



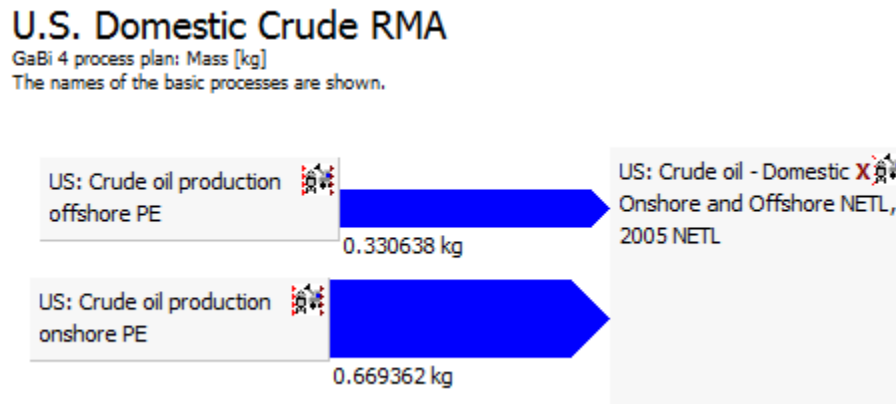
## Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS\_RMA\_Petroleum\_Domestic\_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) as seen in **Figure 1**. At the end, one kilogram of crude oil extracted domestically has been prepared while ending at the boundary of life cycle (LC) Stage #2.

**Figure 1: Plan for RMA of Domestic Petroleum**



## Boundary and Description

LC stage #1, RMA of domestic crude oil, includes two extraction methods (onshore wells and offshore wells) and any initial processing of the oil.

The RMA of domestic crude oil includes the operations of the different extraction wells. No construction data is 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 Domestic Petroleum**

Crude Oil - Domestic, 2005-Updated  
**US: Crude oil - Domestic NETL, 2005 NETL**  
 US: Crude oil production offshore PE  
 US: Crude oil production onshore PE

### Parameters and Balances

The parameters for the highest level modeling plan for RMA of domestic petroleum 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 RMA plan.

**Table 2: Adjustable Parameters for RMA of Domestic Petroleum**

Plan	Parameter	Value	Comment
LC Stage #1			
Domestic Crude Oil RMA	Onshore_prod	0.669	[fraction] Portion of US petroleum extracted onshore, outside of California
Domestic Crude Oil RMA	Offshore_prod	0.331	[fraction] Portion of US petroleum extracted offshore, outside of California

**Table 3: Inputs and Output Balances for RMA of Domestic Petroleum (kg/kg produced)**

Process or Category	Cradle to Gate (RMA)
<b>Inputs</b>	
Flows	1.799E+00
Resources	1.799E+00
Energy resources	1.063E+00
Non renewable energy resources	1.063E+00
Crude oil (resource)	1.014E+00
Crude oil Algeria	1.362E-04
Crude oil Angola	2.241E-04
Crude oil Argentina	4.152E-05
Crude oil Australia	3.820E-05
Crude oil Austria	6.875E-06
Crude oil Bolivia	2.103E-10
Crude oil Brazil	4.912E-05
Crude oil Brunei	1.089E-11
Crude oil Bulgaria	1.659E-11
Crude oil Cameroon	3.442E-05
Crude oil Canada	7.728E-04
Crude oil Chile	1.580E-10
Crude oil China	1.026E-05
Crude oil CIS	1.089E-03
Crude oil Colombia	1.342E-04
Crude oil Czech Republic	4.631E-07

