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VIA E-MAIL: stevev@pscleanair.org

October 21, 2016

Mr. Steve Van Slyke
Compliance Manager
Puget Sound Clean Air Agency
1904 Third Avenue, Suite 105
Seattle, WA 98101

RE: Notice of Construction Application for Tank 208H-211H Modification at Targa Sound Terminal in Tacoma, Washington

Dear Mr. Van Slyke:

Targa Sound Terminal LLC (Targa) respectfully submits this notice of construction (NOC) application to modify four existing fuel storage tanks for their marine bulk fuel logistics terminal (Terminal) in Tacoma, Washington. The Terminal is located on the Hylebos Waterway in the Port of Tacoma and has marine, rail, truck, and pipeline capabilities.

There are four existing fixed roof storage tanks at the Terminal, 208H, 209H, 210H and 211H. These tanks have been exempt from NOC requirements because they currently only store distillate products such as diesel and fuel oil. These tanks were also originally installed with insulation and heating system and are able to keep the fuel oil product temperature between 110 °F to 140 °F when needed. Targa proposes to install internal floating roofs (IFRs) in these tanks, along with new associated fugitive components such as valves and flanges. The addition of IFRs will enable these tanks to store higher vapor pressure products which will include gasoline, natural gasoline, isooctane and ethanol.

This project also includes receiving and distributing a new material, natural gasoline, at the Terminal. The annual throughput of natural gasoline at the Terminal will be 151,500,000 gallons per year. Natural gasoline will be received through rail cars and shipped out from the Terminal by marine vessels.

This project will not affect the existing throughput limit of gasoline, ethanol, and isooctane at the Terminal.

The attached application includes:

- Project Description;
- Emission Calculations Methodology;
- Regulatory Applicability Review;
- Best Available Control Technology Review;
- Toxic Air Polluant Emissions Analysis ;
- Air Quality Dispersion Modeling Analysis;
- Application Forms;
- Detailed Project Emission Calculations;

- Natural Gasoline Safety Data Sheet;
- Reasonably Available Control Technology (RACT), BACT, and Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC) Search Results;
- Modeling Files (provided electronically); and
- Tanks Outputs.

The application filing fee ($1,150) will be submitted under separate cover to Puget Sound Clean Air Agency (PSCAA).

If you have any questions or comments about the information presented in this letter, please do not hesitate to call me at (713) 584-1292.

Sincerely,

Tammy Wallace
Targa Resources LLC
Senior Environmental Specialist

Attachments

cc: Mr. Matthew Kolata, Targa
Mr. Gerry Pade, PSCAA
Ms. Ashley Jones, Trinity

PROJECT REPORT

Targa Sound Terminal LLC> Targa Sound Terminal

Tanks 208-211 Modification NOC Application

Prepared By:

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October 2016

Project 164801.0091

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TABLE OF CONTENTS

LIST OF TABLES

1. EXECUTIVE SUMMARY

Targa Sound Terminal LLC (Targa) owns and operates a marine bulk fuel logistics terminal (Terminal) in Tacoma, Washington. The Terminal is located on the Hylebos Waterway in the Port of Tacoma and has marine, rail, truck, and pipeline capabilities.

Targa is proposing to modify four existing fuel storage tanks at the Terminal. Tanks 208H, 209H, 210H and 211H are existing vertical fixed roof storage tanks and currently designated to store fuel oil and distillate products only. Targa is planning to modify these existing tanks to be internal floating roof tanks and expand the stored products to also include gasoline, natural gasoline, isooctane, and ethanol. The facility-wide throughput of gasoline will not increase as part of this project; and the existing permitted throughput will be distributed among the storage tanks that have the capacity to store gasoline. Natural gasoline, being a new raw material introduced to the facility, will be unloaded from rail and loaded out at the marine docks. The proposed natural gasoline facility-wide throughput is 151,500,000 gallons per year.

This report with the attached appendices serves as the Notice of Construction (NOC) permit application required under Puget Sound Clean Air Agency (PSCAA) Regulation 1, Section 6.03. The State Environmental Policy Act (SEPA) checklist is not provided, because the project activities do not involve constructing new emission sources nor changing land use or the location of the emission sources at the facility. The application includes the following elements:

- Section 2. Project Description
- Section 3. Emission Calculations Methodology
- Section 4. Regulatory Applicability
- Section 5. Best Available Control Technology
- Section 6. Toxic Air Polluant Emissions Analysis
- Section 7. Air Quality Dispersion Modeling
- Appendix A: Application Forms
- Appendix B: Emission Calculations
- Appendix C: Natural Gasoline Safety Data Sheet
- Appendix D: Reasonably Available Control Technology (RACT), BACT, and Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC) Search Results
- Appendix E: Modeling Files
- Appendix F: Tanks Outputs

2. PROJECT DESCRIPTION

The Terminal provides services to customers through truck, rail, pipeline, and marine facilities. Products such as crude, diesel, biodiesel, gasoline, asphalt, ethanol, various grades of fuel oils, and other petroleum products are handled at the Terminal. These products are brought into the Terminal through various means such as by railcar, truck, marine vessel, and pipeline. The petroleum products that are stored at the Terminal are shipped out via truck or marine vessel.

