Oil and Gas Emissions Spreadsheet with Impacts Analysis

Revised 12/08/2011

General Notes

***** Before beginning, make sure to enable macros, so that this spreadsheet will run properly. *** See the links below for more information on creating a trusted location and enabling macros for this spreadsheet.**

Enable Macro Link

Trusted Location Link

See comments in individual cells and other written notes. Cells with red corners contain comments; place cursor anywhere in a cell which has a red corner, to view comment. These were added to guide you through using this spreadsheet and make it as easy as possible to use.

This spreadsheet should be used as follows: (1) Enter information into this Facility Information spreadsheet tab, (2) after running the macro (which is explained below), fill out the emission calculation tabs, (3) populate the Emissions Summary table (you press a button on the Emissions Summary tab and the macro will populate the table with the values from the emission calculation tabs), and (4) go through the impacts review tabs (if applicable). This basically means estimate what each of the individual source emissions are, then summarize them in a table, then evaluate the impact of the emissions (if impacts review is applicable).

If you want to use any of the impacts review tabs, you will need to have answered "Yes" to the initial question of "Are you using this to meet the new Barnett Shale area rule requirements?". You can press the "Reset" button at the bottom of this tab to have the question pop up again.

Yellow cells require information to be entered. Red cells contain calculated values.

Worst case emissions must be estimated on both an hourly and annual basis for air permitting purposes.

> **Hourly emissions must be based on worst case maximum parameters realistically expected to occur over the course of any one hour. As an example, where ambient temperature is used as a parameter to estimate hourly emissions, the maximum temperature from the hottest day of the year must be used.**
>
> **Annual emissions can be based on average parameters. As an example, where ambient temperature is used as a parameter to estimate annual emissions, the average ambient temperature may be used.**
>
> **This difference between hourly and annual emissions could potentially mean that separate calculations or program runs will have to be done to estimate hourly and annual emission rates.**

Planned Maintenance, Start-up, and Shutdown (MSS) versus Alternate Operating Scenarios: Planned MSS emissions are not required to be registered for oil and gas sites until January 5, 2014. Before this date, it is voluntary to factor in planned MSS emissions. Alternate operating scenario emissions should be factored in now. Although historically alternate operating scenarios have sometimes been treated as planned MSS, it is actually different and should be addressed now to ensure that during these periods and continuously, the applicable emission limits are not exceeded. It is also encouraged that planned MSS emissions are addressed now because after the January 5, 2014 deadline, all emissions must continuously be shown not to exceed the applicable emission limits, even with planned MSS emissions factored in.

What is Different About Estimating Emissions for the Barnett Shale Area Rule Requirements?

There are level limits (or caps) for the different levels of authorization, which are: PBR Level 1, PBR Level 2, and Standard Permit. The level limits are emission limits of the following air pollutants: Total VOC, Total crude oil or condensate VOC, Total natural gas VOC, benzene, hydrogen sulfide (H_2S), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM_{10} and $PM_{2.5}$). There are different level limits for hourly and annual emissions and within hourly emissions there are different level limits for steady state emissions versus periodic emissions.

There is an impacts review for both the Permit by Rule (PBR) and Standard Permit for the following air pollutants: benzene, H_2S, SO_2, and NOx.

VOC emissions need to be separated into (1) Crude Oil or Condensate VOC and (2) Natural Gas VOC.

Hourly and annual emissions need to be estimated. There are potentially three hourly emission types that need to be estimated (1) steady state hourly, (2) low pressure periodic, and (3) high pressure periodic. These are described in detail on the Emissions Summary tab.

Benzene emissions need to be speciated for all sources.

Oil and Gas Site General Information	
Administrative Information	
Company Name	Chesapeake Operating, Inc.
Facility/Well Name	Mayfly B Pad
Field Name	
Nearest City/Town	Cleburne
API Number/SIC Code	614240, 614241, 614674, 730010
Latitude/Longitude	32.32245, -97.53974
County	Johnson
Are you using a Form PI-7, PI-7-CERT, APD-CERT, PI-7 and APD-CERT, or are you using ePermits?	ePermits
Customer Number, CNxxxxxxxxx (if known)	CN600514004
Regulated Entity Number, RNxxxxxxxxx (if known)	RN106524846
Technical Information	
Natural Gas Site Throughput (MMSCF/day):	
Oil/Condensate Site Throughput (bbl/day):	0
Produced Water Site Throughput (bbl/day):	400
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	No
What is the date of the site start of construction or the date that the project changes were implemented (whichever is applicable to this project, anticipated date if in the future)?	
Has this site been registered before?	Yes

Run Reset

Run Reset

Next Tab

Equipment/Processes at Site

Before entering any numbers into the Equipment/Processes section of the table below, please make sure to review all of the comments in the cells of the table. These should make it clear what numbers need to be entered and where they need to be entered.

Equipment/Process Types	How many for this project?	How many for this registration?
Fugitives	1	1
IC Engines	2	2
Turbines	0	0
Diesel Engines	0	0
Heaters-Boilers	0	0
Oil / Condensate Tanks	0	0
Produced Water Tanks	4	4
Miscellaneous Tanks	0	0
Loading Jobs	1	1
Glycol Units	0	0
Amine Units	0	0
Vapor Recovery Units	0	0
Flares-Vapor Combustors	0	0
Thermal Oxidizers	0	0
MSS	0	0
Other	1	1

When you are finished entering information on this tab, press the "Run" button below. When it is pressed, the spreadsheet tabs needed will be added and the "Emissions Summary" tab will also be added with the number of rows corresponding to the number of emission points in this registration.

Before pressing "Run", please make sure to review all of the comments in the cells of the table above. These should make it clear what numbers need to be entered and where they need to be entered.

The spreadsheet can be reset if needed by pressing the "Reset" button below. If the "Reset" button is pressed, everything will be cleared and you can start over (the added sheets will disappear along with any data entered into the sheets). When the "Reset" button is pressed and there is anything to clear, a question will pop up asking "Delete all macro created worksheets?". Then if you click "Yes", the question will pop back up asking "Are you using this to meet the new Barnett Shale area requirements?".

If the "Run" button is pressed a second time, everything will be cleared and you can start over (the added sheets will disappear along with any data entered into the sheets). When the "Run" button is pressed a second time, a question will pop up asking "Delete all macro created worksheets?". The question will not pop back up asking "Are you using this to meet the new Barnett Shale area requirements?".

Do not press "Run" again or "Reset", unless you intend to clear all of the added sheets (and any data entered into the sheets). This means that it is important to make sure the right numbers of each equipment/process type are entered. If it is possible that an extra piece of equipment could be included, include it because it is better to have too many entered than not enough.

Chesapeake Operating, Inc.
Mayfly B Pad

Gas and Liquid Analyses

A) Enter information into the yellow boxes.

B) The purpose of this tab is to extract information from a lab analysis that will be used in emission calculations. Unlike the other other tabs which calculate emission from this tab gets pulled to the Emissions Summary table. The big pieces of information needed for emissions estimates are the VOC, benzene, and H_2S weight perce Sampling of gas and liquid streams from appropriate process sampling points is required in order to determine composition or other properties needed to estimate er such as heat content, specific gravity, and vapor pressure. It is essential that stream lab analyses/reports include a measurement of H_2S, individual HAPs, and at least hydrocarbons up to at least 10 carbon atoms per molecule (C10+).

C) There are two boxes on the left, for gas and liquid analyses, which take component weight percent inputs and there are two boxes on the right, for gas and liquid an which take component mole percent inputs. You can either fill out the weight percent box OR the mole percent box, depending on what informaton you have available

The boxes are set up in the following arrangement:

Gas Analysis Wt% Inputs	Gas Analysis Mol% Inputs
Liquid Analysis Wt% Inputs	Liquid Analysis Mol% Inputs

D) If weight percents are provided on the lab report, use the boxes on the left. If only mole percents are provided on the lab report, use the boxes on the right.

E) Make sure to select whether you are inputting weight percents or mole percents from the pull down menus below.

F) If you are using the weight percent boxes (left two), in addition to the component weight percents, you need to enter the gas molecular weight (molecular weight of sample) and the gas and liquid H_2S content in parts per million by volume (H_2S ppmv). This will allow for the calcultion of the gas specific gravity and the long tons of day in the gas, and the determination of sweet versus sour gas.

