NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Gathering and boosting centrifugal compressor venting

Reference Flow: 1 kg of natural gas

Brief Description: Gathering and boosting centrifugal compression venting (not including venting from compressor driver)

Section I: Meta Data

Geographical Coverage: United States **Region:** 14 U.S. production regions

Year Data Best Represents: 2016

Process Type: Basic Process (BP)

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:

2_CENT_CH4

[tonnes] Methane emissions from gathering and boosting centrfigual compressors

2_NG_sent

[Mcf] Annual natural gas throughput, volume

2_mCH4

[Mcf] Mass fraction of methane in natural gas

Tracked Input Flows:

Natural gas [intermediate flow]

[Intermediate flow] Natural gas product input, including what ends up as marketed product and what is vented from gathering and boosting compressors

Tracked Output Flows:

Natural Gas [intermediate flow]

Reference flow

Vent_NG [to venting and flaring]

Natural gas vented from centrifugal compressors

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_NG_GandB_Compressor_Centrif_2018.01.xlsx*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

This unit process provides a summary of venting from gathering and boosting centrifugal compression. Inputs include natural gas product flow, comprising the natural gas that is vented from centrifugal compressors and the natural gas compressed by centrifugal compressors. Fuel consumption and combustion exhaust emissions from compressor drivers is not accounted for in this unit process. Outputs include the reference flow (1 kg of produced natural gas) and the quantity of gas vented from the compressor; gas vented from the compressor is sent to another NETL unit process for component speciation.

Boundary and Description

This unit process provides a summary of venting from gathering and boosting centrifugal compression. Inputs include natural gas product flow, comprising the natural gas that is vented from centrifugal compressors and the natural gas compressed by centrifugal compressors. Fuel consumption and combustion exhaust emissions from compressor drivers is not accounted for in this unit process. Outputs include the reference flow (1 kg of produced natural gas) and the quantity of gas vented from the compressor; gas vented from the compressor is sent to another NETL unit process for component speciation.

