Samson Exploration, LLC
Adrianna CTB

Tank Emissions - E&P Tanks Low or High Pressure Oil Option

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable).

C) A reduction for produced water tank emissions calculated as oil/condensate may be entered.

D) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

E) Make sure to answer the control device question.

E&P TANKS - LOW OR HIGH PRESSURE OIL [FOR ESTIMATING WORKING, BREATHING, AND FLASH LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Separator Pressure (psig)	Separator Temperature (°F)	Ambient Pressure (psia)	Ambient Temperature (°F)	C10+ MW	C10+ SG	Production Rate (bbl/day/tank)	API Gravity	RVP (psia)	Emissions Uncontrolled VOC (lb/hr)	Emissions Uncontrolled VOC (ton/yr)	Emissions Uncontrolled Benzene (lb/hr)	Emissions Uncontrolled Benzene (ton/yr)	Emissions Uncontrolled H_2S (lb/hr)	Emissions Uncontrolled H_2S (ton/yr)	Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	VOC Control Efficiency (%)	H_2S Control Efficiency (%)	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
OST-1 thru OST-14	Storage Tank, Oil 500 bbl	126	117	14.7	70	166	0.893	128.5714286	46.52	7	426.0570776	1866.13	0.399543378	1.75	0.038358164	0.168	(B) cont. by flare/ VCU/TO/VRU				426.06	1866.13	0.40	1.75	0.04	0.17
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																				Totals:	426.06	1866.13	0.40	1.75	0.04	0.17

Enter any notes here:	

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Tank Emissions - E&P Tanks Low or High Pressure Oil Option

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C) A reduction for produced water tank emissions calculated as oil/condensate may be entered.

D) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

E) Make sure to answer the control device question.

E&P TANKS - LOW OR HIGH PRESSURE OIL [FOR ESTIMATING WORKING, BREATHING, AND FLASH LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Separator Pressure (psig)	Separator Temperature (°F)	Ambient Pressure (psia)	Ambient Temperature (°F)	C10+ MW	C10+ SG	Production Rate (bbl/day/tank)	API Gravity	RVP (psia)	Emissions Uncontrolled VOC (lb/hr)	Emissions Uncontrolled VOC (ton/yr)	Emissions Uncontrolled Benzene (lb/hr)	Emissions Uncontrolled Benzene (ton/yr)	Emissions Uncontrolled H_2S (lb/hr)	Emissions Uncontrolled H_2S (ton/yr)	Are tank vapors (A) Uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	VOC Control Efficiency (%)	H_2S Control Efficiency (%)	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
WST-1 thru WST-8	Storage Tank, Produced Water 500 bbl	126	117	14.7	70	166	0.899	575	46.52	7	1035.134247	4533.886	0.947945205	4.152	0.094977169	0.416	(D) cont. by flare/ VC/TO/VRU			99	10.35	45.34	0.01	0.04	0.09	0.42
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																					0.00	0.00	0.00	0.00	0.00	0.00
																				Totals	10.35	45.34	0.01	0.04	0.09	0.42

Enter any notes here:	

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Vapor Recovery Unit Emissions

A) Enter information into the yellow boxes.

B) See notes/instructions incuded below.

C) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

FIN	VRU-1
Identifier	Vapor Recovery Unit 1

Is this unit a mechanical VRU (mVRU) or a liquid VRU (lVRU)? Pick from list.	mVRU
Annual Hours of Operation:	8760
VOC percent control efficiency (%):	100
H_2S percent control efficiency (%):	100

Stream Information

Each numbered column represents a stream. The twelve columns are for any streams sent to the VRU, such as "tank 1", "glycol flash tank", etc. Under the column numbers, these columns should be labeled with the stream name. Information only needs to be entered for the number of streams sent to the VRU. If for example, there are only two process/waste streams routed to the VRU, only colums 1and 2 need to be filled out.

Stream Sent to VRU No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to VRU Name (Enter Names of Each Stream Here)	OST-1 thru OST-14	WST-1 thru WST-8											-
Amount of Time Stream Routed to VRU (hrs/yr)	8760	8760											-

It is suggested that you link these cells below to the cells in the other tabs of this spreadsheet which contain the calculated uncontrolled emissions for the stream.