G) If you are using the mole percent boxes (right two), in addition to the component mole percents, you need to enter a real value, specific to this sample, for the mole of the deacnes plus (C10+) fraction. You may use the default values listed below for the moleclar weights of the other hexanes (C6), other heptanes (C7), other ocatne nonanes (C9) fractions, unless you have a more accurate number. If you enter number other than the default, you need to explain where the number came from and wh appropriate to use.

H) What is expected to be inlcuded on these tables is the the inlet gas and liquid streams (the liquid would most likely be sampled from a separator if there is separati site). These tables can also be used for any sampled gas and liquid streams as needed. If needed, make a copy of this tab.

I) Use the box provided below for entering any notes necessary.

For the gas sample, I am inputting (pick from list):	weight percents	Select whether weight percents or mole percents are being entered for this gas sample.

Then fill out this table **OR** fill out this table.

Gas Analysis - Use if the Inputs are Weight Percents	
Analysis Identifier/Name	Mayfly B Pad
What site is the sample from?	Mayfly B Pad
If the sample is from a representative site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	Sales Gas
What is the temperature and pressure of the sample (include units)?	108.4 psig @ 85.3 F
Who analyzed the sample?	SPL
Date of sample:	7/24/2012

Component	**weight %**
hydrogen	
helium	
nitrogen	1.4720
CO2	2.5960
H2S	
methane (C1)	75.7530
ethane (C2)	13.2720
propane (C3)	4.0040
butanes (C4)	1.9940
pentanes (C5)	0.5660
benzene	0.1900
other hexanes (C6)	0.0000
toluene	0.0000
other heptanes (C7)	0.1110
ethylbenzene	0.0000
xylenes (o, m, p)	0.0000
other octanes (C8)	0.0420
nonanes (C9)	0.0000
decanes plus (C10+)	0.0000
Totals:	100.0000

Gas Analysis - Use if the Inputs are Mole Percents	
Analysis Identifier/Name	
Where was the sample taken?	
If the sample is from a representative site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	**mole %**	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas
hydrogen		2.01588	0
helium		4.0026	0
nitrogen		28.01340	0
CO2		44.00950	0
H2S		34.08188	0
methane (C1)		16.04246	0
ethane (C2)		30.06904	0
propane (C3)		44.09562	0
butanes (C4)		58.12220	0
pentanes (C5)		72.14878	0
benzene		78.110000	0
other hexanes (C6)		86.18000	0
toluene		92.140000	0
other heptanes (C7)		100.20000	0
ethylbenzene		106.170000	0
xylenes (o, m, p)		106.170000	0
other octanes (C8)		114.23000	0
nonanes (C9)		128.26000	0
decanes plus (C10+)			0
Totals:	0.0000	0.00	0

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	6.9070
VOC weight fraction =	0.0691

VOC content of hydrocarbon fraction only

VOC weight% =	7.1999
VOC weight fraction =	0.0720

Hydrogen Sulfide

		Constants:	
H2S weight% =	0.0000	453.59237	mol/lb-mol
H2S weight fraction =	0.00E+00	0.06479891	grams/grain
H2S ppm_V =	2	385.48	scf/lb-mol
H2S ppm_{WT}=	0.00	34.08188	g/mol, lb/lb-mol
H_2S grains/100 SCF =	0.1238		H2S mw

SWEET GAS

Benzene

Benzene content of total sample

Benzene weight% =	0.1900
Benzene weight fraction =	0.0019

Benzene content of hydrocarbon fraction only

Benzene weight% =	0.1940
Benzene weight fraction =	0.0019

		Constants:	
Gas Molecular Weight =	17.93	28.97	air mw
Gas Specific Gravity =	0.62	385.48	scf/lb-mol
Gas Throughput (MMscf/day)=	0		
Long Tons Sulfur Compounds per Day =	0		

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

VOC content of hydrocarbon fraction only

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

Hydrogen Sulfide

		Constants:
H2S weight% =	#DIV/0!	453.59237
H2S weight fraction =	#DIV/0!	0.06479891
H2S ppm_V =	0	385.48
H2S ppm_{WT}=	#DIV/0!	
H_2S grains/100 SCF =	0.0000	

SWEET GAS

Benzene

Benzene content of total sample

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

Benzene content of hydrocarbon fraction only

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

		Constants:
Gas Molecular Weight =	0.00	28.97
Gas Specific Gravity =	0.00	385.48
Gas Throughput (MMscf/day)=	0	
Long Tons Sulfur Compounds per Day =	#DIV/0!	

For the liquid sample, I am inputting (pick from list): Next Tab	weight percents	Select whether weight percents or mole percents are being entered for this liquid sample.

Then fill out this table **OR** fill out this table.

Liquid Analysis - Use if the Inputs are Weight Percents	
Analysis Identifier/Name	Duck Lake 10H
What site is the sample from?	Duck Lake 10H
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	Separator Water
What is the temperature and pressure of the sample (include units)?	260 psig @ 92.1 F
Who analyzed the sample?	SPL
Date of sample:	4/30/2010

Component	weight %
hydrogen	
helium	
nitrogen	14.8990
CO2	24.5580
H2S	
methane (C1)	46.3070
ethane (C2)	1.5670
propane (C3)	0.7570
butanes (C4)	1.2540
pentanes (C5)	1.5510
benzene	0.0470
other hexanes (C6)	2.6230
toluene	0.1850
other heptanes (C7)	2.7730
ethylbenzene	0.0050
xylenes (o, m, p)	0.0410
other octanes (C8)	2.4430
nonanes (C9)	0.8300
decanes plus (C10+)	0.1600
Totals:	100.0000

Liquid Analysis - Use if the Inputs are Mole Percents	
Analysis Identifier/Name	
What site is the sample from?	
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas
hydrogen		2.01588	0
helium		4.0026	0
nitrogen		28.01340	0
CO2		44.00950	0
H2S		34.08188	0
methane (C1)		16.04246	0
ethane (C2)		30.06904	0
propane (C3)		44.09562	0
butanes (C4)		58.12220	0
pentanes (C5)		72.14878	0
benzene		78.110000	0
other hexanes (C6)		86.18000	0
toluene		92.140000	0
other heptanes (C7)		100.20000	0
ethylbenzene		106.170000	0
xylenes (o, m, p)		106.170000	0
other octanes (C8)		114.23000	0
nonanes (C9)		128.26000	0
decanes plus (C10+)			0
Totals:	0.0000	0.00	0

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	12.6690
VOC weight fraction =	0.1267

VOC content of hydrocarbon fraction only

VOC weight% =	20.9256
VOC weight fraction =	0.2093

Hydrogen Sulfide

H2S weight% =	0.0000
H2S weight fraction =	0.00E+00
H2S ppm_V =	2.10
H2S ppm_{WT}=	0.00

Benzene

Benzene content of total sample

Benzene weight% =	0.0470
Benzene weight fraction =	0.0005

Benzene content of hydrocarbon fraction only

Benzene weight% =	0.0776
Benzene weight fraction =	0.0008

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

VOC content of hydrocarbon fraction only

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

Hydrogen Sulfide

H2S weight% =	#DIV/0!
H2S weight fraction =	#DIV/0!
H2S ppm_V =	0.00
H2S ppm_{WT}=	#DIV/0!

Benzene

Benzene content of total sample

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

Benzene content of hydrocarbon fraction only

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

Enter any notes here:	

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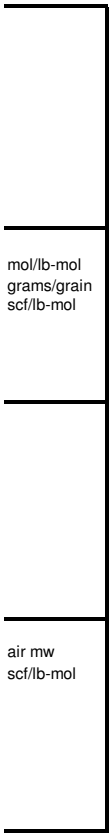
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Fugitives Emissions

EPN	F1
Name	Fugitives

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (as applicable for reductions from leak detection and repair programs).

C) The vapor VOC, benzene, and H_2S weight percents may be entered. The weight percents from the Analyses tab are displayed below.

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

E) This sheet has five parts to it. Part (1) is for Gas Service, (2) is for Heavy Oil Service, (3) is for Light Oil Service, (4) is for Water/Oil Service, and (5) is for a combination of all the results. Fill out all applicable yellow cells in parts (1)-(4) and the final results will be in part (5).

The five parts are set up in this arrangement:

(1)	(2)
(3)	(4)
(5)	

F) Make sure to select the correct *VOC Type* and *Emission Type* from the pull down menus below in part (5).