There are four existing fixed roof storage tanks at the Terminal, 208H, 209H, 210H and 211H. These tanks have been exempt from NOC requirements because they currently only store distillate products such as diesel and fuel oil. These tanks were also originally installed with insulation and heating system and are able to keep the fuel oil product temperature between 110 °F to 140 °F when needed. Targa proposes to install internal floating roofs (IFRs) in these tanks, along with new associated fugitive components such as valves and flanges. The addition of IFRs will enable these tanks to store higher vapor pressure products which will include gasoline, natural gasoline, isooctane and ethanol. This project is referred to as the Tanks Modification Project.

This project also includes receiving and distributing a new material, natural gasoline, at the Terminal. The annual throughput of natural gasoline at the Terminal will be 151,500,000 gallons per year. Natural gasoline will be received through rail cars and shipped out from the Terminal by marine vessels. The rail unloading facility consists of 36 railcar spots used to offload products from railcars. Targa is proposing to have the flexibility to use all 36 unloading spots for natural gasoline as well. The existing Marine Vapor Combustion Unit (MVCU) will be used to capture and control the vapors from loading natural gasoline. This project will not affect the existing throughput limit of gasoline, ethanol and isooctane at the Terminal.[1]

[1] Gasoline throughput limit at the truck rack is 501,875,000 gallons per year (gal/yr) according to NOC 10325. Gasoline and ethanol marine loading is limited to 107,310,000 gallons per year according to NOC 10956. Isooctane marine loading is limited to 126,000,000 gal/yr according to NOC 11069.

3. EMISSION CALCULATION METHODOLOGY

This section discusses the emission units and the potential emission rates from each emission unit. The pollutants expected to be emitted include VOC, hazardous air pollutants (HAPs) and toxic air pollutants (TAPs) defined under Washington Administrative Code (WAC) Chapter 173-460.

3.1. STORAGE TANKS

Tanks 208H, 209H, 210H and 211H are fixed roof storage tanks installed with heating systems for fuel oil. Currently these tanks are used to store distillates only. Targa proposes to install internal floating roofs for these four tanks. The post-project specifications of these storage tanks are summarized in Table 3-1. Note that the storage capacity of these tanks will be reduced by 4 ft in height by converting the fixed roof tanks to internal floating roof tanks. Moreover, the heating system will only be used when the tanks store heavy liquids such as fuel oil.

Table 3-1. Post-Project Storage Tanks Specifications

Tank ID	Diameter (ft)	Shell Height (ft)	Working Height [a] (ft)	Working Volume [b] (gal)	Maximum Heating Temperature [c] (°F)	Material Stored
208H	72.08	60	52.17	1,592,518	140	Diesel, gasoline, natural gasoline, isooctane, fuel oil, ethanol
209H	76.00	60	52.08	1,767,452	140	
210H	95.08	60	53.17	2,824,034	140	
211H	76.00	60	52.42	1,778,764	140	

[a] This refers to the maximum working height after the conversion of the tanks. Installing an internal floating roof will reduce the working height by 4 ft compared to the pre-project status.
[b] The working volume is calculated based on the tank diameter and the maximum working height of each tank.
[c] The heating system typically keeps the temperature of the products between 110 and 140 °F. The heating system will only be used when the tanks store fuel oil.

Potential emissions of VOC, HAP, and TAP from the storage tanks are estimated using the methodology specified in AP-42 Section 7.1 for organic liquids storage tanks.[2] Detailed emission calculations on storage tanks are included in Appendix F, and are summarized in Appendix B. The worst-case maximum daily and annual emission rates of the following emission scenarios are considered for the Tanks Modification Project:

- On annual basis:
  - The maximum annual throughput will be 24 turnovers per year for each tank for diesel/fuel oil. The current facility-wide gasoline throughput limit of 609,185,000 gallons per year[1] will be distributed to all gasoline storage tanks assuming same turnovers for each tank and apportioned accordingly.
  - The annual total throughputs for isooctane and natural gasoline will be the facility-wide maximum throughputs: 126,000,000 gallons for isooctane and 151,500,000 gallons for natural gasoline. The facility-wide throughputs are apportioned to the four tanks based on the working volume (i.e., same number of annual turnovers for the four tanks).
  - The maximum annual emissions are calculated based on a throughput that is the maximum of the filling and withdrawal product.
  - The tanks are assumed to be at 140 °F when storing fuel oil.

[2] Tanks 208H-211H storing ethanol are not calculated, because the gasoline has higher emissions than ethanol.

- On daily basis:
  - The maximum monthly throughput of all products will be 2.54 turnovers for each tank based on Targa's projection. It's conservatively assumed that the monthly throughput could occur in one day.
  - The maximum daily emission rates are calculated based on a product that has the maximum total losses. The emissions are based on the month with maximum VOC emissions rates for storing these materials.