Process or Category	Cradle to Gate (RMA)
Crude oil Denmark	2.124E-04
Crude oil Ecuador	5.876E-05
Crude oil Egypt	2.834E-05
Crude oil France	1.010E-05
Crude oil Gabon	9.686E-05
Crude oil Germany	3.993E-05
Crude oil Greece	1.365E-06
Crude oil Hungary	6.574E-09
Crude oil India	3.898E-13
Crude oil Indonesia	3.077E-05
Crude oil Iran	1.953E-04
Crude oil Iraq	3.726E-04
Crude oil Ireland	5.314E-11
Crude oil Italy	4.443E-05
Crude oil Kuwait	1.622E-04
Crude oil Libya	3.231E-04
Crude oil Malaysia	6.231E-12
Crude oil Mexico	8.677E-04
Crude oil Netherlands	2.786E-05
Crude oil New Zealand	8.908E-07
Crude oil Nigeria	4.618E-04
Crude oil Norway	1.031E-03
Crude oil Oman	9.994E-06
Crude oil Poland	1.802E-06
Crude oil Qatar	5.220E-06
Crude oil Romania	2.751E-06
Crude oil Saudi Arabia	1.211E-03
Crude oil Slovakia	1.498E-11
Crude oil South Africa	9.514E-11
Crude oil Spain	2.276E-06
Crude oil Syria	9.209E-11
Crude oil Trinidad and Tobago	3.617E-05
Crude oil Tunisia	1.297E-05
Crude oil Turkey	1.487E-15
Crude oil United Arab Emirates	6.518E-06
Crude oil United Kingdom	1.368E-03

Process or Category	Cradle to Gate (RMA)
Crude oil USA	1.004E+00
Crude oil Venezuela	8.573E-04
Hard coal (resource)	3.585E-03
Hard coal Australia	1.137E-04
Hard coal Belgium	1.042E-08
Hard coal Bosnia and Herzegovina	1.385E-09
Hard coal Brazil	4.725E-07
Hard coal Canada	1.268E-03
Hard coal Chile	1.647E-08
Hard coal China	1.390E-05
Hard coal CIS	2.727E-05
Hard coal Colombia	1.919E-04
Hard coal Czech Republic	1.132E-05
Hard coal France	2.141E-07
Hard coal Germany	2.419E-04
Hard coal India	7.372E-17
Hard coal Indonesia	9.570E-06
Hard coal Italy	4.335E-10
Hard coal Japan	3.840E-12
Hard coal Malaysia	2.535E-13
Hard coal Mexico	6.803E-09
Hard coal New Zealand	1.369E-08
Hard coal Poland	7.106E-05
Hard coal Portugal	3.435E-10
Hard coal South Africa	1.220E-04
Hard coal Spain	1.007E-05
Hard coal Turkey	6.825E-12
Hard coal United Kingdom	8.048E-06
Hard coal USA	1.440E-03
Hard coal Venezuela	5.413E-05
Hard coal Vietnam	1.126E-06
Lignite (resource)	1.680E-03
Lignite Australia	5.148E-05
Lignite Austria	1.708E-06
Lignite Bosnia and Herzegovina	3.057E-09
Lignite Bulgaria	9.828E-09

Process or Category	Cradle to Gate (RMA)
Lignite Canada	1.960E-05
Lignite CIS	1.232E-06
Lignite Czech Republic	6.497E-06
Lignite France	5.641E-08
Lignite Germany (Central Germany)	1.117E-03
Lignite Germany (Lausitz)	1.448E-04
Lignite Germany (Rheinisch)	2.613E-04
Lignite Greece	6.337E-07
Lignite Hungary	2.671E-08
Lignite India	1.475E-17
Lignite Macedonia	6.340E-09
Lignite Poland	2.306E-06
Lignite Romania	6.185E-10
Lignite Serbia and Montenegro	2.427E-08
Lignite Slovakia	2.333E-09
Lignite Slovenia	2.084E-08
Lignite Spain	2.119E-05
Lignite Turkey	1.843E-13
Lignite USA	5.271E-05
Natural gas (resource)	4.402E-02
Natural gas Algeria	2.789E-05
Natural gas Angola	2.852E-05
Natural gas Argentina	4.095E-06
Natural gas Australia	8.101E-06
Natural gas Austria	1.216E-06
Natural gas Bolivia	4.226E-07
Natural gas Brazil	6.468E-06
Natural gas Brunei	9.999E-08
Natural gas Bulgaria	2.670E-12
Natural gas Cameroon	8.537E-06
Natural gas Canada	1.176E-04
Natural gas Chile	3.760E-08
Natural gas China	1.168E-06
Natural gas CIS	2.085E-04
Natural gas Colombia	1.462E-05
Natural gas Czech Republic	3.547E-08