Gas Weight Percents From Analyses Tab:	
VOC wt %	7.1999
Benzene wt %	0.1940
H_2S wt %	0.0000

(1)

Gas

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
317	Valve	0.009920	3.14464	13.7735232
4	Pump Seal	0.005290	0.02116	0.0926808
0	Connector	0.000440	0	0
772	Flange	0.000860	0.66392	2.9079696
0	Open-ended Line	0.004410	0	0
0	Other	0.019400	0	0
		Total:	3.82972	16.7741736

	VOC content (wt %)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	7.1999	0.1940	0.0000	0.0000
Pump Seal	7.1999	0.1940	0.0000	0.0000
Connector	7.1999	0.1940	0.0000	0.0000
Flange	7.1999	0.1940	0.0000	0.0000
Open-ended Line	7.1999	0.1940	0.0000	0.0000
Other	7.1999	0.1940	0.0000	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.23	0.99	0.00	0.00	0.01	0.03
Pump Seal	0.00	0.01	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.05	0.21	0.00	0.00	0.00	0.01
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.28	1.21	0.00	0.00	0.01	0.03

Liquid Weight Percents From Analyses Tab:	
VOC wt %	20.9256
Benzene wt %	0.0776
H_2S wt %	0.0000

(2)

Heavy Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
	Valve	0.0000185	0	0
	Pumps	0.0011300	0	0
	Connector	0.0000165	0	0
	Flange	0.00000086	0	0
	Open-ended Line	0.0003090	0	0
	Other	0.0000683	0	0
		Total:	0	0

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves				
Pump Seal				
Connector				
Flange				
Open-ended Line				
Other				

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.00	0.00	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.00	0.00	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.00	0.00	0.00	0.00	0.00	0.00

Next Tab

Liquid Weight Percents From Analyses Tab:	
VOC wt %	20.9256
Benzene wt %	0.0776
H_2S wt %	0.0000

(3) **Light Oil**

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
	Valve	0.005500	0	0
	Pump Seal	0.028660	0	0
	Connector	0.000463	0	0
	Flange	0.000243	0	0
	Open-ended Line	0.003090	0	0
	Other	0.016500	0	0
	Total:		0	0

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves				
Pump Seal				
Connector				
Flange				
Open-ended Line				
Other				

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.00	0.00	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.00	0.00	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.00	0.00	0.00	0.00	0.00	0.00

(4) **Water/Oil**

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
99	Valve	0.000216	0.021384	0.09366192
0	Pump Seal	0.000052	0	0
0	Connector	0.000243	0	0
267	Flange	0.000006	0.001602	0.00701676
0	Open-ended Line	0.000550	0	0
0	Other	0.030900	0	0
	Total:		0.022986	0.10067868

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	100.0000	0.0000	0.0000	0.0000
Pump Seal	100.0000	0.0000	0.0000	0.0000
Connector	100.0000	0.0000	0.0000	0.0000
Flange	100.0000	0.0000	0.0000	0.0000
Open-ended Line	100.0000	0.0000	0.0000	0.0000
Other	100.0000	0.0000	0.0000	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.02	0.09	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.00	0.01	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.02	0.10	0.00	0.00	0.00	0.00

(5)

Fugitive Total Emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	0.30	1.31
benzene	0.01	0.03
H_2S	0.00	0.00

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	

Chesapeake Operating, Inc.
Mayfly B Pad

Internal Combustion Engine Emissions

A) Enter information into the yellow boxes.

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

C) Make sure to select the correct *Emission Type* from the pull down menus below. A *VOC type* does not need to be selected here; see the note in the comment for more explanation.

Engine Emission Calculations

Note: The TCEQ prefers the following basis for calculating emissions (in order of preference):
1. Stack test data from the engine
2. Manufacturer's specification sheet and control specification sheet (if control used)
3. AP-42 emission factors

Site Location

County	Johnson
Region	4
Existing or new source:	new
Installation date:	TBD

Discharge Parameters

Stack height (feet)	12
Stack diameter (feet)	0.5
Stage Temperature (°F)	1060
Exit Velocity (fps)	88.56

Fuel Data

Fuel Type	natural gas
Fuel Consumption (BTU/bhp-hr)	7,915
Heat Value (HHV)	1028
Heat Value (LHV)	1028
Sulfur Content (grains/100scf)	0

Engine Data

EPN	E1
Name	Engine 1
Manufacturer	CAT
Model Number	G3406 NA
Serial Number	
Manufacture Date	After 7/1/2008
Last Rebuild Date	NA
Application	gas compression
Ignition/Injection Timing	variable
Horsepower:	215
Fuel consumption (Btu/hp-hr):	7,915
Hours of operation per year:	8,760
Engine Type:	4 Stroke, Rich-Burn

Method of Emission Control

	Yes/No
NSCR Catalyst	Yes
SCR Catalyst	No
JLCC Catalyst	No
Parameter Adjustment	No
Stratified Charge	No
Other (Specify)	

Federal/State Standards

	Yes/No
NSPS Subpart JJJJ	Yes
MACT Subpart ZZZZ	Yes
30 TAC, Chapter 117	Yes

Additional Required Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit a description of the air/fuel ratio control system (manufactuer's information is acceptable).

SO_2 Mass Balance calculation for sour gas fuel:

Fuel Heat Value (Btu/SCF Next Tab	1,028.00	MW SO_2 =	64.06	grams/mole
Fuel H_2S content (mol%)	0.00	Ideal Gas Law	378.61	SCF/lb-mole
SO_2 produced (lb/hr) =	0.00			
SO_2 produced (tpy) =	0.00			

Does the VOC emission factor being used below include formaldehyde? (pick Yes or No from list)	No

To Determine Emissions for Air Permitting

		from AP-42:												
	If available, enter the test results or manufacturer's emission factors before control (g/hp-hr)	Table 3.2-1 2 stroke lean-burn engine emission factors (lb/MMBtu)	Table 3.2-2 4 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-3 4 stroke, rich burn engine emission factors (lb/MMBtu)	appropriate AP-42 factor	emission factor used	units	Uncontrolled lb/hr	Uncontrolled tpy	If present, enter the efficiency of any control device (as a %)	If present, enter the controlled emission factor (as g/hp-hr)	control factor used	lb/hr	tpy
VOC	1	0.12	0.118	0.0296	0.0296	1	g/hp-hr	0.474	2.076			0	0.50	2.20
NOx	0.5	3.17	4.08	2.21	2.21	0.5	g/hp-hr	0.237	1.038			0	0.24	1.04
CO	3	0.386	0.317	3.72	3.72	3	g/hp-hr	1.422	6.228			0	1.42	6.23
PM_{10}		0.0384	0.0000771	0.0095	0.0095	0.0095	lb/MMBtu	0.016	0.071			0	0.02	0.07
$PM_{2.5}$		0.0384	0.0000771	0.0095	0.0095	0.0095	lb/MMBtu	0.016	0.071			0	0.02	0.07
SO_2		0.000588	0.000588	0.000588	0.000588	0.000588	lb/MMBtu	0.001	0.004			0	0.00	0.00
Formaldehyde	0.06	0.0552	0.0528	0.0205	0.0205	0.06	g/hp-hr	0.028	0.125			0	0.03	0.12
Benzene		0.00194	0.000404	0.00158	0.00158	0.00158	lb/MMBtu	0.003	0.012			0	0.00	0.01

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	

Chesapeake Operating, Inc.
Mayfly B Pad

Internal Combustion Engine Emissions

A) Enter information into the yellow boxes.

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

C) Make sure to select the correct *Emission Type* from the pull down menus below. A *VOC type* does not need to be selected here; see the note in the comment for more explanation.

