





# NETL Life Cycle Inventory Data

## Process Documentation File

S3\_FENERGY *Fraction of refinery hydrogen attributable to kerosene*

S3\_RHO\_BBL *Density of refinery product*

### Tracked Input Flows:

None

### Tracked Output Flows:

Kerosene *Kerosene produced at the refinery*

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## Section II: Process Description

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### Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS\_CTG\_Kerosene\_Jet\_Fuel\_Refinery\_2011.02.xls*, which provides additional details regarding relevant calculations, data quality, and references.

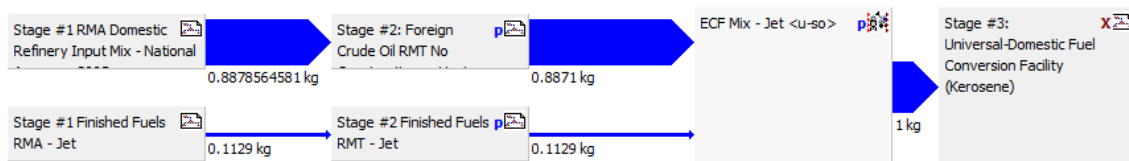
### Goal and Scope

The scope of this unit process covers all aspects of raw material acquisition (RMA), raw material transportation (RMT), and operation of the energy conversion facility (ECF) as seen in **Figure 1**. At the end, one kilogram petroleum kerosene is delivered to the life cycle (LC) Stage #4 boundary. The RMA, RMT, and ECF are discussed separately below.

**Figure 1: Plan for RMA, RMT, and ECF for Kerosene Production**

#### Jet Stages 1 - 3

GaBi 4 process plan: Mass [kg]  
The names of the basic processes are shown.



### Boundary and Description

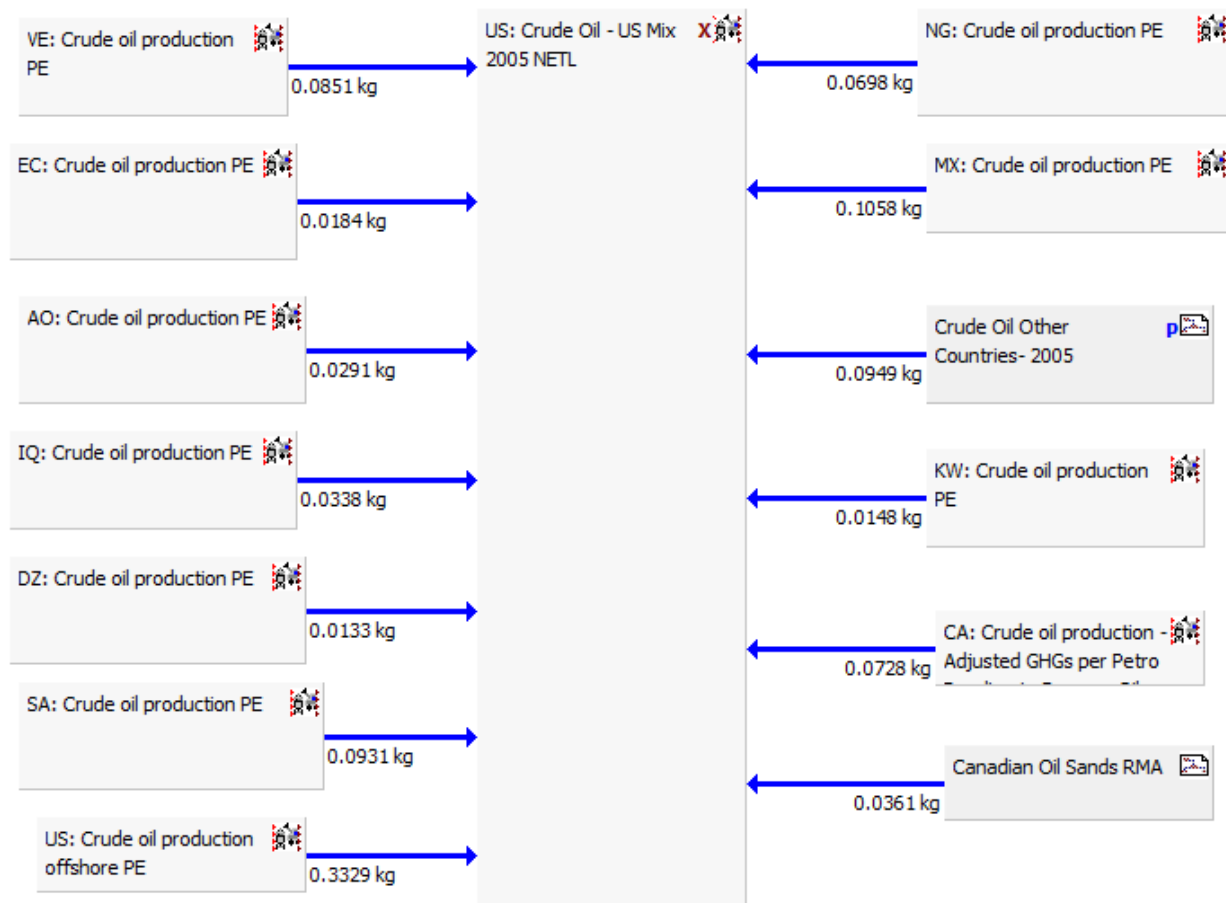
LC stage #1, RMA of petroleum-based kerosene, includes extraction of domestic crude oil from its source within the U.S., combined with oil extracted from foreign sources, along with Canadian oil sands, natural gas liquids, and unfinished oils. In addition to the life cycle model of fuels produced domestically, all three life cycle stages are also modeled for imported finished kerosene as shown in **Figure 1**. Thus, the results are representative of the average kilogram of kerosene is the U.S. at the LC Stage #4 boundary. As shown in **Figure 2**, the modeled 2005 national average crude oil RMA is composed of proprietary crude oil production processes for onshore and offshore crude

oil production, available within the GaBi database. These are combined with a crude oil production processes produced by NETL. Countries considered in the 2005 national profile include the United States, Algeria, Angola, Canada, Ecuador, Iraq, Kuwait, Mexico, Nigeria, Saudi Arabia, Venezuela, and other exporting countries. These processes also account for any initial processing of the oil. The plan for RMA of 2005 national average crude oil is provided in **Figure 2**.

**Figure 2: Plan for RMA of 2005 National Average Crude Oil**

### Conventional Crude Oil - US Mix, 2005

GaBi 4 process plan:Reference quantities  
The names of the basic processes are shown.



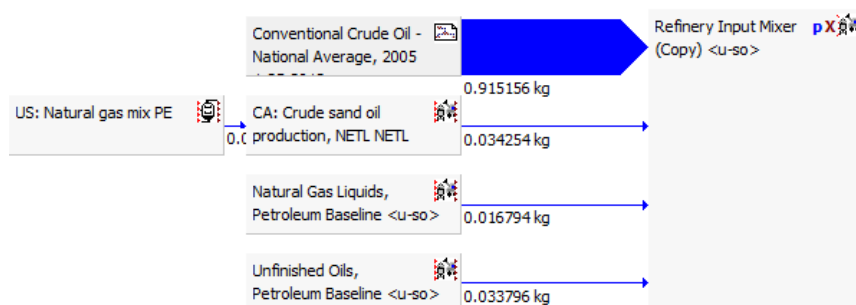
In addition to conventional crude oil and Canadian oil sands, the average U.S. refinery feed mix also consists of natural gas liquids and unfinished oils as seen in **Figure 3**. Together, conventional crude oil and Canadian oil sands makeup almost 95 percent of the average refinery feed, with the remaining 5 percent a mix of natural gas liquids and unfinished oils.

**Figure 3: Plan for RMA of 2005 National Average Refinery Feed Mix**

**Stage #1 RMA Domestic Refinery Input Mix - National Average, 2005**

GaBi 4 process plan: Mass [kg]

The names of the basic processes are shown.



No construction data are included for this RMA. The profiles and processes included in RMA are provided in **Table 1**. Those shown in bold face were developed by NETL.