Process or Category	Cradle to Gate (RMA)
Natural gas Denmark	2.172E-05
Natural gas Ecuador	6.545E-06
Natural gas Egypt	2.857E-06
Natural gas France	1.004E-06
Natural gas Gabon	1.430E-05
Natural gas Germany	1.014E-04
Natural gas Greece	9.353E-08
Natural gas Hungary	3.246E-09
Natural gas India	3.896E-14
Natural gas Indonesia	1.541E-06
Natural gas Iran	2.217E-05
Natural gas Iraq	3.759E-05
Natural gas Ireland	1.186E-07
Natural gas Italy	5.001E-06
Natural gas Japan	3.534E-13
Natural gas Kuwait	1.548E-05
Natural gas Libyan	9.006E-06
Natural gas Malaysia	8.008E-08
Natural gas Mexico	9.312E-05
Natural gas Netherlands	1.164E-04
Natural gas New Zealand	5.921E-08
Natural gas Nigeria	8.560E-05
Natural gas Norway	1.109E-04
Natural gas Oman	1.780E-06
Natural gas Poland	1.240E-07
Natural gas Qatar	2.428E-06
Natural gas Romania	1.758E-07
Natural gas Saudi Arabia	1.120E-04
Natural gas Slovakia	1.416E-10
Natural gas South Africa	3.918E-09
Natural gas Spain	4.387E-07
Natural gas Syria	9.896E-12
Natural gas Trinidad and Tobago	8.080E-06
Natural gas Tunisia	1.699E-06
Natural gas Turkey	1.504E-16
Natural gas United Arab Emirates	1.011E-06

Process or Category	Cradle to Gate (RMA)
Natural gas United Kingdom	1.094E-04
Natural gas USA	4.261E-02
Natural gas Venezuela	8.090E-05
Pit Methane	1.628E-05
Uranium (resource)	3.822E-08
Uranium natural	3.822E-08
Renewable energy resources	2.042E-06
Primary energy from geothermics	0.000E+00
Primary energy from hydro power	0.000E+00
Primary energy from solar energy	0.000E+00
Primary energy from wind power	0.000E+00
Wood	2.042E-06
Material resources	7.361E-01
Non renewable elements	3.396E-11
Iron	7.488E-13
Lead	3.892E-18
Sulphur	3.322E-11
Non renewable resources	4.776E-01
Barium sulphate	3.989E-16
Basalt	5.644E-06
Bauxite	1.129E-05
Bentonite	8.661E-03
Calcium chloride	4.084E-14
Chromium ore (39%)	1.957E-08
Clay	4.761E-04
Colemanite ore	2.892E-09
Copper ore (0.14%)	5.715E-07
Copper ore (4%)	3.142E-15
Copper ore (sulphidic, 1.1%)	3.727E-12
Dolomite	8.613E-09
Ferro manganese	1.946E-18
Fluorspar (calcium fluoride; fluorite)	1.364E-08
Gypsum (natural gypsum)	3.096E-04
Heavy spar (BaSO4)	2.095E-02
Inert rock	4.225E-01
Iron ore (56,86%)	6.353E-03



