# NETL Life Cycle Inventory Data
# Process Documentation File

**Process Name:** Ocean Freighter Transport

**Reference Flow:** 1 kg of Cargo, ocean freighter

**Brief Description:** Transport of an unspecified cargo via ocean freighter.

## Section I: Meta Data

**Geographical Coverage:** US **Region:** N/A

**Year Data Best Represents:** 2013

**Process Type:** Transport Process (TP)

**Process Scope:** Gate-to-Gate Process (GG)

**Allocation Applied:** No

**Completeness:** All 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 | ☐ Other |
| Releases to Water: | ☐ Inorganic | ☐ Organic Emissions | ☐ Other |
| Water Usage: | ☐ Water Consumption | ☐ Water Demand (throughput) | |
| Releases to Soil: | ☐ Inorganic Releases | ☐ Organic Releases | ☐ Other |

**Adjustable Process Parameters:**

| | |
|---|---|
| Distance | *[km] Adjustable Parameter* |
| diesel_frac | *[dimensionless] Fraction of fuel use that is diesel* |
| fueloil_frac | *[dimensionless] Fraction of fuel that is fuel oil* |

**Tracked Input Flows:**

| | |
|---|---|
| diesel combusted in large marine engine | *[Technosphere] Diesel input* |
| fuel oil combusted in large marine engine | *[Technosphere] Fuel oil input* |

| | |
|---|---|
| petroleum product, out of storage tanks | *[Technosphere] Fugitive losses from onboard storage tanks* |
| construction, ocean freighter | *[Technosphere] Construction of ocean freighter* |

**Tracked Output Flows:**

| | |
|---|---|
| cargo, ocean freighter [Other] | *Reference flow* |

## Section II: Process Description

### Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage24_O_Ocean_Freighter_Transport_2010.02.xlsx*, which provides additional details regarding relevant calculations, data quality, and references.

### Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the transport of an unspecified type of cargo by ocean freighter. Flows include diesel and fuel input for combustion, as well as an input for fugitive leakage based on length of voyage. This process can be used regardless of the type of cargo being transported or the location where the transport is taking place.

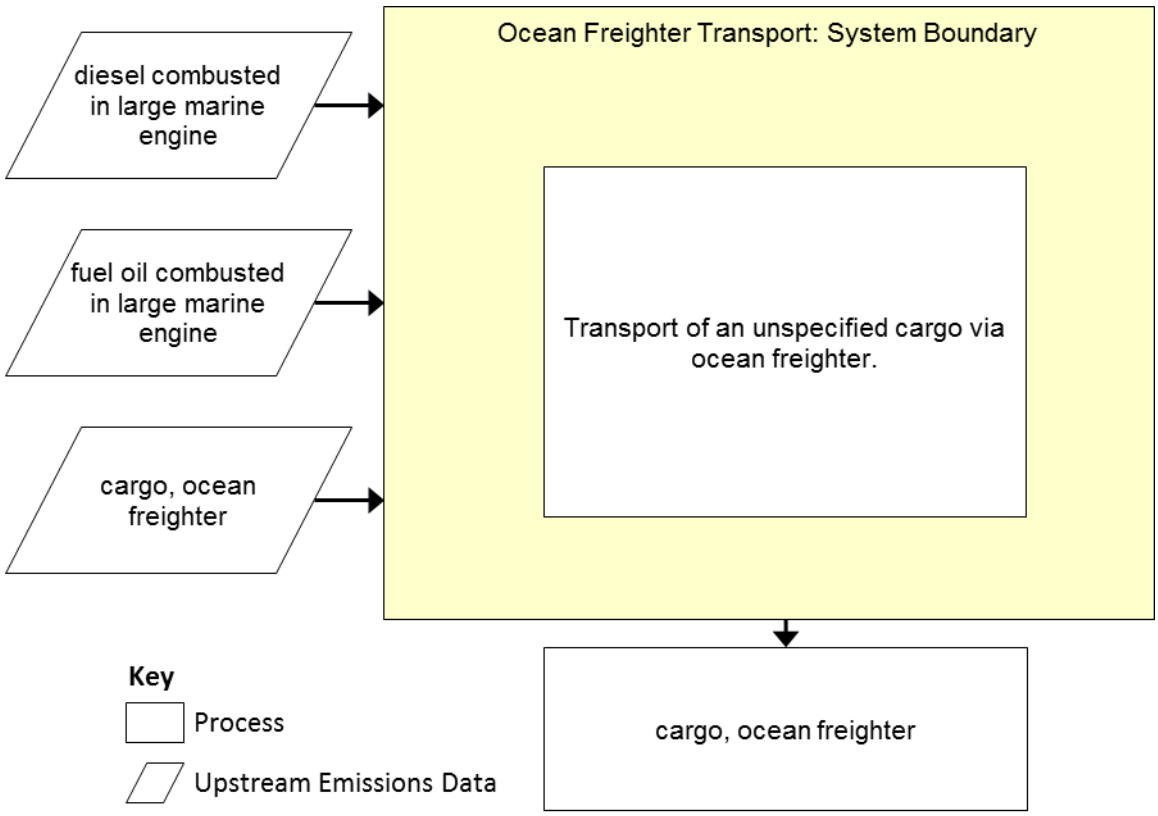
The reference flow of this unit process is: 1 kg of cargo.

