-4	
Na (ion)	-3.14E-2		-1.00E-2	-2.14E-2		-2.64E-2		-2.64E-2		-2.57E-3		-2.57E-3	
Fe (ion)	-3.70E-4		-1.18E-4	-2.52E-4		-3.11E-4		-3.11E-4		.3.02E-5.		-3.02E-5	
phenols	-4.39E-1			-4.39E-1						-8.38E-2		-8.38E-2	
Hg	-1.03E-4			-1.03E-4									
AOx	-1.03E+0			-1.03E+0									
oils	-1.08E+2	-5.29E+1	-1.36E+0	-5.19E+1	-1.68E+0	-1.13E+1		-6.46E-1	-1.07E+1	-3.73E+1		-2.68E+t	
dissolved substances	-1.01E+3		-2.11E+1	-8.62E+2	-1.30E+2	4.70E+2		-4.32E+1	-8.27E+2	: 2.9215+3		- 2.1015+3	
cleaning solvents : white spirit 17 - 18%													
paint residues										-1.56E+5	-1.56E+5		
S										-3.00E+<	- 3.0015+ 4		
	-2.16E+0			-2.16E+0									
NKT	-8.58E+0			-8.58E+0									
Ca													
M													
AI													
P b	-5.71 E-2			-5.71 E-2									
Cu													
Zn													
Mn													
Cr													
Cd													
other nitrogen	- 4.%E+			-4.3915+0									

Life cycle inventory of paint H

Mat solvent-borne paint - p

Limed oil - Iso araffinic

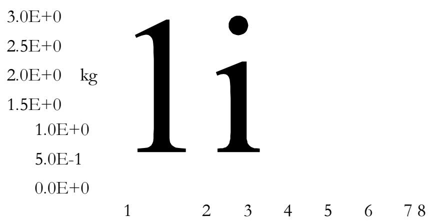
	Limed oil resin	Site	Limed oil Energy production	rosin Raw material production	Raw material transport	Paint	Site	Paint Energy production p	Raw material transport	Application	Application Site	Dilution solvent
Air rmiaaioni	-											
dusts	-1.16E+3	-3.03E-1	-1.01E+1	-1.11E+3	-4.11E+1	-2.97E+2		-2.58E+1	-2.71E+2	-2.811E+2		-1.76E+1
sox	-2.92E+3	-1.02E+0	-1.85E+2	-2.61 E+3	-1.30E+2	-9.39E+2		-3.32E+2	-6.07E+2	-1.42E+3		-9.19E+2
H2SO4	-9.76E+0			-9.76E+0								
HCL	-1.94E+1		-4.30E+0	-1.51E+1		-1.13E+7		-1.13E+1		-1,10E+0		-1.10E+0
NOx	-4.09E+3	-1.14E+2	-7.54E+1	-3.42E+3	-4.77E+2	-3.45E+3		-1.63E+2	-3.28E+3	-3,44E+3		-1.17E+2
N~	-5.22E+1	-3.45E+0	-5.06E+0	-2.70E+1	-1.67E+1	-1,21E+2		-9.30E+0	-1.12E+2	-1,16E+2		-3.39E+0
CO	-4.76E+2	-1.28E+1	-2.20E+1	-2.56E+2	-1.85E+2	-1.33E+3		-4.59E+1	-1.28E+3	-1.31E+3		-1.05E+1
G02	-6.72E+5	-7.09E+4	-2.98E+4	-5.33E+5	-3.84E+4	-3.00E+5		-5.72E+4	-2.43E+5	-297E+5		-5.82E+4
ammoniac	-1.34E+0		-2.56E-2	-1.11E+0	-2.06E-1	-1.37E+0		-6.73E-2	-1.31E+0	-1.49E+t)		-2.08E-1
aldehydes	-2.95E+0		-1.31E-1	-2.41E+0	-4.12E-1	-2.96E+t)		-3.44E-1	-2.62E+0	-3.00E+0		-4.36E-1
fluorides (gazeous)	-1.00E-3		-3.21E-4	-6.84E-4		-8.44E-4		-8.44E-4		-8.20E-5		-8.20E-5
H2S	-7.58E+0			-7.58E+0								
mercaptans	-6.94E+1			-6.94E+1								
other organic substances	-5.00E+0		-2.36E-1	-4.15E+0	-6.18E-1	-4,55E+0		-6.22E-1	-3.92E+0	-4,51E+0		-6.64E-1
VOC : isoparaffinic										-1,63E+6	-1.63E+6	
non specified emissions	-1.54E-3			-1.54E-3								
chlorine	-5.53E-3			-5.53E-3								
total hydrocarbons	-5.39E+3	-1.43E+1	-9.62E+2	-4.25E+3	-1.61E+2	-1.35E+3		-2.79E+2	-1.07E+3	-2.06E+3		-9.80E+2
methan	-	-	-3.26E+2	-1.55E+2	-	-	J	-2.80E+1	-4.33E+1	-8.38E+2		-

PAINT H : CONSUMPTION

Mat solvent-borne paint - Limed oil - Isoparaffinic

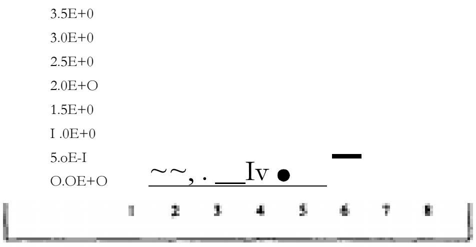
3.13 I Functional Unit (20 m2 covered with 98% opacity)

petroleum 2,9E+0 kg

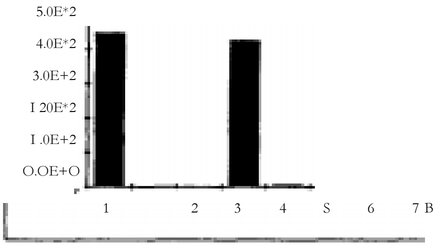


coal 1.7E+0 kg

natural gas
3.4E+0 kg

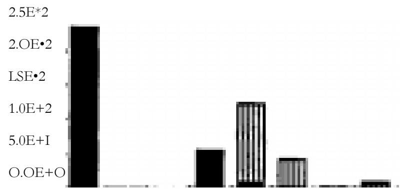


Water consumption
4.5E+2 I

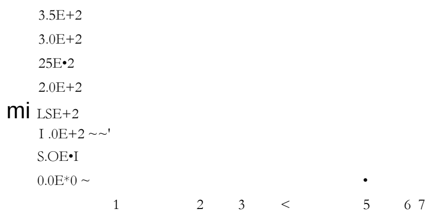


electricity 2,2E+1 M,l

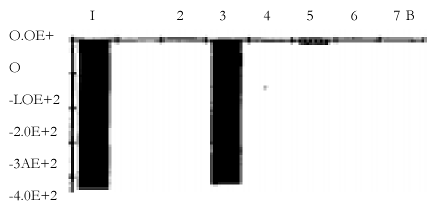
thermal energy
2.3E+2 M,1



primary energy equivalent
3.1E+2



water discharge
-4.4E+2 I



Legend

Site	1 = Total	S = Isoparaffinic solvent
0 Energy	2=	6 = Limed oil resin
Raw material	3 = CaC03	7 = Paint
Transport	4 = Ti02 :(total)	8 = Application

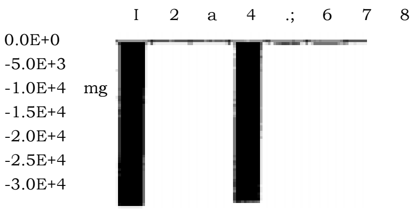
PAINT H : DISCHARGES

Mat solvent-borne paint - Limed oil - Isoparaffinic

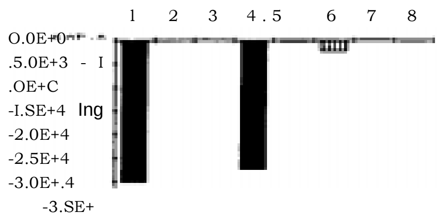
3.13 I

Functional Unit (20 ...covered with 98% opacity)

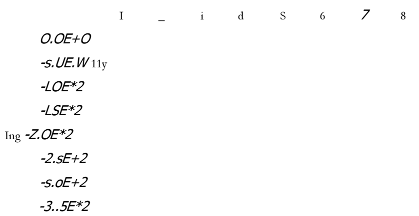
suspended matters -2.9E+4 mg



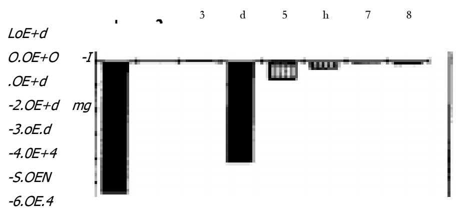
,COD -3.0E+4 mg



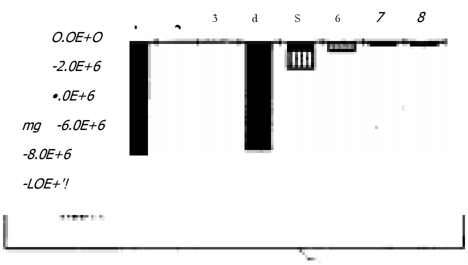
BODS -3.6E+2 mg



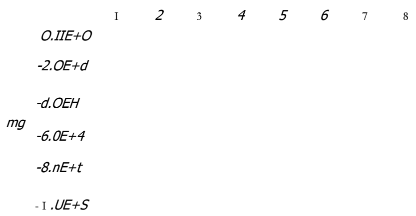
SOX -5.5E+4 mg



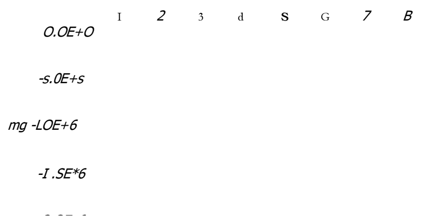
C02 - I. I E+7 mg



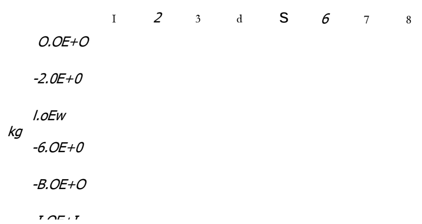
total hydrocarbons -9.6E+4 Ing



total VOC -1.6E+G mg



Waste production -8.1 E+0 kg



Legend

	Site	1 = Total	5 = Isoparaffinic solvent
	Energy	2=	G = Limed oil resin
	Raw material	3 = CaC03	7 = Paint
	Transport	4 = Ti02 (total)	8 = Application

