



# NETL Life Cycle Inventory Data

## Process Documentation File

**Process Name:** Processing flaring  
**Reference Flow:** 1 kg of natural gas  
**Brief Description:** Flaring of natural gas at natural gas processing facilities

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### Section I: Meta Data

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**Geographical Coverage:** United States      **Region:** United States  
**Year Data Best Represents:** 2016  
**Process Type:** Basic Process (BP)  
**Process Scope:** Gate-to-Gate Process (GG)  
**Allocation Applied:** Yes  
**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:**

**3\_FLARE\_vol**

*[scf] Natural gas sent to flares at a processing facility*

**3\_NG\_processed**

*[MCF] Annual natural gas processed at a processing facility*

**3\_NGL\_processed**

*[bbf] Annual natural gas liquids processed at a processing facility*

**3\_NG\_equiv\_mcf**

*[MCF] Annual natural gas and natural gas liquids processed at a processing facility, converted to equivalent energy of natural gas and then converted to units of volume.*

**NG\_flared\_RF**

*[kg] Quantity of natural gas that is flared per unit of natural gas processed*

**NG\_gathered**

*[kg] Total natural gas from gathering and boosting, which is the sum of natural gas that is flared and processed natural gas that exits the processing facility.*

**Tracked Input Flows:****Natural gas [Intermediate Flow]**

*[Intermediate flow] Natural gas input from gathering, including what ends up as processed natural gas and what is combusted and venting by flaring during processing.*

**Tracked Output Flows:****Natural Gas [intermediate flow]**

*Reference flow*

**Flare [to venting and flaring]**

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**Section II: Process Description**

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**Associated Documentation**

This unit process is composed of this document and the data sheet (DS) *DS\_NG\_Processing\_Flaring\_2018.01.xls*, 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 flaring of natural gas at natural gas processing facilities. Outputs include the reference flow (1 kg of natural gas throughput) and the quantity of gas sent to flare stacks; gas that is flared is sent to another

NETL unit process for speciation of all combustion emissions. The reference flow of this unit process is: 1 kg of natural gas

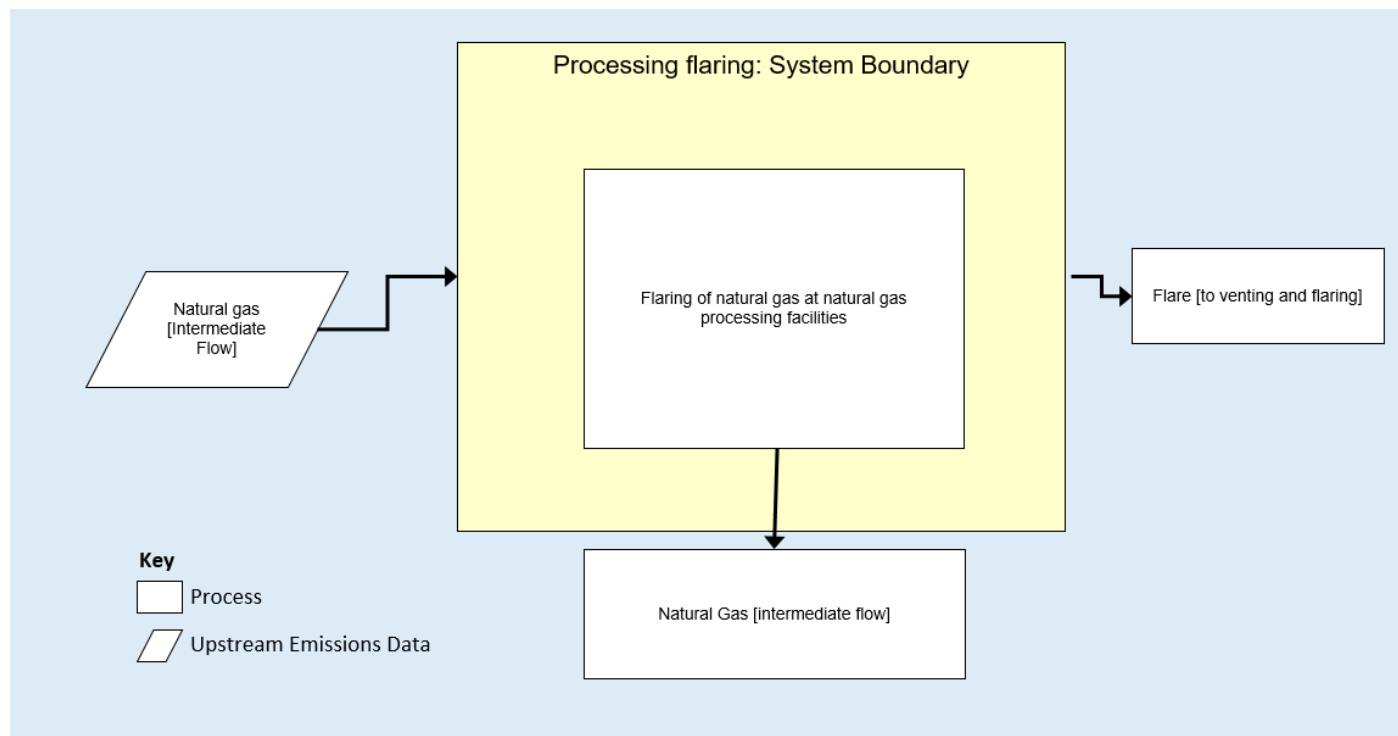
**Boundary and Description**

This unit process provides a summary of relevant input and output flows associated with the flaring of natural gas at natural gas processing facilities. Outputs include the reference flow (1 kg of natural gas throughput) and the quantity of gas sent to flare stacks; gas that is flared is sent to another NETL unit process for speciation of all combustion emissions. The reference flow of this unit process is: 1 kg of natural gas