Process or Category	Cradle to Gate (RMA)
Iron ore (65%)	2.359E-07
Kaolin ore	3.019E-09
Lead - zinc ore (4.6%-0.6%)	1.689E-03
Limestone (calcium carbonate)	1.484E-02
Magnesit (Magnesium carbonate)	6.109E-09
Magnesium chloride leach (40%)	8.999E-05
Manganese ore	3.742E-09
Manganese ore (R.O.M.)	6.625E-05
Molybdenite (Mo 0,24%)	1.569E-10
Natural Aggregate	4.962E-04
Nickel ore (1,5%)	8.382E-12
Nickel ore (1.6%)	2.335E-04
Olivine	2.140E-17
Peat	1.125E-05
Phosphate ore	2.228E-09
Phosphorus minerals	5.635E-09
Potassium chloride	2.769E-09
Precious metal ore (R.O.M)	8.084E-10
Quartz sand (silica sand; silicon dioxide)	1.051E-04
Raw pumice	2.932E-10
Slate	3.600E-17
Sodium chloride (rock salt)	4.470E-06
Sodium sulphate	1.031E-11
Soil	3.162E-04
Sulphur (bonded)	1.591E-11
Talc	2.564E-09
Tin ore	3.459E-17
Titanium ore	2.147E-05
Zinc - copper ore (4.07%-2.59%)	2.803E-04
Zinc - lead - copper ore (12%-3%-2%)	1.169E-04
Zinc - lead ore (4.21%-4.96%)	1.073E-15
Zinc ore (sulphidic, 4%)	2.787E-15
Renewable resources	2.585E-01
Water	1.177E-01
Water (ground water)	1.112E-02
Water (sea water)	1.446E-02

Process or Category	Cradle to Gate (RMA)
Water (surface water)	9.216E-02
Air	1.406E-01
Carbon dioxide	1.857E-04
Nitrogen	6.831E-11
<b>Output</b>	
Flows	3.387E-01
Resources	6.216E-02
Material resources	6.216E-02
Renewable resources	6.216E-02
Water	6.216E-02
Water (river water)	6.216E-02
Emissions to air	2.372E-01
Heavy metals to air	8.357E-08
Antimony	1.300E-10
Arsenic (+V)	9.318E-10
Arsenic trioxide	1.162E-12
Cadmium (+II)	2.611E-10
Chromium (+III)	2.408E-10
Chromium (unspecified)	7.288E-10
Cobalt	3.547E-10
Copper (+II)	1.525E-09
Heavy metals to air (unspecified)	1.020E-11
Hydrogen arsenic (arsine)	9.643E-11
Iron	1.857E-09
Lanthanides	2.990E-13
Lead (+II)	1.636E-08
Manganese (+II)	6.752E-09
Mercury (+II)	4.694E-10
Molybdenum	1.184E-10
Nickel (+II)	3.291E-09
Palladium	1.130E-18
Rhodium	1.091E-18
Selenium	1.169E-09
Silver	1.566E-19
Tellurium	3.210E-11
Thallium	2.362E-10

Process or Category	Cradle to Gate (RMA)
Tin (+IV)	6.692E-10
Titanium	1.755E-11
Vanadium (+III)	3.908E-08
Zinc (+II)	9.235E-09
Inorganic emissions to air	1.715E-01
Ammonia	2.095E-07
Ammonium	4.396E-14
Ammonium nitrate	9.331E-14
Barium	1.319E-05
Beryllium	7.696E-11
Boron compounds (unspecified)	9.912E-09
Bromine	4.270E-09
Carbon dioxide	1.571E-01
Carbon disulphide	1.033E-12
Carbon monoxide	4.210E-04
Chloride (unspecified)	1.972E-08
Chlorine	5.349E-12
Cyanide (unspecified)	7.336E-10
Fluoride	9.784E-10
Fluorides	8.149E-09
Fluorine	1.012E-11
Helium	3.237E-09
Hydrogen	7.626E-07
Hydrogen bromine (hydrobromic acid)	2.447E-10
Hydrogen chloride	3.799E-07
Hydrogen cyanide (prussic acid)	9.610E-11
Hydrogen fluoride	6.528E-08
Hydrogen iodide	9.588E-15
Hydrogen phosphorous	4.102E-14
Hydrogen sulphide	1.091E-06
Lead dioxide	1.635E-15
Nitrogen (atmospheric nitrogen)	1.125E-05
Nitrogen dioxide	1.237E-15
Nitrogen monoxide	3.990E-11
Nitrogen oxides	6.980E-04
Nitrous oxide (laughing gas)	4.741E-06

