



# NETL Life Cycle Inventory Data

## Process Documentation File

**Process Name:** Ocean Freighter, Transport  
**Reference Flow:** 1 kg of cargo  
**Brief Description:** This process includes all inputs for the raw material transportation for 1 kg of cargo.

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### Section I: Meta Data

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**Geographical Coverage:** US **Region:** N/A  
**Year Data Best Represents:** 2006  
**Process Type:** Transport Process (TP)  
**Process Scope:** Gate-to-Gate Process (GG)  
**Allocation Applied:** No  
**Completeness:** Individual Relevant Flows Captured

#### Flows Aggregated in Data Set:

Process  Energy Use  Energy P&D  Material P&D

#### Relevant Output Flows Included in Data Set:

Releases to Air:  Greenhouse Gases  Criteria Air Pollutants  Other  
Releases to Water:  Inorganic Emissions  Organic Emissions  Other  
Water Usage:  Water Consumption  Water Demand (throughput)  
Releases to Soil:  Inorganic Releases  Organic Releases  Other

#### Adjustable Process Parameters:

Distance *The distance the cargo travels*

#### Tracked Input Flows:

Cargo *The cargo that the ocean freighter will carry*

#### Tracked Output Flows:

Cargo *Cargo delivered*



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## Section II: Process Description

### Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS\_RMT\_Ocean\_Freighter\_2011.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

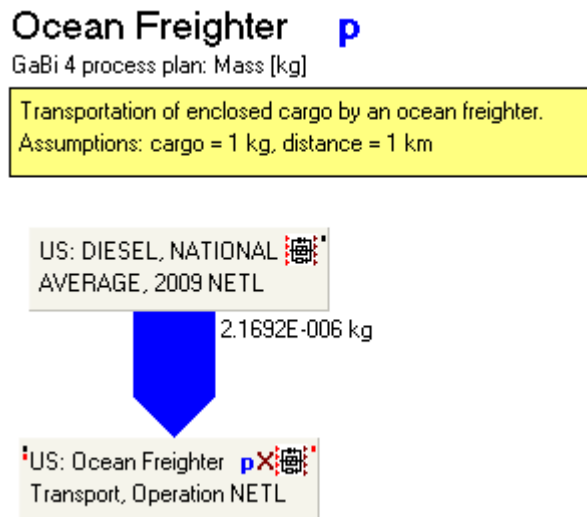
### Goal and Scope

The scope of this unit process covers all aspects of raw material transportation (RMT) as seen in **Figure 1**. These processes were developed for the transportation of cargo. At the end, one kilogram of cargo is delivered to the life cycle (LC) Stage #3 boundary.

### Boundary and Description

This unit process includes the operation of a diesel-powered ocean freighter. The transport distance is an adjustable parameter for RMT. The plan for RMT is provided in **Figure 1**.

**Figure 1: Plan for Ocean Freighter Transportation, Including Operation of Profile**



The profiles and processes included in RMT are provided in **Table 1**. Those shown in bold face were developed by NETL.

**Table 1: Profiles and Processes Included in RMT for Ocean Freighter Transportation**

Ocean Freighter

US: DIESEL, NATIONAL AVERAGE, 2009 NETL <u-so>  
US: Ocean Freighter Transport, Operation NETL

### Parameters and Balances

The parameters for the highest level modeling plan for ocean freighter transportation are shown in **Table 2**. These parameters may or may not include the adjustable parameters shown previously, depending on how the model was created. **Table 3** presents the input and output balances for resources and emissions of interest for the RMT plan.