Figure 1: Unit Process Scope and Boundary

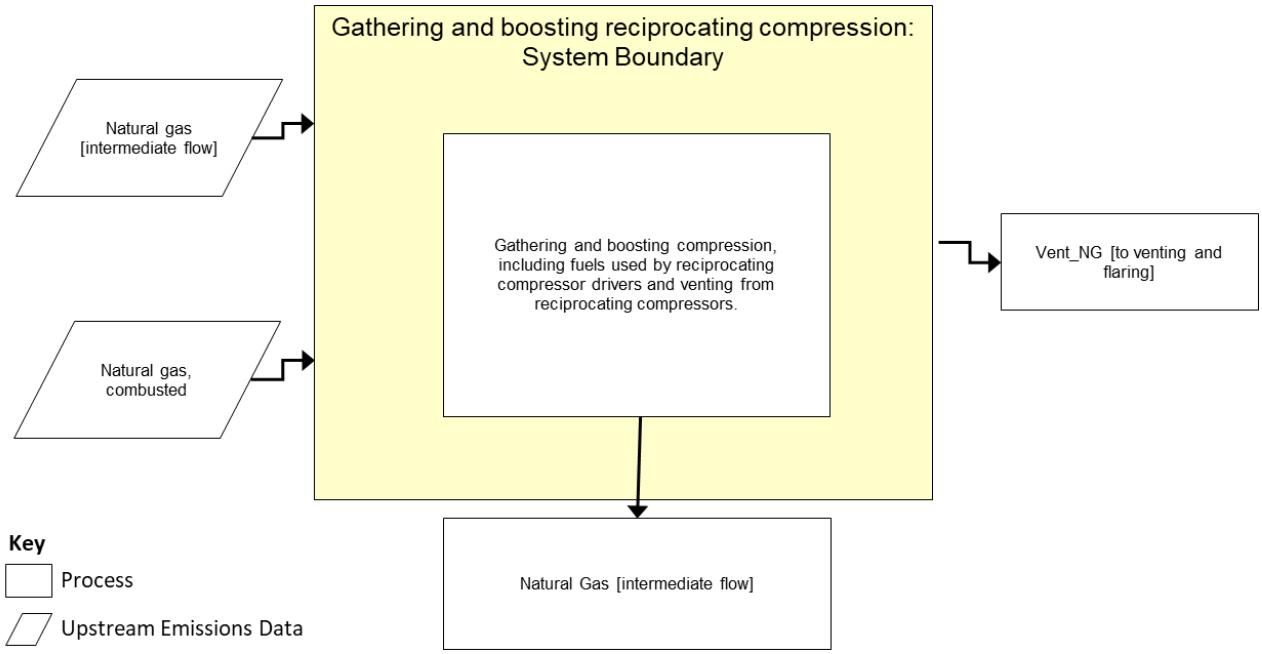

Table 1 shows the input parameters, which include methane emissions and natural gas throughput. The vented emission data are based on EPA's Greenhouse Gas Reporting Program (GHGRP) (EPA, 2016a). NETL stratified the GHGRP to account for variability in in 14 onshore production regions based on data in GHGRP and DI Desktop (Drilling Info, 2018). The low, expected, and high bounds represent the variability in the underlying data and were developed via throughput-weighted statistical bootstrapping. The bootstrapping technique allows computation of the confidence intervals around average activity factors. **Table 1** shows parameters for the Appalachian Shale production scenario; the DS file holds data for Appalachian Shale production as well as 26 other onshore production scenarios. The full scenario list is as follows:

- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Appalachia - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Gulf - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Gulf - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Gulf - Tight
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Arkla - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Arkla - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Arkla - Tight

- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in East Texas - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in East Texas - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in East Texas - Tight
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Arkoma - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Arkoma - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in South Oklahoma - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Anadarko - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Anadarko - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Anadarko - Tight
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Strawn - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Fort Worth - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Permian - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Permian - Shale
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Green River - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Green River - Tight
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Uinta - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Uinta - Tight
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in San Juan - CBM
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in San Juan - Conventional
- Gathering and boosting centrifugal compressor venting for natural gas from gathering and boosting facilities in Piceance - Tight

Table 2 shows the inputs and output for natural gas throughput and venting for Appalachian production scenario. The DS File can compute the output for all 27 onshore production scenarios. The

produced natural gas input accounts for total natural gas vented by the unit process plus the reference flow of the unit process (1 kg of natural gas gathered and boosted). Vented natural gas (which is emitted through centrifugal compressor seals and does not include the gas that is vented through combustion exhaust from the compressor driver) is an output that should be linked to NETL's "venting and flaring" unit process, which speciates the vented gas into hydrocarbons and other components. The reference flow of this unit process is 1 kg of gathered and boosted natural gas.

Table 1: Input Parameters

Parameter	Expected Value	Low	High	Units	Description
2_CENT_CH4	0.00E+00	0.00E+00	0.00E+00	tonnes	Methane emissions from gathering and boosting centrifugal compressors.
2_NG_sent	9.13E+08	6.27E+08	1.23E+09	Mcf	Annual natural gas throughput, volume.
2_mCH4	8.36E-01	8.23E-01	8.49E-01	Mcf	Mass fraction of methane in natural gas.

Table 2: Unit Process Input and Output Flows

Flow Name	Expected	Low	High	Units (Per Reference Flow)
Inputs				
Natural gas [intermediate flow]	**1.00E+00**	**1.00E+00**	**1.00E+00**	kg NG
Outputs				
Natural Gas [intermediate flow]	1.00	1.00	1.00	kg NG
Vent_NG [to venting and flaring]	0.00E+00	0.00E+00	0.00E+00	kg NG

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

Note: Inventory items not included are assumed to be zero based on best engineering judgment or assumed to be zero because no data was available to categorize them for this unit process at the time of its creation.

Embedded Unit Processes

None.

References

EPA. 2016a. Greenhouse Gas Reporting Program. Environmental Protection Agency. https://www.epa.gov/enviro/greenhouse-gas-customized-search. Accessed August 22, 2018.

DrillingInfo. 2018. DI Data & Insights.

Section III: Document Control Information

Date Created: October 22, 2018

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Revision History:

Original/no revisions

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

NETL (2018). *NETL Life Cycle Inventory Data – Unit Process: Gathering and boosting centrifugal compressor venting.* U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: October 2018 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

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