Paint I: mat linseed oil emulsion

4

v

cycle inventory of paint I

seed Oil Emulsion

			Extenders						Pigments	Resin	Paint				Application	
			Aluminium silicate	Site	Energy production	CaC03	Site	=production	Pigments	Linseed oil	Paint	Site	Energy production	Raw material transport	**Application**	Site
	vareur urine a1															
	L 2.94		Functional unit (20 ml covered with 98% opacity)'													
	7.19E-1	kg	7.19E-1	7.19E-1												
	1.63E-2	kg							1.63E-2							
ne	1 21 E+0	kg				7.37E-1	7.37E-1		4.77E-1							
	1.65E-3	kg							1.65E-3							
	1.44E-2	kg							1.44E-2							
m	1.12E-2	kg							1.12E-2							
phate	8.40E-4	kg							8.40E-4							
	1.24E-3	kg							1.24E-3							
	8.80E-3	kg							8.80E-3							
	7.29E-4	kg				4.42E-4	4.42E-4		2.86E-4							
	1.26E-1	kg									1.26E-1	1.26E-1				
	1.61E-1	kg									1.61E-1	1.61E-1				
	5.40E-2	kg									5.40E-2	5.40E-2				
	6.23E-2	kg									6.23E-2	6.23E-2				
one	4.20E-2	kg									4.20E-2	4.20E-2				
	3.60E-3	kg									3.60E-3	3.60E-3				
	2.83E-1	kg							2.83E-1							
	2.74E-1	kg							2.74E-1							
materials	1.18E+0	kg							1.18E+0							
	2.33E-1	kg	2.01E-2		2.01E-2	1.18E-3	8.36E-4	3.45E-4	8.39E-2	8.93E-3	7.41-2		7.34E-3	6.67E-2	4.44E-2	
	6.81E-1	kg	8.31E-2		8.31E-2	1.84E-3	5.54E-6	1.83E-3	5.55E-1	1.47E-3	3.94E=2		3.90E-2	4.42E-4	2.94E-4	
	9.28E-1	kg	1.15E-1		1.15E-1	2.48E-4	3.25E-6	2.45E-4	7.78E-1	2.91E-2	5.48E-3		5.22E-3	2.59E-4	1.73E-4	
	7.78E-2	kg									7.78E-2	7.78E-2				
	1.52E-2	kg	3.60E-3	3.60E-3		5.90E-3	5.90E-3		5.74E-3							
	2.54E-1	kg	1.44E-3	1.44E-3		1.47E-3	1.47E-3		1.43E-3		2.49E-1	2.49E-1				
	1.29E+2	l	2.67E-2	1.44E-2	1.23E-2	4.37E-4	2.64E-4	1.73E-4	1.16E+2	7.63E+0	2.38E+0	2.37E+0	3.68E-3	1.30E-2	2.60E+0	2.59E+(
	2.82E+0	l									2.23E+0	2.23E+0			**5.88E-1**	5.88E-1
	3.69E+1	l							3.48E+1		1.39E-1	1.39E-1			2.00E+0	2.00E+(

t	I				Extenders				Pigments	Resin			Paint			Application	
sion			Aluminium silicate	Site	Energy production	CaC03	Site	Energy productio	**Pigments**	**Linseed** oil	Paint	Site	Energy production	Raw material transport	**Application**	Site	Ra mate trans
	2.04E-1	kg	3.10E-2		3.10E-2	6.90E-4		6.90E-4	1.57E-1	1.12E-3	1.47E-2						
	1.72E-1	kg	4.99E-2		4.99E-2	1.11E-3		1.11E-3	9.74E-2	3.50E-4			1.47E-2				
	1.93E-2	kg	4.90E-3	3.73E-6	4.89E-3	1.04E-5					2.36E-2		2.36E-2				
	2.13E-t							1.04E-5	1.31E-2	1.05E-3	2.22E-4		2.22E-4				
		kg	1.47E-2		t.47E-2	3.92E-4	6.43E-5	3.28E-4	1.57E-1	9.65E-4	3.72E-2		6.98E-3	3.02E-2	3.41E-3		
	7.56E-1	kg	ı 13E-1	9.77E-2	1.51E-2	2.42E-4	2.52E-6	2.39E-4	6.09E-1								3.41
	1.01E-1	kg								2.91E-2	5.29E-3		5.09E-3	2.00E-4	1.34E-4		1.34
	6.10E+0					7.74E-4	7.74E-4		1.64E-2	6.41E-3	3.66E-2			3.66E-2	4.11E-2		4.11
		MJ	1.71E+0		1.71 E+0	3.82E-2		3.82E-2	3.44E+0	9.25E-2	8.12E-1		8.12E-1				
	8.96E-1	MJ	2.50E-1		2.50E-1	5.58E-3		5.58E-3	5.03E-1	1.77E-2	1.19E-1						
													1,19E-1				
	-1.20E+2	I	-2.16E+0	-2.16E+0	-4.60E-3	-1.03E-4		-1.03E-4	-1.15E+2								
	-4.59E+3	mg	-2.34E+2	-2.27E+2	-7.90E+0	-6.56E-3					-1.41E-1	-1.39E-1	-2.18E-3		-2.00E+0	-2.00E+0	
	-4.57E+3						-4.65E-3	-1.92E-3	-4.33E+3	-1.67E+1	-4.11E-1		-4.08E-2	-3.70E-1	-2.47E-1		-2.47
		mg	-2.32E-1		-2.32E-1	-1.91E-2	-1.39E-2	-5.18E-3	-4.18E+3	-3.88E+2	-1.22E+0		-1.10E-1	-1.11E+0	-7.40E-1		
	-5.34E+0	mg	-7.74E-2		-7.74E-2	-6.37E-3	-4.65E-3	-1.73E-3	-4.56E+0	-4.31E-2	-4.07E-1						-7.40
	-i.20E+2	mg	-2.86E-1		-2.86E-1	-6.37E-3							-3.67E-2	-3.70E-1	-2.47E-1		-2.47
	-2.35E+0							-6.37E-3	-9.33E+1	-2.63E+1	-1.36E-1		-1,36E-1				
		mg	•6.16E-1		-6.16E-1	-1.37E-2		-1.37E-2	-1.33E+0	-8.68E-2	-2.92E-1		-2.92E-1				
	-5.09E+1	mg	-1.30E-1		-1.30E-1	-2.90E-3		-2.90E-3	-5.07E+1	-2.05E-2	-6.17E-2		-6.17E-2				
	-6.85E-1	mg	-1.46E-1		-1.46E-1	-3.25E-3		-3.25E-3	-4.45E-1	w2.29E-2	-6.90E-2						
	-1.71E+2	mg	-7.83E-3		-7.83E-3	-1.75E-4		-1.75E-4	-1.71E+2				-6.90E-2				
	-4.58E+1	mg	-4.35E+1	-4.34E+1	-1.01E-1	-2.25E-3				-1.23E-3	-3.71E-3		-3.71E-3				
	-1.89E+4	mg	-1.09E-1	-1.08E-1				-2.25E-3	-2.27E+0	•1.59E-2	-4.79E-2		-4.79E-2				
					-1.19E-3	-2.65E-5		-2.65E-5	-1.89E+4	-1.89E-4	-5.65E-4		-5.65E-4				
	-4.26E-2	mg							-4.26E-2								
	-1.28E-2	mg															
	-4.48E+1	mg	-6.08E+0		-6.08E+0	-1.81E-1	-1.26E-1	-5.51E-2	-1.28E-2	•2.19E+0	•1.12E+1						
									-1.84E+1								
	-2.29E+3	mg	-1.80E+2		-1.80E+2	-1.35E+1	-9.79E+0						-1.17E+0	-1.01E+1	-6.70E+0		-6.70
	-3.00E+4							-3.68E+0	-6.25E+2	-9.52E+1	-8.59E+2		-7.83E+1	-7.81E+2	-5.20E+2		-5.20
	-7 55E+0	mg	-7.55E+0	-7.55E+0											-3.00E+4	-3.00E+4	
		mg															
	-1.BOE+3	mg	-1.19E+1	-1.19E+1					-1.79E+3								
	7.87E+3	mg	-5.18E+0	-5.18E+0					-7.86E+3								
	-4.20E+3	mg	-2.16E-1	-2.16E-1					-4.20E+3								
	-4.32E-1	mg	-4.32E-1	-4.32E-1													
	-1.68E+1	mg	-1.68E+1	-1.68E+1													
	-5.05E+0	mg	-1.08E-2	-1.08E-2					-5.04E+0								
	-2.78E+0	mg	-8.63E-3	-8.63E-3					-2.77E+0								
	-2.39E+2	mg	-4-IOE-2	-4.10E-2					-2.39E+2								
	-1.08E-1	mg	-1.08E-1	-1.08E-t													

t I

sion

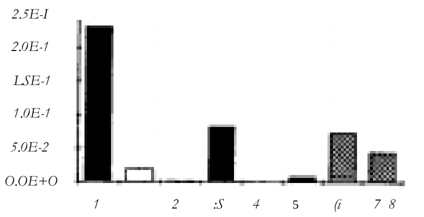
				Extenders				Pigments	Resin			Paint			Application	
		Aluminiu mailicate	Site	Energy production	**CaC03**	Site	Energy productio	**Pigrtwnta**	**Linseed** oil	Paint	Site	Energy production	Raw material transport	**Application**	Site	Ra mate trans
-9.21E+3	mg	-2.16E+2	-1.16E+2	-9.96E+1	-5.47E+0	-3.27E+0	-2.20E+0	-8.53E+3	-2.03E+1	-2.58E+2		-4.69E+1	-2.11E+2	-1.73E+2		-1.73E
-2.67E+4	mg	-1.47E+3	-2.76E+0	-1.46E+3	-3.44E+1	-6.09E+0	-2.83E+1	-2.26E+4	-1.21E+2	-2.09E+3		-6.03E+2	-1.49E+3	-3.23E+2		-3.23E
-1.51E+2	mg	-4.33E+1		-4.33E+1	-9.66E-1		-9.66E-1	-8.50E+i	-8.29E-1	-2.05E+t		-2.05E+1				
-2.26E+4	mg	-1.04E+3	-3.70E+2	-6.69E+2	-5.41 E+1	-d.02E+1	-1.39E+1	-1.67E+4	-3.30E+2	-2.33E+3		-2.96E+2	-2.03E+3	-2.13E+3		-2.13E
-4.59E+2	mg	-5.18E+1	-1.12E+1	-4.05E+1	-2.15E+0	-1.35E+0	-7.93E-1	-1.95E+2	-4.08E+1	-9.75E+1		-1.69E+1	-8.07E+1	-7,19E+1		-7.19E
-5.20E+3	mg	-2.32E+2	-4.18E+1	-1.91E+2	-1.96E+1	-1.57E+1	-3.92E+0	-2.62E+3	-6.44E+2	-8.48E+2		-8.33E+1	-7.64E+2	-8.34E+2		-8.34E
-3.62E+6	mg	-4.75E+5	-2.31E+5	-2.45E+5	-7.76E+3	-2.88E+3	-4.88E+3	-3.55E+6	9.03E+5	-3.34E+5		-1.04E+5	-2.30E+5	-1.53E+5		-1.53E
-3.50E+0	mg	-2.58E-1		-2.SBE-1	-2.12E-2	-1.55E-2	-5.74E-3	-8.95E-1	:1.52E-1	-1.36E+0		-1.22E-1	-1.23E+0	-8.22E-1		-8.22
-2.02E+1	mg	-1.32E+0		-1.32E+0	-6.03E-2	-3.10E-2	-2.93E-2	-4.04E+0	-1.01E+1	-3.09E+0		-6.24E-1	-2.47E+0	-1.64E+0		-1.64E