Process or Category	Cradle to Gate (RMA)
Oxygen	1.385E-04
Scandium	1.507E-13
Steam	1.280E-02
Strontium	5.740E-12
Sulphur dioxide	2.637E-04
Sulphur hexafluoride	1.160E-13
Sulphuric acid	6.203E-09
Tin oxide	1.423E-16
Zinc oxide	2.846E-16
Zinc sulphate	2.430E-09
Organic emissions to air (group VOC)	1.028E-03
Group NMVOC to air	1.826E-04
Group PAH to air	5.021E-08
Anthracene	2.150E-10
Benzo(a)anthracene	1.082E-10
Benzo(a)pyrene	4.751E-11
Benzo(ghi)perylene	9.650E-11
Benzo(a)fluoranthene	1.930E-10
Chrysene	2.657E-10
Dibenz(a)anthracene	6.014E-11
Indeno[1,2,3-cd]pyrene	7.181E-11
Naphthalene	2.258E-08
Phenanthrene	7.091E-09
Polycyclic aromatic hydrocarbons (PAH)	1.948E-08
Halogenated organic emissions to air	1.796E-09
Dichloromethane (methylene chloride)	1.579E-17
Dioxins (unspec.)	9.517E-15
Halogenated hydrocarbons (unspecified)	7.841E-18
Polychlorinated biphenyls (PCB unspecified)	2.120E-10
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	7.500E-15
R 11 (trichlorofluoromethane)	2.388E-10
R 114 (dichlorotetrafluoroethane)	2.445E-10
R 12 (dichlorodifluoromethane)	5.133E-11
R 13 (chlorotrifluoromethane)	3.223E-11
R 22 (chlorodifluoromethane)	5.611E-11
Tetrafluoromethane	1.283E-10

Process or Category	Cradle to Gate (RMA)
Vinyl chloride (VCM; chloroethene)	8.331E-10
Acetaldehyde (Ethanal)	1.219E-08
Acetic acid	1.053E-08
Acetone (dimethylcetone)	1.099E-08
Acrolein	1.517E-09
Aldehyde (unspecified)	5.207E-10
Alkane (unspecified)	2.344E-08
Alkene (unspecified)	1.445E-08
Aromatic hydrocarbons (unspecified)	9.425E-10
Benzene	1.925E-07
Butadiene	4.016E-14
Butane	1.656E-05
Butane (n-butane)	9.542E-09
Cyclohexane (hexahydro benzene)	2.369E-11
Diethylamine	1.099E-18
Ethane	4.403E-05
Ethanol	4.901E-09
Ethene (ethylene)	2.747E-09
Ethyl benzene	1.558E-08
Fluoranthene	7.002E-10
Fluorene	2.222E-09
Formaldehyde (methanal)	3.367E-08
Heptane (isomers)	5.892E-07
Hexamethylene diamine (HMDA)	2.362E-15
Hexane (isomers)	8.742E-07
Mercaptan (unspecified)	1.107E-08
Methanol	4.729E-09
NM VOC (unspecified)	3.345E-05
Octane	3.242E-07
Pentane (n-pentane)	5.545E-06
Phenol (hydroxy benzene)	1.316E-13
Propane	8.070E-05
Propene (propylene)	1.271E-09
Propionic acid (propane acid)	1.102E-12
Styrene	2.623E-14
Toluene (methyl benzene)	6.232E-08