**Table 2: Adjustable Parameters for RMT of Ocean Freighter Transportation**

Plan	Parameter	Value	Comment
<i>LC Stage #2</i>			
Stage #2: Ocean Freightier Transport	Distance	1	[km] input ocean freighter travel distance

**Table 3: Inputs and Output Balances for RMT of Ocean Freighter Transportation (kg/kg delivered)**

Process or Category	Gate to Gate (RMT)
<b>Inputs</b>	
Flows	6.902E-06
Resources	6.902E-06
Energy resources	8.303E-07
Non renewable energy resources	8.303E-07
Crude oil (resource)	6.890E-07
Hard coal (resource)	2.771E-08
Lignite (resource)	5.654E-09
Natural gas (resource)	1.079E-07
Uranium (resource)	7.588E-13
Renewable energy resources	1.816E-12
Biomass	6.528E-13
Renewable fuels	5.986E-19
Wood	1.163E-12
Unspecified	0.000E+00
Land use	0.000E+00
Material resources	6.071E-06
Non renewable elements	1.775E-10
Aluminum	7.361E-16
Chromium	4.883E-17
Copper	3.818E-18
Iron	1.765E-10

Process or Category	Gate to Gate (RMT)
Lead	3.011E-17
Magnesium	5.767E-20
Mercury	1.436E-17
Nickel	1.808E-19
Phosphorus	5.763E-15
Sulphur	5.506E-14
Zinc	9.823E-13
Non renewable resources	3.638E-07
Barium sulphate	4.804E-21
Basalt	7.161E-11
Bauxite	7.759E-10
Bentonite	3.129E-09
Calcium carbonate (CaCO <sub>3</sub> )	4.790E-12
Calcium chloride	4.919E-19
Chalk (Calcium carbonate)	5.353E-44
Chromium ore (39%)	9.037E-14
Clay	2.078E-10
Colemanite ore	7.607E-15
Copper - Gold - Silver - ore (1,0% Cu; 0,4 g/t Au; 66 g/t Ag)	2.279E-13
Copper - Gold - Silver - ore (1,1% Cu; 0,01 g/t Au; 2,86 g/t Ag)	1.388E-13
Copper - Gold - Silver - ore (1,16% Cu; 0,002 g/t Au; 1,06 g/t Ag)	7.837E-14
Copper - Molybdenum - Gold - Silver - ore (1,13% Cu; 0,02% Mo; 0,01 g/t Au; 2,86 g/t Ag)	1.909E-13
Copper ore (0.14%)	1.433E-12
Copper ore (1.2%)	2.363E-14
Copper ore (4%)	1.154E-21
Copper ore (sulphidic, 1.1%)	3.285E-13
Dolomite	1.070E-11
Feldspar (aluminum silicates)	4.065E-15
Ferro manganese	8.887E-18
Fluorspar (calcium fluoride; fluorite)	5.803E-12
Granite	1.101E-24
Gypsum (natural gypsum)	1.137E-10
Heavy spar (BaSO <sub>4</sub> )	7.568E-09
Ilmenite (titanium ore)	9.052E-20
Inert rock	3.411E-07
Iron ore (56,86%)	2.412E-09
Iron ore (65%)	1.220E-13
Kaolin ore	1.286E-14

Process or Category	Gate to Gate (RMT)
Lead - zinc ore (4.6%-0.6%)	6.411E-10
Limestone (calcium carbonate)	6.524E-09
Magnesit (Magnesium carbonate)	2.241E-15
Magnesium chloride leach (40%)	5.308E-11
Manganese ore	1.786E-14
Manganese ore (R.O.M.)	2.395E-11
Molybdenite (Mo 0,24%)	1.185E-13
Natural Aggregate	6.055E-10
Nickel ore (1,5%)	9.298E-18
Nickel ore (1.6%)	8.426E-11
Olivine	9.264E-17
Peat	4.591E-12
Phosphate ore	3.444E-15
Phosphorus minerals	5.264E-13
Phosphorus ore (29% P2O5)	4.414E-18
Potassium chloride	7.433E-14
Precious metal ore (R.O.M)	8.753E-15
Quartz sand (silica sand; silicon dioxide)	9.067E-11
Raw pumice	4.992E-16
Rutile (titanium ore)	1.770E-15
sand	1.370E-14
Slate	2.022E-16
Sodium chloride (rock salt)	3.212E-11
Sodium nitrate	3.070E-24
Sodium sulphate	6.142E-16
Soil	2.186E-10
Sulphur (bonded)	1.058E-17
Talc	1.009E-15
Tin ore	4.166E-22
Titanium ore	7.903E-12
Zinc - copper ore (4.07%-2.59%)	1.026E-10
Zinc - lead - copper ore (12%-3%-2%)	4.660E-11
Zinc - lead ore (4.21%-4.96%)	3.940E-22
Zinc ore (4%)	-7.580E-13
Zinc ore (sulphidic, 4%)	2.143E-21
Renewable resources	5.707E-06
Water	5.156E-06
Water	4.032E-06