Linseed Oil Fmulsion

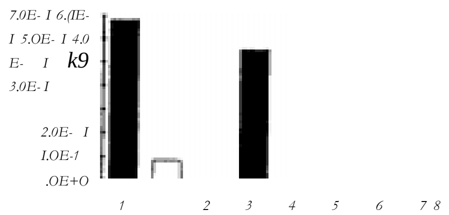
2.94 I

Functional unit (20 ml covered with 98%, opacity)

petroleum 2.3E-I kg

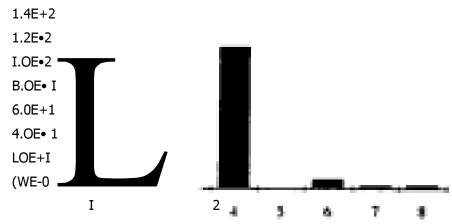


coal 6.8E-1 kg



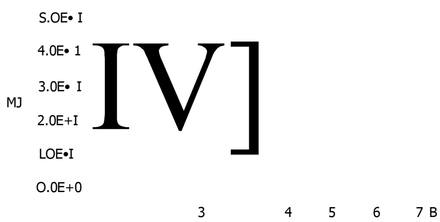
natural gas 9.3E-I kg

Water consumption 1.3E+2 I

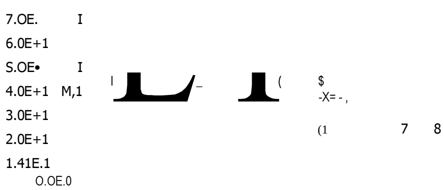


electricity

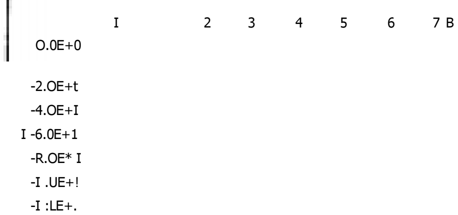
thermal energy 4.9E+1 MJ



primary energy equivalent 6.8E+1 MJ



water discharge -1.2 E+2 I



Legend

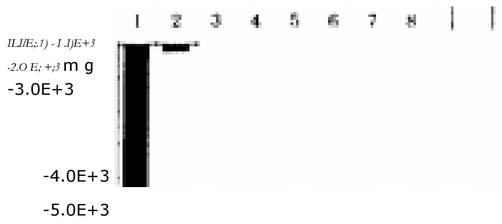
Site	1 = 'total	5=	
Energy	2 = Aluminium silicate	6 = Linseed oil (total)	
Raw material	3 = CaC03	7 = Paint	
Transport	4 = Pigments (total)	8 = Application	

PAINT I : DISCHARGES

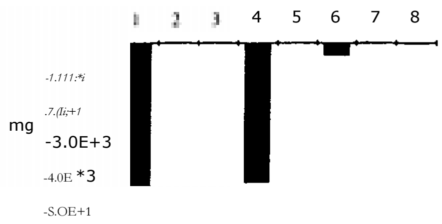
Linseed Oil Emulsion
2.94 I

Functional unit (2() m2 covered with 98°10 opacity)

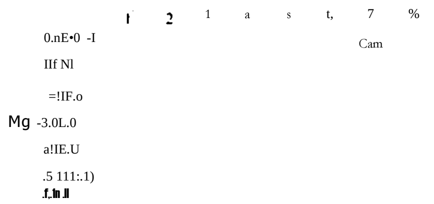
suspended matters -4.6E+3 mg



.COD -4.6E+3 mg

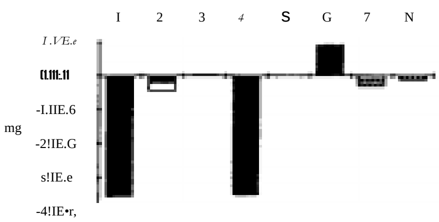


BODS -5.3E+0 mg



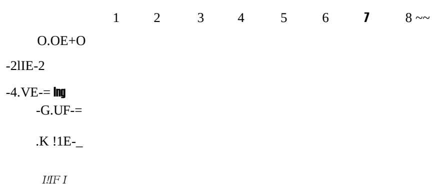
SOX -2.7E+4 mg

C02 -3.6E+6mg

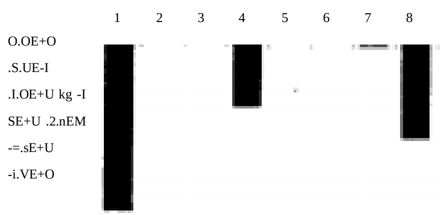


total hydrocarbons -3.3E+4 mg

total VOC -8.6E-2 mg



Waste production -2.9E+0 kg



Legend

Site		1 = Total	5=
	Enemy	2 = Aluminium silicate	6 = Linseed oil (total)
	Raw material	3 = CaC03	7 = Paint
	Transport	4 - Pigments (total)	R = Application

Paint 1: high solid paint : high solid resin - WS <1

Y

Life cycle inventory of paint J Gloss high solid paint - High	Valour	Units SI	Ti02	Solvent				Alkyd resin				
			Ti02	**WS < 1~L solvent**	Site	Energy production	Raw material	**Alkyd** *rosin*	Site	Energy production	Raw material production	Raw material
	1.16	*I*	*Functional Unit (20 m° covered with 989: opacity)*									
Materials		-										
amid wax	4.84E-3	kg										
siccative : Pb/Zn/Co/CarZr complex	3.00E-2	kg										
anti skinning forming agent methyl ethyl	4.64E-3	kg										
rock salt	9.31E-2	kg	4.52E-2					4.78E-2			4.78E-2	
marble or limestone	1.32E+0	kg	1.32E+0					1.32E-5			1.32E-5	
HCI	6.84E-3	kg	4.29E-3					2.55E-3			2.55E-3	
TiCL4	3.99E-2	kg	3.99E-2									
trihydrated aluminium	3.09E-2	kg	3.09E-2									
monoamonico phosphate	2.32E-3	kg	2.32E-3									
iron (metal, ore)	2.01E-5	kg						2.01E-5			2.01E-5	
Zr02 compounds	3.42E-3	kg	3.42E-3									
sodium silicate	2.44E-2	kg	2.44E-2									
explosives	7.93E-4	kg	7.93E-4									
ilrnenite ore	7.83E-1	kg	7.83E-1									
trimellitic anhydride	3.72E-2	kg						3.72E-2	3.72E-2			
clay	2.46E-6	kg						2.46E-6			2.46E-6	
ferromanganese	1.23E-7	kg						1.23E-7			1.23E-7	
bauxite	2.98E-5	kg						2.98E-5			2.98E-5	
hexane	1.33E-3	kg					;	1.33E-3			1.33E-3	
phosphorus	5.80E-3	kg						5.80E-3			S.BOE-3	III
potassium	2.21 E-2	kg						2.21 E-2			2.21 E-2	
au	6.82E-3	m3						6.82E-3	3.16E-3		3.66E-3	
petroleum	8.92E-1	kg	1.54E-i	2.73E-1		8.16E-4	2.73E-1	2.52E-1		1.27E-2	2.27E-1	1.29E-2
coal	7.44E-1	kg	6.42E-1	6.40E-3		2.81E-3	3.59E-3	8.31E-2		4.33E-2	3.98E-2	8.55E-5
natural gas	1.17E+0	kg	7.99E-1	1.66E-2		7.05E-3	9.56E-3	3.51E-1		1.11E-1	2.39E-1	5.01E-5
Packaging												
cardboard		kg										
paper	1.59E-2	kg	1.59E-2									
polyethylene	6.79E-3	kg	3.97E-3									
tin can	2.03E-1	kg										
Water consumption	2.03E+2	I	1.78E+2	1.28E+0	1.59E-1	5.56E-4	1.12E+0	2.29E+1	1,08E+0	8.69E-3	2.18E+1	2.51E-3
cleaning 'f	9.64E+1	I	9.63E+1					9.83E-2	9.83E-2			
cooling	1.01E+2	I	7.92E+1	1.27E+0	1.59E-1		1.11E+0	2,01E+1	9.83E-1		1.91E+1	
boiler	1.79E+0	I	1.57E+0					2.23E-1			2.23E-1	
unspecified water	2.16E+0	I	5.80E-1	4.72E-3		5.56E-4	4.16E-3	1.57E+0		8.69E-3	1.56E+0	2.51E-3 li
[illegible]	[illegible]	I						[illegible]			[illegible]	

Life cycle inventory of paint J
Gloss high solid paint - High solid resin - WS < 1 %