Process or Category	Cradle to Gate (RMA)
Trimethylbenzene	1.386E-15
Xylene (dimethyl benzene)	9.764E-08
Methane	8.421E-04
Organic chlorine compounds	4.667E-14
VOC (unspecified)	3.161E-06
Other emissions to air	6.463E-02
Exhaust	6.311E-02
non used primary energy from wind power	0.000E+00
Unused primary energy from solar energy	0.000E+00
Used air	1.523E-03
Waste heat	0.000E+00
Particles to air	2.939E-05
Dust (PM10)	3.904E-06
Dust (PM2.5)	1.423E-05
Dust (unspecified)	1.126E-05
Metals (unspecified)	5.279E-14
Wood (dust)	5.252E-14
Radioactive emissions to air	3.290E-10
Antimony (Sb124)	0.000E+00
Argon (Ar41)	0.000E+00
Carbon (C14)	0.000E+00
Cesium (Cs134)	0.000E+00
Cesium (Cs137)	0.000E+00
Cobalt (Co58)	0.000E+00
Cobalt (Co60)	0.000E+00
Hydrogen (H3)	0.000E+00
Iodine (I129)	0.000E+00
Iodine (I131)	0.000E+00
Krypton (Kr85)	0.000E+00
Krypton (Kr85m)	0.000E+00
Plutonium (Pu alpha)	0.000E+00
Radon (Rn222)	0.000E+00
Uranium (total)	3.290E-10
Uranium (U234)	0.000E+00
Uranium (U235)	0.000E+00
Uranium (U238)	0.000E+00

Process or Category	Cradle to Gate (RMA)
Xenon (Xe131m)	0.000E+00
Xenon (Xe133)	0.000E+00
Xenon (Xe133m)	0.000E+00
Xenon (Xe135)	0.000E+00
Xenon (Xe135m)	0.000E+00
Xenon (Xe137)	0.000E+00
Xenon (Xe138)	0.000E+00
Emissions to fresh water	2.477E-04
Analytical measures to fresh water	8.482E-06
Adsorbable organic halogen compounds (AOX)	8.282E-08
Biological oxygen demand (BOD)	1.733E-07
Chemical oxygen demand (COD)	7.413E-06
Solids (dissolved)	4.729E-08
Total dissolved organic bounded carbon	2.164E-14
Total organic bounded carbon	7.654E-07
Heavy metals to fresh water	4.592E-06
Antimony	2.703E-16
Arsenic (+V)	1.788E-09
Cadmium (+II)	7.657E-08
Chromium (+III)	7.993E-11
Chromium (+VI)	1.327E-16
Chromium (unspecified)	2.835E-09
Cobalt	3.004E-11
Copper (+II)	7.711E-09
Heavy metals to water (unspecified)	1.068E-10
Iron	4.343E-06
Lead (+II)	5.267E-09
Manganese (+II)	7.520E-09
Mercury (+II)	1.701E-10
Molybdenum	8.956E-10
Nickel (+II)	2.825E-09
Selenium	2.450E-10
Silver	4.906E-11
Strontium	1.231E-07
Thallium	4.072E-11
Tin (+IV)	5.402E-11

Process or Category	Cradle to Gate (RMA)
Titanium	5.971E-10
Vanadium (+III)	6.404E-10
Zinc (+II)	1.817E-08
Inorganic emissions to fresh water	1.211E-04
Acid (calculated as H+)	7.265E-10
Aluminum (+III)	2.880E-08
Ammonia	9.859E-09
Ammonium / ammonia	5.685E-07
Barium	9.494E-09
Beryllium	9.710E-13
Boron	8.686E-09
Bromine	2.631E-11
Calcium (+II)	1.619E-06
Carbonate	5.938E-07
Chloride	9.099E-05
Chlorine (dissolved)	1.281E-07
Cyanide	1.044E-10
Fluoride	2.655E-06
Fluorine	1.266E-08
Hydrogen chloride	2.425E-10
Hydrogen fluoride (hydrofluoric acid)	3.805E-11
Hydroxide	6.663E-09
Magnesium (+III)	2.742E-07
Magnesium chloride	3.075E-13
Nitrate	1.067E-07
Nitrogen	4.258E-09
Nitrogen organic bounded	1.408E-07
Phosphate	1.350E-08
Phosphorus	5.910E-08
Potassium	1.104E-08
Silicate particles	5.290E-11
Sodium (+I)	6.890E-06
Sodium hypochlorite	1.411E-12
Sulphate	1.677E-05
Sulphide	1.218E-07
Sulphite	1.755E-09