Emission calculations for liquids stored in tanks are based on the following speciation profiles:

- Speciation data from TANKS 4.09d default for Gasoline (RVP13) and Gasoline (RVP9) is used to evaluate emissions from storing gasoline, except that the benzene liquid weight percentage rate is based on the limit of 0.62 percent benzene by volume in liquid per 40 CFR 80.1230(a)(1).[3] The Gasoline (RVP13) profile is used for January through April and October through December and the Gasoline (RVP9) profile is used for May through September, according to the maximum RVP limit per 40 CFR 80.27(a)(2).
- Speciation data from TANKS 4.09d default for Gasoline (RVP11) is used to evaluate VOC emissions from storing natural gasoline, which has the comparable vapor pressure profile as the natural gasoline according to the Safety Data Sheet (SDS, see Appendix C). For the speciated emission rates, the liquid weight fractions of benzene and n-hexane are obtained from the SDS.[4]
- Speciation data from TANKS 4.09d default for Distillate Oil No. 2 is used to evaluate emissions from storing diesel and fuel oil.
- Fuel oil vapor pressure is determined based on Antoine two-constant equation; a vapor pressure curve proportional to that of TANKS 4.0.9d was used, with vapor pressure at 60 °F set to 0.002 psia.

3.2. MARINE LOADING

Natural gasoline will be shipped offsite by marine transportation. The modification to the storage tanks will not affect the permitted levels of gasoline and ethanol; therefore, the potential emissions at the marine loading are only evaluated for natural gasoline loading.

The uncontrolled loading losses emission factor for total organic compound (TOC) is calculated based on Equation 1 from AP-42, Section 5.2, Transportation and Marketing of Petroleum Liquids:

$$Loading\ Loss\ \left(\frac{lb}{10^3\ gal}\right) = \frac{12.46 \times Saturation\ Factor \times Molecular\ Weight\ of\ Vapors \times True\ Vapor\ Pressure\ (psia)}{Temperature\ of\ Bulk\ Liquid\ (°F)}$$

The saturation factor is 0.5 according to Table 5.2-1, AP-42 for submerged loading for barges. The molecular weight is assumed to be similar to Gasoline (RVP11) in TANKS 4.09 database, which is 65. The true vapor pressure is set at 11.1 psia, which is the maximum vapor pressure allowed under NSPS Subpart Kb without additional control (such as closed vent system). July maximum daily temperature of 75.2 °F and annual average temperature of 52 °F at SEA-TAC Airport are used to determine the maximum short-term and annual average

[3] The liquid fraction of benzene is converted by the default benzene density (7.365 lb/gal) and gasoline density (5.6 lb/gal) which equals a liquid weight fraction of 0.82 wt%.

[4] Components other than benzene and n-hexane are neither HAP nor TAP; therefore, the speciated emissions for these components are not calculated.

emission factor. It is conservatively assumed that the TOC emission factor is representative of VOC emission factor.

The marine vapor combustion unit (MVCU) will be used when natural gasoline is loaded to marine vessels. The MVCU is equipped with vapor blower staging unit (VBSU) and dock safety unit (DSU) which is designed to capture 100% VOC emitted from marine loading operations.[5] The terminal has the capability to load non-inert and inert vessels. When loading inert vessels, a capture efficiency of 99.8% is achieved at the MVCU based on the requirement for loading of inert barges.[6] To conservatively estimate the potential emissions from the Tanks Modification Project, the capture efficiency of 99.8% is used. The combustion efficiency is 98% based on John Zink's guarantee. The maximum short-term emission rates are determined based on the product loading capacity of 7,000 bbl per hour (i.e., 4,900 gal per minute). The annual throughput is determined based on Targa's projection of 151,500,000 gal per year of natural gasoline.

Since the amount of supplemental fuel (natural gas) needed to combust the VOC vapors at the MVCU pilot will not be affected by introducing natural gasoline at the facility, the emission increase is determined to be the amount of VOC vapors not captured by MVCU at the marine dock (i.e., 0.2% total vapor) and not combusted (i.e., 2% of captured vapor). The speciated emission rates are calculated based on the vapor weight fraction for benzene and n-hexane.

Detailed emission calculations are presented in Appendix B.

3.3. FUGITIVE EQUIPMENT LEAKS

The Tank Modification Project will only add piping components for gasoline, ethanol, isooctane and natural gasoline loading at Tanks 208H, 209H, 210H and 211H. Therefore, the total number of existing component counts at the storage tanks plus the new piping components is used to determine the potential VOC emissions for storage tanks. Additional loading equipment at the marine dock and rail unloading site is not needed to load/unload natural gasoline at the facility. Therefore, the existing number of fugitive components is applied to estimate emissions from component leaks at MVCU and rail unloading site. The number of fugitive component counts is summarized in Table 3-2.

[5] NOC 10554 application submitted in May 2013. NOC 10554 was superseded by NOC 10956 issued in July 2015.

[6] Per technical revisions to NOC 10554 submitted in May 2015.

Table 3-2. Fugitive Component Counts

Component Type [a]	Service	Estimated Number of Components
Tanks [a]		
Valves	Light Liquid	56
Flanges	Light Liquid	160
MVCU/Natural Gasoline [b]		
Valves	Light Liquid	10
Flanges	Light Liquid	30
Rail Unloading/Natural Gasoline [b]		
Valves	Light Liquid	105
Flanges	Light Liquid	178
Pumps	Light Liquid	2
Other	Light Liquid	92

[a] These fugitive components represent the total components at Tanks 208H, 209H, 210H and 211H. Currently each tank has 10 valves and 30 flanges. It's assumed that 4 valves and 10 flanges will be needed on piping for gasoline, ethanol, isooctane and natural gasoline loading, per tank.