			T102	Solvent				Alkyd resin				
			Ti02	WS < 1% solvent	Site	Energy production	Raw material production	**Alkyd resin**	Site	Energy production	Raw material production	Raw material transpor
Energy												
electricity	1.02E+1	MJ	8.19E+0	1.16E-1	4.99E-2	1.08E-3	6.54E-2	1.71E+0	7.67E-1	1.72E-2	9.22E-1	1.58E-3
thermal energy	6.86E+1	MJ	2.29E+1	1.16E+1	2.90E-1	3.06E-2	1.13E+1	2.53E+1	4.59E+0	4.84E-1	1.97E+1	5.52E-1
primary energyequivalent	1.01E+2	MJ	4.90E+1	1.20E+1	2.90E-1	1.93E-1	1.15E+1	3.07E+t	4.59E+0	2.99E+0	2.26E+1	5.57E-1
Fuels		-										
coal	3.97E-1	kg	3.56E-1	2.32E-3		1.04E-3	1.28E-3	3.39E-2		1.60E-2	1.79E-2	
lignite	3.24E-1	kg	2.67E-1	3.73E-3		1.67E-3	2.06E-3	4.63E-2		2.57E-2	2.06E-2	
light fuel oil	4.54E-2	kg	3.45E-2	7.06E-4		3.01 E-4	4.05E-4	9.89E-3		4.76E-3	5.13E-3	
heavy fuel oil	1.81E-1	kg	1.10E-1	1.88E-2		4.94E-4	1.83E-2	3.56E-2		7.59E-3	2.61E-2	1.92E-3
natural gas	6.07E-1	kg	3.62E-1	1.63E-2	6.30E-3	6.40E-4	9.40E-3	2.21E-1	9.98E-2	9.96E-3	1.11E-1	3.88E-5
diesel oil	6.96E-2	kg	5.91E-3					2.43E-2			1.33E-2	1.10E-2
nuclear	1.13E+1	MJ	9.17E+0	1.05E-1		5.74E-2	4.73E-2	1.78E+0		8.83E-1	8.94E-1	
hydraulic	1.66E+0	MJ	1.342+0	1.53E-2		8.40E-3	6.92E-3	2.74E-1		1.29E-1	1.45E-1	
Discharge into water												
water discharge	-1.81E+2	I	-1.76E+2	-1.22E+0	-1.59E-1	-1.54E-4	-1.06E+0	-3.68E+0	-9.83E-2	-2.37E-3	-3.58E+0	
suspended matters	-1.21E+4	mg	-1.20E+4	-7.65E+0	-4.23E+0	-5.07E-1	-2.91E+0	-7.72E+1	-9.83E+0	-8.03E+0	-5.93E+1	-7.16E-2
COD	-1.24E+4	mg	-1.15E+4	-7.52E+1	-4.59E+1	-7.79E-3	-2.93E+1	-8.85E+2	-3.41E+1	-1.20E-1	-8.51E+2	-2.15E-1
BOD5	-2.92E+1	mg	-7.20E-1	-1.67E+1	-1.37E+1	-2.60E-3	- 3.110E+0	-9.74E+0		-3.99E-2	-9.63E+0	-7.16E-2
hydrocarbons	-1.50E+1	mg		-5.29E+0	-4.23E+0		-1.06E+0	-9.04E+0			-9.04E+0	
ammonium hydroxide	-5.62E+1	mg	-1.53E+0	-2.14E-2		-9.58E-3	-1.18E-2	-5.46E+1		-1.47E-1	-5.45E+1	
fluorides	-4.20E+0	mg	-3.30E+0	-4.61E-2		-2.07E-2	-2.55E-2	-7.68E-1		-3.18E-1	-4.50E-1	
sulphates	-8.87E-1	mg	-6.98E-1	-9.74E-3		-4.36E-3	-5.38E-3	-1.62E-1		-6.70E-2	-9.52E-2	
nitrates	-1.08E+0	mg	-7.81 E-1	-1.09E-2		-4.88E-3	-6.02E-3	-2.70E-1		-7.50E-2	-1.95E-1	
chlorides	-9.73E+0	mg	-4.20E-2	-5.86E-4		-2.63E-4	-3.23E-4	-9.68E+0		-4.03E-3	-9.68E+0	
Na(ion)	-8.07E+3	mg	-5.42E-1	-7.56E-3		-3.39E-3	-1.18E-3	-8.07E+3	-8.07E+3	-5.21E-2	-7.40E-2	
Fe (ion)	-5.22E+4	mg	-5.22E+4	-8.91E-5		-3.99E-5	44.92E-5	-1.49E-3		-6.14E-4	-8.74E-4	
phenols	-3.05E-1	mg		-1.36E-1			-1.36E-1	-8.52E-2			-8.52E-2	
Hg	-1.08E-2	mg	-1.08E-2									
oils	-1.69E+2	mg	-4.41E+1	-4.40E+1		-3.16E-1	-4.37E+1	-4.76E+1		-4.97E+0	-4.07E+1	-1.95E+(
dissolved substances	-9.49E+3	mg	-1.44E+3	-3.43E+3		-6.52E+0	-3.43E+3	-1.99E+3		-1.01E+2	-1.74E+3	-1.51E+2
cleaning solvents: white spirit 17 - 18%	-1.56E+5	mg										
paint residues	-3.00E+4	mg										
Ca	-4.95E+3	mg	-4.95E+3									
M g	-2.18E+4	mg	-2.18E+4									
Al	-1.16E+4	mg	-1.16E+4									
Pb	-1.43E+1	mg	-1.39E+1					-3.62E-1			-3.62E-1	
Cu	-7.68E+0	mg	-7.68E+0									
Zn	-5.53E+2	mg	-5.53E+2									
Mn	-3.07E+3	mg	-3.07E+3									
Cr	-1.75E+0	mg	-1.75E+0									
Cd	-2.97E-1	mg	-2.97E-1									
other nitrogen	-1.23E+0	ring						-1.23E+0			-1.23E+0	
others metals ions	-4.21E+1							-4.21 E+			-4.21 E+1	

Life cycle inventory of paint J

Gloss high solid paint - High solid resin - WS < 1 %

			Ti02			Solvent				Alkyd resin		
			Ti02	WS < 1% solvent	Site	Energy production	Raw material production	Alkyd resin	Site	Energy production	Raw material production	Raw material transport
Air emissions		_										
dusts	-4.08E+3	mg	-3.53E+3	-3.21E+1	-6.36E-2	-3.36E+0	-2.87E+1	-3.15E+2	-1.01E+0	-5.17E+1	-2.14E+2	-4.86E+1
Sox	-2.36E+4	mg	-1.75E+4	-1.58E+3	-2.81E+1	-5.50E+1	.1.50E+3	-3.02E+3	-3.39E+0	-8.51E+2	-2.04E+3	-1.31E+2
HCL	-2.84E+2	mg	-2.32E+2	-3.24E+0		145E+0	-1.79E+0	-4.34E+1		-2.23E+1	-2.11E+1	
NOx	-1.22E+4	mg	-6.44E+3	-2.38E+2	-2.39E+1	-2.38E+1	-1.90E+2	-3.27E+3	-3.78E+2	-3.67E+2	-1.94E+3	-5.77E+2
N20	-6.89E+2	mg	-4.41E+2	-7.76E+0	-7.24E-1	-1.51E+0	-5.52E+0	-1.63E+2	-1.15E+1	-2.34E+1	-1.09E+2	-1.99E+1
CC	-4.53E+3	mg	-1.81E+3	-2.66E+1	-2.70E+0	-6.85E+0	-1.71E+1	-1,86E+3	-4.27E+t	-1.06E+2	-1.49E+3	-2.?4E+2
C02	-2.46E+6	mg	-3.25E+6	-1.19E+5	-1.49E+4	-9.02E+3	-9.48E+4	1.14E+6	-2.36E+5	-1.40E+5	1.56E+6	-4.44E+4
ammoniac	-4.44E+0	mg	-2.01E+0	-3.47E-1		-8.63E-3	-3.38E-1	-1.04E+0		-1.33E-1	-6.71E-1	-2.39E-1
aldehydes	-3.60E+1	mg	-1.02E+1	-7.54E-1		-4.41E-2	-7.09E-1	-2.29E+1		-6.78E-1	-2.17E+1	-4.78E-1
fluorides (gazeousl	-2.20E-2	mg	-1.73E-2	-2.42E-4		-1.08E-4	.1.33E-4	-4.01E-3		-1.66E-3	-2.34E-3	
H2S	-7.86E-1	mg						-7.86E-1			-7.86E-1	
other organic substances	-2.76E+1	mg	-1.84E+1	-1.16E+0		-7.99E-2	-1.08E+0	-4.63E+0		-1.23E+0	-2.69E+0	-7.16E-1
VOC : white spirit 17-18%	-9.61E+3	mg		-4.04E+1	-4.04E+1			-1.50E+1			-1.50E+1	
VOC : white spirit < 5 0	-2.59E+5	mg		-4.98E+2	-4.98E+2			-1.93E+2	-7.37E+0		-1.85E+2	
chlorine	-5.91E-2	mg	-2.89E-2					-3.01E-2			-3.01E-2	
total hydrocarbons	-4.41E+4	mg	-3.02E+4	-1.81E+3	-3.01E+0	-2.15E+2	-1.60E+3	-1.03E+4	-4.77E+t	-3.39E+3	-6.69E+3	-1.91E+2
methan	-1.34E+4	mg	-8.01E+3	-1.37E+3	-2.71E+0	-6.97E+1	- 19.29E+3	-3.15E+3	-4.29E+1	-1.10E+3	-2.00E+3	-7.67E+0
non methanic hydrocarbons	-3.08E+4	mg	-2.22E+4	-4.48E+2	-3.OIE-1	-1.46E+2	-3.03E+2	-7.18E+3	-4.77E+0	-2.29E+3	-4.70E+3	-1.84E+2
VOC methyl ethyl cetoxime	-3.52E+3	mg										
hexane	-8.77E+2	mg						-8.77E+2			-8.77E+2	
metals	-1.23E-1	mg						-1.23E-1			-1.23E-1	
total VOC	-2.73E+5	mg		-5.38E+2	-5.38E+2			-2.08E+2	-7.37E+0		-2.00E+2	
Waste production	-3.35E+0	kg	-2.60E+0	-2.29E-3	-1.11E-4	-8.06E-4	-1.38E-3	-1.33E-1	-8.03E-2	-1.24E-2	-4.02E-2	-1.86E-5
toxic wastes	-6.79E-2	kg	-5.17E-4	-1.86E-4	-1.11E-4		-7.45E-5	-6.54E-2	-6.54E-2		-7.76E-5	
industrial wastes or post-consumer wastes	-8.87E-1	kg	-2.62E-1					-1.55E-2	-1.49E-2		-5.33E-4	
inert wastes	-7.61 E-4	kg						-7.61 E-4			-7.61 E-4	
incineration	-2.79E-3	kg		-1.54E-4			-1.54E-4	-2.54E-3			-2.54E-3	
recuperation	-2.12E+0	kg	-2.10Ei0	-4.52E-5			-4.52E-5	-2.34E-2			-2,34E-2	
inert minerals	**-6,44E-4**	kg	**-6.44E-4**									
unspecified wastes ꞵ`	-2.70E-1	k	-2.40E-1	..1.91E-3		-8.06E-4	-1.10E-3	-2.53E-2.		-1.24E-	-1.29E-2	-1.86E-5

Life cycle inventory of paint J Gloss high solid paint - High solid resin - WS < 1 %	Paint				Application			
	Paint	Site	Energy production	Raw material transport	Application	Site	Dilution solvent	Raw material transport
Materials								
amid wax	4.84E-3	4.84E-3						
siccative . Pb/Zn/Co/Ca/Zr complex	3.00E-2	3.00E-2						
anti skinning forming agent : methyl ethyl	4.64E-3	4.64E-3						
rock salt								
marble or limestone								
HCI								
TiCI-4								
Inhydrated aluminium								
monoamonico phosphate								
iron (metal, ore)								
Zr02 compounds								
sodium silicate								
explosives								
ilmenite ore								
trimellitic anhydride								
clay								
ferromanganese								
bauxite								
hexane								
phosphorus								
potassium								
air								
petroleum	2.27E-2		1.73E-3	2.10E-2	1.90E-1		1.68E-1	2.27E-2
coal	9.34E-3		9.20E-3	1.39E-4	2.36E-3		2.21E-3	1.50E-4
natural gas	1.31E-3		1.23E-3	8.16E-5	5.96E-3		5.87E-3	8.81E-5
Packaging								
cardboard								
paper								
polyethylene	2.82E-3	2.82E-3						
tin can	2.03E-1	2.03E-1						
Water consumption	4.95E-3		8.69E-4	4.OBE-3	6.91E-1		6.87E-1	4.41E-3
cleaning								
cooling					6.84E-1		6.84E-1	
boiler								
unspecified water	4.95E-3		8.69E-4	4.08E-3	6.96E-3		2.56E-3	~I 4.41 E-3
rocess								