Process or Category	Cradle to Gate (RMA)
Sulphur	1.532E-09
Sulphuric acid	3.126E-08
Organic emissions to fresh water	2.654E-05
Halogenated organic emissions to fresh water	1.311E-10
1,2-Dibromoethane	5.564E-15
Chlorinated hydrocarbons (unspecified)	1.393E-17
Chloromethane (methyl chloride)	1.311E-10
Dichloropropane	1.896E-18
Polychlorinated dibenzo-p-dioxins (2,3,7,8 - TCDD)	3.785E-23
Hydrocarbons to fresh water	1.003E-07
Acenaphthene	1.927E-12
Acenaphthylene	7.934E-13
Acetic acid	2.905E-09
Acrylonitrile	1.387E-13
Anthracene	2.487E-12
Aromatic hydrocarbons (unspecified)	1.716E-09
Benzene	4.310E-09
Benzo{a}anthracene	2.965E-13
Benzo[fluoranthene	1.902E-13
Chrysene	1.396E-12
Cresol (methyl phenol)	3.968E-11
Ethyl benzene	3.066E-10
Fluoranthene	3.465E-13
Hexane (isomers)	4.332E-12
Hydrocarbons (unspecified)	1.523E-09
Methanol	4.729E-08
Oil (unspecified)	2.691E-08
Phenol (hydroxy benzene)	5.245E-09
Polycyclic aromatic hydrocarbons (PAH, unspec.)	1.194E-09
Toluene (methyl benzene)	2.932E-09
Xylene (isomers; dimethyl benzene)	5.894E-09
Carbon, organically bound	2.644E-05
Naphthalene	1.149E-10
Organic chlorine compounds (unspecified)	4.673E-14
Organic compounds (unspecified)	6.486E-24
Other emissions to fresh water	0.000E+00

Process or Category	Cradle to Gate (RMA)
non used primary energy from water power	0.000E+00
Unused primary energy from geothermal	0.000E+00
Waste heat	0.000E+00
Particles to fresh water	8.705E-05
Metals (unspecified)	4.411E-12
Soil loss by erosion into water	6.009E-10
Solids (suspended)	8.704E-05
Radioactive emissions to fresh water	0.000E+00
Americium (Am241)	0.000E+00
Antimony (Sb124)	0.000E+00
Antimony (Sb125)	0.000E+00
Carbon (C14)	0.000E+00
Cesium (Cs134)	0.000E+00
Cesium (Cs137)	0.000E+00
Cobalt (Co58)	0.000E+00
Cobalt (Co60)	0.000E+00
Curium (Cm alpha)	0.000E+00
Hydrogen (H3)	0.000E+00
Iodine (I129)	0.000E+00
Iodine (I131)	0.000E+00
Manganese (Mn54)	0.000E+00
Plutonium (Pu alpha)	0.000E+00
Radium (Ra226)	0.000E+00
Ruthenium (Ru106)	0.000E+00
Silver (Ag110m)	0.000E+00
Strontium (Sr90)	0.000E+00
Uranium	0.000E+00
Emissions to sea water	3.912E-02
Analytical measures to sea water	3.324E-04
Adsorbable organic halogen compounds (AOX)	2.398E-11
Biological oxygen demand (BOD)	2.645E-05
Chemical oxygen demand (COD)	2.795E-04
Total organic bounded carbon	2.645E-05
Heavy metals to sea water	8.291E-05
Arsenic (+V)	4.212E-08
Cadmium (+II)	3.902E-08

