



NETL Life Cycle Inventory Data

Process Documentation File

Process Name: Crude oil storage tank
Reference Flow: 1 kg of crude oil output
Brief Description: VOC losses from a crude oil storage tank at an enhanced oil recovery (EOR) extraction site

Section I: Meta Data

Geographical Coverage: United States **Region:** Permian Basin

Year Data Best Represents: 2010

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 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:

VOC *[kg/kg] kg of VOC emissions per kg of crude oil throughput; uncertainty range based on range of technologies (historical, best practices, advanced)*

Crude_in *[kg/kg] kg of crude oil input to storage tank, including the mass of VOC to be lost during storage*

Tracked Input Flows:

Crude oil

*[Technosphere] Crude oil from
gas/oil/water separation at wellhead***Tracked Output Flows:**Crude oil
NMVOC (unspecified)*Reference flow (crude oil output)
VOC to venting and flaring*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_Crude_Storage_Tank_2012.01.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 storage of crude oil in a tank at an enhanced oil recovery (EOR) site. The flashing and working losses of a storage tank result in volatile organic compound (VOC) emissions that are recovered by vapor recovery equipment and sent to venting or flaring. The reference flow of this unit process is: 1 kg of crude oil output.

Boundary and Description

This unit process provides a summary of relevant input and output flows associated with the storage of crude oil in a tank at an enhanced oil recovery (EOR) site. The flashing and working losses of a storage tank result in volatile organic compound (VOC) emissions that are recovered by vapor recovery equipment and sent to venting or flaring.

The data and calculation methods of this unit process are based on NETL's existing work on enhanced oil recovery (EOR) operations (NETL, 2010). The loss of VOCs from a storage tank is caused by the flashing of new crude oil that enters the storage tank, the volume change caused by new crude that enters the tank (working losses), and the expansion of product in the tank due to temperature increases (standing losses) (NETL, 2010). The source document (NETL, 2010) used the Vasquez-Beggs correlation for gas

and oil mixtures to calculate VOC losses from crude flashing. The source document also used an EPA model for calculating working and standing losses (NETL, 2010).

VOC losses are captured by a vapor recovery unit (VRU) that sends captured VOC to a venting and flaring process. The direct venting of VOCs to air or the flaring of VOCs are not included in this unit process.

Figure 1: Unit Process Scope and Boundary

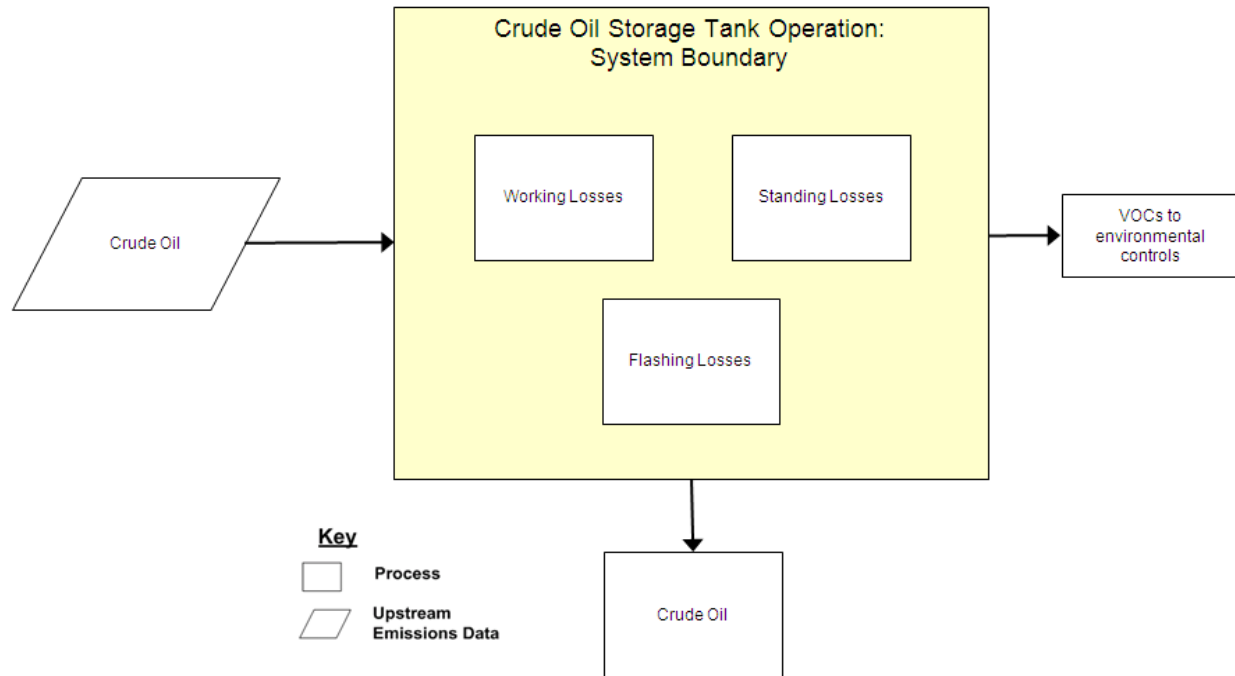


Table 1: Annual Tank Losses and Product Throughput

EOR Technology	Tank Losses (kg/yr)	Tank Throughput (barrel/yr)	Reference
Historical	29,000	173,100	NETL, 2010
Best Practices	32,000	199,500	NETL, 2010
Advanced	30,600	179,300	NETL, 2010

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Crude oil	1.00124	kg
Outputs		
Crude oil	1.00	kg
NMVOC (unspecified)	1.24E-03	kg

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

Embedded Unit Processes

None.

References

NETL, 2010.

NETL, 2010. An Assessment of Gate-to-Gate Environmental Life Cycle Performance of Water-Alternating-Gas CO₂-Enhanced Oil Recovery in the Permian Basin, National Energy Technology Laboratory, Pittsburgh, PA. Accessed on September 27, 2012 at <http://www.netl.doe.gov/energy-analyses/refshelf/PubDetails.aspx?Action=View&PubId=333>.



Section III: Document Control Information

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