**Table 1: Profiles and Processes Included in RMA for 2005 National Average Crude Oil, for Kerosene Production**

**Crude oil - Canada NETL, 2005**

**CA: Crude oil Canadian (Conventional) NETL**

**CA: Crude sand oil production, NETL NETL**

CA: Natural gas mix PE

**Crude Oil - Domestic, 2005-Updated**

**US: Crude oil - Domestic NETL, 2005 NETL**

US: Crude oil production offshore PE

US: Crude oil production onshore PE

AO: Crude oil production PE

DZ: Crude oil production PE

EC: Crude oil production PE

IQ: Crude oil production PE

KW: Crude oil production PE

MX: Crude oil production PE

NG: Crude oil production PE

SA: Crude oil production PE

US: Crude oil mix PE

**US: National Average, 2005 NETL**

**US: Natural Gas Liquids, 2005 NETL**

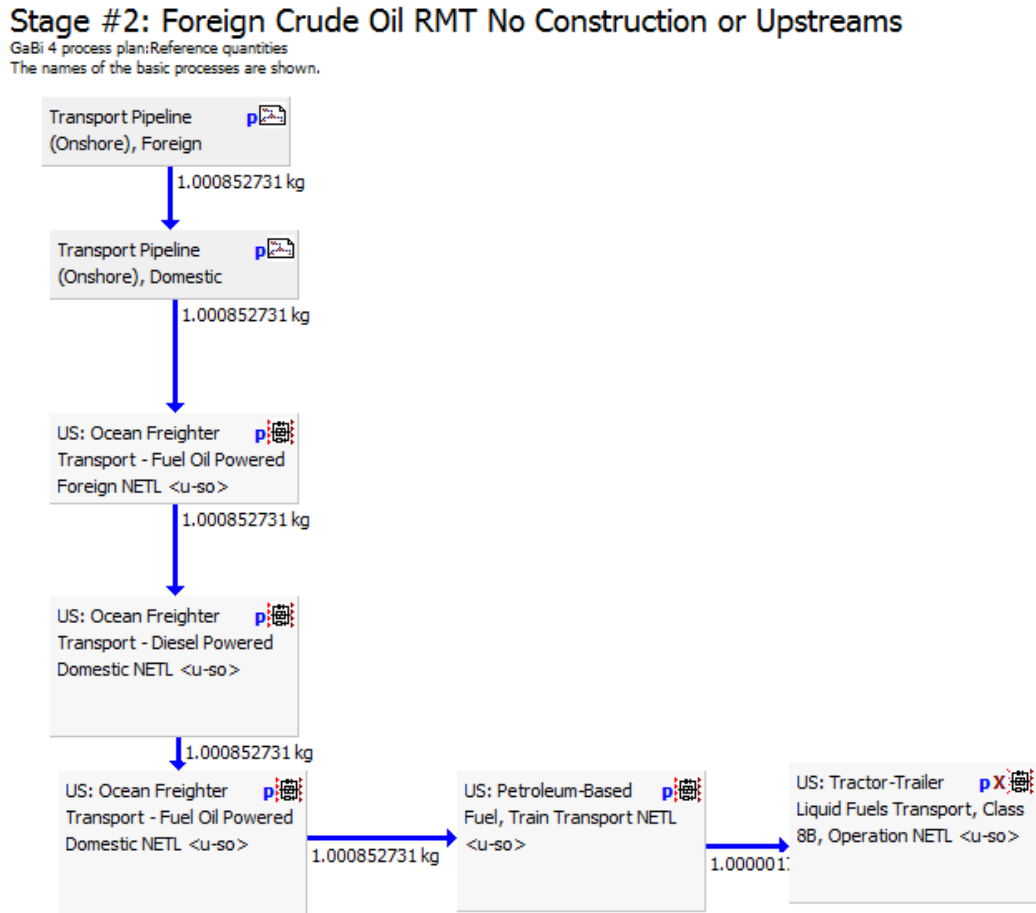
**US: Unfinished Oils, 2005 NETL**

VE: Crude oil production PE

LC Stage #2 (RMT) includes the transport of the produced crude oil from the extraction site to the ECF (LC Stage #3). The construction of equipment used to transport 2005 national average crude oil includes pipelines, water carriers (tanker ships), trains, and

semi-trucks (tanker-tractor). The transport distance can be adjusted via a series of adjustable parameters for RMT, as shown previously. The plan for RMT of 2005 national average crude oil is provided in **Figure 4**. Similar transportation modes are modeled for finished fuels imports.

**Figure 4: Plan for RMT of 2005 National Average Crude Oil for Kerosene Production, Including Construction and Operation Profiles for Transport**



Construction of the water carriers, train, and tractor-trailer for RMT includes the materials required to construct the following pieces of equipment for transport:

- Water Carrier  
(DS/ DF\_Stage2\_C\_Water\_Carrier\_300000DWT\_2011.01.doc)
- Train  
(DS/ DF\_Stage2\_C\_Tanker\_Railcar\_26470\_Gal\_Net\_Capacity\_ 2010.01.doc)
- Pipeline Transport  
(DS/ DF\_Stage2\_O\_Pipeline\_Crude\_Petroleum\_Transport\_2011.01.doc)
- Tractor-trailer  
(DS/ DF\_Stage4\_C\_Tanker\_Trailer\_7500gal\_2010.01.doc)

The profiles and processes included in RMT are provided in **Table 2**. Those shown in bold face were developed by NETL.

**Table 2: Profiles and Processes Included in RMT for 2005 National Average Crude Oil**

Fuel Tanker-Tractor Transport

Tanker Transport, Construction

DE: Lead (99,995%) PE

DE: Styrene-butadiene rubber mix (SBR) PE

RER: Aluminum sheet mix PE

RER: Nylon 6.6 granulate (PA 6.6) ELCD/PlasticsEurope <p-agg>

RER: Polyurethane flexible foam (PU) PlasticsEurope

**US: Fuels Tanker Trailer, 7,500 gallon, Construction NETL <u-so>**

**WOR: Steel Plate, BF, Manufacture NETL <u-so>**

Tanker-Tractor Transport, Operation

**US: DIESEL, NATIONAL AVERAGE, 2009 NETL <u-so>**

**US: Tractor-Trailer Liquid Fuels Transport, Class 8B, Operation NETL <u-so>**

**US: Tanker (Truck) Transport NETL**

Off-Shore Transportation (water carrier)

Water Carrier Tanker(10000-30000 DWT)Transport

Water Carrier (300,000 DWT), Construction

DE: Lead (99,995%) PE

RER: Aluminum sheet mix PE

RER: Polyurethane flexible foam (PU) PlasticsEurope

**US: Fuels Tanker Trailer, 7,500 gallon, Construction NETL <u-so>**

US: Nylon 6 granulate (PA 6) PE

US: Styrene-butadiene rubber (SBR) PE

**WOR: Steel Plate, BF, Manufacture NETL <u-so>**

GLO: Tanker PE <u-so>

US: Fuel oil heavy at refinery PE

**US: Fuel tanker/10000 to 30000 dwt/ocean transport NETL**

**US: Petroleum Water Carrier Loading/Unloading, Operation NETL <u-so>**

Off-Shore Transportation (water carrier)

Water Carrier Tanker(10000-30000 DWT) Transport

Water Carrier (300,000 DWT), Construction

DE: Lead (99,995%) PE

RER: Aluminum sheet mix PE

RER: Polyurethane flexible foam (PU) PlasticsEurope

**US: Fuels Tanker Trailer, 7,500 gallon, Construction NETL <u-so>**

US: Nylon 6 granulate (PA 6) PE

US: Styrene-butadiene rubber (SBR) PE  
WOR: Steel Plate, BF, Manufacture NETL <u-so>  
GLO: Tanker PE <u-so>  
US: Fuel oil heavy at refinery PE  
**US: Fuel tanker/10000 to 30000 dwt/ocean transport NETL**  
**US: Petroleum Water Carrier Loading/Unloading, Operation NETL <u-so>**

On-Shore Transport Pipeline  
Transport Pipeline (Onshore), Construction  
**US: Fuel Transport Pipeline, Construction NETL <u-so>**  
**WOR: Steel Pipe, Welded, BF, Manufacture NETL <u-so>**  
Transport Pipeline (Onshore), Operation  
**US: North American Average Electricity Mix, 2007 080811 NETL**  
**US: Pipeline Transport of Diesel Fuel, Operation NETL <u-so>**  
**US: OnShore Transport Pipeline NETL**

On-Shore Transport Pipeline  
Transport Pipeline (Onshore), Construction  
**US: Fuel Transport Pipeline, Construction NETL <u-so>**  
**WOR: Steel Pipe, Welded, BF, Manufacture NETL <u-so>**  
Transport Pipeline (Onshore), Operation  
**US: North American Average Electricity Mix, 2007 080811 NETL**  
**US: Pipeline Transport of Diesel Fuel, Operation NETL <u-so>**  
**US: OnShore Transport Pipeline NETL**

Railroad Transport Fuel (Crude oil)  
Fuel Train Construction  
RER: Aluminum sheet mix PE  
**US: Coal Railcar, 244000 lbs Net Capacity, Construction NETL <u-so>**  
**US: Tanker Railcar, 26,470 Gal Net Capacity, Construction NETL <u-so>**  
**US: Tanker Unit Train Assembly, 100 Railcars, Construction NETL <u-so>**  
**WOR: Steel Plate, BF, Manufacture NETL <u-so>**  
Fuel Transport Train, Operation  
**US: DIESEL, NATIONAL AVERAGE, 2009 NETL <u-so>**  
**US: Petroleum-Based Fuel, Train Transport NETL <u-so>**  
**US: Assembly: Fuel Rail Transport (Construction & Operation) NETL**

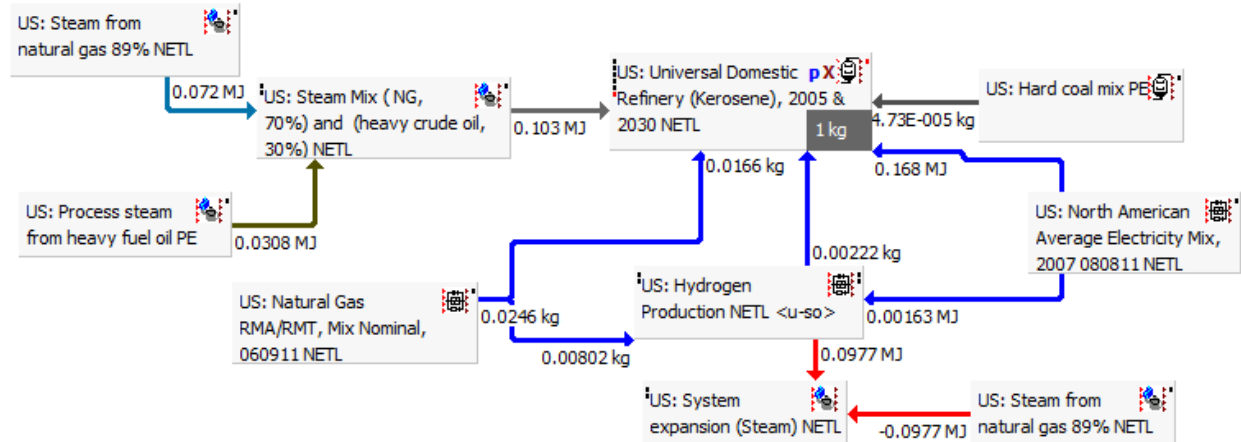
LC Stage #3 (ECF) includes the conversion of transported crude oil into kerosene. Other refinery products are also considered outside the scope of this process. Non-kerosene products are considered within this process only in that energy and processes that are not used directly in support of kerosene production are excluded from quantified kerosene related flows. Key refinery processes can be adjusted via a series of adjustable parameters for RMT, as shown previously. The plan for ECF of kerosene is provided in **Figure 5**.

Figure 5: Plan for ECF of Kerosene Fuel Production

Stage #3: Universal-Domestic Fuel Conversion Facility (Kerosene) P

ENERGY CONVERSION FACILITY OPERATIONS. INPUTS INCLUDE CRUDE OIL FROM AN UNSPECIFIED SOURCE, HYDROGEN, AND PURCHASED FUELS. OUTPUTS INCLUDE REFINERY PRODUCTS AND EMISSIONS.

NOTE: ADJUST PARAMETERS FOR EACH CASE



The profiles and processes included for the ECF are provided in **Table 3**. Those shown in bold face were developed by NETL.

**Table 3: Profiles and Processes Included for the ECF for Kerosene Fuel Production**

US: Hard coal mix PE  
**US: Hydrogen Production NETL <u-so>**  
**US: Natural Gas RMA/RMT, Mix Nominal, 060911 NETL**  
**US: North American Average Electricity Mix, 2007 080811 NETL**  
 US: Process steam from heavy fuel oil PE  
**US: Steam from natural gas 89% NETL**  
**US: Steam from natural gas 89% NETL**  
**US: Steam Mix (NG, 70%) and (heavy crude oil, 30%) NETL**  
**US: System expansion (Steam) NETL**  
**US: Universal Domestic Refinery (Kerosene), 2005&2030 NETL**

### Parameters and Balances

The parameters for the highest level modeling plan for RMA, RMT, and ECF for petroleum kerosene are shown in **Table 4**. These parameters may or may not include the adjustable parameters shown previously, depending on how the model was created. The distances for the various transportation modes are based on the travel distance for the average barrel of crude oil processed in the U.S. Not all barrels proceed via every mode of transportation listed, indicating why some distances are particularly short (e.g. truck and rail transport).