Process or Category	Gate to Gate (RMT)
Water (feed water)	3.735E-10
Water (ground water)	1.473E-07
Water (sea water)	5.983E-09
Water (surface water)	9.696E-07
Water (well water)	4.072E-11
Water (with river silt)	6.241E-22
Air	5.511E-07
Carbon dioxide	6.219E-10
Nitrogen	1.339E-12
Oxygen	0.000E+00
Unspecified	2.112E-13
Unspecified minerals	4.805E-14
Unspecified resources	1.632E-13
Area of Production Land	0.000E+00
<b>Output</b>	
Flows	9.481E-06
Resources	7.674E-07
Energy resources	0.000E+00
Land use	0.000E+00
Material resources	7.674E-07
Renewable resources	7.674E-07
Water	7.674E-07
Water (river water)	7.422E-07
Water (wastewater)	2.517E-08
Nitrogen	0.000E+00
Oxygen	1.035E-11
Ecoinvent	8.727E-18
Long-term emission	8.727E-18
Fresh water	8.727E-18
Dissolved organic carbon, DOC (Ecoinvent)	8.727E-18
Production residues in life cycle	9.363E-10
Hazardous waste for disposal	2.231E-10
Dross (Fines)	1.482E-12
Sodium oxide	2.519E-12
Red mud (dry)	2.189E-10
Soil and sand containing heavy metals	1.657E-14

Process or Category	Gate to Gate (RMT)
Toxic chemicals (unspecified)	2.655E-13
Hazardous waste for recovery	9.345E-13
Used oil	3.985E-13
Waste water processing residue	5.361E-13
Waste for disposal	4.620E-10
Incineration good	1.449E-13
Sludge from water works (6% dry matter-content)	8.345E-15
Waste (solid)	3.298E-10
Waste from steel works	1.320E-10
Waste for recovery	2.503E-10
Aluminum scrap	3.327E-18
Chemicals (unspecified)	7.961E-14
Cooling water	2.467E-10
Cryolite	6.909E-13
Dross	4.973E-13
Gypsum (FDI)	7.697E-20
Plastic (unspecified)	1.495E-13
Production residues (unspecified)	1.103E-15
Rolling tinder	1.353E-26
Slag	2.140E-12
Waste paper	2.197E-17
Wood	8.343E-17
Wooden pallet (EURO)	4.441E-22
Mixed Waste (Hazardous or Radioactive)	0.000E+00
Neutralized residues	1.458E-20
Emissions to air	8.677E-06
Heavy metals to air	3.127E-13
Antimony	8.415E-16
Arsenic (+V)	1.030E-14
Arsenic trioxide	4.201E-19
Cadmium (+II)	7.655E-16
Chromium (+III)	8.840E-17
Chromium (unspecified)	1.920E-15
Cobalt	8.018E-16
Copper (+II)	4.403E-15
Heavy metals to air (unspecified)	4.565E-18
Hydrogen arsenic (arsine)	3.487E-17
Iron	2.646E-15