Engine Emission Calculations

Note: The TCEQ prefers the following basis for calculating emissions (in order of preference):
1. Stack test data from the engine
2. Manufacturer's specification sheet and control specification sheet (if control used)
3. AP-42 emission factors

Site Location

County	Johnson
Region	4
Existing or new source:	new
Installation date:	After 4/1/11

Discharge Parameters

Stack height (feet)	12
Stack diameter (feet)	0.5
Stage Temperature (°F)	1060
Exit Velocity (fps)	88.56

Fuel Data

Fuel Type	natural gas
Fuel Consumption (BTU/bhp-hr)	7,915
Heat Value (HHV)	1028
Heat Value (LHV)	1028
Sulfur Content (grains/100scf)	0

Engine Data

EPN	E2
Name	Engine 2
Manufacturer	CAT
Model Number	G3406 NA
Serial Number	
Manufacture Date	After 7/1/2008
Last Rebuild Date	NA
Application	gas compression
Ignition/Injection Timing	variable
Horsepower:	215
Fuel consumption (Btu/hp-hr):	7,915
Hours of operation per year:	8,760
Engine Type:	4 Stroke, Rich-Burn

Method of Emission Control

	Yes/No
NSCR Catalyst	Yes
SCR Catalyst	No
JLCC Catalyst	No
Parameter Adjustment	No
Stratified Charge	No
Other (Specify)	

Federal/State Standards

	Yes/No
NSPS Subpart JJJJ	Yes
MACT Subpart ZZZZ	Yes
30 TAC, Chapter 117	Yes

Additional Required Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit a description of the air/fuel ratio control system (manufactuer's information is acceptable).

SO_2 Mass Balance calculation for sour gas fuel:

Fuel Heat Value (Btu/SCF Next Tab	1,028.00	MW SO_2 =	64.06	grams/mole
Fuel H_2S content (mol%)	0.00	Ideal Gas Law	378.61	SCF/lb-mole
SO_2 produced (lb/hr) =	0.00			
SO_2 produced (tpy) =	0.00			

Does the VOC emission factor being used below include formaldehyde? (pick Yes or No from list)	No

To Determine Emissions for Air Permitting

		from AP-42:												
	If available, enter the test results or manufacturer's emission factors before control (g/hp-hr)	Table 3.2-1 2 stroke lean-burn engine emission factors (lb/MMBtu)	Table 3.2-2 4 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-3 4 stroke, rich burn engine emission factors (lb/MMBtu)	appropriate AP-42 factor	emission factor used	units	Uncontrolled lb/hr	Uncontrolled tpy	If present, enter the efficiency of any control device (as a %)	If present, enter the controlled emission factor (as g/hp-hr)	control factor used	lb/hr	tpy
VOC	1	0.12	0.118	0.0296	0.0296	1	g/hp-hr	0.474	2.076			0	0.50	2.20
NOx	0.5	3.17	4.08	2.21	2.21	0.5	g/hp-hr	0.237	1.038			0	0.24	1.04
CO	3	0.386	0.317	3.72	3.72	3	g/hp-hr	1.422	6.228			0	1.42	6.23
PM_{10}		0.0384	0.0000771	0.0095	0.0095	0.0095	lb/MMBtu	0.016	0.071			0	0.02	0.07
$PM_{2.5}$		0.0384	0.0000771	0.0095	0.0095	0.0095	lb/MMBtu	0.016	0.071			0	0.02	0.07
SO_2		0.000588	0.000588	0.000588	0.000588	0.000588	lb/MMBtu	0.001	0.004			0	0.00	0.00
Formaldehyde	0.06	0.0552	0.0528	0.0205	0.0205	0.06	g/hp-hr	0.028	0.125			0	0.03	0.12
Benzene		0.00194	0.000404	0.00158	0.00158	0.00158	lb/MMBtu	0.003	0.012			0	0.00	0.01

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	

Chesapeake Operating, Inc.
Mayfly B Pad

Tank Emissions - Lab Gas Water Ratio (GWR) Method

A) Enter information into the yellow boxes.

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

C) The tank vapor VOC, benzene, and H_2S weight percents may be entered.

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

E) The table below can be used to calculate the flash gas molecular weight and the component weight percents if needed.

F) Make sure to answer the control device question.

G) Make sure to select the correct *VOC Type* and *Emission Type* from the pull down menus below.

GWR [FOR ESTIMATING FLASH LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Flash Initial Press. (psig)	Flash Initial Temp. (°F)	Flash Final Press. (psig)	Flash Final Temp. (°F)	GWR (scf of flash gas/bbl of water produced)	Barrels of Water per day (bbl/day)	Flash Gas Molecular Weight	Flash Gas VOC wt%	Flash Gas Benzene wt%	Flash Gas H_2S wt%	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 (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
T1	Produced Water Tank 1	240	71.9	0	70	1.44	100	23.961552	12.8159	0.0456	0.0000	(A) uncontrolled			0.05	0.21	0.00	0.00	0.00	0.00
T2	Produced Water Tank 2	240	71.9	0	70	1.44	100	23.961552	12.8159	0.0456	0.0000	(A) uncontrolled			0.05	0.21	0.00	0.00	0.00	0.00
T3	Produced Water Tank 3	240	71.9	0	70	1.44	100	23.961552	12.8159	0.0456	0.0000	(A) uncontrolled			0.05	0.21	0.00	0.00	0.00	0.00
T4	Produced Water Tank 4	240	71.9	0	70	1.44	100	23.961552	12.8159	0.0456	0.0000	(A) uncontrolled			0.05	0.21	0.00	0.00	0.00	0.00
														Totals:	**0.19**	**0.85**	**0.00**	**0.00**	**0.00**	**0.00**

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	

GWR Calculator

This table can be used to calculate the flash gas molecular weight and the component weight percents if needed, if the flash gas mole percents are entered. It can also calculate the overall VOC, benzene, and H2S flash emissions if the GWR and the oil/condensate throughput are entered.

Gas Water Ratio:	1.44	in standard cubic feet of flash gas per barrel (SCF/bbl) of water produced
Barrels of Oil or Condensate per day:	400	

Flash Gas Speciation:

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen		2.01588	0	0.0000
helium		4.0026	0	0.0000
nitrogen	12.7230	28.01340	356	14.8744
CO2	13.3480	44.00950	587	24.5159
H2S		34.08188	0	0.0000
methane (C1)	69.0510	16.04246	1108	46.2302
ethane (C2)	1.2460	30.06904	37	1.5636
propane (C3)	0.4110	44.09562	18	0.7563
butanes (C4)	0.5160	58.12220	30	1.2516
pentanes (C5)	0.5140	72.14878	37	1.5477
benzene	0.0140	78.110000	1	0.0456
other hexanes (C6)	0.7310	86.18000	63	2.6291
toluene	0.0480	92.140000	4	0.1846
other heptanes (C7)	0.6630	100.20000	66	2.7725
ethylbenzene	0.0010	106.170000	0	0.0044
xylenes (o, m, p)	0.0100	106.170000	1	0.0443
other octanes (C8)	0.5350	114.23000	61	2.5505
nonanes (C9)	0.1590	128.26000	20	0.8511
decanes plus (C10+)	0.0300	142.28000	4	0.1781
	100.0000		2396.16	100.0000

Flash Gas MW =	23.961552
Total gas emitted:	
lb/hr:	1.5154221
tpy:	6.6375489
VOC wt% =	12.8159
VOC, lb/hr:	0.1942144
VOC, tpy:	0.8506591
Benzene wt% =	0.0456
Benzene, lb/hr:	0.0006916
Benzene, tpy:	0.0030292
H_2S wt% =	0.0000
H_2S, lb/hr:	0
H_2S, tpy:	0

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Mayfly B Pad

Tank Emissions - Tanks 4.0

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) The tank vapor VOC, benzene, and H_2S weight percents may be entered.

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

F) Make sure to answer the control device question.

G) Make sure to select the correct *VOC Type* and *Emission Type* from the pull down menus below.

Tanks 4.0 Software TANKS 4.0 SOFTWARE [FOR ESTIMATING WORKING AND BREATHING LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Throughput (gal/year)	Turnovers per year	Mixture/Component	Basis for VP Calculations	Vapor MW	Total Uncontrolled Emissions (lb/hr)	Total Uncontrolled Emissions (ton/yr)	Tank Vapor VOC wt%	Tank Vapor Benzene wt%	Tank Vapor H_2S wt%	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	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 (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
T1	Produced Water Tank 1	1533000	120.67	Gasoline (RVP=10)	Option 4:RVP=10	66	1.080436073	4.73246	12.81586	0.0456373	0	99	(A) uncontrolled			0.00	0.01	0.00	0.00	0.00	0.00
T2	Produced Water Tank 2	1533000	120.67	Gasoline (RVP=10)	Option 4:RVP=10	66	1.080436073	4.73246	12.81586	0.0456373	0	99	(A) uncontrolled			0.00	0.01	0.00	0.00	0.00	0.00
T3	Produced Water Tank 3	1533000	120.67	Gasoline (RVP=10)	Option 4:RVP=10	66	1.080436073	4.73246	12.81586	0.0456373	0	99	(A) uncontrolled			0.00	0.01	0.00	0.00	0.00	0.00
T4	Produced Water Tank 4	1533000	120.67	Gasoline (RVP=10)	Option 4:RVP=10	66	1.080436073	4.73246	12.81586	0.0456373	0	99	(A) uncontrolled			0.00	0.01	0.00	0.00	0.00	0.00
															Totals:	**0.01**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:

Chesapeake Operating, Inc.
Mayfly B Pad

Loading Emissions

A) Enter information into the yellow boxes.