### Boundary and Description

The unit process is designed such that the type of cargo being transported and location of transport are irrelevant. This unit process assumes that the unspecified type of cargo is loaded into the ocean freighter during a previous unit process. This unit process transports the unspecified cargo from one location to another.

**Figure 1** provides an overview of the boundary of this unit process. As shown, upstream emissions associated with the production and combustion of fuel and processed cargo are accounted for outside of the boundary of this unit process. So, if the freighter is transporting cargo that will have emissions (e.g. crude transport with tank losses) then a process that accounts for those emissions will need to be connected upstream of this transport process.

**Figure 1: Unit Process Scope and Boundary**




The lower heating values are used for fuel energy content and are taken from the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model and converted to mass basis using density data from the same source (ANL, 2013). The default values for the share of diesel oil and fuel used in freighter transportation are based on domestic consumption of transportation energy (ORNL, 2013). The energy intensity of ocean freighter is based on the engine power and capacity for a size class 10,000 container ship (74,000 kW and 114,900 tonnes) and an assumed thermal efficiency of 50 percent (Mercator Transport Group, 2005; Takaishi et al. 2008).

**Table 1: Unit Process Input and Output Flows**

| Flow Name | Value | Units (Per Reference Flow) |
|---|---|---|
| **Inputs** | | |
| **diesel combusted in large marine engine** | **7.45E-07** | **kg** |
| **fuel oil combusted in large marine engine** | **1.73E-06** | **kg** |
| **Construction, ocean freighter** | **1.00E+00** | **piece** |
| **petroleum product, out of storage tanks [Intermediate products]** | **1.00E+00** | **kg** |
| **Outputs** | | |
| cargo, ocean freighter [Other] | 1.00E+00 | kg |

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

## Embedded Unit Processes

None.

## References


ANL 2013 — Argonne National Laboratory. 2013. GREET.net 2013 v.1.10.9210. Argonne, IL: Argonne National Laboratory. Retrieved December 2, 2013 from http://greet.es.anl.gov/main

Mercator Transport Group 2005 — Forecast of Container Vessel Specifications and Port Calls Within San Pedro Bay. Bellevue, WA. Retrieved May 25, 2010 from http://www.portoflosangeles.org/DOC/REPORT_SPB_Vessel_Forecast.pdf

Takaishi et al. 2008 — Takaishi, T., Nakano, A., Sakaguchi, K. 2008. Approach to High Efficiency Diesel and Gas Engines. Mitsubishi Heavy Industries, Ltd. Technical Review, Vol 45, No. 1. March 2008. Retrieved July 9, 2010 from http://www.mhi.co.jp/technology/review/pdf/e451/e451021.pdf

ORNL 2013 — Oak Ridge National Laboratory. 2013. Transportation Energy Data Book: Edition 32. Oak Ridge, TN: Oak Ridge National Laboratory. Retrived December 2, 2013 from http://cta.ornl.gov/data/download32.shtml

## Section III: Document Control Information

**Date Created:** July 7, 2010

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**Revision History:**

02DEC13 Reorganized UP to call combustion and tank losses, updated data

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