[b] Fugitive component emissions for MVCU and Rail Unloading are only evaluated for natural gasoline, because the throughput for other products are not affected by this project. The MVCU is assumed to have 10 valves and 30 flanges. The fugitive components for the rail unloading presented here include all 36 unloading spots, and it's assumed that the natural gasoline will be unloaded at any unloading spot.

Emission factors obtained from Table 2-3, EPA Protocol for Equipment Leak Emission Estimates for Marketing Terminal are used to estimate the potential VOC emissions at fugitive components. Speciated emissions for equipment leaks at the storage tanks are determined based on the worst-case of liquid fraction of a specified compound among gasoline, natural gasoline, isooctane and diesel. Moreover, speciated emissions for equipment leaks at the MVCU and rail unloading facility are solely based on the liquid and vapor fraction of natural gasoline, since the Tank Modification Project does not affect the product loading/unloading at existing permitted levels for gasoline, diesel, and isooctane.

3.4. PROJECT EMISSION SUMMARY

The project emissions by emission source are summarized in Table 3-3 below. Pre- and post-project VOC and HAP emission rates are presented in Table 3-4. Potential emissions for the Tanks Modification Project for speciated HAPs and Washington TAPs are provided in Section 6.

Table 3-3. Emission Summary

Emission Unit	Maximum Hourly VOC Emission Rate (lb/hr)	Annual VOC Emission Rate (tpy)
Tank 208H [a]	17.84	1.88
Tank 209H [a]	18.64	1.96
Tank 210H [a]	30.72	3.23
Tank 211H [a]	18.64	1.96
Tanks Fugitives [a]	0.01	0.04
MVCU [b]	54.27	14.62
Marine Barge Loading Fugitives [b]	1.48E-03	6.47E-03
Rail Fugitives [b]	0.04	0.18
Total VOC	140.17	23.87

[a] Tanks emissions (including Tanks 208H, 209H, 210H and 211H) are evaluated for the worst-case for storing diesel, gasoline, natural gasoline and isooctane. Ethanol is not expected to have VOC emissions higher than any of these products; therefore, emissions for storing ethanol are not evaluated.

[b] Permitting Tanks 208H-211H to have the capability to store gasoline, ethanol and isooctane does not affect current throughput limits, nor cause additional VOC emissions at the marine dock and rail unloading. Therefore, emissions for MVCU and rail unloading are only evaluated for natural gasoline.

Table 3-4. Facility-Wide Emissions Summary

	VOC [a] (tpy)	Individual HAP [b] (tpy)	Total HAPs (tpy)
Post-Project Facility-Wide Emissions	89.27	6.18	11.43
PSD Threshold	250	N/A	N/A
Title V Threshold	100	10	25

[a] This project only has VOC and HAP emission increase. Therefore, other criteria pollutants are not listed. The post-project facility-wide VOC emission rate includes fugitives.

[b] The individual HAP with highest emissions is 2,2,4-trimethylpentane.

The Terminal is located in Tacoma, Washington, which is an attainment area for all criteria pollutants. The emissions expected from this project are VOC, HAP, and TAP. The following section analyzes regulatory requirements potentially applicable to the emission sources identified for the Tanks Modification Project.

4.1. NOC APPLICABILITY

Per PSCAA Regulation I Section 6.03, an NOC permit application must be filed and the permit issued by PSCAA, prior to the construction, reconstruction or modification of an affected facility, or if a project triggers certain federal requirements. The proposed project involves the construction of new fugitive equipment, the installation of internal floating roofs in Tanks 208H – 211H, and a change in service of Tanks 208H – 211H to allow gasoline, natural gasoline, isooctane and ethanol storage. Therefore, an NOC is required for the proposed changes at Tanks 208H-211H.

4.2. BACT

Pursuant to WAC 173-400-113(2), each new or modified stationary source must employ BACT for all pollutants not previously emitted, or any pollutants for which there is an emissions increase. The modification of Tanks 208H-211H requires BACT review for VOC, TAP, and HAP. A BACT analysis is performed for the storage tanks and equipment leak fugitives. A summary of the BACT determinations is provided in Table 4-1 below. A more detailed BACT analysis is provided in Section 5 of this report.

Table 4-1. Summary of BACT Determinations

Source	Pollutant	Control Technology
Marine Loading	VOC	Vapor Combustion Unit with VBSU and DSU
Tanks 208H, 209H, 210H, and 211H	VOC	Internal Floating Roof with secondary seals
Equipment Leaks	VOC	Good Operating Practices

4.3. PREVENTION OF SIGNIFCANT DETERIORATION (MAJOR NEW SOURCE REVIEW)

The Washington State Department of Ecology (Ecology) is responsible for the Prevention of Significant Deterioration (PSD) program for stationary sources in PSCAA jurisdiction. A project is subject to the PSD permitting program under WAC 173-400-700 if the project is either a "major modification" to an existing "major source," or is a new major source itself. The Terminal is not an existing major source under the PSD program, and the post-project emissions as shown in Table 3-4 at the Terminal are not above the major source thresholds. Since the Terminal will remain below the major source thresholds after this project is completed, the PSD requirements are not applicable to this project.