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

C) The vapor VOC, benzene, and H_2S weight percents may be entered.

D) There are two separate areas below to calculate hourly and annual loading emissions. Then underneath, there is a table summarizing the hourly and annual loading emissions.

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

F) If vapor balancing is being performed and the tank is not being controlled, contact TCEQ about the appropriate tank working loss calculation.

G) Make sure to answer the control device question.

H) Make sure to select the correct *VOC Type* and *Emission Type* from the pull down menus below.

EPN	L1
Identifier	Water Loading

Truck Hourly Loading Emission Calculations

Using equation L_L = 12.46* SPM/T from AP-42, Chapter 5, Section 5.2-4

S =	0.60	Saturation Factor
P =	10.20	True vapor pressure of liquid loaded (psia)
M =	66.00	Molecular Weight of Vapors (lb/lb-mole)
T =	527.32	Temperature of bulk liquid loaded (in degrees Rankine)
Hourly Loading Rate	8000	Gallons Loaded per Hour
L_L =	9.54	Loading Loss (lb VOC released/1000 gal liquid loaded)
	76.33	VOC Uncontrolled Emissions (lb/hr)

Are loading 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?	(A) uncontrolled

Vapor Weight Percents

VOC	12.82	Vapor VOC wt%
benzene	0.05	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%

Produced Water Reduction

	99.00	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)

Uncontrolled Emissions

VOC	0.10	Emissions Uncontrolled VOC (lb/hr)
benzene	0.00	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.00	Emissions Uncontrolled H_2S (lb/hr)

Enter temperature in Fahrenheit (°F):	Temperature in Rankine (°R):
67.65	527.32

Enter Barrels of Liquid	Gallons of liquid:
	0

Enter gallons per year	Barrels per day:
	0

Enter any notes here:

Truck Ann[illegible]oading Emission Calculations

Using equation L_L = 12.46* SPM/T from AP-42, Chapter 5, Section 5.2-4

S =	0.60	= Saturation Factor
P =	10.20	= True vapor pressure of liquid loaded (psia)
M =	66.00	= Molecular Weight of Vapors (lb/lb-mole)
T =	527.32	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	6132000	= Gallons Loaded per Year
L_L =	9.54	Loading Loss (lb VOC released/1000 gal liquid loaded)
	29.26	VOC Uncontrolled Emissions (ton/yr)

Vapor Weight Percents

VOC	12.82	Vapor VOC wt%
benzene	0.05	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%

Produced Water Reduction

	99.00	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)

Uncontrolled Emissions

VOC	0.04	Emissions Uncontrolled VOC (ton/yr)
benzene	0.00	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.00	Emissions Uncontrolled H_2S (ton/yr)

Enter temperature in Fahrenheit (°F):	Temperature in Rankine (°R):
67.65	527.32

Enter Barrels of Liquid	Gallons of liquid:
146000	6132000

Enter gallons per year	Barrels per day:
	0

Enter any notes here:

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	0.10	0.04
benzene	0.00	0.00
H_2S	0.00	0.00

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)
Low Pressure Periodic

Chesapeake Operating, Inc.
Mayfly B Pad

Other Emissions

A) Enter information into the yellow boxes.

B) Please provide a separate detailed calculation for these emissions; also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

C) Since these emissions fall into the category of "Other", which does not have a pre-made emission estimation sheet with pre-approved methods, the time to review this project cannot be guaranteed to be as quick as if only pre-made sheets had been used.

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

E) Make sure to answer the control device question.

E) Make sure to select the correct *VOC Type* and *Emission Type* from the pull down menus below.

EPN:	MSS1
Name:	MSS

Are these 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?	(A) uncontrolled

Uncontrolled Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	3.21	0.03
NOx	0.00	0.00
CO	0.00	0.00
PM2.5	0.00	0.00
PM10	0.00	0.00
H2S	0.00	0.00
SO2	0.00	0.00
benzene	0.09	0.00
formaldehyde	0.00	0.00

Total Emissions (control efficiencies factored in if applicable)

Next Tab

	Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	3.21	0.03
NOx	0.00	0.00
CO	0.00	0.00
PM2.5	0.00	0.00
PM10	0.00	0.00
H2S	0.00	0.00
SO2	0.00	0.00
benzene	0.09	0.00
formaldehyde	0.00	0.00

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)

High Pressure Periodic

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Emissions Summary

The table below is a summary of all emission points for this registration. It is separated into *Project Emissions* and *Other Registration Emissions*.

The table has separate totals for *Project Total Emission Rates* and *Registration Total Emission Rates*.

On the table, for each emission source, there is a space for three emission rates on a pound per hour basis and one emission rate on a ton per year (tpy) basis. Periodic emissions are authorized to exceed steady state limits of the rule (150, 300, and 600 hours per year for PBR Level 1, PBR Level 2, and Standard Permit, respectively), in which case the periodic emission limits must be met. Note that emitting activities, such as loading and MSS activities, are not limited to occurring less than these. It is only for that amount of time that the emissions can exceed the normal steady state limits.

Any formaldehyde emissions must be included as part of VOC emissions.

Upd

Before pressing the *Update* button, make sure you have selected the correct VOC Type and Emis from the pull down menus in each emission calculation tab.

Emissions Summary

Project Emissions (This needs to include all emission points being added for the first time to the reg emission points with emissions that are changing from previously registered emissions. It does NOT inc points for which the emissions have not changed and have previously been registered (unless the em emissions are chosen to be re-calculated as part of this project); those emissions will be entered below Registration Emissions section of this table.)

Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates		
			steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr
F1	Fugitives	Total VOC	0.2987		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.2987		
		Benzene	0.0074		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		

		$PM_{2.5}$	0.0000		
E1	Engine 1	**Total VOC**	0.5024		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0000		
		Benzene	0.0027		
		Formaldehyde	0.0284		
		H_2S	0.0000		
		SO_2	0.0010		
		NO_X	0.2370		
		CO	1.4220		
		PM_{10}	0.0162		
		$PM_{2.5}$	0.0162		
E2	Engine 2	**Total VOC**	0.5024		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0000		
		Benzene	0.0027		
		Formaldehyde	0.0284		
		H_2S	0.0000		
		SO_2	0.0010		
		NO_X	0.2370		
		CO	1.4220		
		PM_{10}	0.0162		
		$PM_{2.5}$	0.0162		
T1	Produced Water Tank 1	**Total VOC**	0.0486		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0486		
		Benzene	0.0002		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
		Total VOC	0.0486		

T2	Produced Water Tank 2	**Total Crude Oil or Condensate VOC**	0.0000		
		Total Natural Gas VOC	0.0486		
		Benzene	0.0002		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
T3	Produced Water Tank 3	**Total VOC**	0.0486		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0486		
		Benzene	0.0002		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
T4	Produced Water Tank 4	**Total VOC**	0.0486		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0486		
		Benzene	0.0002		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
		Total VOC	0.0014		

T1	Produced Water Tank 1	**Total Crude Oil or Condensate VOC**	0.0000		
		Total Natural Gas VOC	0.0014		
		Benzene	0.0000		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
T2	Produced Water Tank 2	**Total VOC**	0.0014		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0014		
		Benzene	0.0000		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
T3	Produced Water Tank 3	**Total VOC**	0.0014		
		Total Crude Oil or Condensate VOC	0.0000		
		Total Natural Gas VOC	0.0014		
		Benzene	0.0000		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
		Total VOC	0.0014		

