



NETL Life Cycle Inventory Data

Process Documentation File

Process Name: Pipeline Transport of Diesel Fuel, Operation
Reference Flow: 1 kg of Cargo
Brief Description: Transport of liquid diesel fuel via a pipeline powered by electric pumps. No loss of fuel is assumed during pipeline transport.

Section I: Meta Data

Geographical Coverage: US **Region:** Not Applicable
Year Data Best Represents: 2009
Process Type: Basic Process (BP)
Process Scope: Gate-to-Gate Process (GG)
Allocation Applied: No
Completeness: Individual Relevant Flows Recorded
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:

Fuel Transport Distance *Transport distance (length of pipeline). Default value is 1 mile.*
Product Loss Factor *Mass based loss factor for diesel fuel during pipeline transport. Default is assumed to be 0.0 (no loss).*

Tracked Input Flows:

Cargo [Other] *Diesel fuel product being transported.*
Power [Electric Power] *Electricity supplied via grid; recommend using average US electricity grid, unless specific region of pipeline transport is identified.*



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Tracked Output Flows:

Cargo [Other]

Reference flow

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage4_O_Pipeline_Diesel_Transport_2010.01.xls*, which provides additional details regarding relevant, calculations, data quality, and references.

Goal and Scope

The scope of this process covers pipeline transport of diesel fuel in the United States, using electric motors to drive pipeline transport pumps. This transport occurs within Life Cycle (LC) Stage #4, in support of transport of finished diesel fuel for distribution. The pipeline operation unit process includes electricity use of pumps used to move the liquid fuel, and is based on the reference flow of 1 kg of diesel fuel cargo delivered. Considered are the consumption of electricity, as well as pipeline mileage and fuel loss/emissions during transport.

Boundary and Description

Figure 1 provides an overview of the boundary of this unit process. Upstream emissions from the production of electricity are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model.

The pipeline is assumed to be either an industrial pipeline or major trunk-line. Power to pump the diesel is assumed to be obtained from U.S. electricity grid. Energy consumption is calculated based on an energy intensity per ton-mile factor obtained from a Franklin Associates report, Appendix A (Oregon DEQ 2004). The power factor is based on 1993 transport data.

Because this process was built for use in a study using the Petroleum LCA as a Baseline Document (NETL 2009), energy consumption for the pipeline is taken directly from that source. Energy consumption is thus calculated by multiplying the power factor by the pipeline distance and by the quantity of diesel transported (in the appropriate units). Pipeline distance is included as an adjustable parameter, which is applied linearly as a scalar to the electricity use factor for the pipeline. The default value of 1 mile would not likely be applicable, and under typical conditions would be tens to hundreds of miles.

No loss of liquid fuels is assumed during pipeline transport. Therefore, a default mass efficiency of 100% is included in the model. However, an adjustable parameter has been included to account for evaporative losses of diesel fuel, in the event that more recent data are found. If a loss of liquid fuels is assumed, 100% of the total quantity lost is assumed to be through evaporative emissions and assigned to non-methane volatile organic compounds (NMVOCs) released to the air. The loss factor for a specific type of fuel is a data limitation

within this unit process and is recommended for sensitivity analysis, or replacement with updated loss factor values.

Figure 1: Unit Process Inputs, Outputs, and Boundaries

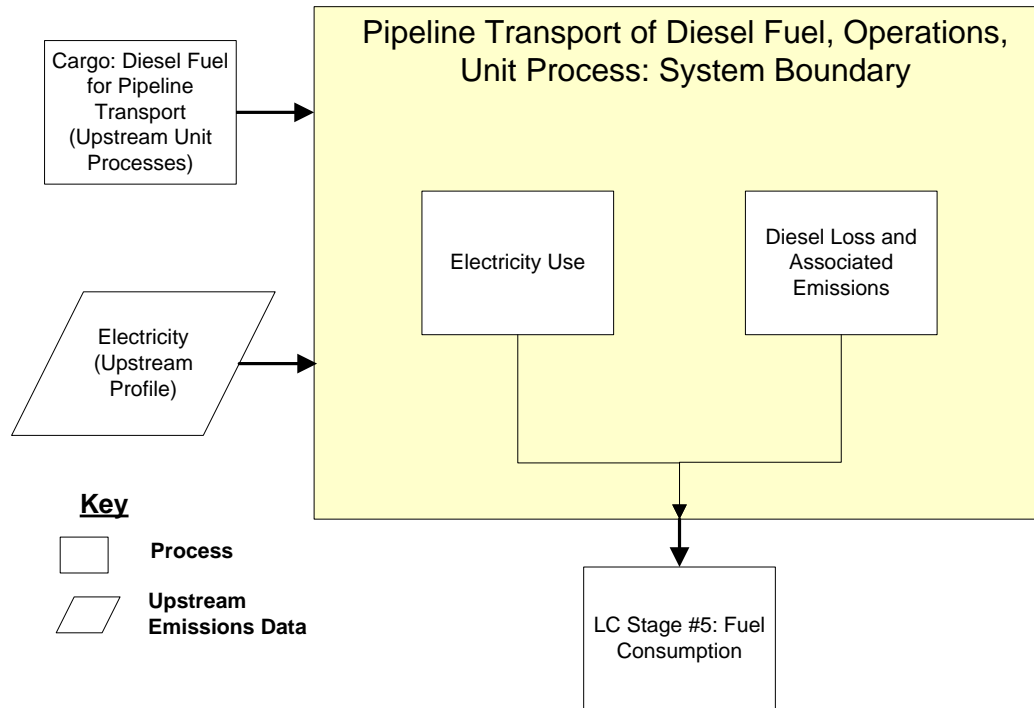


Table 1 provides an overview of energy requirements for pumping of diesel fuel along a pipeline, as well as other key data points for this unit process. **Table 2** provides a summary of modeled input and output flows. Additional detail regarding input and output flows, including calculation methods, is contained in the associated DS.

Table 1: Energy Requirements and Other Key Data Points

Flow Name	Value	Units	Reference
Energy Required to Power Diesel Pipeline	260	Btu/ton-mile	Oregon DEQ 2004
Electricity Required to Power Diesel Pipeline	2.772E-05	kWh/kg-mile	NETL Engineering Calculation
Default Pipeline Transport Distance	1.00	Mile	NETL Engineering Judgment
Default Proportion of Diesel Loss	0.00	[unitless]	Oregon DEQ 2004

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Cargo [Other]	1	kg
Power [Electrical power]	2.77193E-05	kWh
Outputs		
Cargo [Other]	1.00	kg
NMVOCs [Inorganic emissions to air]	0	kg

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. Upstream environmental flows are added during the modeling process using GaBi modeling software, as shown in Figure 1.

Embedded Unit Processes

None

References

NETL 2008	NETL. 2008. <i>Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum-Based Fuels</i> . DOE/NETL-2009/1346. U.S. Department of Energy, National Energy Technology Laboratory, Pittsburgh, PA. November 26, 2008.
Oregon DEQ 2004	Oregon Department of Environmental Quality. 2004. <i>Life Cycle Inventory of Packaging Options for Shipment of Retail Mail-Order Soft Goods: Appendix A - Energy Requirements and Environmental Emissions for Fuel Consumption</i> . Report prepared by Franklin Associates, Inc. for U.S. Environmental Protection Agency.

Section III: Document Control Information

Date Created: February 16, 2010

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

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