Life cycle inventory of paint J Gloss high solid paint - High solid resin - WS < 1 %	Point				Application			
	Paint	Site	Energy production	Raw material transport	*Application*	Site	Dilution solvent	Raw material transport
Energy								
electricity	1.69E-1	167E-1		2.56E-3	4.30E-2		4.02E-2	2.77E-3
thermal energy	8.99E-1			8.99E-1	7.91E+0		6.93E+0	9.73E-1
primary energy equivalent	1.44E+0		5.32E-1	9.07E-1	8.04E+0		7.06E+0	9.82E-1
Fuels								
coal	3.47E-3		3.47E-3		7.86E-4		7.86E-4	
lignite	5.59E-3		5.59E-3		1.27E-3		1.27E-3	
light fuel oil	5.24E-5		5.24E-5		2.49E-4		2.49E-4	
heavy fuel oil	4.24E-3		1.65E-3	2.59E-3	1.30E-2		1.13E-2	1.74E-3
natural gas	1.27E-3		1.20E-3	6.31E-5	5.84E-3		5.78E-3	6.82E-5
diesel oil	1.85E-2			1.85E-2	2.10E-2			2.10E-2
nuclear	1.92E-1		1.92E-1		2.91E-2		2.91E-2	
hydraulic	2.80E-2		2.80E-2		4.25E-3		4.25E-3	
Discharge into water								
water discharge	-5.15E-4		-5.15E-4		-6.53E-1		-6.53E-1	
suspended matters	-1.26E-t		-9.64E-3	-1.17E-1	-1.92E+0		-1.79E+0	-1.26E-1
COD	-3.76E-1		-2.60E-2	-3.50E-1	-1.84E+1		-1.80E+1	-3.78E-1
BOD5	-1.25E-1		-8.67E-3	-1.17E-1	-1.97E+0		-1.85E+0	-1.26E-1
hydrocarbons					-6.51E-1		-6.51E-1	
ammonium hydroxide	-3.20E-2		-3.20E-2		-7.25E-3		-7.25E-3	
fluorides	-6.90E-2		-6.90E-2		-1.56E-2		-1.56E-2	
sulphates	-1.46E-2		-1.46E-2		-3.30&3		-3.30E-3	
nitrates	-1.63E-2		-1.63E-2		-3.70E-3		-3.70E-3	
chlorides	-8.77E-4		-8.77E-4		-1.99E-4		-1.99E-4	
Na (ion)	-1.13E-2		-1.13E-2		-2.57E-3		-2.57E-3	
Fe (ion)	-1.33E-4		-1.33E-4		-3.02E-5		-3.02E-5	
phenols					-8.38E-2		-8.38E-2	
Hg								
oils	-3.44E+0		-2.77E-1	-3.17E+0	-3.02E+1		-2.68E+1	-3.42E+0
dissolved substances	-2.64E+2		-1.85E+1	-2.46E+2	-2.37E+3		-2.10E+3	-2.65E+2
cleaning solvents : white spirit 17 - 18%					-1.56E+5	-1.56E+5		
paint residues					-3.00E+4	-3.00E+4		
Ca								
Mg								
AI								
Pb								
Cu								
Zn								
Mn								

Life cycle inventory of paint J

Gloss high solid paint - High solid resin - WS < 1 %

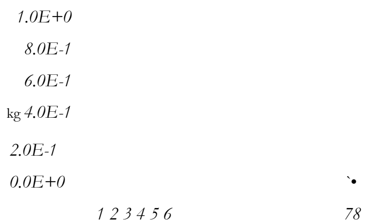
			Paint			Applic ation		
	Paint	Site	Energy production	Raw material transport	**Application**	Site	Dilution solvent	Raw material transport j
Air omissions								
dusts	-9.11E+1		-1.11E+1	.8.01E+1	-1.06E+2		-1.76E+1	-8.85E+1
SOX	-3.34E+2		-1.42E+2	-1,92E+2	-1.08E+3		-9.19E+2	-1.65E+2
HCL	-4.85E+0		-4.85E+0		-1.10E+0		-1.10E+0	
NOx	-1.03E+3		-7.ODE+1	-9.63E+2	-1.21E+3		-1.17E+2	-1.09E+3
N20	-3.69E+1		-3.98E+0	-3.29E+1	-4.01E+1		-3.39E+0	-3.67E+1
CO	-3.95E+2		-1.97E+1	-3.7°E+2	-4.36E+2		-1.05E+1	-4.26E+2
C02	-9.68E+4		-2.45E+4	-7.23E+4	-1.36E+5		-5.82E+4	-7.80E+04
ammoniac	-4.17E-1		-2.88E-2	-3.89E-1	-6.27E-1		-2.08E-1	-4.20E-1
aldehydes	-9.24E-1		-1.47E-1	-7.77E-1	-1.28E+0		-4.36E-1	-8.39E-1
fluorides (gazeous)	-3.62E-4		-3.62E-4		-8.20E-5		-8.20E-5	
H2S								
other organic substances	-1.43E+D		-2.67E-1	-1.17E+0	-1.92E+0		-6.64E-1	-1.26E+0
VOC : white spirit 17-18 %								
VOC : white spirit < 5 %					-9.55E+3	-		

PAINT J : CONSUMPTION

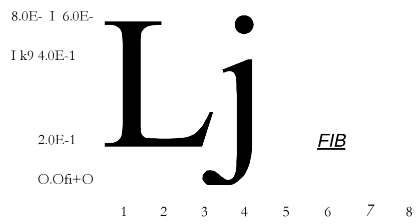
Gloss high solid paint - High solid resin - WS < 1%

1.16 I Functional Unit (20 m² covered with 98% opacity)

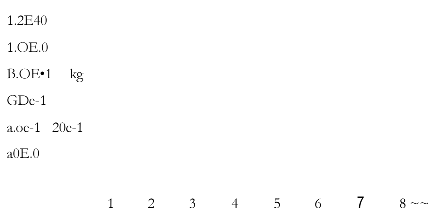
petroleum 8.9E-1 kg



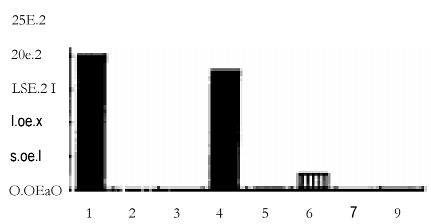
coal 7.4E-1 kg



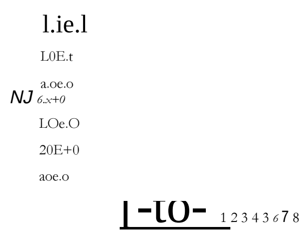
natural gas
1.2E+0 kg



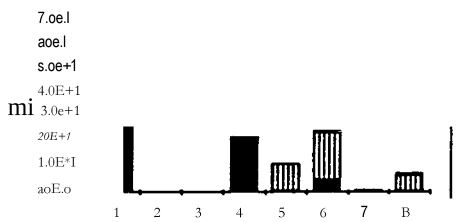
Water consumption
2.0E+2



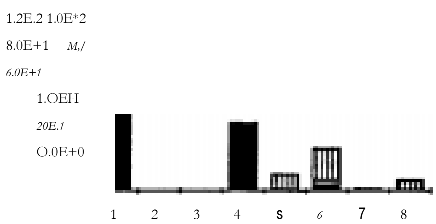
electricity 1.0E+1 MJ



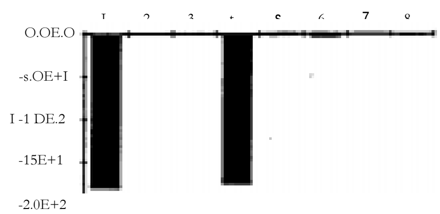
thermal energy
6.9E+1 MJ



primary energy equivalent
1.0E+2 MJ



water discharge
-1.8E+2 l



Legend

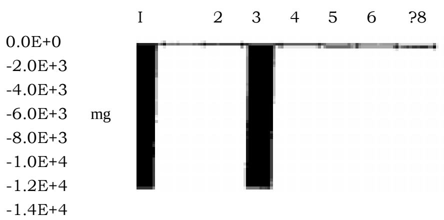
Site	1 = Total	5 = WS < 1% solvent
Energy	2 =	6 = Alkyd resin
Raw material	3 =	7 = Paint
Transport	4 = TiO2: (total)	8 = Application

PAINT J : DISCHARGES

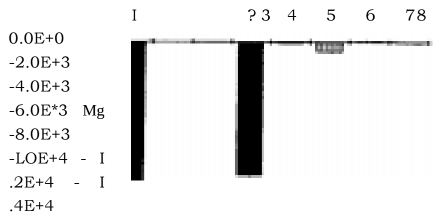
Gloss high solid paint - High solid resin - WS < 1 %

Functional Unit (20 m1 covered with 9801 opacity)

suspended matters -1.2E+4 mg

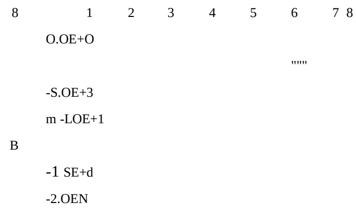


COD -1.2E+4 mg

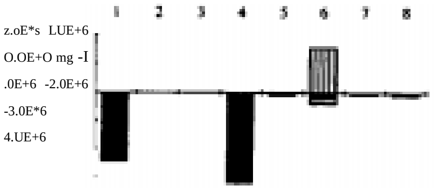


BODS -2.9E+1 mg

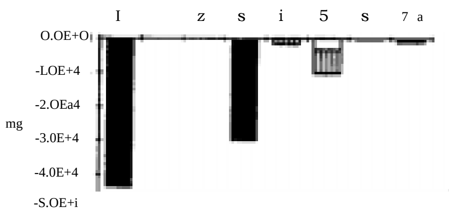
SOX -2.4E+4 mg



C02 -2.5E+6mg

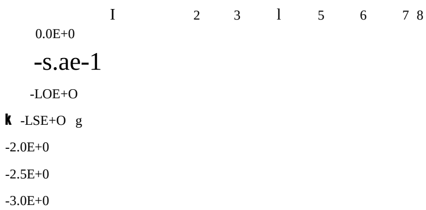


total hydrocarbons -4.4E+4 mg



total VOC -2.7E+5 mg

Waste production -3.4E+0 kg



Legend

Site
0 Energy
Raw material
Transport

1 = Total
3
4 = Ti02 (total)