Mass Flow Rates of the Vapors Sent to this Control Device, Hourly Basis (lb/hr)

Stream Sent to VRU No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to VRU Name	OST-1 thru OST-14	WST-1 thru WST-8											-
H2S	0.04	0.09											0.133333
Crude or Condensate VOC	426.06	10.35											436.4084
Natural Gas VOC													0
Total VOC	426.06	10.35											436.4084
benzene	0.40	0.01											0.409023

Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)

H2S	0.17	0.42											0.584
Crude or Condensate VOC	1866.13	45.34											1911.469
Natural Gas VOC													0
Total VOC	1866.13	45.34											1911.469
benzene	1.75	0.04											1.79152

Samson Mechanical VRU Control Efficiency Basis Table

Category	Compliance Criteria	Compliance Method/Procedure
VRU Basic Design/Function	The VRU system is designed to capture and handle the maximum volume of vapors expected from the storage tanks. As liquids and vapors flash in the tanks, the pressure rise trips a pressure switch (PLC or relay) sending a digital signal to the VRU starter control. The VRU piping is adequately sized, minimized 90 degree pipe bends to reduce vapor friction, and is gradually sloped to prevent liquids accumulation.	
VRU Additional Design/Function	Additional sensing equipment	An electronic pressure transducer is mounted on the tank vent manifold rather than at the VRU suction header to more accurately measure tank pressure and control the VRU operation.
	VRU operation	The VRU system is designed to operate only when the tank pressure is above the control set-point (Pressure switch high - PSH). The VRU system switches off when the tank pressures fall below the low set point (Pressure switch low - PSL). No recycle or bypass is used.
	Compressor suitability for application	The system consists of motor drive, oil-flooded screw compressors with full voltage (ACL) starters. The VRU is designed for continuous service but operates on an intermittent demand basis.
	Gas Blanket	Tank pressures are always positive to ensure that air and oxygen do not enter the system. Due to the high rate of production and high gravity condensate, additional gas is not required and a gas blanket is always present.
	Additional VRU System Control	The VRU bypass to flare is designed to vent tank vapors to the flare in the event of a power failure and loss of VRU control capacity. Tank thief hatches are set at 12 - 16 oz pressure and the Enardo bypass is set at 10 oz pressure to ensure that hatches do not pop open and vent if VRU control capacity is lost due to power

Category	Compliance Criteria	Compliance Method/Procedure
		failure. Tank vapors vented to the flare are controlled at 98% destruction efficiency and are permitted as MSS emissions.
Parametric Monitoring and Recordkeeping	Pressure Recorder on VRU	VRU flowrate is measured with a dedicated orifice meter and electronic flow recorder. Pressure, differential pressure and temperature are recorded.
	Daily hatch, seal, and VRU inspection	Daily visual inspection of VRU system, hatches and seals are conducted and recorded in the log book.
Monitoring of Ambient Site Conditions	LEL and H2S Site Monitoring	The location has combustible atmosphere detectors (gas detectors) located on the site boundary side of the tanks and in the VRU area. These alarm at 10% of combustible limits (LEL) and send a site shutdown signal at 20% of LEL.

Controlled Emissions

Hourly (lb/hr)

Stream Sent to VRU No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to VRU Name	OST-1 thru OST-14	WST-1 thru WST-8											-
H2S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Crude or Condensate VOC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Natural Gas VOC		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Total VOC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
benzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

Next Tab

Annual (tpy)

Stream Sent to VRU No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to VRU Name	OST-1 thru OST-14	WST-1 thru WST-8											-
H2S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Crude or Condensate VOC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Natural Gas VOC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Total VOC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
benzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

Vapor Combustor Total Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total Crude Oil or Condensate VOC	0.00	0.00
Total Natural Gas VOC	0.00	0.00
Total VOC	0.00	0.00
H2S	0.00	0.00
benzene	0.00	0.00

Enter any notes here as needed. You must address the following:

(1) How is this control efficiency justified? Please be specific.

(2) Explain what happens to the material once it is recovered.

(3) Explain what happens when this unit is down. Include how long the unit could be down for.