NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Stabilizer column

Reference Flow: 1 kg of Crude oil processed in stabilizer column

Brief Description: The use of a high-pressure stabilizer column to remove dissolved gas from produced oil.

Section I: Meta Data

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

Year Data Best Represents: N/A

Process Type: Auxiliary Process (AP)

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:

API	*[deg API] API of the crude oil being produced. Heavy Venezuelan crude has an API of just over 10, and Bakken crude can be around 42.*
Feed_temp	*[deg F] Temperature of the feed entering the stabilizer column*
Process_temp	*[deg F] Temperature that the crude oil is raised to in the stabilizer column*

Crude_SH	*[btu/bbl] The specific heat of crude oil*
Heat_loss	*[dimensionless] A heat loss factor*
Hfuel_eff	*[dimensionless] Reboiler efficiency using natural gas, NGL fuel, or electricity*
Heater_Type	*[boolean] Select 1 if a gas fired heater is used; 0 for electric heater*
Gas_Fuel_Type	*[boolean] Select 1 if natural gas is used in the gas fired heater; 0 if NGLs are used*

Tracked Input Flows:

Natural gas, combusted in boiler [Natural gas products]	*[Technosphere] Natural gas heat source for the heater-treater*
LPG, combusted in boiler [Natural gas products]	*[Technosphere] NGL heat source for the heater-treater*
Electricity [Electric power]	*[Technosphere] Electricity heat source for the heater-treater*

Tracked Output Flows:

Degassing, crude oil stabilizer column [Valuable substances] *Reference flow*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_O_Stabilizer_Column_2013.01.xlsx*, 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 use of a high-pressure stabilizer column immediately after the extraction of crude oil. The stabilizer column removed dissolved gas from the crude in order to meet Reid vapor pressure (RVP) specifications. High-pressure stabilizers are used in OPGEE rather than low-pressure stabilizers, which require

a lower boiler temperature. The reference flow of this unit process is: 1 kg of Crude oil processed in stabilizer column

Boundary and Description

The removal of volatile organic hydrocarbons from wellhead crude oil is called crude oil stabilization. Essentially, dissolved gas is removed to substantially decrease the Reid vapor pressure (RVP) and meet pipeline and storage specifications. In this unit process, it is assumed that a reboiled stabilizer column is utilized in the oil-gas separation scheme. The reboiler produces a stabilized crude oil as the vapor flows up the column, stripping out methane, ethane, propane, and sufficient butane.

High-pressure stabilizers are used rather than low-pressure stabilizers, as higher pressures correlate with higher separation efficiency. Moreover, a high pressure stabilizer at 100 psi requires a higher reboiler temperature compared to a low pressure stabilizer. The Oil Production Greenhouse Gas Emissions Estimator (OPGEE) assumes a direct-fired heater to provide the necessary temperature as a heat source (El-Houjeiri *et al.,* 2013).

Ultimately, the use of a stabilizer column and the number of stages of crude oil processing is directly dependent on the gas-to-oil ratio (GOR). For example, onshore locations may range between 25-100 scf/bbl and thus a one stage flash separation followed by wash tanks tends to be used (El-Houjeiri *et al.,* 2013). The use of reboiled stabilization or a series of flash drums are utilized primarily for high volume, high GOR streams (>150 scf/bbl), as it is of economic benefit (El-Houjeiri *et al.,* 2013).

As shown in **Figure 1**, this unit process is not set up with an input oil flow and an output of stabilized oil. Instead, this process is designed to provide the service of crude oil stabilization by use of a stabilizer column. It calculates the amount of energy used to provide that service. In order to use this unit process, it must be called by another process to treat a specific amount of crude oil.

A list of key parameters and properties used to determine energy use is included in **Table 1**.

