



NETL Life Cycle Inventory Data

Process Documentation File

Process Name: CO₂ Pipeline Operation
Reference Flow: 1 kg of carbon dioxide
Brief Description: The CO₂ emissions from the operation of a CO₂ pipeline.

Section I: Meta Data

Geographical Coverage: United States **Region:** N/A
Year Data Best Represents: 2012
Process Type: Transport Process
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 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:

CO₂_lossrate *Fraction of CO₂ lost during pipeline operation*
Pipe_L *Length of CO₂ pipeline*
CO₂_thru *Throughput of CO₂*

Tracked Input Flows:

Carbon Dioxide *CO₂ from CO₂ recovery operations at an ECF*

Tracked Output Flows:

Carbon Dioxide *CO₂ for enhanced oil recovery or sequestration*



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Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_O_CO2_Pipeline_2012.01.doc*, 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 operation of a carbon dioxide pipeline that is used for the conveyance of carbon dioxide captured at an energy conversion facility, to a site for sequestration or other use, as relevant. The key emission of this unit process is CO₂ that leaks from the pipeline. Compression needed to drive pressurized CO₂ through the pipeline is provided by the energy conversion facility, under a separate unit process. Boost pressurization along the pipeline, and the CO₂ emissions from boost pressurization, are also accounted for in another unit process.

The only tracked input is CO₂, and the key output is CO₂ emissions. The reference flow of this unit process is the delivery of one kilogram of CO₂ as described below and shown in **Figure 1**. This unit process is used within Life Cycle (LC) Stage #3 of NETL's energy conversion models.

Boundary and Description

This unit process provides a summary of relevant input and output flows associated with the operation of a carbon dioxide pipeline that is used for the conveyance of carbon dioxide captured at an energy conversion facility, to a site for sequestration or other use, as relevant. The only tracked input is CO₂, and the key output is CO₂ emissions. The reference flow of this unit process is the delivery of one kilogram of CO₂.

This unit process uses IPCC (Intergovernmental Panel on Climate Change) emission factors to calculate CO₂ emissions (Holloway, 2006). The IPCC factors are pipeline only (not compressor emissions) and were calculated by multiplying methane emissions from NG transmission pipelines by 1.66 (the square root of ratio of gas densities) (Holloway, 2006). The IPCC emission factor does not specify the flow rate of total CO₂ through a pipeline, so this unit process uses a flow rate of 10,000 tons of CO₂ per day, which is comparable to the CO₂ captured by a 550 MW_{net} coal fired power plant with 90 percent CO₂ capture.

Figure 1 provides an overview of the boundary of this unit process. There is one input to this unit process, CO₂ that has been captured and compressed at an energy conversion facility. The capture and compression of CO₂ is not included in this unit process. The fugitive emission of CO₂ is accounted for in this unit process. There is one tracked output for this unit process: 1 kg of CO₂.

Figure 1: Unit Process Scope and Boundary

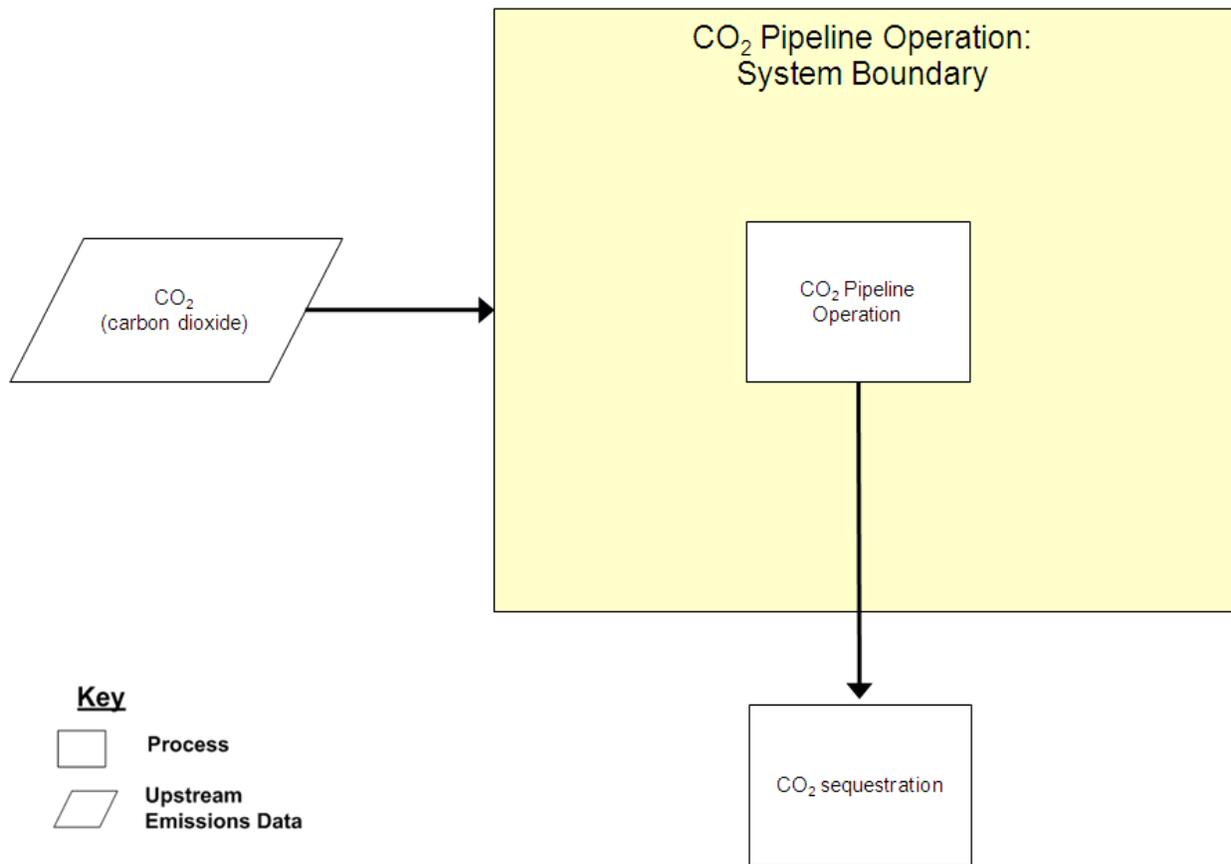


Table 1 summarizes airborne emission factors and other parameters that are relevant to this unit process. **Table 2** provides a summary of modeled input and output flows and shows all inputs and outputs on the basis of the reference flow (the pipeline transport of one kilogram of CO₂). Additional detail regarding input and output flows, including calculation methods, is contained in the associated DS.

Table 1: Emission Factors and Other Relevant Parameters

Flow Name	Value	Units
Carbon dioxide emission factor	1.06E+04	kg/(mi-yr)
Pipeline distance	100	mi

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Carbon dioxide	1.000319	kg

Outputs		
Carbon dioxide	1.000	kg
Carbon dioxide [Inorganic emissions to air]	3.19E-04	kg

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

Embedded Unit Processes

None.

References

- Holloway, 2006
- Holloway, S., 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 5: Carbon Dioxide Transport, Injection, and Geological Storage, Intergovernmental Panel on Climate Change (IPCC). Accessed on July 25, 2012 at http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf.

Section III: Document Control Information

Date Created: July 30, 2012

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

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