Process or Category	Gate to Gate (RMT)
Lanthanides	1.613E-19
Lead (+II)	1.736E-14
Manganese (+II)	4.791E-15
Mercury (+II)	2.027E-15
Molybdenum	1.896E-16
Nickel (+II)	2.788E-14
Palladium	1.361E-23
Rhodium	1.314E-23
Selenium	2.431E-14
Silver	2.231E-23
Tellurium	1.179E-17
Thallium	8.687E-17
Tin (+IV)	8.677E-15
Titanium	1.042E-17
Vanadium (+III)	1.730E-13
Zinc (+II)	3.262E-14
Inorganic emissions to air	8.250E-06
Ammonia	2.913E-10
Ammonium	7.454E-20
Ammonium nitrate	6.123E-20
Barium	4.783E-12
Beryllium	1.658E-16
Boron compounds (unspecified)	1.918E-13
Bromine	7.621E-14
Carbon dioxide	7.977E-06
Carbon dioxide (biotic)	2.738E-10
Carbon disulphide	1.120E-17
Carbon monoxide	2.189E-08
Chloride (unspecified)	2.311E-14
Chlorine	2.354E-15
Cyanide (unspecified)	1.340E-15
Fluoride	1.311E-13
Fluorides	3.538E-15
Fluorine	5.333E-18
Helium	1.756E-15
Hydrogen	4.308E-13
Hydrogen bromine (hydrobromic acid)	1.163E-16
Hydrogen chloride	2.681E-12



Process or Category	Gate to Gate (RMT)
Hydrogen cyanide (prussic acid)	6.145E-17
Hydrogen fluoride	4.510E-13
Hydrogen iodide	3.684E-20
Hydrogen phosphorous	3.658E-18
Hydrogen sulphide	4.055E-12
Lead dioxide	1.071E-17
Nitrogen (atmospheric nitrogen)	6.665E-11
Nitrogen dioxide	8.296E-11
Nitrogen monoxide	3.046E-15
Nitrogen oxides	2.001E-08
Nitrous oxide (laughing gas)	1.950E-10
Oxygen	4.084E-10
Scandium	7.723E-20
Steam	2.275E-07
Strontium	3.029E-18
Sulphur dioxide	2.161E-09
Sulphur hexafluoride	1.200E-18
Sulphuric acid	2.278E-15
Tin oxide	1.496E-21
Unspecified Particles	3.933E-13
Zinc oxide	2.993E-21
Zinc sulphate	8.781E-16
Organic emissions to air (group VOC)	7.738E-09
Group NMVOC to air	1.580E-09
Group PAH to air	4.302E-14
Anthracene	1.125E-16
Benzo(a)anthracene	5.663E-17
Benzo(a)pyrene	1.248E-15
Benzo(ghi)perylene	5.052E-17
Benzo(a)fluoranthene	1.010E-16
Chrysene	1.391E-16
Dibenz(a)anthracene	3.148E-17
Indeno[1,2,3-cd]pyrene	3.759E-17
Naphthalene	1.182E-14
Phenanthrene	3.713E-15
Polycyclic aromatic hydrocarbons (PAH)	2.571E-14
Halogenated organic emissions to air	4.287E-14
Dichloroethane (ethylene dichloride)	1.562E-20

Process or Category	Gate to Gate (RMT)
Dichloromethane (methylene chloride)	6.249E-19
Dioxins (unspec.)	1.127E-20
Halogenated hydrocarbons (unspecified)	7.467E-17
Polychlorinated biphenyls (PCB unspecified)	7.659E-17
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	9.155E-21
R 11 (trichlorofluoromethane)	5.554E-15
R 114 (dichlorotetrafluoroethane)	5.688E-15
R 116 (hexafluoroethane)	2.696E-15
R 12 (dichlorodifluoromethane)	1.194E-15
R 13 (chlorotrifluoromethane)	7.498E-16
R 22 (chlorodifluoromethane)	1.305E-15
Tetrafluoromethane	2.432E-14
Vinyl chloride (VCM; chloroethene)	1.218E-15
Acetaldehyde (Ethanal)	3.089E-14
Acetic acid	7.204E-14
Acetone (dimethylcetone)	2.911E-14
Acrolein	7.942E-16
Aldehyde (unspecified)	2.027E-15
Alkane (unspecified)	4.263E-13
Alkene (unspecified)	3.638E-13
Aromatic hydrocarbons (unspecified)	7.165E-15
Benzene	1.262E-13
Butadiene	6.837E-20
Butane	5.938E-11
Butane (n-butane)	7.820E-14
Caprolactam	4.260E-17
Cyclohexane (hexahydro benzene)	2.816E-17
Diethylamine	1.864E-24
Ethane	1.613E-10
Ethanol	3.662E-14
Ethene (ethylene)	4.023E-15
Ethyl benzene	3.628E-13
Fluoranthene	3.666E-16
Fluorene	1.163E-15
Formaldehyde (methanal)	1.973E-13
Heptane (isomers)	1.989E-12
Hexamethylene diamine (HMDA)	4.022E-21
Hexane (isomers)	2.982E-12