**Table 5** presents the input and output balances for resources and emissions of interest for the cradle-to-gate plan as well as each of the RMA, RMT, and ECF plans.

**Table 4: Adjustable Parameters for RMA, RMT, and ECF of Kerosene Fuel**

Plan	Parameter	Value	Comment
<b>LC Stage #1</b>			
<b>LC Stage #2</b>			
2005 National Average Crude Oil RMT	S2_F_TRAIN_DIS	1.2	[miles] User Defined parameter, default value is 200 miles one way.
2005 National Average Crude Oil RMT	S2_TRK_TANK_DIS	2.7	[miles] adjustable parameter for distance from Origin to Destination.
2005 National Average Crude Oil RMT	S2_WATDOMDISZ	331	[miles] Transportation via water carrier from U.S.A. ports to U.S.A. port (Domestic).
2005 National Average Crude Oil RMT	S2_WATFOREDISZ	4309	[miles] Transportation via water carrier from foreign port to U.S.A. port (Foreign).
2005 National Average Crude Oil RMT	S2D_PIPE_LENGTH	328.3	[mile] User Defined Value
2005 National Average Crude Oil RMT	S2F_PIPE_LENGTH	66.3	[mile] User Defined Value.
<b>LC Stage #3</b>			
Kerosene ECF	S3_FENERGY	0.061	[dimensionless] Fraction of refinery energy attributable to a chosen refinery product (kerosene jet fuel)
Kerosene ECF	S3_FH2	0.090	[dimensionless] Fraction of refinery hydrogen attributable to a chosen refinery product (kerosene jet fuel)
Kerosene ECF	S3_RHO_BBL	128.368	[kg/bbl] density of refinery product (based on specific gravity of input crude)

**Table 5: Inputs and Output Balances for Cradle-to-Gate, RMA, RMT, and ECF for Kerosene Fuel (kg/kg delivered)**

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
<b>Inputs</b>				
Flows	3.962E+00	1.550E+00	4.963E-01	2.029E+00
Resources	3.962E+00	1.550E+00	4.963E-01	2.029E+00
Energy resources	1.078E+00	1.020E+00	2.365E-02	3.473E-02
Non renewable energy resources	1.078E+00	1.020E+00	2.365E-02	3.473E-02
Crude oil (resource)	9.718E-01	9.559E-01	1.462E-02	1.295E-03
Crude oil Algeria	2.081E-02	2.054E-02	2.593E-04	7.642E-06
Crude oil Angola	3.610E-02	3.593E-02	1.455E-04	2.530E-05
Crude oil Argentina	6.674E-05	4.207E-05	1.933E-05	5.335E-06
Crude oil Australia	1.190E-03	7.164E-04	4.692E-04	4.815E-06
Crude oil Austria	1.331E-05	1.063E-05	2.369E-06	3.163E-07
Crude oil Bolivia	1.511E-10	1.205E-10	2.570E-11	4.915E-12
Crude oil Brazil	1.731E-03	1.042E-03	6.841E-04	4.838E-06
Crude oil Brunei	4.924E-10	1.189E-10	4.878E-11	3.248E-10

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Crude oil Bulgaria	7.943E-11	2.730E-11	3.117E-11	2.097E-11
Crude oil Cameroon	1.795E-04	1.201E-04	5.726E-05	2.116E-06
Crude oil Canada	1.060E-01	1.058E-01	2.836E-05	1.043E-04
Crude oil Chile	5.535E-09	5.386E-09	6.456E-11	8.423E-11
Crude oil China	6.793E-04	4.188E-04	2.591E-04	1.351E-06
Crude oil CIS	7.117E-03	4.708E-03	2.355E-03	5.316E-05
Crude oil Colombia	9.306E-05	6.241E-05	1.327E-05	1.739E-05
Crude oil Czech Republic	1.857E-06	1.289E-06	5.474E-07	2.121E-08
Crude oil Denmark	1.349E-03	8.933E-04	4.453E-04	9.992E-06
Crude oil Ecuador	2.362E-02	2.361E-02	3.373E-06	7.740E-06
Crude oil Egypt	1.496E-04	1.006E-04	4.775E-05	1.296E-06
Crude oil France	7.233E-05	5.038E-05	2.147E-05	4.765E-07
Crude oil Gabon	8.397E-05	5.705E-05	1.447E-05	1.245E-05
Crude oil Germany	1.392E-04	9.552E-05	4.197E-05	1.754E-06
Crude oil Greece	2.545E-06	2.054E-06	4.284E-07	6.304E-08
Crude oil Hungary	2.833E-06	1.694E-06	1.139E-06	2.573E-10
Crude oil India	3.955E-11	4.624E-12	1.498E-11	1.995E-11
Crude oil Indonesia	5.648E-04	3.507E-04	2.101E-04	3.979E-06
Crude oil Iran	2.247E-03	1.481E-03	7.568E-04	9.112E-06
Crude oil Iraq	3.902E-02	3.857E-02	4.187E-04	3.932E-05
Crude oil Ireland	4.700E-11	4.250E-11	2.573E-12	1.934E-12
Crude oil Italy	2.184E-04	1.480E-04	6.837E-05	2.033E-06
Crude oil Japan	8.259E-11	5.573E-11	2.686E-11	0.000E+00
Crude oil Kuwait	2.573E-02	2.546E-02	2.565E-04	1.725E-05
Crude oil Libya	1.511E-03	1.022E-03	4.742E-04	1.452E-05
Crude oil Malaysia	2.901E-10	9.084E-11	3.952E-11	1.597E-10
Crude oil Mexico	1.014E-01	1.011E-01	2.361E-04	1.084E-04
Crude oil Netherlands	2.119E-04	1.441E-04	6.651E-05	1.293E-06
Crude oil New Zealand	7.885E-05	4.717E-05	3.159E-05	9.783E-08
Crude oil Nigeria	6.983E-02	6.921E-02	5.765E-04	4.815E-05
Crude oil Norway	7.992E-03	5.522E-03	2.404E-03	6.528E-05
Crude oil Oman	2.496E-04	1.684E-04	7.995E-05	1.201E-06
Crude oil Poland	8.676E-06	5.853E-06	2.742E-06	8.110E-08
Crude oil Qatar	5.309E-04	3.457E-04	1.845E-04	6.790E-07
Crude oil Romania	5.287E-06	4.228E-06	9.324E-07	1.265E-07
Crude oil Saudi Arabia	1.205E-01	1.188E-01	1.515E-03	1.245E-04
Crude oil Slovakia	1.885E-07	1.127E-07	7.587E-08	1.450E-12

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Crude oil South Africa	6.261E-11	5.848E-11	1.607E-12	2.521E-12
Crude oil Spain	4.367E-06	3.498E-06	7.643E-07	1.050E-07
Crude oil Syria	4.310E-10	1.423E-10	1.689E-10	1.198E-10
Crude oil Trinidad and Tobago	2.008E-05	1.372E-05	1.617E-06	4.744E-06
Crude oil Tunisia	7.699E-05	5.176E-05	2.464E-05	5.899E-07
Crude oil Turkey	9.578E-15	5.452E-15	3.684E-15	4.418E-16
Crude oil United Arab Emirates	1.073E-03	7.127E-04	3.594E-04	8.284E-07
Crude oil United Kingdom	5.960E-03	4.157E-03	1.720E-03	8.363E-05
Crude oil USA	2.824E-01	2.819E-01	1.070E-04	4.018E-04
Crude oil Venezuela	1.129E-01	1.125E-01	2.549E-04	1.067E-04
Hard coal (resource)	1.626E-02	1.746E-03	6.596E-03	7.919E-03
Hard coal Australia	1.161E-04	7.863E-05	2.626E-05	1.125E-05
Hard coal Belgium	3.334E-08	1.300E-08	1.070E-08	9.644E-09
Hard coal Bosnia and Herzegovina	6.437E-09	2.112E-09	2.547E-09	1.778E-09
Hard coal Brazil	3.335E-07	2.619E-07	5.286E-08	1.880E-08
Hard coal Canada	5.908E-04	5.280E-04	1.715E-05	4.563E-05
Hard coal Chile	5.772E-07	5.616E-07	6.821E-09	8.807E-09
Hard coal China	6.004E-05	3.855E-05	2.012E-05	1.375E-06
Hard coal CIS	3.360E-05	2.273E-05	8.721E-06	2.147E-06
Hard coal Colombia	2.238E-04	8.525E-05	6.242E-05	7.611E-05
Hard coal Czech Republic	5.411E-06	4.683E-06	2.561E-07	4.721E-07
Hard coal France	1.013E-06	4.820E-07	3.396E-07	1.919E-07
Hard coal Germany	1.148E-04	9.949E-05	5.045E-06	1.025E-05
Hard coal India	1.927E-09	2.922E-17	9.620E-10	9.645E-10
Hard coal Indonesia	3.832E-05	8.275E-06	1.462E-05	1.542E-05
Hard coal Italy	1.965E-08	1.157E-08	7.865E-09	2.162E-10
Hard coal Japan	1.197E-11	6.739E-12	2.251E-12	2.982E-12
Hard coal Malaysia	1.014E-11	3.177E-12	1.380E-12	5.587E-12
Hard coal Mexico	1.156E-05	1.127E-05	2.023E-07	8.735E-08
Hard coal New Zealand	4.976E-07	4.746E-07	1.579E-08	7.209E-09
Hard coal Poland	4.034E-05	3.240E-05	4.187E-06	3.754E-06
Hard coal Portugal	7.472E-10	7.172E-10	1.947E-11	1.046E-11
Hard coal South Africa	7.937E-05	5.917E-05	1.143E-05	8.770E-06
Hard coal Spain	7.017E-06	5.664E-06	1.112E-06	2.414E-07
Hard coal Turkey	4.240E-11	2.405E-11	1.617E-11	2.180E-12
Hard coal United Kingdom	1.642E-05	9.277E-06	4.776E-06	2.371E-06
Hard coal USA	1.485E-02	7.370E-04	6.396E-03	7.713E-03