Figure 1: Unit Process Scope and Boundary

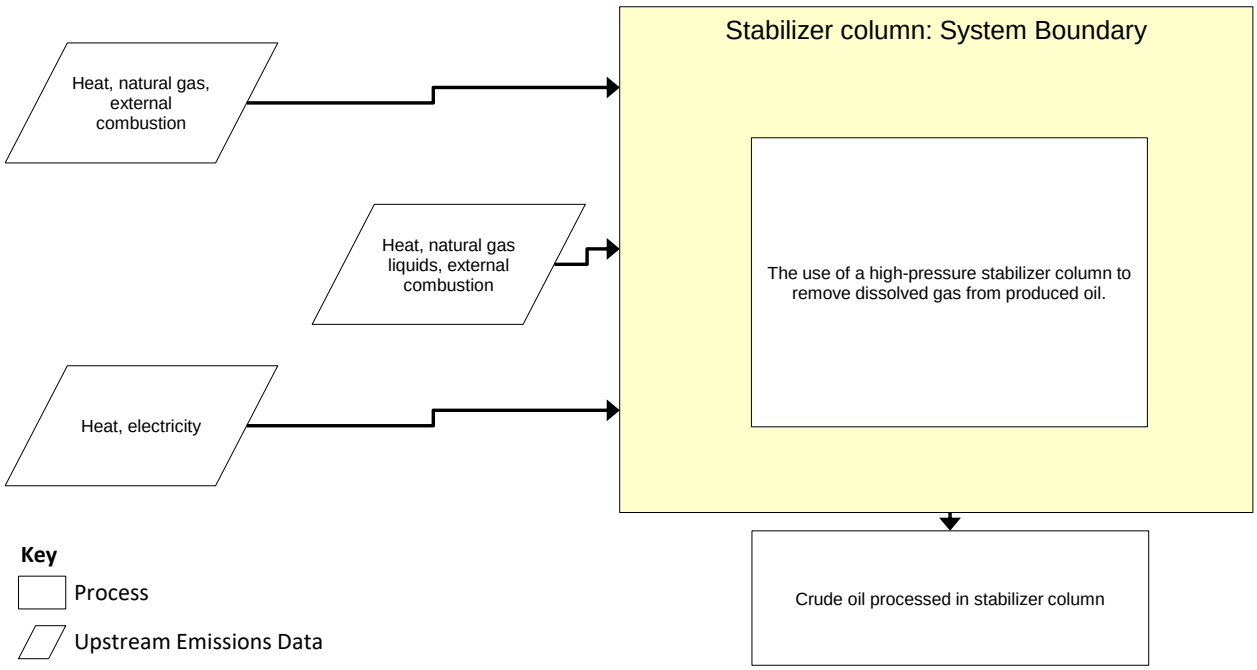

Table 1: Default Properties for Stabilizer Column

Property	Value	Source
Low GOR range	25-100 scf/bbl	Manning and Thompson 1995
High GOR range	>150 scf/bbl	Manning and Thompson 1995
Specific heat of oil	150 Btu/bbl – °F	Manning and Thompson 1995
Feed temperature	120°F	Manning and Thompson 1995
Reboiler temperature	344°F	Manning and Thompson 1995
Heat loss	0.02	Manning and Thompson 1995

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Heat, natural gas, external combustion	**3.24E-01**	**MJ**
Heat, natural gas liquids, external combustion	**0.00E+00**	**MJ**
Heat, electricity	**0.00E+00**	**kWh**
Outputs		
Crude oil processed in stabilizer column	**1.00**	**kg**

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

Embedded Unit Processes

None.

References

El-Houjeiri *et al.* 2013 — El-Houjeiri, H.M., McNally, S., and Brandt, A. R. (2013). *Oil Production Greenhouse Gas Emissions Estimator OPGEE v1.1 DRAFT A: User guide & Technical documentation.*

Manning and Thompson 1995 — Manning, F.S., Thompson, R (1995). *Oil processing, Volume 2: Crude oil;* Pennwell: Tulsa, OK

Section III: Document Control Information

Date Created: October 18, 2013

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 (2013). NETL Life Cycle Inventory Data – Unit Process: Stabilizer column. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: July 2013 (version 01). www.netl.doe.gov/LCA (http://www.netl.doe.gov/LCA)

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.