4.4. TITLE V OPERATING PERMIT

PSCAA is responsible for the Title V Air Operating Permit program in its jurisdiction. As shown in Table 3-4, the post-project facility-wide PTE, is below the Title V major source emission threshold.

4.5. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

WAC 173-400-115 adopts federal NSPS by reference. NSPS apply to certain types of equipment that are newly constructed, modified, or reconstructed after a given applicability date. NSPS applicability is reviewed below for each emission unit for the Tanks Modification Project.

4.5.1. NSPS Subpart A

All affected sources subject to an NSPS are also subject to the general provisions of NSPS Subpart A unless specifically excluded by the source-specific NSPS.

- Initial construction/reconstruction notification
- Initial startup notification
- Performance test requirements
- Performance test date initial notification
- General monitoring requirements
- General recordkeeping requirements
- Semiannual monitoring system and/or excess emission reports

4.5.2. NSPS Subpart K

NSPS Subpart K (Standards of Performance for Storage Vessels for Petroleum Liquids) applies to each storage vessel for petroleum liquids which has a storage capacity greater than 40,000 gallons and for which construction, reconstruction, or modification commenced after June 11, 1973, and prior to May 19, 1978. The four proposed storage vessels, Tanks 208H through 211H, in the project will be modified after May 18, 1978. Therefore, the proposed Tanks 208H through 211H are not subject to Subpart K.

4.5.3. NSPS Subpart Ka

NSPS Subpart Ka (Standards of Performance for Storage Vessels for Petroleum Liquids) applies to each storage vessel for petroleum liquids which has a storage capacity greater than 40,000 gallons and for which construction, reconstruction, or modification commenced after May 19, 1978, and prior to July 23, 1984. The four storage vessels proposed to be modified, Tanks 208H through 211H, in the project will be modified after July 23, 1984. Therefore, the proposed Tanks 208H through 211H are not subject to Subpart Ka.

4.5.4. NSPS Subpart Kb

NSPS Subpart Kb (Standards of Performance for Storage Vessels for Volatile Organic Liquids) applies to each storage vessel for petroleum liquids which has a storage capacity greater than 75 cubic meters and for which construction, reconstruction, or modification commenced after July 23, 1984. The four storage vessels, Tanks 208H to 211H, in the project will be modified after July 23, 1984.

Tanks 208H, 209H, 210H, and 211H have storage capacities of 6,028; 6,691; 10,690 and 6,733 cubic meters, respectively. Per the definition of maximum true vapor pressure according to 40 CFR 51.100, the organic liquids proposed to be stored in these vessels have maximum true vapor pressures of greater than 3.5 kPa. Therefore, Subpart Kb applies to Tanks 208H, 209H, 210H and 211H. The other existing tanks at the Terminal will be not be modified as part of this project.

The standards for volatile organic compounds as set out by Subpart Kb apply to storage vessels having a design capacity greater than or equal to 151 cubic meters that store a volatile organic liquid (VOL) with a maximum

true vapor pressure equal to or greater than 5.2 kPa but less than 76.6 kPa. The VOLs, including gasoline, natural gasoline[7], ethanol and isooctane stored in Tanks 208H, 209H, 210H and 211H are within this vapor pressure range, and these tanks must be equipped with a VOC emission control system as set forth by §60.112b(a). As part of this project, Targa has proposed to construct internal floating roofs and required double seals for Tanks 208H, 209H, 210H and 211H that will satisfy these requirements.

Targa will follow the applicable testing, procedures, reporting, recordkeeping, and monitoring of operation requirements as set out by §60.112b to §60.117b for Tanks 208H, 209H, 210H and 211H.

4.6. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

NESHAPs have been established in 40 CFR 61 and 63 to control the emissions of Hazardous Air Pollutants (HAPs). NESHAP regulations codified in 40 CFR 63 establish Maximum Achievable Control Technology (MACT) standards for specific types of equipment at qualifying facilities. MACT regulations typically apply to facilities that are major sources. Under 40 CFR 63, a major source is defined as "any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any HAP or 25 tons per year or more of any combination of HAP…". The Terminal is not considered a major source of HAP per this definition.

4.6.1. NESHAP Subpart R

NESHAP Subpart R (Standards for Gasoline Distribution Facilities) applies to bulk gasoline terminals that are classified as major sources. The Terminal is not considered a major source; therefore NESHAP Subpart R does not apply to the Terminal.

4.6.2. NESHAP Subpart Y

NESHAP Subpart Y (NESHAP for Marine tank Vessel Loading Operations) applies to new and existing affected sources at affected marine loading operations. The maximum achievable control technology (MACT) standards apply to major sources and the reasonably available control technology (RACT) standards apply to area sources with throughput of 10 million bbls or 200 million bbls. The definition of source(s) with throughput of 10 million bbls or 200 million bbls is:

> *Source(s) with throughput of 10 M barrels or 200 M barrels means source(s) having aggregate loading from marine tank vessel loading operations at all loading berths as follows:*
>
> *(1) Prior to the compliance date, of 1.6 billion liters (10 M barrels) or more of gasoline on a 24-month annual average basis or of 32 billion liters (200 M barrels) or more of crude oil on a 24-month annual average basis after September 19, 1996; or*

[7] The natural gasoline SDS shows a vapor pressure of 11.8 psia at 100 °F. However, the daily maximum ambient temperature at the Terminal according to Table 7.1-7, AP-42 for SEA-TAC airport is 75.2 °F. The vapor pressure at this temperature is approximately 7.95 psia, which is well below the limit of 76.6 kPa (11.1 psia). Additionally, the maximum monthly vapor pressure at liquid surface temperature for Tanks 208H through 211H storing natural gasoline is 7.95 psia (see Appendix B, Tanks Calculations outputs), which is also well below the limit of 76.6 kPa.