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Hard coal Venezuela	7.305E-05	2.347E-05	2.221E-05	2.737E-05
Hard coal Vietnam	8.120E-07	6.304E-07	1.261E-07	5.560E-08
Lignite (resource)	1.453E-03	8.449E-04	2.327E-04	3.750E-04
Lignite Australia	7.447E-05	5.085E-05	2.141E-05	2.215E-06
Lignite Austria	7.560E-07	6.959E-07	1.933E-08	4.080E-08
Lignite Bosnia and Herzegovina	1.482E-08	4.830E-09	5.884E-09	4.107E-09
Lignite Bulgaria	6.426E-08	3.723E-08	2.463E-08	2.398E-09
Lignite Canada	1.252E-04	1.155E-04	8.760E-07	8.810E-06
Lignite CIS	9.916E-06	6.197E-06	3.674E-06	4.386E-08
Lignite Czech Republic	3.529E-06	2.937E-06	3.487E-07	2.423E-07
Lignite France	2.448E-07	1.076E-07	8.601E-08	5.117E-08
Lignite Germany (Central Germany)	4.854E-04	4.453E-04	8.128E-06	3.198E-05
Lignite Germany (Lausitz)	7.736E-05	6.096E-05	7.205E-06	9.194E-06
Lignite Germany (Rheinisch)	1.415E-04	1.099E-04	1.382E-05	1.780E-05
Lignite Greece	2.158E-06	1.596E-06	4.866E-07	7.574E-08
Lignite Hungary	1.813E-07	9.943E-08	6.972E-08	1.219E-08
Lignite India	3.854E-10	5.844E-18	1.925E-10	1.930E-10
Lignite Macedonia	3.478E-08	1.576E-08	1.351E-08	5.508E-09
Lignite Poland	1.999E-06	1.429E-06	4.281E-07	1.422E-07
Lignite Romania	1.343E-08	7.393E-09	5.417E-09	6.198E-10
Lignite Serbia and Montenegro	1.140E-07	3.723E-08	4.481E-08	3.197E-08
Lignite Slovakia	3.117E-08	1.693E-08	1.234E-08	1.900E-09
Lignite Slovenia	4.420E-07	2.558E-07	1.757E-07	1.047E-08
Lignite Spain	1.476E-05	1.191E-05	2.342E-06	5.087E-07
Lignite Turkey	1.187E-12	6.757E-13	4.565E-13	5.475E-14
Lignite USA	5.143E-04	3.704E-05	1.735E-04	3.038E-04
Natural gas (resource)	8.892E-02	6.157E-02	2.204E-03	2.514E-02
Natural gas Algeria	1.686E-03	1.618E-03	3.376E-05	3.455E-05
Natural gas Angola	4.418E-03	4.397E-03	1.785E-05	3.224E-06
Natural gas Argentina	7.086E-06	5.607E-06	9.140E-07	5.653E-07
Natural gas Australia	8.325E-05	5.085E-05	3.186E-05	5.460E-07
Natural gas Austria	1.099E-06	9.706E-07	8.661E-08	4.161E-08
Natural gas Bolivia	3.034E-07	2.420E-07	5.151E-08	9.878E-09
Natural gas Brazil	9.822E-05	5.962E-05	3.803E-05	5.742E-07
Natural gas Brunei	4.349E-06	1.089E-06	4.505E-07	2.810E-06
Natural gas Bulgaria	1.542E-11	7.706E-12	5.954E-12	1.758E-12
Natural gas Cameroon	4.434E-05	2.970E-05	1.412E-05	5.272E-07

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Natural gas Canada	1.301E-02	8.546E-03	2.469E-04	4.216E-03
Natural gas Chile	1.317E-06	1.281E-06	1.536E-08	2.004E-08
Natural gas China	3.584E-05	2.211E-05	1.357E-05	1.537E-07
Natural gas CIS	4.177E-04	2.924E-04	1.142E-04	1.110E-05
Natural gas Colombia	8.751E-06	5.947E-06	9.096E-07	1.895E-06
Natural gas Czech Republic	8.228E-08	6.239E-08	1.828E-08	1.609E-09
Natural gas Denmark	5.058E-05	3.662E-05	1.290E-05	1.053E-06
Natural gas Ecuador	1.439E-03	1.438E-03	3.130E-07	8.622E-07
Natural gas Egypt	8.503E-06	6.192E-06	2.180E-06	1.309E-07
Natural gas France	3.061E-06	2.220E-06	7.464E-07	9.454E-08
Natural gas Gabon	1.227E-05	8.337E-06	2.090E-06	1.839E-06
Natural gas Germany	5.864E-05	4.935E-05	3.714E-06	5.571E-06
Natural gas Greece	1.327E-07	1.144E-07	1.399E-08	4.235E-09
Natural gas Hungary	9.730E-08	5.798E-08	3.867E-08	6.445E-10
Natural gas India	1.490E-10	4.621E-13	7.392E-11	7.461E-11
Natural gas Indonesia	3.748E-05	2.338E-05	1.389E-05	2.086E-07
Natural gas Iran	1.442E-04	9.847E-05	4.471E-05	1.041E-06
Natural gas Iraq	1.578E-03	1.556E-03	1.761E-05	3.963E-06
Natural gas Ireland	1.048E-07	9.476E-08	5.743E-09	4.319E-09
Natural gas Italy	1.076E-05	8.088E-06	2.415E-06	2.579E-07
Natural gas Japan	2.851E-07	1.924E-07	9.273E-08	9.517E-13
Natural gas Kuwait	9.286E-04	9.173E-04	9.578E-06	1.665E-06
Natural gas Libyan	7.940E-05	5.075E-05	2.825E-05	3.965E-07
Natural gas Malaysia	4.815E-06	1.410E-06	6.088E-07	2.796E-06
Natural gas Mexico	5.633E-03	5.604E-03	1.530E-05	1.436E-05
Natural gas Netherlands	7.560E-05	6.030E-05	6.687E-06	8.621E-06
Natural gas New Zealand	5.269E-06	3.152E-06	2.111E-06	6.478E-09
Natural gas Nigeria	1.237E-02	1.224E-02	1.046E-04	2.093E-05
Natural gas Norway	1.740E-04	1.276E-04	3.959E-05	6.789E-06
Natural gas Oman	1.614E-05	9.166E-06	4.055E-06	2.919E-06
Natural gas Poland	3.192E-07	2.311E-07	8.240E-08	5.710E-09
Natural gas Qatar	7.410E-05	2.187E-05	9.986E-06	4.224E-05
Natural gas Romania	2.659E-07	2.271E-07	3.065E-08	8.113E-09
Natural gas Saudi Arabia	4.018E-03	3.952E-03	5.450E-05	1.166E-05
Natural gas Slovakia	5.520E-09	3.305E-09	2.199E-09	1.529E-11
Natural gas South Africa	5.078E-09	1.610E-09	1.552E-09	1.916E-09
Natural gas Spain	4.269E-07	3.624E-07	5.006E-08	1.444E-08

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Natural gas Syria	4.631E-11	1.529E-11	1.815E-11	1.287E-11
Natural gas Trinidad and Tobago	2.251E-04	3.229E-05	1.080E-05	1.820E-04
Natural gas Tunisia	6.295E-06	4.454E-06	1.764E-06	7.724E-08
Natural gas Turkey	9.686E-16	5.514E-16	3.726E-16	4.468E-17
Natural gas United Arab Emirates	4.106E-05	2.733E-05	1.364E-05	9.341E-08
Natural gas United Kingdom	2.238E-04	1.663E-04	4.862E-05	8.840E-06
Natural gas USA	3.702E-02	1.530E-02	1.202E-03	2.051E-02
Natural gas Venezuela	4.801E-03	4.778E-03	1.273E-05	1.028E-05
Pit Methane	6.339E-05	8.178E-06	2.516E-05	3.005E-05
Uranium (resource)	3.938E-07	2.961E-08	1.672E-07	1.970E-07
Uranium natural	3.938E-07	2.961E-08	1.672E-07	1.970E-07
Renewable energy resources	1.144E-06	9.110E-07	9.047E-08	1.421E-07
Primary energy from geothermics	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Primary energy from hydro power	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Primary energy from solar energy	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Primary energy from wind power	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Wood	1.144E-06	9.110E-07	9.047E-08	1.421E-07
Land use	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Occupation	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Biotic Production	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Erosion Resistance	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Groundwater Replenishment	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Mechanical Filtration	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Physicochemical Filtration	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Transformation	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Biotic Production	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Erosion Resistance	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Groundwater Replenishment	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Mechanical Filtration	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Physicochemical Filtration	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Material resources	2.883E+00	5.297E-01	3.597E-01	1.994E+00
Non renewable elements	2.144E-11	1.719E-11	1.398E-12	2.854E-12
Iron	4.917E-13	3.872E-13	3.329E-14	7.123E-14
Lead	1.768E-17	6.033E-18	1.172E-18	1.048E-17
Sulphur	2.095E-11	1.680E-11	1.365E-12	2.783E-12
Non renewable resources	2.847E-01	1.940E-01	3.705E-02	5.368E-02
Barium sulphate	1.813E-15	6.184E-16	1.202E-16	1.074E-15