Process or Category	Cradle to Gate (RMA)
Chromium (unspecified)	4.946E-08
Cobalt	3.163E-08
Copper (+II)	1.527E-06
Iron	4.412E-06
Lead (+II)	5.091E-07
Manganese (+II)	4.361E-07
Mercury (+II)	7.838E-09
Molybdenum	3.128E-08
Nickel (+II)	4.155E-07
Silver	9.280E-08
Strontium	7.474E-05
Tin (+IV)	1.112E-07
Titanium	1.132E-08
Vanadium (+III)	3.585E-08
Zinc (+II)	4.218E-07
Inorganic emissions to sea water	1.764E-02
Aluminum (+III)	3.645E-07
Ammonia	1.083E-05
Barium	3.087E-06
Beryllium	7.913E-11
Boron	5.894E-06
Calcium (+II)	6.437E-04
Carbonate	1.942E-04
Chloride	1.598E-02
Magnesium	1.600E-04
Nitrate	2.517E-07
Sodium (+I)	5.283E-04
Sulphate	8.249E-05
Sulphide	3.535E-05
Sulphur	3.154E-06
Organic emissions to sea water	1.120E-05
Hydrocarbons to sea water	1.115E-05
Acenaphthene	1.195E-09
Acenaphthylene	4.548E-10
Acetic acid	1.526E-10
Anthracene	2.651E-10

Process or Category	Cradle to Gate (RMA)
Aromatic hydrocarbons (unspecified)	2.645E-07
Benzene	1.358E-06
Benzo{a}anthracene	2.715E-10
Benzo{fluoranthene	3.044E-10
Chrysene	1.542E-09
Cresol (methyl phenol)	8.169E-08
Ethyl benzene	2.990E-08
Fluoranthene	3.156E-10
Hexane (isomers)	8.918E-09
Oil (unspecified)	7.949E-06
Phenol (hydroxy benzene)	2.524E-07
Toluene (methyl benzene)	1.122E-06
Xylene (isomers; dimethyl benzene)	7.426E-08
Naphthalene	4.960E-08
Particles to sea water	2.105E-02
Solids (suspended)	2.105E-02
Emissions to industrial soil	2.575E-05
Heavy metals to industrial soil	7.560E-06
Arsenic (+V)	6.684E-12
Cadmium (+II)	8.839E-11
Chromium (+III)	2.261E-12
Chromium (unspecified)	1.423E-08
Cobalt	2.540E-10
Copper (+II)	1.120E-10
Iron	1.793E-08
Lead (+II)	6.353E-12
Manganese (+II)	2.970E-09
Mercury (+II)	2.363E-13
Nickel (+II)	3.482E-09
Strontium	7.520E-06
Zinc (+II)	1.306E-09
Inorganic emissions to industrial soil	1.818E-05
Aluminum (+III)	1.331E-08
Ammonia	1.104E-05
Bromide	2.177E-09
Calcium (+II)	1.758E-09

Process or Category	Cradle to Gate (RMA)
Chloride	2.539E-06
Fluoride	7.255E-08
Magnesium (+III)	2.810E-10
Phosphorus	1.223E-06
Potassium (+I)	1.342E-06
Sodium (+I)	1.473E-10
Sulphate	2.770E-07
Sulphide	1.662E-06
Organic emissions to industrial soil	1.173E-08
Oil (unspecified)	1.173E-08

### Embedded Unit Processes

NETL (2010). NETL Life Cycle Inventory Data – Unit Process: California Thermal Enhanced Oil Recovery, Operation. 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>)

### References

None.

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### Section III: Document Control Information

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**Section IV: Disclaimer**

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