NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Blended Jet Fuel Transport to Aircraft, Operation

Reference Flow: 1 kg of Blended Jet Fuel Delivered to Aircraft

Brief Description: This unit process provides a summary of relevant input and output flows for transporting blended jet fuel from the blending tank at the refinery to aircraft fuel tanks at either a single large airport or a large airport plus regional airports.

Section I: Meta Data

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

Year Data Best Represents: 2006, 2009

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:

Transport Scenario	*Changes transport process scenario. (1) is used for pipeline transport to a single airport; (2) is used for pipeline to a storage terminal/single airport plus trucks to other airports*
Pipeline Tortuosity	*Tortuosity coefficient of the transport pipeline*
Point-to-Point Distance	*Point-to-point distance from petroleum refinery in Wood River, Ill to bulk storage terminal*

Tracked Input Flows:

Electricity	*Amount of electricity required to pump fuel from the blending facility to aircraft according to selected scenario, in kWh*
Blended Jet Fuel [Intermediate Product]	*Jet fuel for transport*

Tracked Output Flows:

Blended Jet Fuel Delivered to Aircraft [Intermediate Product]	*Blended jet fuel delivered to the airport*
Blended Jet Fuel Delivered to Tanker Trucks for Transport [Intermediate Product]	*Blended jet fuel delivered to tanker trucks for transport to regional airports; used in scenario 2*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage4_O_Blended_JetFuel_Transport_2012.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

The scope of this unit process covers the elements required for the transport of finished fuel under Life Cycle (LC) Stage #4, from the plant to the bulk storage facility over the 30-year study period, as described below and in **Figure 1** or **Figure 2** depending on the selected transport option. Electricity and blended jet fuel are the input flows for the operation of the transport process. The total amount of electricity required is based on the length of the pipeline, the electricity required to pump fuel through the pipeline per kilogram of fuel and mile traveled, and the total amount of fuel transported over the study period.

Boundary and Description

This unit process can be configured for two different options. **Figure 1** provides an overview of the boundary of this unit process for Options 1 and 2. The first option includes exclusive pipeline delivery of the blended jet fuel to a single large airport, while the second includes pipeline delivery to a single large airport, plus tanker truck delivery to additional smaller regional airports.
The amount of electricity required to pump fuel through the pipeline was obtained from IAWG 2011. The default pipeline lengths displayed in the DS are based on study values.

Under Option 1, pipeline transport would be used to transport blended jet fuel from the refinery/blending station directly to a single major airport. The airport is assumed to be located 245 miles from the blending station. This option considers operation of a pipeline that connects the blending station to the airport, as well as fuel handling and transport operations at the airport. Electricity input and emissions associated with electricity production are considered for the pumps needed to pump the blended jet fuel along transport pipelines.

The model assumes, for Option 1, that all facilities needed for handling and transport operations, from the refinery through fuel handling and transport at the airport, would be pre-existing, and that no construction or manufacture of new facilities or infrastructure would be required. The airport is also considered existing for this study. The airport is defined as the fuel storage tank, fuel pumps, and dispensing stations. The energy needed within the airport to deliver the blended jet fuel to the aircraft fuel tank is considered negligible in this evaluation. The emissions at the airport associated with handling the blended jet fuel are also assumed to be negligible. Electricity supplied by the regional electrical grid is assumed to power all pumps in the pipeline.

This option evaluates the potential for additional life cycle emissions to occur as a result of distributing blended jet fuel to several airports, including smaller regional airports that could potentially be provided with such fuel. Under Option 2, transport of the blended jet fuel includes (1) operation of a pipeline from Wood River refinery that transports blended jet fuel to a bulk terminal facility 100 miles distant; (2) operation of a pipeline from the bulk terminal facility transporting 60 percent of the blended product to the single major airport located 160 miles distant; and (3) tanker truck transport operations that ship 40 percent of the blended jet fuel to regional airports, located 50 miles distant (one way). Fuel handling, transport operations and associated emissions at the airports are assumed to be negligible for this evaluation.

Electricity input and emissions associated with electricity production are considered for the pumps needed to pump the blended jet fuel from the blending station to the bulk terminal facility, and then from the terminal facility to major airport. The emissions associated with the electricity used for operation of the bulk terminal facility are modeled eGRID 2007 data. Because no operational electricity use data were found for a bulk terminal facility, the energy use is assumed to be equivalent to that of a refueling station (fuel processing energy use only). This assumption is considered valid because of the similar energy consuming components operating in a bulk terminal facility and in the fuel processing portions of a refueling station.

Construction and operation of the diesel powered tanker trucks needed to transport the blended jet fuel to regional airports are considered. Trucks are assumed to be Class 8B (> 60,000 lbs gross vehicle weight) truck-trailer combinations to transport fuel to regional airports and then return (empty) to the bulk terminal facility. The tanker

truck transport process assumes that any potential loss of transported fuel during transport would be negligible, due to the relatively short distance traveled and the characteristics of the tanker trucks (they are designed to minimize volatile emissions).

The trucks are assumed to be powered by 100 percent conventional diesel fuel. The fuel economy for Class 8B trucks ranges from 5 mpg with a full trailer to 9 mpg with the trailer empty based on recent US Department of Transportation statistics. These modeling assumptions are consistent with the fuel economy parameter used in the GREET model for heavy-duty truck transport (ANL, 2009).