Process or Category	Gate to Gate (RMT)
Mercaptan (unspecified)	1.618E-14
Methanethiol	1.000E-14
Methanol	3.305E-14
NMVOG (unspecified)	1.040E-09
Octane	1.094E-12
Pentane (n-pentane)	2.050E-11
Phenol (hydroxy benzene)	1.574E-18
Propane	2.899E-10
Propene (propylene)	3.278E-14
Propionic acid (propane acid)	1.658E-17
Styrene	2.087E-19
Toluene (methyl benzene)	1.953E-13
Trimethylbenzene	1.458E-20
Xylene (dimethyl benzene)	1.530E-12
Hydrocarbons (unspecified)	7.003E-14
Methane	3.979E-09
Organic chlorine compounds	9.299E-17
Unspecified Organic Compounds	2.734E-19
VOC (unspecified)	2.178E-09
Other emissions to air	4.186E-07
Aldehydes, unspecified	1.367E-19
Exhaust	4.173E-07
Particulate Matter, unspecified	2.502E-11
Sand (Silica) (SiO <sub>2</sub> )	2.606E-15
Used air	1.228E-09
Particles to air	4.851E-10
Dust (PM <sub>10</sub> )	4.630E-12
Dust (PM <sub>2,5</sub> - PM <sub>10</sub> )	4.277E-10
Dust (PM <sub>2.5</sub> )	1.302E-11
Dust (unspecified)	3.974E-11
Metals (unspecified)	7.347E-17
Unspecified Organic Chlorine Compounds	1.803E-18
Wood (dust)	5.523E-19
Radioactive emissions to air	6.521E-15
Uranium (total)	6.521E-15
Unspecified Heavy Metals	1.408E-22
Emissions to fresh water	2.598E-08
Analytical measures to fresh water	1.097E-10

Process or Category	Gate to Gate (RMT)
Adsorbable organic halogen compounds (AOX)	1.662E-13
Biological oxygen demand (BOD)	6.044E-12
Chemical oxygen demand (COD)	9.614E-11
Nitrogenous Matter (unspecified, as N)	1.912E-14
Solids (dissolved)	1.015E-12
Total dissolved organic bounded carbon	1.440E-14
Total organic bounded carbon	6.330E-12
Heavy metals to fresh water	5.584E-09
Aluminium	1.012E-09
Antimony	8.963E-12
Arsenic (+V)	2.871E-11
Cadmium (+II)	2.821E-12
Chromium (+III)	1.428E-15
Chromium (+VI)	7.860E-19
Chromium (unspecified)	4.961E-11
Cobalt	7.455E-16
Copper (+II)	4.173E-11
Heavy metals to water (unspecified)	1.012E-16
Iron	2.230E-09
Lead (+II)	9.703E-11
Manganese (+II)	9.294E-14
Mercury (+II)	4.882E-13
Molybdenum	1.682E-14
Nickel (+II)	7.688E-10
Selenium	2.834E-15
Silver	8.752E-12
Strontium	2.103E-12
Thallium	1.473E-17
Tin (+IV)	2.626E-15
Titanium	2.129E-15
Unspecified Substance	1.218E-18
Vanadium (+III)	6.394E-15
Zinc (+II)	1.334E-09
Inorganic emissions to fresh water	1.550E-08
Acid (calculated as H+)	1.551E-13
Aluminum (+III)	5.316E-13
Ammonia	2.691E-13
Ammonium (total N)	1.095E-08