Flaring is an environmental control measure. At natural gas processing sites, flaring is used to combust methane and other natural gas components that cannot be sent to the natural gas product stream.

**Figure 1** shows input and output flows of the unit process. The reference flow is 1 kg of processed natural gas.

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



**Table 1** shows the input parameters, which include the amount of natural gas sent to flare and the natural gas throughput at a processing facility. The emissions from flare stacks is based on data reported by the Greenhouse Gas Reporting Program (EPA, 2018). These data were stratified by NETL into 14 onshore production basins and extraction technologies (conventional, tight gas, shale gas, and coalbed methane extraction). The variability in the flaring data accounts for the 97.5 percent confidence interval in the mean flaring volume, which was obtained by statistical bootstrapping (which simulates the production-weighted average in the flaring volumes). The annual production rates for natural gas wells are based on data from DI Desktop, which are also stratified by basin and extraction technology (DI Desktop, 2018).

**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:

- Quantity of natural gas flared at natural gas processing facilities in Appalachia - Shale
- Quantity of natural gas flared at natural gas processing facilities in Gulf - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Gulf - Shale
- Quantity of natural gas flared at natural gas processing facilities in Gulf - Tight
- Quantity of natural gas flared at natural gas processing facilities in Arkla - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Arkla - Shale
- Quantity of natural gas flared at natural gas processing facilities in Arkla - Tight
- Quantity of natural gas flared at natural gas processing facilities in East Texas - Conventional
- Quantity of natural gas flared at natural gas processing facilities in East Texas - Shale
- Quantity of natural gas flared at natural gas processing facilities in East Texas - Tight
- Quantity of natural gas flared at natural gas processing facilities in Arkoma - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Arkoma - Shale
- Quantity of natural gas flared at natural gas processing facilities in South Oklahoma - Shale
- Quantity of natural gas flared at natural gas processing facilities in Anadarko - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Anadarko - Shale
- Quantity of natural gas flared at natural gas processing facilities in Anadarko - Tight
- Quantity of natural gas flared at natural gas processing facilities in Strawn - Shale
- Quantity of natural gas flared at natural gas processing facilities in Fort Worth - Shale
- Quantity of natural gas flared at natural gas processing facilities in Permian - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Permian - Shale
- Quantity of natural gas flared at natural gas processing facilities in Green River - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Green River - Tight
- Quantity of natural gas flared at natural gas processing facilities in Uinta - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Uinta - Tight
- Quantity of natural gas flared at natural gas processing facilities in San Juan - CBM
- Quantity of natural gas flared at natural gas processing facilities in San Juan - Conventional
- Quantity of natural gas flared at natural gas processing facilities in Piceance – Tight

**Table 2** shows the values for natural gas resource inputs and flaring output for Appalachian production scenario. The DS File can compute the output for all 27 onshore production scenarios. The

natural gas resource flow accounts for the total amount of input natural gas resource that goes to product (the reference flow of 1 kg) and the flared quantity; this allows the model to account for the total amount of natural gas resource extraction associated with this process. The flared output (“Flare [to venting and flaring]”) shows the quantity of natural gas sent to a separate instance of NETL’s “venting and flaring” unit processes wherein combustion chemistry and flaring effectiveness are used to convert the whole natural gas stream into speciated hydrocarbons and other components that are emitted to the atmosphere.

**Table 1: Input Parameters**

Parameter	Expected Value	Low	High	Units	Description
3_FLARE_vol	3.54E+08	2.98E+08	4.15E+08	scf	Natural gas sent to flares at a processing facility
3_NG_processed	3.36E+07	2.84E+07	3.88E+07	MCF	Annual natural gas processed at a processing facility
3_NGL_processed	0.00E+00	0.00E+00	0.00E+00	bbl	Annual natural gas liquids processed at a processing facility

**Table 2: Unit Process Input and Output Flows**

Flow Name	Expected Value	Minimum	Maximum	Units (Per Reference Flow)
<b>Inputs</b>				
Natural gas [Resource]	1.011E+00	1.0105E+00	1.0107E+00	kg NG
<b>Outputs</b>				
Natural Gas [intermediate flow]	1	1	1	kg NG
Flare [to venting and flaring]	1.054E-02	1.049E-02	1.0703E-02	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. 2016. 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.

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**Section III: Document Control Information**

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**Revision History:**

Original/no revisions

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