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Basalt	3.462E-05	3.191E-05	6.228E-07	2.090E-06
Bauxite	4.911E-06	4.489E-06	9.104E-08	3.302E-07
Bentonite	3.662E-03	3.434E-03	2.604E-05	2.015E-04
Calcium chloride	1.856E-13	6.331E-14	1.230E-14	1.100E-13
Chromium ore (39%)	8.919E-08	2.929E-08	2.639E-08	3.351E-08
Clay	2.548E-04	2.380E-04	4.728E-06	1.202E-05
Colemanite ore	7.781E-09	1.344E-09	3.008E-09	3.430E-09
Copper - Gold - Silver - ore (1,0% Cu; 0,4 g/t Au; 66 g/t Ag)	2.075E-07	0.000E+00	1.036E-07	1.039E-07
Copper - Gold - Silver - ore (1,1% Cu; 0,01 g/t Au; 2,86 g/t Ag)	1.264E-07	0.000E+00	6.313E-08	6.329E-08
Copper - Gold - Silver - ore (1,16% Cu; 0,002 g/t Au; 1,06 g/t Ag)	7.136E-08	0.000E+00	3.563E-08	3.573E-08
Copper - Molybdenum - Gold - Silver - ore (1,13% Cu; 0,02% Mo; 0,01 g/t Au; 2,86 g/t Ag)	1.739E-07	0.000E+00	8.681E-08	8.704E-08
Copper ore (0.14%)	1.958E-06	5.809E-07	6.107E-07	7.667E-07
Copper ore (1.2%)	2.152E-08	0.000E+00	1.075E-08	1.077E-08
Copper ore (4%)	1.341E-15	1.245E-15	1.685E-17	7.966E-17
Copper ore (sulphidic, 1.1%)	1.592E-12	1.477E-12	1.999E-14	9.452E-14
Dolomite	5.333E-09	3.941E-09	2.589E-10	1.133E-09
Ferro manganese	8.842E-18	3.016E-18	5.861E-19	5.240E-18
Fluorspar (calcium fluoride; fluorite)	6.583E-09	5.463E-09	3.921E-10	7.284E-10
Gypsum (natural gypsum)	1.321E-04	1.229E-04	1.413E-06	7.769E-06
Heavy spar (BaSO4)	8.857E-03	8.306E-03	6.293E-05	4.874E-04
Inert rock	2.602E-01	1.718E-01	3.649E-02	5.193E-02
Iron ore (56,86%)	2.693E-03	2.520E-03	2.205E-05	1.515E-04
Iron ore (65%)	1.120E-07	9.800E-08	3.249E-09	1.075E-08
Kaolin ore	1.304E-08	1.551E-09	5.389E-09	6.103E-09
Lead - zinc ore (4.6%-0.6%)	7.139E-04	6.696E-04	5.061E-06	3.919E-05
Limestone (calcium carbonate)	6.883E-03	5.909E-03	3.042E-04	6.696E-04
Magnesit (Magnesium carbonate)	2.606E-09	2.423E-09	2.938E-11	1.531E-10
Magnesium chloride leach (40%)	5.793E-05	5.193E-05	1.068E-06	4.932E-06
Manganese ore	1.766E-08	5.621E-09	5.358E-09	6.678E-09
Manganese ore (R.O.M.)	2.798E-05	2.625E-05	1.999E-07	1.523E-06
Molybdenite (Mo 0,24%)	1.069E-07	2.431E-10	5.305E-08	5.356E-08
Natural Aggregate	5.381E-04	3.114E-04	1.024E-04	1.243E-04
Nickel ore (1,5%)	2.170E-11	3.870E-12	8.328E-12	9.504E-12
Nickel ore (1.6%)	9.869E-05	9.257E-05	7.273E-07	5.397E-06

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Olivine	9.727E-17	3.318E-17	6.447E-18	5.764E-17
Peat	1.299E-05	9.378E-06	3.349E-06	2.607E-07
Phosphate ore	5.078E-09	4.806E-09	2.134E-10	5.907E-11
Phosphorus minerals	2.480E-09	2.288E-09	3.914E-11	1.526E-10
Potassium chloride	1.196E-09	1.113E-09	1.398E-11	6.922E-11
Precious metal ore (R.O.M)	6.761E-09	1.721E-09	2.347E-09	2.693E-09
Quartz sand (silica sand; silicon dioxide)	1.214E-04	1.146E-04	4.203E-06	2.652E-06
Raw pumice	1.267E-09	1.506E-10	5.234E-10	5.928E-10
Slate	1.636E-16	5.581E-17	1.084E-17	9.693E-17
Sodium chloride (rock salt)	2.082E-06	1.769E-06	8.267E-08	2.306E-07
Sodium sulphate	5.360E-12	4.098E-12	5.001E-13	7.614E-13
Soil	2.220E-04	1.722E-04	2.075E-05	2.905E-05
Sulphur (bonded)	1.026E-11	8.174E-12	6.940E-13	1.391E-12
Talc	1.290E-09	1.023E-09	1.019E-10	1.650E-10
Tin ore	1.572E-16	5.363E-17	1.042E-17	9.316E-17
Titanium ore	9.171E-06	8.525E-06	1.008E-07	5.452E-07
Zinc - copper ore (4.07%-2.59%)	1.189E-04	1.113E-04	9.218E-07	6.727E-06
Zinc - lead - copper ore (12%-3%-2%)	4.949E-05	4.635E-05	3.882E-07	2.753E-06
Zinc - lead ore (4.21%-4.96%)	4.581E-16	4.251E-16	5.755E-18	2.720E-17
Zinc ore (sulphidic, 4%)	2.452E-15	2.188E-15	1.007E-16	1.630E-16
Renewable resources	2.599E+00	3.357E-01	3.227E-01	1.940E+00
Water	2.225E+00	2.282E-01	2.036E-01	1.793E+00
Water	1.541E+00	0.000E+00	4.915E-05	1.541E+00
Water (ground water)	9.015E-02	7.232E-02	7.674E-03	1.015E-02
Water (river water)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water (sea water)	1.109E-02	1.054E-02	6.198E-04	0.000E+00
Water (surface water)	5.825E-01	1.453E-01	1.953E-01	2.419E-01
Air	3.735E-01	1.074E-01	1.191E-01	1.471E-01
Carbon dioxide	3.245E-04	1.369E-04	3.602E-05	1.515E-04
Nitrogen	4.283E-11	4.042E-11	6.241E-13	1.788E-12
Oxygen	4.414E-07	3.521E-14	2.199E-07	2.215E-07
Crude Oil Virgin Islands	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels Average Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels Average Crude Oil to RMT - Jet	0.000E+00	0.000E+00	1.129E-01	0.000E+00
Finished Fuels Canadian Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels South Korean Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00



Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Finished Fuels Virgin Islands Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Output</b>				
Flows	1.364E+00	4.986E-01	4.751E-01	6.165E-01
Resources	4.532E-01	2.323E-01	2.654E-01	1.814E-01
Energy resources	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Non renewable energy resources	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Crude oil (resource)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Crude oil Ecuador	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Crude oil Iraq	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Material resources	4.532E-01	1.194E-01	1.525E-01	1.814E-01
Renewable resources	4.532E-01	1.194E-01	1.525E-01	1.814E-01
Water	4.532E-01	1.194E-01	1.525E-01	1.814E-01
Water (ground water)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water (river water)	4.527E-01	1.189E-01	1.525E-01	1.813E-01
Water (sea water)	0.000E+00	0.000E+00	1.505E-05	5.478E-05
Water (wastewater)	4.971E-04	4.971E-04	0.000E+00	0.000E+00
Crude Oil Virgin Islands	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels Average Crude Oil	0.000E+00	0.000E+00	1.129E-01	0.000E+00
Finished Fuels Average Crude Oil to RMT - Jet	0.000E+00	1.129E-01	0.000E+00	0.000E+00
Finished Fuels Canadian Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels South Korean Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Finished Fuels Virgin Islands Crude Oil	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Emissions to air	8.764E-01	2.418E-01	2.087E-01	4.259E-01
Heavy metals to air	1.739E-07	1.132E-07	2.407E-08	3.665E-08
Antimony	5.781E-10	1.267E-10	2.228E-10	2.286E-10
Arsenic (+V)	5.950E-09	8.657E-10	2.243E-09	2.841E-09
Arsenic trioxide	4.914E-13	4.607E-13	3.509E-15	2.713E-14
Cadmium (+II)	4.385E-10	1.617E-10	1.249E-10	1.518E-10
Chromium (+III)	1.027E-10	9.556E-11	1.098E-12	6.041E-12
Chromium (unspecified)	1.013E-09	4.976E-10	2.270E-10	2.887E-10
Cobalt	6.076E-10	3.133E-10	1.281E-10	1.662E-10
Copper (+II)	2.209E-09	1.598E-09	2.586E-10	3.527E-10
Heavy metals to air (unspecified)	6.892E-12	4.118E-12	1.213E-12	1.561E-12
Hydrogen arsenic (arsine)	4.079E-11	3.824E-11	2.912E-13	2.252E-12
Iron	1.296E-09	1.024E-09	7.441E-11	1.979E-10
Lanthanides	1.547E-13	1.268E-13	9.945E-15	1.792E-14
Lead (+II)	1.159E-08	7.556E-09	1.206E-09	2.826E-09

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Manganese (+II)	4.178E-09	2.856E-09	5.559E-10	7.665E-10
Mercury (+II)	8.846E-10	2.696E-10	2.179E-10	3.971E-10
Molybdenum	8.612E-11	6.875E-11	4.230E-12	1.315E-11
Nickel (+II)	1.619E-08	1.349E-08	1.008E-09	1.697E-09
Palladium	5.137E-18	1.752E-18	3.405E-19	3.044E-18
Rhodium	4.959E-18	1.692E-18	3.287E-19	2.938E-18
Selenium	1.315E-08	9.970E-10	5.579E-09	6.576E-09
Silver	1.318E-18	3.351E-19	4.575E-19	5.250E-19
Tellurium	1.369E-11	1.274E-11	1.465E-13	8.055E-13
Thallium	1.007E-10	9.375E-11	1.039E-12	5.906E-12
Tin (+IV)	4.969E-09	3.888E-10	2.096E-09	2.485E-09
Titanium	9.563E-12	7.422E-12	8.045E-13	1.337E-12
Vanadium (+III)	9.874E-08	7.752E-08	7.194E-09	1.403E-08
Zinc (+II)	1.179E-08	5.250E-09	2.927E-09	3.614E-09
Inorganic emissions to air	6.146E-01	1.998E-01	1.099E-01	3.049E-01
Ammonia	5.352E-06	2.039E-06	1.054E-06	2.260E-06
Ammonium	1.830E-13	2.773E-14	7.292E-14	8.233E-14
Ammonium nitrate	6.013E-14	4.794E-14	4.074E-15	8.120E-15
Barium	5.586E-06	5.231E-06	4.328E-08	3.111E-07
Beryllium	1.129E-10	4.658E-11	2.818E-11	3.819E-11
Boron compounds (unspecified)	9.221E-08	7.800E-09	3.841E-08	4.600E-08
Bromine	3.967E-08	3.483E-09	1.661E-08	1.957E-08
Carbon dioxide	4.781E-01	1.860E-01	5.364E-02	2.385E-01
Carbon dioxide (biotic)	1.253E-05	1.223E-05	3.032E-07	0.000E+00
Carbon dioxide (biotic)	7.786E-05	6.656E-06	1.908E-05	5.212E-05
Carbon disulphide	7.339E-13	4.842E-13	1.299E-13	1.198E-13
Carbon monoxide	5.237E-04	4.023E-04	2.509E-05	9.628E-05
Chloride (unspecified)	1.533E-08	1.352E-08	5.559E-10	1.258E-09
Chlorine	2.556E-12	2.125E-12	1.147E-13	3.160E-13
Cyanide (unspecified)	5.039E-10	3.913E-10	2.808E-11	8.455E-11
Fluoride	1.083E-08	9.752E-10	4.470E-09	5.380E-09
Fluorides	5.921E-09	5.925E-09	0.000E+00	-3.877E-12
Fluorine	5.101E-12	4.077E-12	3.661E-13	6.581E-13
Helium	1.985E-09	1.790E-09	5.626E-11	1.386E-10
Hydrogen	5.069E-07	4.770E-07	1.163E-08	1.821E-08
Hydrogen bromine (hydrobromic acid)	1.137E-10	9.731E-11	2.021E-12	1.439E-11
Hydrogen chloride	6.263E-07	2.730E-07	1.529E-07	2.005E-07