Process or Category	Gate to Gate (RMT)
Ammonium / ammonia	1.142E-12
Barium	5.207E-13
Beryllium	1.954E-17
Boron	3.064E-13
Bromate	8.296E-19
Bromine	5.343E-17
Calcium (+II)	4.292E-11
Carbonate	3.270E-11
Chlorate	7.943E-16
Chloride	3.058E-09
Chlorine (dissolved)	7.315E-13
Copper ion (+II/+III)	1.230E-19
Cyanide	8.143E-11
Fluoride	7.611E-11
Fluorine	4.616E-15
Hydrogen chloride	8.904E-17
Hydrogen fluoride (hydrofluoric acid)	5.116E-17
Hydrogen Ions (H+)	2.720E-16
Hydroxide	4.752E-13
Inorganic salts and acids (unspecified)	3.483E-26
Magnesium (+II)	9.868E-12
Magnesium chloride	3.704E-18
Metal ions (unspecific)	3.762E-14
Neutral salts	6.364E-19
Nitrate	2.917E-12
Nitrate (as total N)	4.369E-18
Nitrogen	1.732E-14
Nitrogen organic bounded	1.784E-13
Phosphate	2.151E-14
Phosphorus	9.663E-10
Potassium	2.744E-14
Silicate particles	1.911E-17
Sodium (+I)	1.412E-10
Sodium chloride (rock salt)	4.575E-18
Sodium hypochlorite	6.004E-18
Sulphate	1.291E-10
Sulphide	5.967E-12
Sulphite	5.069E-14

Process or Category	Gate to Gate (RMT)
Sulphur	7.448E-14
Sulphuric acid	1.148E-14
Unspecified Iron Oxides	3.120E-18
Unspecified Oil	1.105E-17
Unspecified Organic Chlorine compounds	2.505E-20
Unspecified Salt	1.002E-16
Unspecified Solids (Suspended)	3.891E-16
Organic emissions to fresh water	1.151E-11
Halogenated organic emissions to fresh water	7.033E-17
1,2-Dibromoethane	6.615E-21
Chlorinated hydrocarbons (unspecified)	6.424E-23
Chloromethane (methyl chloride)	7.031E-17
Dichloroethane (ethylene dichloride)	4.188E-23
Dichloropropane	3.228E-24
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	1.975E-24
Vinyl chloride (VCM; chloroethene)	7.387E-21
Hydrocarbons to fresh water	1.972E-12
Acenaphthene	1.000E-16
Acenaphthylene	4.166E-17
Acetic acid	2.514E-15
Acrylonitrile	2.361E-19
Anthracene	1.426E-16
Aromatic hydrocarbons (unspecified)	6.101E-14
Benzene	2.001E-13
Benzo(a)anthracene	1.449E-17
Benzofluoranthene	7.887E-18
Chrysene	6.543E-17
Cresol (methyl phenol)	1.929E-15
Ethyl benzene	9.891E-15
Fluoranthene	1.665E-17
Hexane (isomers)	2.106E-16
Hydrocarbons (unspecified)	8.775E-15
Methanol	1.017E-13
Oil (unspecified)	1.234E-12
Phenol (hydroxy benzene)	1.770E-13
Polycyclic aromatic hydrocarbons (PAH, unspec.)	5.112E-15
Toluene (methyl benzene)	1.288E-13
Xylene (isomers; dimethyl benzene)	4.095E-14

Process or Category	Gate to Gate (RMT)
Carbon, organically bound	9.519E-12
Naphthalene	6.403E-15
N-unspecified (N)	8.650E-18
Organic chlorine compounds (unspecified)	1.395E-17
Organic compounds (dissolved)	5.996E-15
Organic compounds (unspecified)	1.678E-15
Unspecified wastewater	6.541E-15
Other emissions to fresh water	0.000E+00
Particles to fresh water	4.770E-09
Metals (unspecified)	5.212E-16
Silicon dioxide (silica)	2.176E-21
Soil loss by erosion into water	9.287E-16
Solids (suspended)	4.770E-09
Suspended solids, unspecified	2.403E-14
Unspecified Oxides	2.594E-18
Radioactive emissions to fresh water	0.000E+00
Bromide	0.000E+00
Radionuclide	0.000E+00
Sulfite	0.000E+00
Unspecified Solids (Dissolved)	7.499E-16
Uranium (total)	0.000E+00
Emissions to sea water	1.049E-08
Analytical measures to sea water	5.035E-11
Adsorbable organic halogen compounds (AOX)	3.279E-18
Biological oxygen demand (BOD)	3.617E-12
Chemical oxygen demand (COD)	4.311E-11
Total organic bounded carbon	3.617E-12
Heavy metals to sea water	1.079E-11
Arsenic (+V)	1.117E-13
Cadmium (+II)	5.611E-14
Chromium (unspecified)	1.751E-13
Cobalt	7.990E-15
Copper (+II)	3.589E-13
Iron	5.847E-13
Lead (+II)	9.687E-14
Manganese (+II)	5.809E-14
Mercury (+II)	1.320E-15
Molybdenum	3.783E-15