5 = WS < 1 % solvent
6 = Alkyd resin
7 = Paint
8 = Application

Life cycle inventory of paint K mat water-borne paint - microvoid resin			Extenders						Ti02	Acrylic and microvoid resin			
			Ksotin	Site	Energy producti o	C&C03	Site	Energy producti on	Tit72	Acrylic & 4ic~0oi d rasin	Site	Energy productio n	Raw malarial production
Valour Unf SI													
Materials	2.47	-	Funcdnnal unir inn mxcv-- - m										
solvent/coales. agent : butyl diglycol	7,15E-2::	kg											
kaolin ore	1 62E-1.	kg	162E•1	1.62E-1									
dispersing agent : sodium polyphosphate	2.86E-2	kg											
dispersing agent : surfactant nonylphenols	1.91E-2 .	kg											
cellulose thickener	1.43E-2	kg											
other antifoaming agent	2 62E.2>•	kg											
rust preventing agent : sodium benzoate	1 43E-2:	kg											
other biocides	1 19E 2::	kg											
neutralizing amines	4 76E .2.	kg											
nonylphenol ethoxyle sulfate	2 97E2: ::	kg											
acrylamid	5 88E-3	kg								2 ~7E Z:	2.97E-2		
acrylic monomers: acrylic acid	960E 3: :	kg								5	68E5.88E-3		
ammonium persulphate	2.63E-3	kg								9 GOE 3:'	9.60E-3		
alkalis	6.35E-9::	kg								$ ¢,9:,	2.63E-3		
TBAP	1.08E-3	kg								9151:•$	6.35E-3		
sodium metabisulfite / sodium sulfate	7.74E-4				kg					7 ~9E 3 :	1.08E-3		
SBX acticide	108E-3	kg								.74E-,1:.	7.74E-4		
nopco NXZ	7 74E;5	kg								08ly$;	LOBE -3		
rock salt	4 67E-2	kg								7.r4E•5 :	7.74E-5		
marble or limestone	2 68E+0: :	kg							9 82E-2	.SQE 3:::			8.50E-3
HCI						1:561:4-	1.56E+0		1-12E~(f	: 332E-$::			7.32E-5
TiCl4	3 70E 3::	kg							962tR	: .7435::.	7.23E-5		
	337E-2	kg							397E-2				
trihydraoed aluminium	2.61E-2:	kg											
monoamonico phosphate	1.96E-3	kg							2,61E 2				
iron (metal, ore)	1.18E-4	kg							196E 3				
Zr02 compounds	2.89E-3	kg								t;164			1.18E-4
sodium silicate	2.06E-2	kg							2.89E 3	:.			
oil									2:06E-2				
	4.55E-4	kg											
grease	5.99E-5	kg								577E-6.	5.17E-6		
explosives	1.61E-3	kg				9.35E•4:	9.35E-4		6.70E-4				
ilmeniteore	661E-1	kg											
diverse compounds & catalysts	2.00E-3	kg							6.61E-1				
clay	9.05E-6	kg								2.00E-3			2.00E-3
ferromanganese	4.53E•7	kg								9:05E-6			9.05E-6
bauxite	6.10E=4	kg								4.53E-7			4.53E-7
ore (Cu2S, Fe2S3)	5.26E-3:,	kg								6;10E-4			6.10E-4
air	1 80E 1	m3								5:26E•3			5.26E-3
petroleum	798E .1.	kg	2.40E.3'		2.40E-3	250E.31.7 7E-3		7.29E-4		I:BOE-3. CBBEf			1.80E-1
coal	7 65E=1								1.30E-1			~1.46E-2	4.75E-1
natural gas		kg	1.14E-2		1.14E-2	9.88E-3	1.17E-5	3.87E-3	5.43E-t	6.27E-2		1.27E-2	5.00E-2
Packaging	1.20E+0	kg	7.32E-3		7.32E-3	5.25E-4	6.87E-6	5.18E-4	6.75E-1	4.91E-1		3.83E-3	4.87E-1
		-											
cardboard	5.69E•2	kg											
paper	2.67E-2	kg	8.t0E-4	8.10E-4		1.25E-2	1.25E-2		1.34E-2				
polyethylene	2.83E-2	kg	3.24E-4	3.24E-4		%12E3	3.12E-3		3:35E•3.				
tin can	4,18E-1.	k											

Life cycle inventory of paint K

mat water-borne paint -

microvoid resin

Water consumption	1:67Et2:	I
composition	2.21 E+0	I
cleaning	8.37 7	I
cooling	7 76Ef1:	I
boiler	1.66Er0	I
unspecified water	1 52E+Q. :	I
process	2 70E-:1	I
Ensryy		-
electricity	1.11E+1	MJ
thermal energy	6.76E+1:	MJ
primary energy equivalent	1 03E+2 :	MJ
FIJOIa		
coal	3 836•1.:	kg
lignite	3.52E-1	kg
light fuel oil	4 716-2: :	kg
hqavy fuel oil	2.11 E-1	kg
natural gas	5 12E-:1'	kg
diesel oil	$ 386:':	k9
nuclear	122E+1:	MJ
hydraulic	183E+0:MJ	
other fuels	3 07E-~:MJ	
Discharge into water		-
water discharge	•1.61 E+2.	I
suspended matters	-1.06E+4	mg
COD	-1.196+4.	mg
BOOS	-1.05E+2	mg
hydrocarbons	-1.52E+2	mg
ammonium hydroxide	-2.18E+1	mg
fluorides	-4.466+0:	mg
sulphates	-5.54E+.3	
nitrates	•1.51.+0.:	mg
chlorides	-6.46E+I	mg
Na (ion)	-2.98E+3	mg
Fe (ion)	-4.416+4	rng
phenols	-2.156•1	mg
Hg	-9.14E-3	mg
oils	-1.466+2	mg
dissolved substances	-4.00E+3	mg
paint residues	-3.126+4	
	.1.40E+0	mg
NKT	-6.69E+0	mg
K	-1.706+0.	mg
ca	-4.19E+3::	mg
M9	-1.84Ei4	mg
AI	-9.83E+3	mg
P04	-9.72E-2	mg
Si02	-3.78E+r	mg
Pb	-1.186+	

Kaolin Site		Extenders Energy xC&C03 • Site Energy produc0o productio				Ti02 : : TM ::::	Acrylic and microvoid rosin :Acryllo ,>l;: Site Energy Flaw material Raw Irtfotxavoid production production material Mirt ;: transport			
4$7E-3	3.24E-3	1.3363	824E-4:	5.59E-4	3.65E-4	:1506+x...i4 1E1•I		1.046+1	3.64E-3	2.95E+0
							1?7QE:~ :	9.70E-1		
						8146+1	:358~•i•	3.456•1		1.24E-2
								9.10E+0		1.34E+0
						S se£~	:a			
							u4sa			
						t 32E+fs	8 34E #			3.34E-1
7.33E-3		1.33E 3	9	24>k.4i5.5 9E-4	3.65E-4	; 4 80l„.1	:$ tf~1~..# .		3.64E-3	9.93E-1
3.24E-3::	3.24E-3						2,fi?~,t :			2.67E-1
2076.1.::.	2.06E-7	8.42E-4	70362:.:	7.03E-2		8826+0	'12~EI~G:	2.28E-1	1.83E-3	1.016+0
2 78E-1:,.	2.52E-1	2.66E 2	7 :886 ,2::	7.59E-2		3 89Et1:	: 4	i9>*t1.:5.5 3E-1	5.33E-2	4.10E+1
9E 7 V	2.52E-1	E 6.86 -1		7.66E-2	2.24E- 1	A.4 i 4		5.53E-1	7.85E-1	4.42E+I
4.2$Ea9		4.28E 3	I AGE-3.		1.46E 3	:s01 E•# :	3 p9s-.2:::		4.73E-3	2.62E-2
6 89E-3,		6.89E 3	..Zgr,E	.2.35E	3	..2 256-;.	:9 036•2;:.		7.62E-3	2.27E-2
313E?4:.	8.39E-7	3.13E-4	2206•5..		2.20E 5	29162	16662:	1.32E-4	1.61E-4	1.63E-2
2036:3:		2.0363	829£-il	1.36E-4	6.94E-4	.:~Q)£.~	:~98E-2	1.11E-2	3.18E-3	6.46E-2
20E3 :	5.47E-3	1.7363	•53#E•4;	5.32E-6	5.06E-4	.~O6Et	:1:77E:~	1.98E-3	1.77E-3	1.73E-1
			1 f~t».3 ,	1.646•3		4 996.3.:.	:.$ 04,3			1.97E
2.376;1',		2.37E 1	8:p~ 2 :		8.07E 2	7 35£+0:	f IpgrO'		2.62E-1	9.26E-1
3.466::2::		3.46E 2	:'1 1pE~' :		1.18E 2	.;	#3E,~..;:2: 12E-#.		3.836•2	1.74E-t
							3 03E		23.07E-2	
-4 876•1:	-4.86E-t	-6.35E-4	21TE4		-2.17E-4	.a 4,g1:+2	:•1 081*t1.	-9.796+0	-7.03E-4	-5.08E-1
S 15611'	-5.10E+t	-4.50E 1	:1.3gE-2	-9.82E-3	-4.05E-3	:y Ot£,~4:	418E±2	-1.98E+2	-2.39E-1	-2.20E+2
-3.21E-2		-3.21E-2	4.04E-2	-2.85E-2	-1.OHE-2	-9.69E+3	.•2.2163	-1.22E+3	-2.38E-1	-9.93E+2
-1.07E-2		-1.07E-2	-1.35E-2	-9.82E-3	-3.65E-3 ~	-6.08E-1	-•1..C3E+2	-7.64E+1	-7.9CE-2	-2.61E+1
							:1.526+2			-1.52E+2
-3.95E-2		-3.95E 2	-1.356-2		-1.35E-2	-t 306+0	:-1.78E+1		-4.37E-2	-1.78E+1
-8.51E-2		-B.S1E 2	' 2.p0E-Z		-2.90E-2	-2.76EM	.:::-3.86E-t		-9.42E-2	-2.91E-1
-1:806-?		=1.80E-2	':;:6.136=3		-6.13E-3	-5.80EA'	-5:541~+3		-1.99E-2	-5.54E+3
-2.Ot E-2		-2.01 E-2	:-6:866•3.		-6.86E-3	•6 606•1	:: -5.44.•1		-2.23E-2	-5.21 E-1
1:086 3		-1.08E 3	-3.69E-4		-3.69E-4	-3.55£:2.	•-6:ISE+1		-1.20E-3	.45E+
-9.78E+0	-9.77E+0	-1.40E-2	=4,76E-3		-4.76E-3	4.58E-1	-2.97E+3		-1.55E-2	-2.97E+3
-2:456-2.	-2.43E-2	-1.656-4	•5.616-5		-5.61E-5	-4.416+4	.::.7:45fr-4		-1.82E-4	-5.63E-4
							:1.84£•1	-1.06E-2		•1.746-t
						-9.14E-3				
-5.44E-1		-5.44E-1	-3.83E-1	-2.67E-1	-1.16E-1	-3.73E+1	-8.14E+1		-2.29E+0	-7.81E+1
-2.376+1		-2.37E+1	.2.85E+1	-2.07E+1	.7.78E+0	-1.21E+3	-7.59E+2		-1.69E+2	-5.146+2
							-1.40E+0	-5.31 E-1	~	-8.68E-1
							-6.~E~R~	-6.69E+0		
-7.706+0	-1.70E+0									
2:67E4	-2.67E+0					:4.186+3				
-7.176+0	-1.17E+0					-1 64E44	.			
4.86E=2.	-4.86E-2					-				
						8.836+3:::				
-0.72E-2:	-9.72E-2									
•3:79G0	-3.796+0									
-2.43E-3	-2.43E-3					:1:18& 7	:::3:156-2			-3.15E-2

