NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Natural Gas Extraction, Pneumatic Venting

Reference Flow: 1 kg of Natural Gas Extracted

Brief Description: This unit process quantifies the mass of gas emitted as a result of fugitive venting from pneumatic devices and valves used during natural gas extraction.

Section I: Meta Data

Geographical Coverage: United States **Region:** N/A

Year Data Best Represents: 2006

Process Type: Extraction Process (EP)

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	☑ Other
Releases to Water:	☐ Inorganic	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Vent_rate	*[kg/kg] Adjustable parameter; mass of natural gas that is vented (from pneumatics and valves) per kg of natural gas production.*
share_CO2	*[dimensionless] fraction of CO_2 in vented gas*

share_CH4	*[dimensionless] fraction of CH_4 in vented gas*
share_NMVOC	*[dimensionless] fraction of NMVOC in vented gas*
share_N2	*[dimensionless] fraction of nitrogen in vented gas*

Tracked Input Flows:

Natural gas [resource]	*[Resource] Natural gas from nature*

Tracked Output Flows:

Natural Gas	*Reference flow*
Carbon dioxide [Inorganic emissions to air]	*Emission to air*
Methane [Organic emissions to air (group VOC)]	*Emission to air*
NMVOC (unspecified) [Group NMVOC to air]	*Emission to air*
Nitrogen	*Emission to air*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_O_NG_Extraction_PneumaticVenting_2011.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

This unit process accounts for the gas that is vented by pneumatic devices and valves at a generic natural gas well. This unit process is applicable to all natural gas well installations as relevant. The reference flow of this unit process is 1 kg of extracted natural gas.

Boundary and Description

The extraction of natural gas uses pneumatic devices for the opening and closing of valves and other control systems. When a valve is opened or closed, a small amount of natural gas leaks through the valve stem and is released to the atmosphere. It is not feasible to install vapor recovery equipment on all valves and other control devices at a

natural gas extraction site, and thus the pneumatic operation of valves results in the emission of fugitive gas.

Data for the fugitive emissions from valves (and other pneumatically-operated devices) are based on EPA data for onshore and offshore gas wells (EPA, 2011). EPA's data are based on 2006 production (EPA, 2011) and show the annual methane emissions for specific extraction activities. EPA's data were converted from an annual basis to a unit-of-production basis by dividing the methane emission rate by the natural gas production rate in 2006. In 2006, valve fugitive emissions from natural gas extraction were 52,421 and 7.0 MMcf for onshore and offshore natural gas, respectively. During the same year, the U.S. extracted 19,950,828 MMCF of onshore natural gas and 3,584,190 MMCF of offshore natural gas (EIA, 2011).

Table 1 shows valve fugitive emissions from onshore and offshore natural gas extraction and the corresponding emission factors.

Figure 1: Unit Process Scope and Boundary

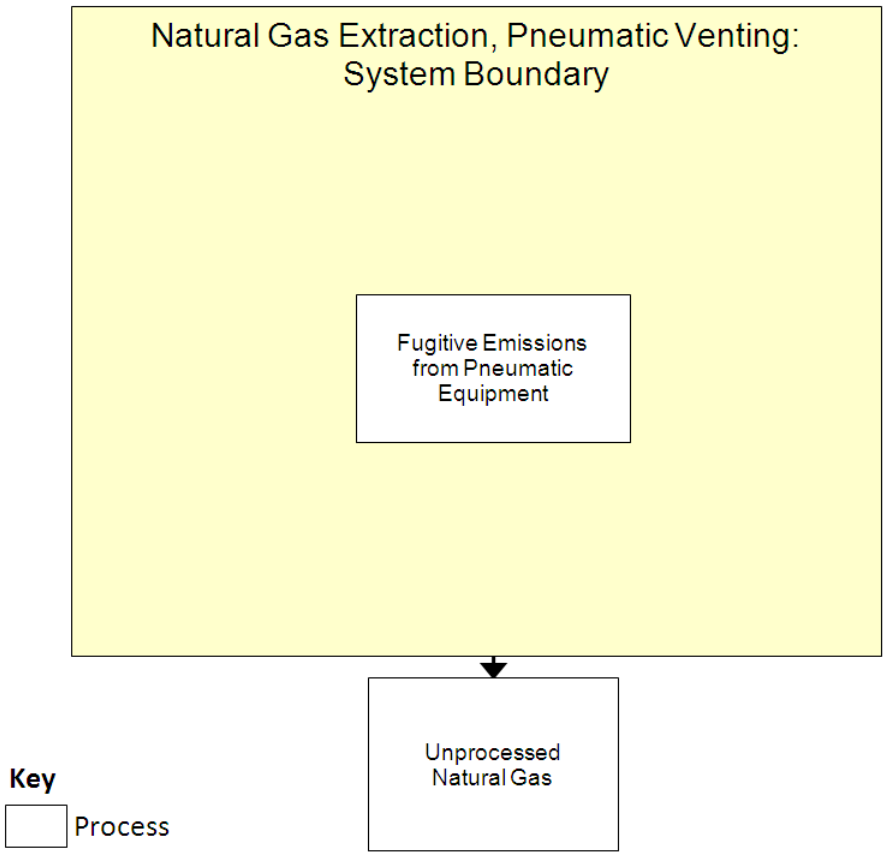

Table 1: Pneumatic Venting from Natural Gas Extraction

Location	MMcf/yr (EPA, 2011)		Emission Factor
	CH_4 emission	NG Production	kg CH_4/kg NG
Onshore	52,421	19,950,828	2.63E-03
Offshore	7.0	3,584,190	1.95E-06

Table 2: Unit Process Input and Output Flows

Flow Name	Onshore Extraction	Offshore Extraction	Units (Per Reference Flow)
Inputs			
Natural gas [resource]	2.63E-03	1.95E-06	kg
Outputs			
Natural Gas	**1.00**	**1.00**	**kg**
Carbon dioxide [Inorganic emissions to air]	3.99E-05	2.97E-08	kg
Methane [Organic emissions to air (group VOC)]	2.07E-03	1.54E-06	kg
NMVOC (unspecified) [Group NMVOC to air]	4.70E-04	3.50E-07	kg
Nitrogen	4.68E-05	3.48E-08	kg

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

Embedded Unit Processes

None.

References

EIA. (2011). Natural Gas Gross Withdrawals and Production. U.S. Energy Information Administration. Retrieved April 5, 2011, from http://www.eia.doe.gov/dnav/ng/ng_prod_sum_a_EPG0_VRN_mmcf_a.htm

EPA. (2011). Background Technical Support Document - Petroleum and Natural Gas Industry.Washington, D.C.

Section III: Document Control Information

Date Created: January 3, 2013

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

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