Process or Category	Gate to Gate (RMT)
Nickel (+II)	1.152E-13
Silver	1.122E-14
Strontium	9.047E-12
Tin (+IV)	1.344E-14
Titanium	1.369E-15
Vanadium (+III)	7.191E-15
Zinc (+II)	1.387E-13
Inorganic emissions to sea water	7.549E-09
Aluminum (+III)	4.408E-14
Ammonia	1.310E-12
Barium	1.438E-12
Beryllium	2.476E-16
Boron	7.128E-13
Calcium (+II)	7.784E-11
Carbonate	9.043E-11
Chloride	7.230E-09
Magnesium	1.942E-11
Nitrate	1.172E-13
Sodium (+I)	7.223E-11
Sulphate	3.819E-11
Sulphide	1.646E-11
Sulphur	3.814E-13
Organic emissions to sea water	4.566E-12
Hydrocarbons to sea water	4.543E-12
Acenaphthene	4.833E-16
Acenaphthylene	1.912E-16
Acetic acid	1.448E-16
Anthracene	3.560E-16
Aromatic hydrocarbons (unspecified)	3.617E-14
Benzene	5.350E-13
Benzo(a)anthracene	9.273E-17
Benzofluoranthene	8.677E-17
Chrysene	4.915E-16
Cresol (methyl phenol)	9.879E-15
Ethyl benzene	2.562E-14
Fluoranthene	1.077E-16
Hexane (isomers)	1.079E-15
Oil (unspecified)	3.025E-12



Process or Category	Gate to Gate (RMT)
Phenol (hydroxy benzene)	4.472E-13
Toluene (methyl benzene)	3.594E-13
Xylene (isomers; dimethyl benzene)	1.021E-13
Naphthalene	2.292E-14
Particles to sea water	2.879E-09
Solids (suspended)	2.879E-09
Emissions to agricultural soil	0.000E+00
Emissions to industrial soil	3.072E-11
Heavy metals to industrial soil	8.002E-12
Arsenic (+V)	8.888E-18
Cadmium (+II)	9.203E-17
Chromium (+III)	4.431E-17
Chromium (unspecified)	2.139E-14
Cobalt	3.813E-16
Copper (+II)	2.507E-16
Iron	3.026E-14
Lead (+II)	7.186E-17
Manganese (+II)	4.493E-15
Mercury (+II)	8.498E-19
Nickel (+II)	6.083E-15
Strontium	7.936E-12
Zinc (+II)	2.458E-15
Inorganic emissions to industrial soil	2.268E-11
Aluminum (+III)	2.316E-14
Ammonia	1.228E-11
Bromide	3.268E-15
Calcium (+II)	1.776E-14
Chloride	3.813E-12
Fluoride	1.089E-13
Magnesium (+III)	2.495E-15
Phosphorus	1.291E-12
Potassium (+I)	2.594E-12
Sodium (+I)	1.547E-15
Sulphate	3.643E-13
Sulphide	2.186E-12
Organic emissions to industrial soil	3.274E-14
Oil (unspecified)	3.274E-14
Radioactive emissions to industrial soil	0.000E+00

Process or Category	Gate to Gate (RMT)
Calcium Fluoride	0.000E+00
Radionuclide	0.000E+00

**Embedded Unit Processes**

NETL (2009). NETL Life Cycle Inventory Data – Process Documentation File: Ocean Freighter Transport, Operations. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: July 2010 (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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