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Hydrogen cyanide (prussic acid)	4.363E-11	3.861E-11	1.145E-12	3.883E-12
Hydrogen fluoride	1.043E-07	4.405E-08	2.706E-08	3.317E-08
Hydrogen iodide	1.684E-14	5.759E-15	1.667E-15	9.412E-15
Hydrogen phosphorous	2.820E-14	1.878E-14	3.988E-15	5.428E-15
Hydrogen sulphide	4.774E-06	4.416E-06	1.223E-07	2.356E-07
Lead dioxide	1.376E-14	3.500E-15	4.777E-15	5.482E-15
Nitrogen (atmospheric nitrogen)	6.693E-05	5.208E-05	5.194E-06	9.659E-06
Nitrogen dioxide	1.266E-04	4.904E-16	5.396E-15	1.266E-04
Nitrogen monoxide	1.774E-11	1.642E-11	2.698E-13	1.047E-12
Nitrogen oxides	7.456E-04	5.705E-04	1.067E-04	6.839E-05
Nitrous oxide (laughing gas)	9.768E-06	5.003E-06	1.083E-06	3.682E-06
Oxygen	2.234E-04	9.820E-05	1.811E-05	1.071E-04
Scandium	7.558E-14	6.388E-14	3.938E-15	7.762E-15
Steam	1.326E-01	1.177E-02	5.523E-02	6.558E-02
Strontium	2.931E-12	2.432E-12	1.753E-13	3.238E-13
Sulphur dioxide	1.355E-03	9.012E-04	1.346E-04	3.195E-04
Sulphur hexafluoride	9.492E-13	2.430E-13	3.264E-13	3.798E-13
sulphur oxide	7.462E-04	0.000E+00	7.462E-04	0.000E+00
Sulphuric acid	2.627E-09	2.460E-09	1.993E-11	1.468E-10
Tin oxide	1.197E-15	3.044E-16	4.157E-16	4.770E-16
Zinc oxide	2.394E-15	6.090E-16	8.314E-16	9.540E-16
Zinc sulphate	1.028E-09	9.636E-10	7.312E-12	5.659E-11
Organic emissions to air (group VOC)	5.572E-03	4.377E-03	7.987E-04	3.964E-04
Group NMVOC to air	1.639E-03	7.676E-04	7.676E-04	1.034E-04
Group PAH to air	3.078E-08	2.803E-08	6.594E-10	2.087E-09
Anthracene	1.450E-10	1.380E-10	1.310E-12	5.644E-12
Benzo(a)anthracene	7.294E-11	6.944E-11	6.590E-13	2.840E-12
Benzo(a)pyrene	3.624E-11	3.013E-11	2.286E-12	3.820E-12
Benzo(ghi)perylene	6.507E-11	6.195E-11	5.879E-13	2.533E-12
Benzo(a)fluoranthene	1.301E-10	1.239E-10	1.176E-12	5.067E-12
Chrysene	1.792E-10	1.706E-10	1.619E-12	6.976E-12
Dibenz(a)anthracene	4.055E-11	3.860E-11	3.664E-13	1.579E-12
Indeno[1,2,3-cd]pyrene	4.842E-11	4.609E-11	4.375E-13	1.885E-12
Naphthalene	1.522E-08	1.449E-08	1.375E-10	5.927E-10
Phenanthrene	4.783E-09	4.553E-09	4.320E-11	1.862E-10
Polycyclic aromatic hydrocarbons (PAH)	1.005E-08	8.304E-09	4.702E-10	1.278E-09

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Halogenated organic emissions to air	9.422E-09	2.338E-09	3.279E-09	3.805E-09
Dichloromethane (methylene chloride)	7.177E-17	2.448E-17	4.757E-18	4.253E-17
Dioxins (unspec.)	4.018E-15	3.772E-15	2.806E-17	2.182E-16
Halogenated hydrocarbons (unspecified)	3.551E-17	1.217E-17	2.356E-18	2.099E-17
Polychlorinated biphenyls (PCB unspecified)	8.962E-11	8.405E-11	6.390E-13	4.935E-12
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	5.755E-15	3.187E-15	1.088E-15	1.480E-15
R 11 (trichlorofluoromethane)	2.870E-09	1.976E-10	1.227E-09	1.446E-09
R 114 (dichlorotetrafluoroethane)	2.939E-09	2.023E-10	1.257E-09	1.480E-09
R 12 (dichlorodifluoromethane)	6.171E-10	4.247E-11	2.638E-10	3.108E-10
R 13 (chlorotrifluoromethane)	3.875E-10	2.667E-11	1.656E-10	1.951E-10
R 22 (chlorodifluoromethane)	6.745E-10	4.643E-11	2.883E-10	3.397E-10
Tetrafluoromethane	5.897E-11	5.138E-11	2.243E-12	5.351E-12
Vinyl chloride (VCM; chloroethene)	1.785E-09	1.687E-09	7.434E-11	2.293E-11
Acetaldehyde (Ethanal)	3.011E-08	2.262E-08	2.518E-09	4.972E-09
Acetic acid	4.279E-08	1.244E-08	9.195E-09	2.116E-08
Acetone (dimethylcetone)	2.752E-08	2.020E-08	2.394E-09	4.923E-09
Acrolein	1.023E-09	9.739E-10	9.242E-12	3.983E-11
Aldehyde (unspecified)	1.073E-09	3.595E-10	1.957E-10	5.176E-10
Alkane (unspecified)	2.383E-07	2.239E-08	9.356E-08	1.224E-07
Alkene (unspecified)	2.040E-07	1.202E-08	8.738E-08	1.046E-07
Aromatic hydrocarbons (unspecified)	3.609E-09	1.090E-09	6.500E-10	1.869E-09
Benzene	1.419E-07	1.197E-07	9.061E-09	1.316E-08
Butadiene	1.735E-13	2.063E-14	7.168E-14	8.118E-14
Butane	7.665E-05	7.420E-05	1.029E-06	1.425E-06
Butane (n-butane)	6.861E-08	1.258E-08	2.851E-08	2.752E-08
Cyclohexane (hexahydro benzene)	1.682E-11	1.110E-11	2.977E-12	2.746E-12
Diethylamine	4.575E-18	6.933E-19	1.823E-18	2.058E-18
Ethane	2.053E-04	1.972E-04	2.833E-06	5.265E-06
Ethanol	1.997E-08	5.600E-09	4.051E-09	1.032E-08
Ethene (ethylene)	5.865E-09	5.535E-09	2.480E-10	8.140E-11
Ethyl benzene	2.056E-07	1.470E-08	8.720E-08	1.037E-07
Fluoranthene	4.721E-10	4.495E-10	4.266E-12	1.838E-11
Fluorene	1.498E-09	1.426E-09	1.354E-11	5.833E-11
Formaldehyde (methanal)	1.384E-07	3.162E-08	4.752E-08	5.928E-08
Heptane (isomers)	2.660E-06	2.624E-06	3.382E-08	2.806E-09

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Hexamethylene diamine (HMDA)	1.021E-14	1.214E-15	4.217E-15	4.775E-15
Hexane (isomers)	3.947E-06	3.892E-06	5.049E-08	4.545E-09
Mercaptan (unspecified)	2.370E-08	2.242E-08	9.851E-10	3.017E-10
Methanol	1.812E-08	5.467E-09	3.254E-09	9.398E-09
NMVOC (unspecified)	9.328E-04	8.447E-05	7.576E-04	9.080E-05
Octane	1.463E-06	1.443E-06	1.860E-08	1.543E-09
Pentane (n-pentane)	2.595E-05	2.479E-05	4.385E-07	7.275E-07
Phenol (hydroxy benzene)	6.264E-13	2.083E-13	5.881E-14	3.592E-13
Propane	3.876E-04	3.785E-04	4.872E-06	4.149E-06
Propene (propylene)	1.838E-08	1.043E-09	7.914E-09	9.424E-09
Propionic acid (propane acid)	8.984E-12	1.739E-12	4.726E-13	6.772E-12
Styrene	1.863E-14	1.229E-14	3.296E-15	3.041E-15
Toluene (methyl benzene)	1.328E-07	4.400E-08	4.009E-08	4.866E-08
Trimethylbenzene	1.166E-14	2.966E-15	4.049E-15	4.647E-15
Xylene (dimethyl benzene)	8.747E-07	7.573E-08	3.645E-07	4.345E-07
Methane	3.877E-03	3.555E-03	2.883E-05	2.930E-04
Organic chlorine compounds	3.012E-14	2.399E-14	2.041E-15	4.088E-15
VOC (unspecified)	5.631E-05	5.402E-05	2.218E-06	7.369E-08
Other emissions to air	2.561E-01	3.754E-02	9.794E-02	1.206E-01
Exhaust	2.553E-01	3.692E-02	9.786E-02	1.205E-01
non used primary energy from wind power	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Particulate Matter, unspecified	2.967E-05	9.106E-06	0.000E+00	2.056E-05
Unused primary energy from solar energy	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Used air	8.034E-04	6.089E-04	7.440E-05	1.202E-04
Waste heat	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Particles to air	7.702E-05	2.037E-05	5.119E-05	5.463E-06
Dust (PM10)	4.947E-06	4.369E-06	2.194E-07	3.585E-07
Dust (PM2,5 - PM10)	4.722E-05	0.000E+00	4.722E-05	0.000E+00
Dust (PM2.5)	1.276E-05	9.622E-06	1.315E-06	1.819E-06
Dust (unspecified)	1.210E-05	6.381E-06	2.435E-06	3.285E-06
Metals (unspecified)	1.467E-13	1.010E-13	1.272E-14	3.300E-14
Wood (dust)	4.419E-13	1.124E-13	1.534E-13	1.761E-13
Radioactive emissions to air	3.384E-09	2.547E-10	1.437E-09	1.693E-09
Antimony (Sb124)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Argon (Ar41)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Carbon (C14)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cesium (Cs134)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Cesium (Cs137)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cobalt (Co58)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cobalt (Co60)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Hydrogen (H3)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Iodine (I129)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Iodine (I131)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Krypton (Kr85)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Krypton (Kr85m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Plutonium (Pu alpha)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Radon (Rn222)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Uranium (total)	3.384E-09	2.547E-10	1.437E-09	1.693E-09
Uranium (U234)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Uranium (U235)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Uranium (U238)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe131m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe133)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe133m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe135)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe135m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe137)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Xenon (Xe138)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Emissions to fresh water	1.495E-02	5.551E-03	2.726E-04	9.125E-03
Analytical measures to fresh water	6.467E-05	4.068E-05	8.430E-06	1.556E-05
Adsorbable organic halogen compounds (AOX)	2.338E-07	2.237E-07	7.692E-09	2.433E-09
Biological oxygen demand (BOD)	3.396E-06	2.783E-06	6.612E-08	5.470E-07
Chemical oxygen demand (COD)	5.684E-05	3.457E-05	8.073E-06	1.419E-05
Solids (dissolved)	4.935E-07	3.688E-08	2.096E-07	2.470E-07
Total dissolved organic bounded carbon	5.795E-13	1.317E-14	2.826E-13	2.837E-13
Total organic bounded carbon	3.715E-06	3.070E-06	7.293E-08	5.724E-07
Heavy metals to fresh water	2.180E-03	3.316E-06	4.844E-06	2.172E-03
Antimony	4.359E-06	5.783E-16	7.897E-16	4.359E-06
Arsenic (+V)	1.401E-05	7.538E-08	2.830E-09	1.393E-05
Cadmium (+II)	1.411E-06	6.605E-08	2.086E-09	1.343E-06
Chromium (+III)	7.774E-10	7.157E-11	3.241E-10	3.817E-10
Chromium (+VI)	5.670E-17	5.262E-17	6.972E-19	3.383E-18
Chromium (unspecified)	2.422E-05	1.138E-07	3.665E-09	2.411E-05