T4	Produced Water Tank 4	**Total Crude Oil or Condensate VOC**	0.0000		
		Total Natural Gas VOC	0.0014		
		Benzene	0.0000		
		Formaldehyde	0.0000		
		H_2S	0.0000		
		SO_2	0.0000		
		NO_X	0.0000		
		CO	0.0000		
		PM_{10}	0.0000		
		$PM_{2.5}$	0.0000		
L1	Water Loading	**Total VOC**		0.0978	
		Total Crude Oil or Condensate VOC		0.0000	
		Total Natural Gas VOC		0.0978	
		Benzene		0.0003	
		Formaldehyde		0.0000	
		H_2S		0.0000	
		SO_2		0.0000	
		NO_X		0.0000	
		CO		0.0000	
		PM_{10}		0.0000	
		$PM_{2.5}$		0.0000	
MSS1	MSS	**Total VOC**			3.2127
		Total Crude Oil or Condensate VOC			0.0000
		Total Natural Gas VOC			3.2127
		Benzene			0.0884
		Formaldehyde			0.0000
		H_2S			0.0000
		SO_2			0.0000
		NO_X			0.0000
		CO			0.0000
		PM_{10}			0.0000
		$PM_{2.5}$			0.0000
		Total VOC			

		Total Crude Oil or Condensate VOC			
		Total Natural Gas VOC			
		Benzene			
		Formaldehyde			
		H_2S			
		SO_2			
		NO_X			
		CO			
		PM_{10}			
		$PM_{2.5}$			

Project Total Emission Rates (Note that these periodic totals are NOT simply the sum of the periodic emission rates from each emission point. The periodic emission limits in the rule need to be compared to the sum of steady state and periodic emissions, that is the worst case combination of continuously and periodically emitting sources that could occur in any one hour. The periodic emission rates shown here are the sum of all steady state and periodic emissions in the project. If the worst case combination of continuously and periodically emitting sources is less than this, then please input the values in this table to the right. **Please explain below which emission points are included in this worst case combination.**)

Air Contaminant Name (3)	Emission Rates		
	steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr
Total VOC	1.50	1.60	4.81
Total Crude Oil or Condensate VOC	0.00	0.00	0.00
Total Natural Gas VOC	0.50	0.60	3.81
Benzene	0.01	0.01	0.10
Formaldehyde	0.06	0.06	0.06
H_2S	0.00	0.00	0.00
SO_2	0.00	0.00	0.00
NO_X	0.47	0.47	0.47
CO	2.84	2.84	2.84
PM_{10}	0.03	0.03	0.03
$PM_{2.5}$	0.03	0.03	0.03

If the automated formulas for the project emission totals (which assume that it is possible for all steady state and periodic emissions in the project to occur in the same hour) have been overwritten, explain any changes made and list the project emission points that occur in the realistic worst case hour. (Leave this blank or put NA if none of the formulas have been overwritten.)

Other Registration Emissions (This needs to include any other emission points not included in th Emissions Summary that are in the registration. This should be all the operationally dependent units th 1/4 mile of each other and are also owned/operated by the same company and located on contiguous property. It is possible that nothing needs to be entered here.)

There are no other registration emission points.

Registration Total Emission Rates (Note that these periodic totals are NOT simply the sum of the periodic emission rates from each emission point. The periodic emission limits in the rule need to be compared to the sum of steady state and periodic emissions, that is the worst case combination of continuously and periodically emitting sources that could occur in any one hour. The periodic emission rates shown here are the sum of all steady state and periodic emissions in the registration. If the worst case combination of continuously and periodically emitting sources is less than this, then please input the values in this table to the right. **Please explain below which emission points are included in this worst case combination.**)	**Air Contaminant Name (3)**	**Emission Rates**		
		steady state lbs/hr	**< 30 psig periodic lbs/hr**	**≥ 30 psig periodic lbs/hr**
	Total VOC	1.50	1.60	4.81
	Total Crude Oil or Condensate VOC	0.00	0.00	0.00
	Total Natural Gas VOC	0.50	0.60	3.81
	Benzene	0.01	0.01	0.10
	Formaldehyde	0.06	0.06	0.06
	H_2S	0.00	0.00	0.00
	SO_2	0.00	0.00	0.00
	NO_X	0.47	0.47	0.47
	CO	2.84	2.84	2.84
	PM_{10}	0.03	0.03	0.03
	$PM_{2.5}$	0.03	0.03	0.03
If the automated formulas for the registration emission totals (which assume that it is possible for all steady state and periodic emissions in the registration to occur in the same hour) have been overwritten, explain any changes made and list the registration emission points that occur in the realistic worst case hour. (Leave this blank or put NA if none of the formulas have been overwritten.)				
Based on the Registration Total Emission Rates, this authorization falls under:				**PBR L**

Enter any notes here:	

(1) Emission point identification - either specific equipment designation or emission point num
plan.

(2) Specific point source name. For fugitive sources, use area name or fugitive source name.

(3)

VOC	volatile organic compounds as defined in Title 30 Texas Administrative Coc
H_2S	hydrogen sulfide
SO_2	sulfur dioxide
NO_X	total oxides of nitrogen
CO	carbon monoxide
PM_{10}	total particulate matter equal to or less than 10 microns in diameter, includi
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter

(4) Compliance with annual emission limits (tons per year) is based on a 12 month rolling per

(5) If emissions from a source are:

(A) uncontrolled, then the uncontrolled emissions are reported in this table emitted from the source.

(B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recov (VRU), then the controlled emissions are reported on this table as being en the control device.

(C) controlled by another type of control device, then the controlled emissic reported on this table for the source (even though emissions are actually b at the control device).

(6) For controlled tank, glycol/amine flash tank and regenerator, and MSS emissions, it is ass vapors make it to the control device (100% collection efficiency). For controlled loading e 100% collection efficiency is <u>not</u> assumed.

(7) A VRU itself is not actually considered an emission point; however, this table associates u (uncontrolled) emissions from sources controlled by a VRU at the VRU.

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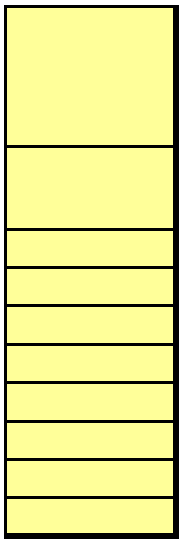

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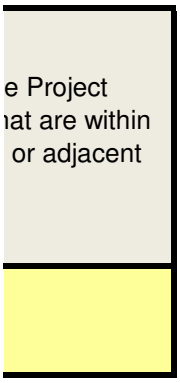
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Authorization Level Determination

The level of authorization is determined by comparing the Registration Total Emission Rates (as shown on the previous tab) to the emission limits of the different authorization levels.

This table is an expanded explanation of how the authorization level shown on the Emissions Summary tab was determined. The table shows which authorization level each compound's emissions fall into, and then at the bottom of the chart it shows which authorization level the entire authorization falls under.

The possible authorization levels are:

PBR Level 1
PBR Level 2
Standard Permit
NSR Case-by-case Permit

	Based on the Registration Total Emission Rates (on the previous tab), what Level of Authorization Does Each Emission Rate Fall Into?			
Air Contaminant Name	Emission Rates			
	steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr	TPY
Total VOC	NA, no limit	NA, no limit	NA, no limit	PBR Level 1
Total Crude Oil or Condensate VOC	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
Total Natural Gas VOC	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
Benzene	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
Formaldehyde	NA, no limit	NA, no limit	NA, no limit	PBR Level 1
H_2S	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
SO_2	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
NO_X	PBR L	Next Tab R Level 1	PBR Level 1	PBR Level 1
CO	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
PM_{10}	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
$PM_{2.5}$	PBR Level 1	PBR Level 1	PBR Level 1	PBR Level 1
	What Level of Authorization Applies to this Registration? (If any of the registration emissions are equal to or greater than the limits of a level, then the whole registration falls into that level above.)			
	PBR Level 1			

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Is a Full Impacts Review Required?

and NO_2. A full impacts review involves showing protection of public health and welfare and compliance with applicable ambient air standards (state and federal) on a short term and long term basis.

A full impacts review is not required for a certain compound under these certain circumstances:

> **if there is no receptor (to be affected by benzene emissions) or property line (where compliance with NO_2, SO_2, and H_2S ambient air quality standards is required) within a certain distance of a registration (that is if there is no receptor or property line within a certain distance of any emitting source in the registration), or**
>
> **if the net project emission increases of that compound are very small.**

Based on these circumstances, the worksheet below determines whether or not a full impacts review is required for any of the four compounds (benzene, H_2S, SO_2, and NO_2).