Life cycle inventory of paint K					Extenders				Ti02		Acrylic	and microvoid	rosin	
mat water-borne paint - mICfOVOId resin			tc.oun:	site	Energy production	rte;:	sit.	Energy productio	>~at ;	J Miorov4Nd ~n .:	fSlw	Energy production	Raw material production	Fla mate trans
u	-8.48&0	rTr9	1.9aE3	-7.94E-3					~.dgE+4					
	-4.87E+2	mg	9 23E-3:	-9.23E-3										
	-2.43E-2	mg	•2.43Ez.	-2.43E-2										
n	-2,59E+9	mg	7 d1 E:2:	-1.41 E-2					-258E+3					
	:1.48E+0	mg	1.84E-3:	-1.94E-3					- 1.48E+0:::					
d	-2.51 E-t	mg												
	-7.37E+1	mg	1.97*.1	-1.37E+1										
	•2.241:•;	mg	2 24E1.	-2.24E-1										
ner nitrogen	**-7.32E40**	mg												
hers metals ions	-3.14E+2	ring								-7-32E+0.			-7.32E+0	
r rmiaaiona		-								:~;1(~			-3.14E+2	
sts	-4.60Et9.	mg	3 91E+1::	-2.60E+1	-1.37E+1	1 16E.r:l	-6.91 E+0	-4.66E+0	-2 98E+3	::1 08E+3	-9.81 E+0	-1.76E+1	-1.03E+3	-2.51
x	-3.21Ef4.;	mg	7 86Et2	-5.88E-2	-1.86E+2	328&1	-1.29E+1	-5.98E+1	-148E~	-198Ea:l::	-7.60E+1	-2.42E+2	-1.35E+4	-5.74
CL	-3.17E+2	mg	- 5.98E+Q		-5.98E+0	2:Q4E+O		-2.04E+0		?186&+2v $65E'r:- 6.62E+0			-2.98E+1	
Dx	-1.97E+4	mg	•7,.10£+2	-2.08E+1	-8.88E+1	11 4E+z	-8.49E+1	-2.95E+1	::544;;+3	:$¢2£+3	-6.34E+1	-1.18E+2	-8.14E+3	-3.03
20	-6.20E+2	mg	=5.82E+0	-6.30E-1	-5.19E+0	:1:64Ea.0	-2.86E+0	-1.68E+0		•3.M+2::S. ZOE+3	-7.15E+0	-6.08E+0	-2.85E+1	-1.03
	-4.81E+3	mg	.2.74E+1	-2.34E+0	-2.51E+1	:4.15E+1	-3.32E+1	-8.28E+0		-1:53£+3:- 1rI5Et3	-3.71E+0	-3.00E+1	-1.30E+3	-1.18
02	-4.39Ei6.	mg	=4.46E+4	-1.29E+4	-3.17E+4	1.x£+4	-6.09E+3	-1.03E+4	-Z.74E+6	.:8,13Et5.	-2.95E+4	-3.72E+4	-8.24E+5	-2.25
nmoniac	-3.65E+9	mg	-3.56E-2		-3.56E 2	.:4.d9E 2	-3.27E-2	-1.21E-2	-1 70E+Q	:•a.09E-1		-2.64E_1	-4.24E-1	-1.21
dehydes	.1.64E+7	mg	-1:82E-1		-1.82E 1	1.Z7`E1	-6.55E-2	-6.20E-2	-8.63E+G	-2ttE+0		-6.51E-1	-1.21E+0	-2.42
orides (gazeous)	-2.34E-2	mg	-4.46E-4		-4.46E-4	-1.62E-4		-1.52E-4	•1.46E-2	-Z.02E3		.4.94E-4	-t.53E-3	
2S	-3.13E+0	mg								-3.t3E+0			-3.13E+0	
ner organic substances	-2.84E+1	mg	-3,29E-1		-3.29E-1	-2,10E-t	-9.82E-2	-1.12E-i	-1.56E+T	-3.5d£+0		-1.04E+0	-2.18E+0	-3.63
OC : white spirit 17-18%	-d,92£+.4	mg												
OC : butyl diglycol	-5.48E+4	mg												
ner VOC	-4.20E+1	mg								-4,20E+1			-4.20E+1	
e acrylic monomers	-5.72Et2	mg						~~		-1.30£t11	-1.39E+1			
nines	-3,64E+4	mg												
lorine	-2.71E-2	mg							-2.41E-2	-2.63E3			-2.63E-3	
tal hydrocarbons	•3.93Et4	mg	-3.06E+2	-2.62E+0	-3.04E+2	.7.78Ei1	-2.75E+1	-5.03E+i	-2.55E+4	-9.84E+3	-4.22E+0	-2.96E+2	-9.44E+3	-9.91
ethan	-7.87E+3	mg	-7.47Ea1	-2.35E+0	-7.23E+1	-6.17E+0	-1.11E+0	-5.06E+0	-6.77£+9	-4.67E+2	-8.53E-1	-3.93E+i	-4.23E+2	-3.98
n methanichydrocarbons	-9.14E+4	mg	-2.9tE+2	-2.62E-1	-2.31E+2	-7.16E+1	-2.63E*1	-4.52E+1	-1.88E+4	-9.37E+3	-3.37E+0	-2.57E+2	-9.01E+3	-9.51
drogen	**-5.58E+0**	mg								-S.58£+0			-5.58E+0	
etals	-2.97E+0	mg								-2.97£+p			-2.97E+0	
tal VOC	1.35E+5	mg								:5„80£+1	-1.39E+1		-4.20E+1	
aab production	3,91E+t1	kg	3.25E 3		-3.25E 3	1.10E•3	-2.55E-6	-1.10E-3	-2.20E+0	':.673£:2 `	-3.95E-2	-3.60E-3	-2.42E-2	-9.44
xic wastes	-2.54E-2	kg							.•.3rE-4	:::Z,pg£:2:	•2.05E-2		-4.08E-4	
dustrial wastes or post-consumer wastes	.1.78E+V	kg							•2.22E-1,	.: -x.8¢£•2	-1.79E-2			
ert wastes	-3.94E-9	kg								gg4£.g.			-8.72E-3	
													-3.94E-3	
cineration 91	-3.55E-4	kg								~.20E-4	-2.86E-4	~	-3.42E-5	
cineration and recovery	-1.25E-1	kg												
cycling	-8.52E-4	kg								-8:52E4	-8.52E			
cuperation	-1.77E+0	kg							-1.77E+Q	: •7:9CiE-5			-7.93E-5	
ert minerals	-5.44E-4	kg							-5:44E-4	::-•,'•'v				
specified wastes	-2.63E-1	k	-3.25E-3		-3.25E-3	-1.10E-3	-2.55E-6	-1.10E-3	-2.03E-1	'=1.48E-2		-3.60E-3	-1.10E-2	-9.44

Life cycle inventory of paint K mat water-borne paint - microvoid resin	Paint					Application		
	Paint - :	Site	Energy production	Raw material production	Raw material transport	A **ioation**	Site	Raw material transport
materials								
olvent/coales. agent : butyl diglycol	7 15E-2:	7.15E-2						
kaolin ore								
dispersing agent: sodium polyphosphate	Z SEE 2 :	2.86E-2						
dispersing agent : surfactant nonylphenols	1 91 E-2	1.91E-2						
cellulose thickener	1.43E-2	1.43E-2						
other antifoaming agent	2.62E-2	2.62E-2						
rust preventing agent : sodium benzoate	1.43E-2	1.43E-2						
other biocides	1.19E-2	1.19E-2						
neutralizing amines	4.76E-2	4.76E-2						
nonylphenol ethoxyle sulfate								
acrylarnid								
acrylic monomers: acrylic acid								
ammonium persulphate								
alkalis								
TBHP								
sodium metabisulfite / sodium sulfate								
SPX acticide								
nopco NXZ								
rock salt								
marble or limestone								
HCI								
TiCL4								
trihydraOSd aluminium								
monoamonico phosphate								
iron (metal, ore)								
Zr02 compounds								
sodium silicate								
oil	4.49E-4	4.49E-4						
grease	5.99E-5	5.99E-5						
explosives								
ilmenite ore								
diverse compounds & catalysts								
clay								
ferromanganese								
bauxite								
ore (Cu2S, Fe2S3)								
air								
petroleum	1.09E-1		2.68E-2	6.26E-2	1.94E-2	5.79E•2		&E-2
coal	1.44E-1		1.42E-1	8.57E-4	1.19E-3	3.84E-4		3.84E-4
natural gas	2.44E-2		1.90E-2	5.14E-3	2.43E-4	2.25E-4		2.25E-4
Packaging								
cardboard	5.69E-2	5.69E-2						
paper								
polyethylene	2.15E-2	2.15E-2						
tin can	4.18E-1	4.18E-1						