(2) After the compliance date, of 1.6 billion liters (10 M barrels) or more of gasoline annually or of 32 billion liters (200 M barrels) or more of crude oil annually after September 21, 1998.

The Terminal is not a major source; therefore, MACT standards do not apply. Additionally, the gasoline and crude throughput limits at the marine dock are 2,555,000 bbls/yr (107,310,000 gal/yr) and 14,601,600 bbl/yr (613,267,200 gal/yr), respectively, which are less than the 10 million bbls of gasoline threshold and 200 million bbls of crude threshold. Therefore, the RACT standards set forth under §63.562(c) and §63.562(d) do not apply to the Terminal.

Note that per NOC 10956 the facility marine loading sources are required to comply with 40 CFR Part 63, Subpart Y sections 63.562(1)(ii)-(iii) and these requirements are not expected to change per this application.

4.6.3. NESHAP Subpart EEEE

NESHAP Subpart EEEE (Standards for Organic Liquids Distribution (Non-Gasoline)) applies to organic liquid distribution operations at major sources of HAP emissions. Since the Terminal is not a major source of HAP the project is not subject to NESHAP Subpart EEEE.

4.6.4. NESHAP Subpart BBBBBB

NESHAP Subpart BBBBBB (Standards for Source Category: Gasoline Distribution Bulk Terminals) is applicable for gasoline distribution bulk terminals, bulk plants, and pipeline facilities. The affected source as defined by Subpart BBBBBB is each area source bulk gasoline terminal that is not subject to NESHAP Subpart R or NESHAP Subpart CC. NESHAP Subpart CC applies only to petroleum refining process units. The following definition is pertinent to determining NESHAP Subpart BBBBBB applicability:

Bulk gasoline terminal: any gasoline storage and distribution facility that receives gasoline by pipeline, ship or barge, or cargo tank and has a gasoline throughput of 20,000 gallons per day or greater. Gasoline throughput shall be the maximum calculated design throughput as may be limited by compliance with an enforceable condition under Federal, State, or local law and discoverable by the Administrator and any other person.

The Terminal qualifies as a bulk gasoline terminal as defined above. The Terminal is not subject to NESHAP Subpart R or NESHAP Subpart CC, and is a gasoline storage and distribution facility with a gasoline throughput of greater than 20,000 gallons per day. Therefore, the facility is currently subject to NESHAP Subpart BBBBBB.

Per 40 CFR 63.11082, the affected source subject to NESHAP Subpart BBBBBB provisions includes the gasoline storage tanks, gasoline loading racks, vapor collection-equipped gasoline cargo tanks, and equipment components in vapor or liquid gasoline service. Facilities must comply with NESHAP Subpart BBBBBB by different dates depending on if the affected source is new, reconstructed, or existing.

The loading rack, all storage tanks that store gasoline, and equipment components in gasoline service at the Terminal are currently subject to NESHAP Subpart BBBBBB. The affected source does not fall under the definition of a new source because the terminal was constructed before November 9, 2006. The proposed changes will impact the affected source since there will be an addition of four existing storage vessels modified to store gasoline, but the facility will not meet the definition of reconstruction or "new". The affected source definition applies to the bulk gasoline terminal and not individual pieces of equipment. Targa became subject to the control requirements in this subpart once the Terminal started loading gasoline in excess of 20,000 gallons of gasoline per day, which first occurred on January 26, 2013. According to §63.11083(c), an existing affected source must comply with the standards in Tables 1 through 3 of Subpart BBBBBB no later than 3 years after the

affected source becomes subject to the control requirements in this subpart. The existing equipment at the Terminal meets the requirements set forth in Table 1 for storage tanks and Table 2 for loading rack of Subpart BBBBBB no later than January 26, 2016.

For storage vessels, NESHAP Subpart BBBBBB requires in Table 1 that a gasoline storage tank with a capacity of greater than 75 cubic meters and with a throughput of greater than 480 gallons per day, must meet selected requirements set out in §60.112b(a)(1) of NSPS Subparts Kb, respectively. As noted in Section 4.5.4, the storage tanks (Tanks 208H, 209H, 210H and 212H) will be subject to NSPS Subpart Kb requirements, which will satisfy the NESHAP Subpart BBBBBB requirements for tanks. Similarly, NESHAP Subpart BBBBBB requires in Table 2 that a gasoline loading rack with a gasoline throughput of 250,000 gallons per day or greater must be equipped with a vapor collection system, limit the total organic compounds (TOC) emissions to no more than 80 mg/L of gasoline loaded and prevent a bypass of TOC vapors. The truck loading rack has been subject to and in compliance with these requirements. Targa will ensure continuous compliance status with the specified requirements set forth under NESHAP BBBBBB.