If any of (1)-(3) below shows that a full impacts review is not required for a compound, then under (4) it will show that no further impacts review needs to be done and it will explain that "you are done" for that compound. If all of (1)-(3) show that a full impacts review is required, then (4) will explain that one of the three methods for doing a full impacts review (screening modeling, dispersion modeling, or the modeling tables from the rule) must be used.

If the modeling tables from the rule are used, then the spreadsheet tabs labeled for benzene, H_2S, SO_2, and NO_2 should be used. These tabs provide a way to use the modeling tables and perform the necessary calculations to show whether the impacts review is passed.

(1) **Based on receptor and property line distances, is a full impacts review required for any air contaminant? (Is there a receptor or property line within the specified distance of the registration? The distances are 1/4 mile for PBR Level 1, 1/2 mile for PBR Level 2, and 1 mile for Standard Permit.) First the level of authorization must be known.**

Based on the Registration Total Emission Rates, this authorization falls under:
PBR Level 1

What is the shortest distance in feet to any receptor from any facility/unit included in this registration?	546	ft
What is the shortest distance in feet to any property line from any facility/unit included in this registration?	546	ft

Based on the nearest receptor distance:
A full impacts review is required for benzene.

Based on the nearest property line distance:
A full impacts review is required for H2S, SO2, and NO2.

(2) **Based on the net project emission increases, is a full impacts review required for any air contaminent? (Are the net project emission increases less than any of the de-minimis rates?)**

Net Project Emission Increases				
Air Contaminant Name	Emission Rates			
	steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr	TPY
Benzene	0.01	0.01	0.10	0.06
H_2S	0.00	0.00	0.00	0.00
SO_2	0.00	0.00	0.00	0.01
NO_X	0.47	0.47	0.47	2.08
Please explain the logic behind the values here if any values are different than the Project Total Emission Rates from the Emissions Summary tab.				

De-minimis Rates	
Air contaminant	lb/hr
Benzene	0.039
H_2S	0.025
SO_2	2
NO_X	4

Based on the net project emission increases:
A full impacts review is required for benzene.
A full impacts review is NOT required for H2S.
A full impacts review is NOT required for SO2.
A full impacts review is NOT required for NO2.

(3) **Based on the project maximum predicted concentrations, is a full impacts review required for any air contaminant? (Are the project maximum predicted benzene concentrations ≤ 10% of the applicable effects screening level (ESL) or ≤ 25% of the applicable ESL when combined with project increases over 60-month period after rule effective date? Are project maximum predicted H_2S, SO_2, and NO_X concentrations ≤ the significant impact level, SIL, also known as a de-minimis impact in Chapter 101 of 30 TAC, where the SIL = 4% of the applicable ambient air standard (AAQS)?)**

ESLs and AAQS needed for impacts review:	
ESLs and AAQSs	**(µg/m^3)**
Benzene Short Term ESL	170
Benzene Long Term ESL	4.5
H_2S Hourly SAAQS	108
SO_2 Hourly NAAQS	196
NO_2 Hourly NAAQS	188

What is the project maximum predicted 1-hr concentration of benzene in micrograms per cubic meter?	NA	**(µg/m^3)**
Based on this:		
A full impacts review is required for benzene on an hourly basis.		

What is the maximum predicted 1-hr concentration of benzene in micrograms per cubic meter for the project combined with previous project increases over a 60-month period after the effective date of the this rule?	NA	**(µg/m^3)**
Based on this:		
A full impacts review is required for benzene on an hourly basis.		

What is the project maximum predicted annual concentration of benzene in micrograms per cubic meter?	NA	**(µg/m^3)**
Based on this:		
A full impacts review is required for benzene on an annual basis.		

What is the maximum predicted annual concentration of benzene in micrograms per cubic meter for the project combined with previous project increases over a 60-month period after the effective date of the this rule?	NA	**(µg/m^3)**
Based on this:		
A f Get Impacts Sheets v is required for benzene on an annual basis.		

Next Tab

What is the project maximum predicted 1-hr concentration of H_2S in micrograms per cubic meter?	NA	**(µg/m^3)**
Based on this:		
A full impacts review is required for H2S on an hourly basis.		

What is the project maximum predicted 1-hr concentration of SO_2 in micrograms per cubic meter?	NA	**(µg/m^3)**
Based on this:		
A full impacts review is required for SO2 on an hourly basis.		

What is the project maximum predicted 1-hr concentration of NO_2 in micrograms per cubic meter?	NA	**(µg/m^3)**
Based on this:		

A full impacts review is required for NO2 on an hourly basis.

(4)

Based on the above assessment from (1) - (3):
A full impacts review is required for benzene. Perform review on benzene impacts tab. Consider the Impacts Scope table on the next tab as additional emission points outside of the registration may need to be considered for the impacts review.
A full impacts review is NOT required for H2S.
A full impacts review is NOT required for SO2.
A full impacts review is NOT required for NO2.

Press this button to make the impacts review tabs visible if needed, that is if you want to use the modeling tables from the rule for any of the four compounds.

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Emissions Summary Including Any Additional Impacts Scope Emissions

Registration emissions are included in the impacts scope totals.

The only air contaminents that potentially may need to be filled in are benzene H_2S, SO_2, and NO_X these are the four air contaminents that a full impacts review could potentially be required for (nc impacts review is actually done on NO_2, not NO_X). Within those four contaminents, the only ones absolutely need to be filled in are the ones which require a full impacts review. The rest can be fi chosen to be.

To change the number of rows in the charts below, click on the button to the right of the chart tha "Expand Table" and it will ask how many rows you need. You can press the button more than on delete more rows; the rows will be added or deleted starting at the bottom.

Impacts Scope Emissions (This needs to include any other emission points not included in the Projec Summary or the Registration Emissions Summary that are in the impacts review scope. The impacts r includes all units owned/operated by the same company, located on contigous or adjacent property, an under same two digit standard industrial classification (SIC) code, within 1/4 mile of any unit in the proj Level 1, within 1/4 mile of any unit in the project for PBR Level 2, and within 1 mile of any unit in the pr Standard Permit, regardless of the units being operationally dependent and regardless of the unit au type(s). It is possible that nothing needs to be entered here.)

Emission Point No.	Source Name	Air Contaminant Name	Emission Rates		
			steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr
		Total VOC			
		Total Crude Oil or Condensate VOC			
		Total Natural Gas VOC			
		Benzene			
		Formaldehyde			
		H_2S			
		SO_2			
		NO_X			
		CO			
		PM_{10}			
		$PM_{2.5}$			

Impacts Scope Total Emission Rates
(Note that these periodic totals are NOT simply the sum of the periodic emission rates from each emission point. The periodic emission limits need to be compared to the sum of steady state and periodic emissions, that is the worst case combination of continously and periodically emitting sources that could occur in any one hour. The periodic emission rates shown here are the sum of all steady state and periodic emissions. If the worst case combination of continously and periodically emitting sources is less than this, then please input the values in this table to the right. **Please explain below which emission points are included in this worst case combination.**)

Air Contaminant Name	Emission Rates		
	steady state lbs/hr	< 30 psig periodic lbs/hr	≥ 30 psig periodic lbs/hr
Total VOC	1.50	1.60	4.81
Total Crude Oil or Condensate VOC	0.00	0.00	0.00
Total Natural Gas VOC	0.50	0.60	3.81
Benzene	0.01	0.01	0.10
Formaldehyde	0.06	0.06	0.06
H_2S	0.00	0.00	0.00
SO_2	0.00	0.00	0.00
NO_X	0.47	0.47	0.47
CO	2.84	2.84	2.84
PM_{10}	0.03	0.03	0.03
$PM_{2.5}$	0.03	0.03	0.03

If the automated formulas for the impacts scope emission totals (which assume that it is possible for all steady state and periodic emissions in the impacts scope to occur in the same hour) have been overwritten, explain any changes made and list the impacts scope emission points that occur in the realistic worst case hour. (Leave this blank or put NA if none of the formulas have been overwritten.)