Life cycle inventory of paint K mat water-borne paint - microvoid resin	Paint					Application		
	::esncsic		Energy production	Haw material production	Raw material transport	:w ication .	silo	Raw material transport
Water consumption	151E0	1.24E+0	1.34E-2	2.58E-1	4.43E-3	2:01E+Q:.	2.00E+0	1.13E-2
composition	1,241=. ,x0	1.24E+0						
Geaning						200E+0 '	2.00E+0	
cooling	2 55E-1			2.55E-1				
boiler	2.14E-3			2.14E-3				
unspecified water	1-89E-2		1.34E-2	1.08E-3	4.43E-3	1:13E•2		1.13E-2
process								
Erwryy								
electricity	2;710	2.57E+0		1.56E-2	1.19E-1	7.08E-:`		7.08E-3
thermal energy	3.558+0			2.72E+0	8.23E-1	2.498+0		2.49E+0
primary energy equivalent	1.2281 1		8.21E+0	2.778+0	1.18E+0	2:518+D		2.51E+0
Fuels								
coal	5.48E-2		5.35E-2	2.96E-4	9.72E-4			
lignite	8.67E-2		8.62E-2	4.77E-4	5.86E-5			
light fuel oil	1.03E-3		8.08E-4	2.19E-4	6.76E-6			
heavy fuel oil	3.14E-2		2.54E-2	4.20E-3	1.75E-3	4.45E-3		4.45E-3
natural gas	2.10E-2		1.86E-2	2.25E-3	2.21E-4	1.74E-4		1.74E-4
diesel oil	1.77E-2				1.77E-2	5.36E-2		5.36E-2
nuclear	2.97E+0		2.96E+0	1.10E-2				
hydraulic	4.34E-1		4.33E-1	1.61 E-3				
other fuels								
Discharge into water								
water discharge	-2.52E-1		-7.95E-3	-2.43E-1	-7.05E-4	-2.008+0	-2.00E+0	
suspended matters	-1 158+0		-1.49E-1	-8.90E-1	-1.08E-1	•3.228-1 :		-3.22E-1
COD	1.54Er1		-4.01E-1	-1.47E+1	-3.23E-1	-9:858-1:		-9.65E-1
SODS	-9.29E-1		-1.34E-1	-6.a8E-1	-1.08E-1	=3.22E=1 .		-3.22E-1
hydrocarbons	-2.42E-.1			-2.42E-1				
ammonium hydroxide	•-2.71Et0		-4.94E-1	-2.17E+0	-4.39E-2			
fluorides	-1.17E+0		-1.07E+0	-5.89E-3	-9.44E-2			
sulphates	•2.468•1		-2.25E-1	-1.24E-3	-2.00E-2			
nitrates	-2.75E-1		-2.52E-1	-1.39E-3	-2.23E-2			
chlorides	4.48E-2		-1.35E-2	-7.49E-5	-1.21E-3			
Na (ion)	-1.91E-1:		-1.75E-1	-9.67E-4	-1.55E-2			
Fe (ion)	-2.25E-3		-2.06E-3	-1.14E-5	-1.83E-4			

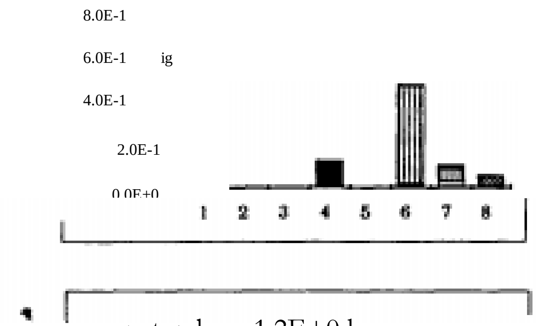
Life cycle inventory of paint K mat water-borne paint - microvoid resin	**Paint**					**Application**		
	paint	Site	Energy production	Raw material production	Raw material transport	Application	Site	Raw material transport
Cu								
Zn								
8								
Mn								
Cr								
Cd								
CI-								
F								
other nitrogen								
others metals ions								
Air emissions								
dusts	-2.54E+2		-1.71E+2	-6.60E+0	-7.63E+1	-2.26E+2		-2.26E+2
sox	-2.71 E+3		-2.20E+3	-3.48E+2	-1.64E+2	-4.21 E+2		-4.21 E+2
HCL	-7.81E+1		-7.49E+1	-4,15E-1	-8.02E-1			
NOx	ZOSE+3		-1.08E+3	-4.47E+1	-9.29E+2	-2.78Ea3		-2.78E+3
N20	-9.16E+t.		-6.15E+1	-1.41E+0	-2.87E+1	:9.38Ei1		-9.38E+1
CO	- **$.70E+2**		-3.04E+2	-4.35E+0	-3.62E+2	-1:ME+3:		-1.09E+3
C02	-4:70E45		-3.78E+5	-2.24E+4	-6.98E+4	-1.89E+5.		-1.99E+5
ammoniac	-8:82E-1		-4.45E-1	-7.74E-2	-3.59E-1	w3.64E+3	-3.64E+3	-1.07E+0
aldehydes	-3.17E+0		-2.27E+0	-1.63E-1	-7.29E-1	-2.14E*o		-2.14E+0
fluorides (gazeous)	-6.11E-3		-5.58E-3	-3.09E-5	-4.97E-4			
H2S								
other organic substances	-5.46E+0		-4.12E+0	-2.48E-1	-1.10E+0	-3.22Es0		-3.22E+0
VOC : white spirit 17-18%	-8.08E+2	-8.08E+2				-4.24E+4	-4.24E+4	
VOC : butyl diglycol	-8.08E+2	-8.08E+2				-5.40E+4:	-5.40E+4	
other VOC								
free acrylic monomers						-5.58E+2	-5.58E+2	
amines						-3.&4E+4	-3.64E+4	
chlorine								
total hydrocarbons	-2.61E+3		-1.85E+3	-4.45E+2	-3.24E+2	-9.0064		-9.00E+2
methan	-5.24E+2		-1.86E+2	-3.25E+2	-1.36E+1	-3.65E+1:		-3.65E+1
non methanic hydrocarbons	-2.09E+3		-1.66E+3	-1.206+2	-3.11 E+2	-8.63E+2.		-8.63E+2
hydrogen								
metals								
total VOC	-1.62E+3	-1.62E+3				:1:331~+5:	-1.33E+5	
Wubproduction	-1.95E-t	-1.53E-1	-4.04E-2	-3.27E-4	-6.84E-4	-1.51Et0	-1.51E+0	-8.36E-5
toxic wastes	-4.09E-3	-4.07E-3		-1.71E-5				
industrial wVtes or post-consumer wastes	-2.37E-2	-2.376-2				-1,51E+0'	-1.51 E+0	
inert wastes								
incineration	-3.53E-ti			-3.53E-5				
incineration and recovery	-1:256-1	-1.25E-1						
recycling								
recuperation	-1.03E-5			-1.03E-5				
inert minerals								
unspecified wastes	-4:136-2		-4,04E-2	-2.65E-4	-6.846-	-8.366-3		-8.36E-5

PAINT K : CONSUMPTIONS

mat water-borne paint - microvoid resin

2.47 l Functional Unit (20 mz covered with 98% opacity)

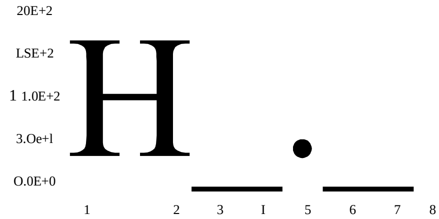
petroleum g,OE_I kg



coal 7.7E-1 kg

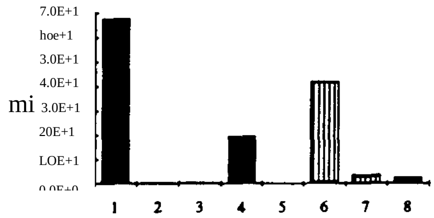
natural gas 1,2E+0 kg

Water consumption
1.7E+2 1

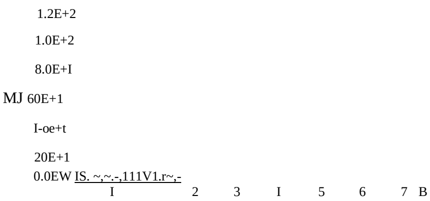


electricity 1,1E+1

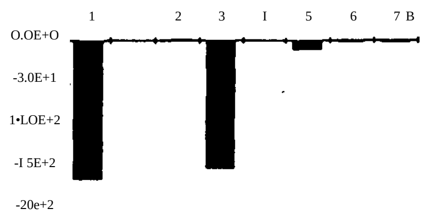
thermal energy
6.8E+1 MJ



primary energy equivalent
1.0E+2 MJ



water discharge
-1.6E+2 1



Legend

Site	1 = Total	
Energy	2 = Kaolin	6 = Acrylic & Microvoid resin
Raw materiab	3 = CaC03	7 = Paint
Transport	4 = Ti02 (total)	8 = Application

PAINT K : DISCHARGES

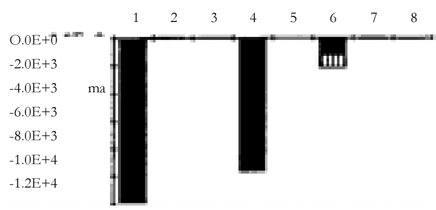
mat water-borne paint - microvoid resin

2 47 1

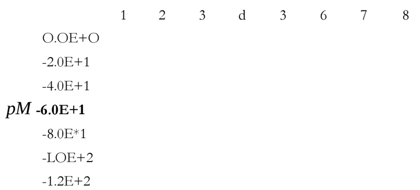
Functional Unit (20 m2 covered with 98% opacity)

suspended matters -1.1E+4 mg

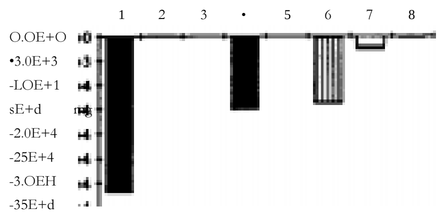
COD -1.2E+4 mg



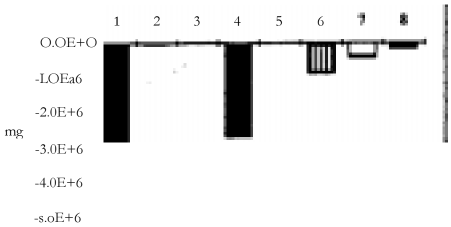
BODS -1.0E+Z mg



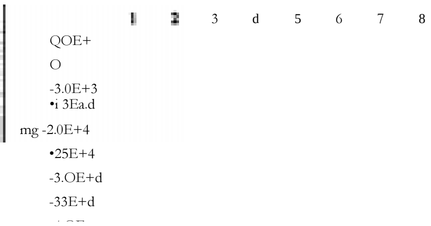
SOX -3.2E+4 mg



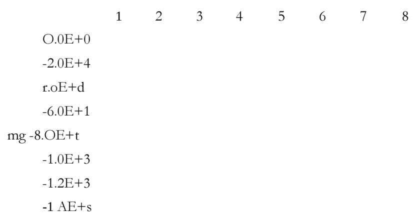
C02 -4.4E+6mg



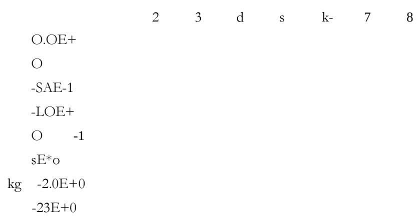
total hydrocarbons -3.9E+4 mg



total VOC -1.4E+5 mg



Waste production -4.0E+0 kg



Legend

Site	1 = Total	5=
Energy	2 = Kaolin	6 = Acrylic & Microvoid resin
Raw material	3 = CaC03	7 = Paint
Transport	4 = Ti02 (total)	8 = Application