4.7. STATE AND LOCAL REGULATORY APPLICABILITY

4.7.1. Washington Toxic Air Pollutants Regulations

In Washington, all new sources emitting TAPs are required to show compliance with the Washington TAP program pursuant to WAC 173-460. PSCAA incorporates the Washington TAP program by reference. Each listed TAP has an established de minimis level, Small Quantity Emission Rate (SQER), and an Acceptable Source Impact Level (ASIL). If the TAP emissions rate from a source is above its respective de minimis level and respective SQER, further determination of compliance with the ASIL is required. TAP emission calculations are included in Appendix B of this report. All the TAPs emitted from the Tanks Modification Project are in compliance with their respective ASILs as shown in Table 7-6.

Since all toxic air pollutant emissions from the Tanks Modification Project are emitted as volatiles, the BACT determinations in Section 5 of this application are sufficient to satisfy tBACT requirements for these TAPs.

4.7.2. Local Regulatory Applicability

The Terminal will be subject to the following Ecology and PSCAA regulations:

- No air contaminant source shall exceed opacity of 20% for more than 3 minutes in a given hour, except as stated in PSCAA Regulation I Section 9.03 b through e. (PSCAA Regulation I Section 9.03a)
- No air contaminant shall be emitted in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property. (PSCAA Regulation I Section 9.11)
- No features, devices, control equipment, or machines shall operate unless such equipment are maintained in good working order. (PSCAA Regulation I Section 9.20)
- All stationary storage tanks with a capacity of 40,000 gallons or greater storing volatile organic compounds with a true vapor pressure of 1.5 Psia or greater at actual monthly average storage temperatures shall meet all of the criteria in PSCAA Regulation II Section 3.02. Included in these criteria are the following:
  - The storage vessel must be equipped with an external floating roof, a fixed roof with an internal floating-type cover, or a fixed roof with control equipment that reduces emissions by 95% or greater;
  - Routine inspections shall be performed for external and internal floating roof tanks.

- The Terminal will comply with the reporting requirements as specified in PSCAA Regulation I Section 5.05(b) if and when actual emissions of air contaminants emitted during the previous calendar year equal or exceed:
  - 2.5 tpy of any single HAP
  - 6.25 tpy of total HAPs
  - 25 tpy of carbon monoxide, nitrogen oxides, particulate matter under 10 micrometers, sulfur oxides, or VOC

Under WAC 173-400-113, the WA Department of Ecology requires BACT for all pollutants not previously emitted or whose emissions would increase as a result of the new source or modification. A BACT analysis is included in this section for the storage vessels, MVCU, and fugitive equipment leaks. The BACT required for the TAPs are presented in Section 4.7.1.

5.1. BACT ANALYSIS FOR STORAGE VESSELS

The proposed Tanks 208H, 209H, and 210H and 211H are existing tanks being modified for this project. The tanks will be able to store gasoline, natural gasoline, isooctane, ethanol, distillates and fuel oil. Targa proposes to install internal floating roofs and both primary and secondary seals based on the requirements under NSPS Subpart Kb for these tanks. According to the RACT/BACT/LAER Clearinghouse (RBLC), a BACT control method used for controlling VOCs for petroleum liquid storage in floating roof tanks with secondary seals meets the NSPS Subpart Kb and NESHAP Subpart BBBBBB requirements for tanks in gasoline service. Tanks 208H, 209H, 210H and 211H will be compliant with NSPS Kb regulations. More details about the RBLC search results can be found in Appendix D of this application. Compliance with applicable NSPS Subpart Kb requirements is considered BACT for these tanks.

5.2. BACT ANALYSIS FOR MARINE LOADING

A MVCU will capture the VOC vapors from the proposed natural gasoline loading operations at the marine dock, similar to current operations with gasoline and crude oil loading. As presented in NOC 10554 application and technical revision (May 2013 and May 2015, respectively), a control devices such as marine vapor combustors is commonly listed as BACT in compliance with the provisions of 40 CFR 60.18 in NSPS Subpart A, and the MVCU with destruction efficiency of 98% and the use of VBSU results in emissions comparable to or better than other units in the RBLC represents BACT. Therefore, the current configuration of the MVCU is considered BACT for natural gasoline unloading.

Targa will use the MVCU with VBSU and DSU during all loading operations to maintain the vacuum pressure for non-inert vessels.[8]

5.3. BACT ANALYSIS FOR EQUIPMENT LEAKS

Equipment components in a facility are susceptible to leaks, causing small amounts of fugitive emission releases into the atmosphere. As seen in detailed calculations in Appendix B, VOC emissions from these leaks are estimated to be minimal (0.23 tpy). Targa proposes good operating practices as BACT for fugitive equipment leaks.

[8] Note that use of MVCU combined with VBSU and DSU will not achieve the 100% vapor capture efficiency for inert barge loading per Technical Revision to NOC 10554 (May 2015). NOC 10554 was superseded by NOC 10956.

6. TOXIC AIR POLLUTANT EMISSIONS ANALYSIS

As discussed in Section 4.7.1, all TAPs emissions from the Tank Modification Project need to demonstrate compliance with WAC 173-460.