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Full Impacts Review

A full impacts review must be done for all of the following as applicable:

- **Benzene Hourly Steady State**
- **Benzene Hourly Low Pressure Periodic**
- **Benzene Hourly High Pressure Periodic**
- **Benzene Annual**

The maximum acceptable emission rate can be found on an hourly steady state basis, hourly periodic (low pressure) basis, hourly periodic (high pressure) basis, and annual basis, which can be expressed as $E_{max,hourly,steadystate}$, $E_{max,hourly,periodic(low\ pressure)}$, $E_{max,hourly,periodic(high\ pressure)}$, and $E_{max,annual,\ respectively}$.

The equations for Emax,hourly and Emax,annual are:

$$E_{max,hourly} = (WR_{EPN1}) * \left(\frac{P \text{ or } ESL}{G_{hourly,EPN1}}\right) + \cdots + (WR_{EPNx}) * \left(\frac{P \text{ or } ESL}{G_{hourly,EPNx}}\right)$$

$$E_{max,annual} = \left(\frac{8,760}{2,000}\right) * (WR_{EPN1}) * \left(\frac{P \text{ or } ESL}{0.08 * G_{hourly,EPN1}}\right) + \cdots + \left(\frac{8,760}{2,000}\right) * (WR_{EPNx}) * \left(\frac{P \text{ or } ESL}{0.08 * G_{hourly,EPNx}}\right)$$

The emissions must include all emissions in the impacts scope, which are contained in the Impacts Scope Emissions Totals box on the Impacts Scope Tab.

Impacts review is passed when the total estimated emission rate is less than the calculated maximum acceptable emission rate $E_{estimated,total} \leq E_{max,total}$.

The shortest distance from any emitting source to the nearest receptor can be used for each emitting source or the actual distance from the source to the nearest receptor.

The appropriate G factor can be found on the impact chart tabs based on the distance from the emission point to the nearest receptor, the height of the emission release point, and the type of emission point.

To change the number of rows in the charts below, click on the button to the right of the chart that says "Set Row Count" and it will ask how many rows you need. You can press the button more than once to add or delete more rows; the rows will be added or deleted starting at the bottom.

Benzene Short Term ESL ($\mu g/m^3$):	170
Benzene Long Term ESL ($\mu g/m^3$):	4.5

Benzene Hourly Steady State - Impact Review

EPN	Source Name	Which impacts table corresponds to this EPN?	Steady state hourly estimated emissions for each EPN (lbs/hr)	WR_{EPNx}	$ESL_{benzene,\ short\ term}$ ($\mu g/m^3$)	Distance from emission point to nearest receptor (ft)	Height of emission release point (ft)	G_{EPNx}	$E_{max,EPNx,\ hourly,steadystate}$ (lb/hr)
F1	Fugitives	Fugitive	0.0074306	0.5496254	170	546	4	478	0.19549474
E1	Engine 1	Eng. ≤ 250 hp	0.0026887	0.1988798	170	546	8	84	0.40126636
E2	Engine 2	Eng. ≤ 250 hp	0.0026887	0.1988798	170	546	8	84	0.40126636
T1	Tank 1	Tank Hatch	0.0001778	0.0131538	170	546	12	164	0.01367066
T2	Tank 2	Tank Hatch	0.0001778	0.0131538	170	546	12	164	0.01367066
T3	Tank 3	Tank Hatch	0.0001778	0.0131538	170	546	12	164	0.01367066
T4	Tank 4	Tank Hatch	0.0001778	0.0131538	170	546	12	164	0.01367066
					170				
					170				
					170				
			$E_{estimated,total,hourly,steadystate}$ (lb/hr)	Total		Passed			$E_{max,total,\ hourly,steadystate}$ (lb/hr)
			0.0135193	1					1.05271012

Benzene Hourly Low Pressure Periodic - Impact Review

EPN	Source Name	Which impacts table corresponds to this EPN?	Periodic (low P) hourly estimated emissions for each EPN (lbs/hr)	WR_{EPNx}	$ESL_{benzene,\ short\ term}$ ($\mu g/m^3$)	Distance from emission point to nearest receptor (ft)	Height of emission release point (ft)	G_{EPNx}	$E_{max,EPNx,\ hourly,periodic(low\ pressure)}$ (lb/hr)
L1	Loading 1	Low P. Blowd./Purg./ Pig.	0.0003484	1	170	546	8	515	0.33022533
					170				
					170				
					170				
					170				
					170				
					170				
					170				
					170				
					170				

$E_{estimated,total,hourly,periodic(low\ pressure)}$ (lb/hr)	Total		Passed		$E_{max,total,hourly,periodic(low\ pressure)}$ (lb/hr)
0.0003484	1				0.33022533

Benzene Hourly High Pressure Periodic - Impact Review

EPN	Source Name	Which impacts table corresponds to this EPN?	Periodic (high P) hourly estimated emissions for each EPN (lbs/hr)	WR_{EPNx}	$ESL_{benzene,\ short\ term}$ ($\mu g/m^3$)	Distance from emission point to nearest receptor (ft)	Height of emission release point (ft)	G_{EPNx}	$E_{max,EPNx,\ hourly,periodic(high\ pressure)}$ (lb/hr)
MSS1	MSS	High P. Blowd./Purg./ Pig.	0.0883755	1	170	546	8	37	4.55641919
					170				
					170				
					170				
					170				
					170				
					170				
					170				
					170				
					170				

$E_{estimated,total,hourly,periodic\ (high\ pressure)}$ (lb/hr)	Total		Passed		$E_{max,total,\ hourly,periodic(high\ pressure)}$ (lb/hr)
0.0883755	1				4.55641919

Benzene Annual - Impact Review

EPN	Source Name	What amount of time is this source is emitting? (hrs/yr)	Which impacts table corresponds to this EPN?	Annual estimated emissions for each EPN (tons/yr)	WR_{EPNx}	$ESL_{benzene,\ long\ term}$ ($\mu g/m^3$)	Distance from emission point to nearest receptor (ft)	Height of emission release point (ft)	G_{EPNx}	$E_{max,EPNx,\ annual}$ (tons/yr)
F1	Fugitives	8760	Fugitive	0.0325459	0.6363571	4.5	546	4	478	0.328033
E1	Engine 1	8760	Eng. ≤ 250 hp	0.0117766	0.2302633	4.5	546	8	84	0.673309
E2	Engine 2	8760	Eng. ≤ 250 hp	0.0026887	0.0525715	4.5	546	8	84	0.153724
T1	Tank 1	8760	Tank Hatch	0.0007789	0.0152294	4.5	546	12	164	0.022939
T2	Tank 2	8760	Tank Hatch	0.0007789	0.0152294	4.5	546	12	164	0.022939
T3	Tank 3	8760	Tank Hatch	0.0007789	0.0152294	4.5	546	12	164	0.022939
T4	Tank 4	8760	Tank Hatch	0.0007789	0.0152294	4.5	546	12	164	0.022939
L1	Loading 1	766.5	Loading	0.0001335	0.0026105	4.5	546	8	515	0.000109
MSS1	MSS	20	High P. Blowd./Purg./Pig.	0.0008838	0.0172797	4.5	546	8	37	0.000261
						4.5				
				$E_{estimated,total,annual}$ (tons/yr)	Total		Passed			$E_{max,total,\ annual}$ (tons/yr)
				0.0511441	1					1.247191

Generic Modeling Factor (G) Look-up	
Fugitive	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	4
G [(µg/m³)/(lb/hr)]:	478

Generic Modeling Factor (G) Look-up	
Loading	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	8
G [(µg/m³)/(lb/hr)]:	515

Generic Modeling Factor (G) Look-up	
Tank Hatch	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	12
G [(µg/m³)/(lb/hr)]:	164

Generic Modeling Factor (G) Look-up	
Process Vessel	
Distance from emission source to nearest receptor or property line (ft):	
Height of emission release point (ft):	
G [(µg/m³)/(lb/hr)]:	469

Generic Modeling Factor (G) Look-up	
Low Pressure (< 30 psig) Blowdowns, Purging, and Pigging	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	8
G [(µg/m³)/(lb/hr)]:	743

Generic Modeling Factor (G) Look-up	
High Pressure (≥ 30 psig) Blowdowns, Purging, and Pigging	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	8
G [(µg/m³)/(lb/hr)]:	37

Generic Modeling Factor (G) Look-up	
Engines Less Than or Equal to 250 hp	
Distance from emission source to nearest receptor or property line (ft):	546
Height of emission release point (ft):	8
G [(µg/m³)/(lb/hr)]:	84