Relevant properties fuel transport properties used for the calculation of input and output flows for this unit process are shown in **Table 1**. **Table 2 and Table 3** provide a summary of modeled input and output flows for each scenario. Additional details showing calculation methods for input and output flows, and other relevant information, are contained in the associated DS.

Figure 1: Unit Process Scope and Boundary, Scenario 1

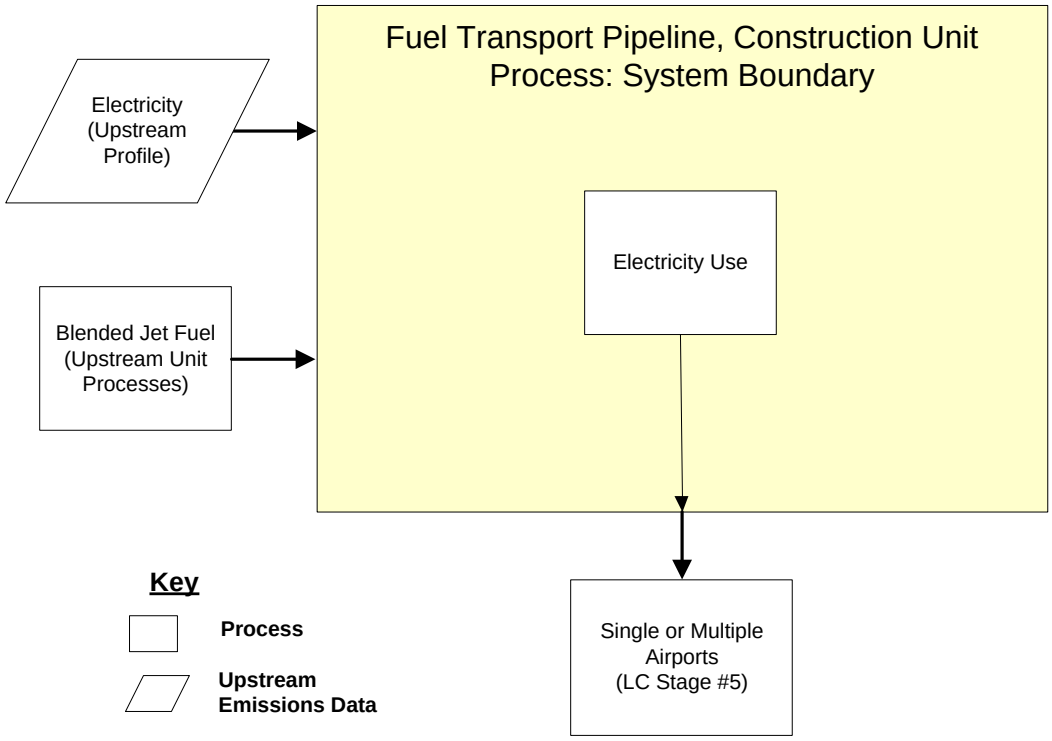

Table 1: Properties of a Fuel Transport

Default Pipeline and Fuel Properties		
Property	**Value**	**Units**
Pipeline length from Wood River, Ill refinery to Bulk Storage Terminal	100	miles
Pipeline length from Bulk Storage Terminal to O'Hare Airport	178	miles
Pipeline length from Wood River, Ill refinery to O'Hare Airport	272	miles
Fuel transported by tanker trailer	0 / 40	percent
Fuel transported by pipeline	100 / 60	percent
Electricity required to pump fuel through pipeline	2.77E-05	kWh/kg-mi

Table 2: Unit Process Input and Output Flows for Transport to a Single Large Airport (Option 1)

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Electricity [Electricity]	**7.541E-03**	**kWh**
Blended Jet Fuel [Intermediate Product]	**1.0**	**kg**
Outputs		
Blended Jet Fuel Delivered to Aircraft [Intermediate Product]	1.0	kg
Blended Jet Fuel Delivered to Tanker Trucks [Intermediate Product]	0.0	kg

- **Bold face** clarifies that the value shown *does not* include upstream environmental flows. See also the documentation for embedded unit processes, as shown below.

Table 3: Unit Process Input and Output Flows for Transport to a Large Airport and Regional Airports (Option 2)

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Electricity [Electricity]	**1.044E-02**	**kWh**
Blended Jet Fuel [Intermediate Product]	**1.67**	**kg**
Outputs		
Blended Jet Fuel Delivered to Aircraft [Intermediate Product]	1.0	kg
Blended Jet Fuel Delivered to Tanker Trucks [Intermediate Product]	1.0	kg

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. See also the documentation for embedded unit processes, as shown below.

Embedded Unit Processes

None.

References

IAWG 2011 — Aviation Fuel Life Cycle Assessment Working Group (IAWG). 2011. AFRL-RZ-WP-TR-2011-2138: Life Cycle Greenhouse Gas Analysis of Advanced Jet Propulsion Fuels: Fischer-Tropsch Based SPK-1 Case Study. Available at: http://www.netl.doe.gov/energy-analyses/pubs/iawg_cbtl_report.pdf Accessed April 9, 2012.

Section III: Document Control Information

Date Created: April 09, 2012

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

Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2012). *NETL Life Cycle Inventory Data – Unit Process: Blended Jet Fuel Transport, Operation.* U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: April 2012 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

Section IV: Disclaimer

Neither the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) nor any person acting on behalf of these organizations:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document may not infringe on privately owned rights; or

B. Assumes any liability with this report as to its use, or damages resulting from the use of any information, apparatus, method, or process disclosed in this document.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by NETL. The views and opinions of the authors expressed herein do not necessarily state or reflect those of NETL.