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Cobalt	5.237E-11	4.734E-11	2.005E-12	3.021E-12
Copper (+II)	2.046E-05	2.530E-07	6.678E-09	2.020E-05
Heavy metals to water (unspecified)	7.767E-11	4.446E-11	1.376E-11	1.945E-11
Iron	1.041E-03	2.442E-06	4.747E-06	1.034E-03
Lead (+II)	4.721E-05	5.528E-08	4.508E-09	4.715E-05
Manganese (+II)	4.535E-08	4.781E-09	1.852E-08	2.205E-08
Mercury (+II)	2.377E-07	1.021E-09	6.069E-11	2.367E-07
Molybdenum	8.450E-09	6.790E-10	3.558E-09	4.213E-09
Nickel (+II)	3.738E-04	7.826E-08	3.076E-09	3.737E-04
Selenium	1.514E-09	1.814E-10	6.093E-10	7.231E-10
Silver	4.251E-06	1.839E-11	5.018E-12	4.251E-06
Strontium	2.955E-07	1.885E-07	4.692E-08	6.000E-08
Thallium	1.723E-11	1.615E-11	1.230E-13	9.512E-13
Tin (+IV)	3.111E-11	1.921E-11	2.227E-12	9.667E-12
Titanium	1.089E-09	2.686E-10	3.716E-10	4.487E-10
Vanadium (+III)	2.766E-09	3.710E-10	1.085E-09	1.310E-09
Zinc (+II)	6.488E-04	3.565E-08	2.392E-09	6.487E-04
Inorganic emissions to fresh water	1.001E-02	3.302E-03	2.050E-04	6.501E-03
Acid (calculated as H+)	2.077E-09	1.335E-09	3.896E-10	3.522E-10
Aluminum (+III)	4.918E-04	2.140E-08	1.157E-07	4.917E-04
Ammonia	5.325E-03	3.958E-09	2.427E-10	5.325E-03
Ammonium / ammonia	1.238E-06	9.976E-07	1.192E-07	1.208E-07
Barium	6.346E-07	6.164E-07	1.692E-08	1.260E-09
Beryllium	1.014E-11	7.571E-13	4.305E-12	5.073E-12
Boron	9.589E-08	4.890E-09	4.084E-08	5.016E-08
Bromine	7.538E-11	7.220E-11	2.452E-12	7.320E-13
Calcium (+II)	1.503E-05	8.820E-07	6.358E-06	7.793E-06
Carbonate	3.989E-05	3.877E-05	1.050E-06	6.288E-08
Chloride	3.420E-03	3.168E-03	1.501E-04	1.012E-04
Chlorine (dissolved)	4.015E-07	6.409E-08	1.540E-07	1.834E-07
Cyanide	3.956E-05	7.640E-11	2.848E-12	3.956E-05
Fluoride	4.291E-05	1.768E-06	1.854E-05	2.261E-05
Fluorine	5.383E-09	5.027E-09	4.786E-11	3.083E-10
Hydrogen chloride	1.035E-10	9.624E-11	1.134E-12	6.115E-12
Hydrogen fluoride (hydrofluoric acid)	7.448E-11	7.040E-11	3.045E-12	1.030E-12
Hydroxide	2.862E-09	2.641E-09	4.396E-11	1.772E-10
Magnesium (+III)	3.532E-06	6.279E-07	1.268E-06	1.636E-06

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Magnesium chloride	1.397E-12	4.767E-13	9.263E-14	8.281E-13
Neutral salts	2.183E-17	0.000E+00	1.090E-17	1.093E-17
Nitrate	1.567E-06	1.190E-07	6.537E-07	7.942E-07
Nitrogen	1.815E-09	1.689E-09	1.967E-11	1.059E-10
Nitrogen organic bounded	1.071E-07	9.229E-08	4.263E-09	1.052E-08
Phosphate	1.232E-08	8.330E-09	1.591E-09	2.399E-09
Phosphorus	4.699E-04	1.083E-07	3.423E-09	4.697E-04
Potassium	3.293E-08	3.081E-08	1.386E-09	7.285E-10
Silicate particles	2.236E-11	2.097E-11	1.667E-13	1.225E-12
Sodium (+)	7.508E-05	5.732E-05	3.776E-06	1.398E-05
Sodium chloride (rock salt)	4.165E-12	0.000E+00	2.080E-12	2.085E-12
Sodium hypochlorite	9.393E-13	6.157E-13	1.284E-13	1.952E-13
Sulphate	7.522E-05	2.538E-05	2.256E-05	2.727E-05
Sulphide	7.287E-06	7.085E-06	1.910E-07	1.058E-08
Sulphite	2.857E-08	1.170E-09	1.235E-08	1.505E-08
Sulphur	8.748E-10	5.446E-10	5.986E-11	2.704E-10
Sulphuric acid	1.334E-08	1.241E-08	1.462E-10	7.883E-10
Organic emissions to fresh water	1.331E-05	1.249E-05	1.558E-07	6.634E-07
Halogenated organic emissions to fresh water	7.617E-11	6.778E-11	2.089E-12	6.303E-12
1,2-Dibromoethane	3.952E-15	2.608E-15	6.992E-16	6.451E-16
Chlorinated hydrocarbons (unspecified)	4.274E-17	2.960E-17	3.672E-18	9.465E-18
Chloromethane (methyl chloride)	7.616E-11	6.777E-11	2.085E-12	6.299E-12
Dichloropropane	8.191E-18	9.740E-19	3.385E-18	3.833E-18
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	1.720E-22	5.868E-23	1.140E-23	1.019E-22
Vinyl chloride (VCM; chloroethene)	6.241E-15	0.000E+00	3.117E-15	3.125E-15
Hydrocarbons to fresh water	2.142E-06	2.007E-06	7.771E-08	5.730E-08
Acenaphthene	1.040E-10	1.010E-10	2.813E-12	2.171E-13
Acenaphthylene	4.465E-11	4.336E-11	1.199E-12	8.556E-14
Acetic acid	1.143E-08	7.884E-09	3.416E-09	1.266E-10
Acrylonitrile	5.991E-13	7.124E-14	2.475E-13	2.803E-13
Anthracene	1.930E-10	1.878E-10	4.978E-12	2.409E-13
Aromatic hydrocarbons (unspecified)	3.409E-08	2.792E-08	6.731E-10	5.499E-09
Benzene	2.381E-07	2.316E-07	6.191E-09	3.825E-10
Benzo(a)anthracene	1.201E-11	1.163E-11	3.410E-13	3.506E-14
Benzofluoranthene	1.648E-12	1.541E-12	8.022E-14	2.762E-14
Chrysene	4.435E-11	4.284E-11	1.327E-12	1.748E-13



Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Cresol (methyl phenol)	2.266E-11	1.411E-11	1.550E-12	7.003E-12
Ethyl benzene	1.302E-08	1.266E-08	3.410E-10	2.101E-11
Fluoranthene	1.365E-11	1.321E-11	3.919E-13	5.062E-14
Hexane (isomers)	2.475E-12	1.540E-12	1.696E-13	7.649E-13
Hydrocarbons (unspecified)	3.648E-09	7.945E-10	1.281E-09	1.572E-09
Methanol	6.498E-08	1.984E-08	1.946E-08	2.567E-08
Oil (unspecified)	1.330E-06	1.275E-06	3.339E-08	2.156E-08
Phenol (hydroxy benzene)	2.419E-07	2.352E-07	6.342E-09	3.707E-10
Polycyclic aromatic hydrocarbons (PAH, unspec.)	4.200E-09	1.355E-09	1.316E-09	1.529E-09
Toluene (methyl benzene)	1.450E-07	1.409E-07	3.753E-09	2.654E-10
Xylene (isomers; dimethyl benzene)	5.509E-08	5.327E-08	1.533E-09	2.822E-10
Carbon, organically bound	1.116E-05	1.048E-05	7.794E-08	6.061E-07
Naphthalene	7.471E-09	7.266E-09	1.937E-10	1.138E-11
Organic chlorine compounds (unspecified)	3.039E-14	2.408E-14	2.059E-15	4.247E-15
Organic compounds (dissolved)	3.469E-14	0.000E+00	1.732E-14	1.737E-14
Organic compounds (unspecified)	2.757E-24	2.570E-24	2.865E-26	1.583E-25
Other emissions to fresh water	0.000E+00	0.000E+00	0.000E+00	0.000E+00
non used primary energy from water power	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Unused primary energy from geothermal	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Waste heat	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Particles to fresh water	2.682E-03	2.192E-03	5.421E-05	4.356E-04
Metals (unspecified)	2.171E-12	1.928E-12	5.437E-14	1.885E-13
Soil loss by erosion into water	1.369E-09	1.296E-09	5.755E-11	1.593E-11
Solids (suspended)	2.682E-03	2.192E-03	5.421E-05	4.356E-04
Radioactive emissions to fresh water	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Americium (Am241)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Antimony (Sb124)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Antimony (Sb125)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Carbon (C14)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cesium (Cs134)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cesium (Cs137)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cobalt (Co58)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cobalt (Co60)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Curium (Cm alpha)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Hydrogen (H3)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Iodine (I129)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Iodine (I131)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Manganese (Mn54)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Plutonium (Pu alpha)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Radium (Ra226)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ruthenium (Ru106)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Silver (Ag110m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Strontium (Sr90)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Uranium	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Emissions to sea water	1.971E-02	1.895E-02	6.650E-04	8.694E-05
Analytical measures to sea water	1.065E-04	1.048E-04	7.968E-07	9.134E-07
Adsorbable organic halogen compounds (AOX)	7.133E-12	7.053E-12	1.332E-14	6.735E-14
Biological oxygen demand (BOD)	7.869E-06	7.780E-06	1.469E-08	7.429E-08
Chemical oxygen demand (COD)	9.081E-05	8.927E-05	7.674E-07	7.648E-07
Total organic bounded carbon	7.869E-06	7.780E-06	1.469E-08	7.429E-08
Heavy metals to sea water	2.443E-05	2.430E-05	1.161E-07	1.960E-08
Arsenic (+V)	1.735E-07	1.670E-07	6.221E-09	2.839E-10
Cadmium (+II)	8.342E-08	7.941E-08	2.839E-09	1.170E-09
Chromium (unspecified)	2.682E-07	2.570E-07	9.844E-09	1.275E-09
Cobalt	1.601E-08	1.369E-08	2.229E-09	8.659E-11
Copper (+II)	6.827E-07	6.687E-07	9.679E-09	4.360E-09
Iron	1.326E-06	1.297E-06	2.744E-08	1.318E-09
Lead (+II)	1.942E-07	1.913E-07	1.947E-09	9.715E-10
Manganese (+II)	1.316E-07	1.286E-07	2.871E-09	1.363E-10
Mercury (+II)	2.713E-09	2.661E-09	2.962E-11	2.281E-11
Molybdenum	8.780E-09	8.778E-09	4.520E-13	1.975E-12
Nickel (+II)	2.128E-07	2.072E-07	4.443E-09	1.183E-09
Silver	2.605E-08	2.604E-08	1.341E-12	5.861E-12
Strontium	2.099E-05	2.098E-05	2.257E-09	6.241E-09
Tin (+IV)	3.120E-08	3.119E-08	1.606E-12	7.020E-12
Titanium	3.178E-09	3.177E-09	1.636E-13	7.151E-13
Vanadium (+III)	1.495E-08	1.336E-08	1.529E-09	6.027E-11
Zinc (+II)	2.656E-07	2.184E-07	4.472E-08	2.473E-09
Inorganic emissions to sea water	1.330E-02	1.262E-02	6.520E-04	2.687E-05
Aluminum (+III)	1.023E-07	1.023E-07	5.267E-12	2.302E-11
Ammonia	3.040E-06	3.040E-06	1.565E-10	6.841E-10
Barium	2.510E-06	2.377E-06	1.285E-07	4.538E-09

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Beryllium	4.295E-10	2.973E-10	1.273E-10	4.839E-12
Boron	1.654E-06	1.654E-06	8.517E-11	3.722E-10
Calcium (+II)	1.807E-04	1.806E-04	9.302E-09	4.065E-08
Carbonate	1.579E-04	1.495E-04	8.083E-06	2.855E-07
Chloride	1.266E-02	1.200E-02	6.386E-04	2.485E-05
Magnesium	4.498E-05	4.496E-05	4.810E-09	2.278E-08
Nitrate	2.046E-07	1.938E-07	1.048E-08	3.701E-10
Sodium (+I)	1.571E-04	1.554E-04	2.934E-07	1.484E-06
Sulphate	6.671E-05	6.318E-05	3.405E-06	1.223E-07
Sulphide	2.874E-05	2.722E-05	1.472E-06	5.196E-08
Sulphur	8.853E-07	8.850E-07	4.557E-11	1.992E-10
Organic emissions to sea water	8.159E-06	7.736E-06	4.056E-07	1.683E-08
Hydrocarbons to sea water	8.116E-06	7.698E-06	4.012E-07	1.670E-08
Acenaphthene	9.588E-10	8.223E-10	1.324E-10	4.028E-12
Acenaphthylene	3.758E-10	3.235E-10	5.071E-11	1.526E-12
Acetic acid	1.179E-09	8.015E-10	3.706E-10	7.109E-12
Anthracene	5.895E-10	5.445E-10	4.343E-11	1.516E-12
Aromatic hydrocarbons (unspecified)	7.869E-08	7.780E-08	1.469E-10	7.429E-10
Benzene	9.544E-07	9.185E-07	3.474E-08	1.157E-09
Benzo(a)anthracene	1.920E-10	1.620E-10	2.909E-11	8.631E-13
Benzo(a)fluoranthene	1.892E-10	1.565E-10	3.169E-11	9.393E-13
Chrysene	1.037E-09	8.687E-10	1.631E-10	4.832E-12
Cresol (methyl phenol)	2.293E-08	2.292E-08	1.180E-12	5.159E-12
Ethyl benzene	4.273E-08	3.974E-08	2.888E-09	1.021E-10
Fluoranthene	2.228E-10	1.879E-10	3.391E-11	1.087E-12
Hexane (isomers)	2.503E-09	2.503E-09	1.289E-13	5.633E-13
Oil (unspecified)	5.460E-06	5.178E-06	2.706E-07	1.157E-08
Phenol (hydroxy benzene)	7.222E-07	6.629E-07	5.740E-08	1.897E-09
Toluene (methyl benzene)	6.604E-07	6.396E-07	2.012E-08	6.822E-10
Xylene (isomers; dimethyl benzene)	1.672E-07	1.522E-07	1.447E-08	5.202E-10
Naphthalene	4.253E-08	3.799E-08	4.402E-09	1.356E-10
Particles to sea water	6.262E-03	6.191E-03	1.169E-05	5.913E-05
Solids (suspended)	6.262E-03	6.191E-03	1.169E-05	5.913E-05
Emissions to industrial soil	4.433E-05	4.187E-05	1.755E-06	7.034E-07
Heavy metals to industrial soil	1.145E-05	1.082E-05	4.340E-07	1.990E-07
Arsenic (+V)	1.293E-11	1.221E-11	5.303E-13	1.874E-13
Cadmium (+II)	1.280E-10	1.208E-10	4.875E-12	2.348E-12

Process or Category	Cradle to Gate	Cradle to Gate (RMA)	Gate to Gate (RMT)	Gate to Gate (ECF)
Chromium (+III)	9.674E-13	8.970E-13	1.230E-14	5.808E-14
Chromium (unspecified)	3.136E-08	2.965E-08	1.317E-09	3.962E-10
Cobalt	5.594E-10	5.292E-10	2.336E-11	6.915E-12
Copper (+II)	3.073E-10	2.908E-10	1.337E-11	3.147E-12
Iron	4.468E-08	4.226E-08	1.914E-09	4.999E-10
Lead (+II)	9.444E-12	8.906E-12	3.663E-13	1.716E-13
Manganese (+II)	6.566E-09	6.188E-09	2.839E-10	9.339E-11
Mercury (+II)	6.138E-13	5.807E-13	2.650E-14	6.579E-15
Nickel (+II)	8.865E-09	8.313E-09	4.128E-10	1.391E-10
Strontium	1.136E-05	1.073E-05	4.298E-07	1.978E-07
Zinc (+II)	3.374E-09	3.189E-09	1.469E-10	3.843E-11
Inorganic emissions to industrial soil	3.286E-05	3.105E-05	1.319E-06	4.961E-07
Aluminum (+III)	3.421E-08	3.233E-08	1.486E-09	3.896E-10
Ammonia	1.765E-05	1.667E-05	6.800E-07	2.919E-07
Bromide	4.794E-09	4.535E-09	2.002E-10	5.926E-11
Calcium (+II)	1.426E-08	3.706E-09	4.917E-09	5.639E-09
Chloride	5.594E-06	5.291E-06	2.339E-07	6.946E-08
Fluoride	1.598E-07	1.512E-07	6.675E-09	1.975E-09
Magnesium (+III)	2.028E-09	5.666E-10	6.816E-10	7.802E-10
Phosphorus	1.847E-06	1.745E-06	6.991E-08	3.217E-08
Potassium (+I)	3.851E-06	3.642E-06	1.697E-07	3.936E-08
Sodium (+I)	1.238E-09	3.150E-10	4.297E-10	4.931E-10
Sulphate	5.294E-07	5.001E-07	2.162E-08	7.693E-09
Sulphide	3.177E-06	3.001E-06	1.297E-07	4.616E-08
Organic emissions to industrial soil	1.760E-08	7.916E-09	1.396E-09	8.285E-09
Oil (unspecified)	1.760E-08	7.916E-09	1.396E-09	8.285E-09

### Embedded Unit Processes

NETL (2010). *NETL Life Cycle Inventory Data – Unit Process: Fuels Tanker Trailer, 7500 gallons, Construction*. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: February 2010 (version 01). [www.netl.doe.gov/energy-analyses](http://www.netl.doe.gov/energy-analyses) (<http://www.netl.doe.gov/energy-analyses>)

NETL (2011). *NETL Life Cycle Inventory Data – Process Documentation File: Pipeline Transport of Crude Petroleum, Operation*. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: September, 2011 (version 01). [www.netl.doe.gov/energy-analyses](http://www.netl.doe.gov/energy-analyses) (<http://www.netl.doe.gov/energy-analyses>)

NETL (2010). *NETL Life Cycle Inventory Data – Unit Process: Tanker Railcar, 26,470 Gal Net Capacity, Construction*. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: February 2010 (version 01). [www.netl.doe.gov/energy-analyses](http://www.netl.doe.gov/energy-analyses) (<http://www.netl.doe.gov/energy-analyses>)

NETL (2010). *NETL Life Cycle Inventory Data – Unit Process: Water Carrier, 300000 DWT, Construction*. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: September 2011 (version 01). [www.netl.doe.gov/energy-analyses](http://www.netl.doe.gov/energy-analyses) (<http://www.netl.doe.gov/energy-analyses>)

## References

None.

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## Section III: Document Control Information

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## Section IV: Disclaimer

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