The emission rate of toxic air pollutants expected from this project is detailed in Table 6-1 below. These emission rates are compared to their respective SQERs to determine if modeling is required. TAPs above their respective SQER must be modeled, and the highest 1st high concentration resulting from the respective averaging period for each TAP is compared to the ASIL. For TAPs with impacts less than the ASIL, no further action is necessary to show compliance with WAC 173-460.

Table 6-1. TAPs Emission Screening Calculations

Pollutant	Averaging Period	SQER [a] (lb/averaging period)	Total TAP (lb/averaging period)	Modeling Required?
Benzene	Year	6.62	142.13	Yes
Cyclohexane	24-Hour	789	1.62	No
Ethyl benzene	Year	76.8	14.07	No
Isopropyl benzene	24-Hour	52.6	0.34	No
n-Hexane	24-Hour	92	178.64	Yes
Toluene	24-Hour	657	15.69	No
Xylenes (mixed isomers)	24-Hour	29	6.49	No

[a] WAC 173-460-150 provides the ASIL and SQER values.

As shown in Table 6-1, modeling analysis to demonstrate compliance with the ASIL for benzene and n-hexane is required. The air dispersion modeling analysis presented in Section 7 demonstrates compliance with the ASILs for these two TAPs.

7. AIR QUALITY DISPERSION MODELING

This section describes the air quality dispersion modeling analysis performed to estimate the impacts on near-field ground-level concentrations of TAPs from the Terminal. Included in this application are the AERMOD modeled results for benzene and n-hexane. The modeling in this project includes the post-project emissions from Tanks 208H, 209H, 210H and 211H as well as the MVCU and the fugitive equipment leaks.

7.1. DISPERSION MODELING

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) modeling system, the AERMOD dispersion model, version 15181, with Plume Rise Model Enhancements (PRIME) advanced downwash algorithms is used as the dispersion model in the air quality analysis.

7.2. METEOROLOGICAL DATA

The modeling analysis is performed using five years of representative meteorological data (2007-2011) for the AERMOD dispersion model, including:

- Surface meteorological data (wind speed and wind direction) from Tacoma Tideflats;
- Additional AERMOD met data parameters not measured at the Tacoma Tideflats augmented with the same five years of SeaTac Automated Surface Observing System (ASOS) data obtained in hourly format from the National Climate Data Center (NCDC); and
- Quillayute upper air meteorological data.

The AERMOD meteorological preprocessor AERMET (Version 12345) was used to process the data. SeaTac is selected as the surface site and Tacoma Tideflats is selected for onsite data.

7.3. TERRAIN ELEVATIONS

Terrain elevations for receptors, buildings, and sources are determined using National Elevation Dataset (NED). The NED is a seamless dataset with the best available raster elevation data of the contiguous United States. It is the primary elevation product of the USGS. Elevations are converted from the NED 30 m (1 arc-second) grid spacing to the air dispersion model spacing using the AERMOD preprocessor, AERMAP version 11103.

7.4. COORDINATE SYSTEM

The location of emission sources, structures, and receptors are represented in the Universal Transverse Mercator (UTM) coordinate system using the North American 1983, CONUS (NAD83) projection. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central meridian of a particular zone, which is set at 500 km). UTM coordinates for this analysis are based on UTM Zone 10. The location of the terminal is approximately 5,236,242 meters Northing and 546,363 meters Easting in UTM Zone 10.

7.5. RECEPTOR GRIDS

Two square Cartesian receptor grids (i.e., a fine grid and a coarse grid), as well as receptors placed on the facility's property boundary (fence line boundary), are used for this dispersion modeling analysis.[9]

- The fence line boundary consists of discrete receptors placed at 10-meter intervals.
- The fine grid contains 10-meter spaced receptors extending 350 meters beyond the Terminal property boundary, which is appropriately 800 meters from the center point of the Terminal.
- The coarse grid contains 25-meter spaced receptors extending from 350 meters out to 800 meters, which is appropriately 1,250 meters from the center point of the Terminal.

Additionally, the receptor grid is revised to exclude receptors on the waterway where marine barge loading occurs, including a buffer around the barge of approximately 120 feet. The total extension from the fenceline on land to the furthest extent of the barge loading buffer zone is 265 feet. These receptors around the barge and over the water are removed because the purpose of an air toxics review is to assess human health exposure to the identified TAPs. This revised receptor grid is consistent with the modeling analysis as part of the effort to develop the Technical Revision to NOC 10554 (May 2015) for annual benzene standards.

However, the averaging period for n-hexane is 24-hour according to WAC 173-460. In order to assess the possible 24-hour human health exposure, the 10-meter spaced receptors that are located on the marine dock and the waterway are included and only the receptors on the modeled barge loading source locations are removed as this area is not publicly accessible.

7.6. BUILDING DOWNWASH

Emission sources from the terminal are evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the buildings were absent. Direction-specific building dimensions and the dominant downwash structure parameters used as input to the dispersion models are determined using the BREEZE-WAKE/BPIP software, developed by Trinity. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274. BPIP is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents. Table 7-1 and Table 7-2 present a list of the buildings included in this modeling analysis.

[9] Obtained from WA Department of Ecology Guidance on First, Second, and Third Tier Review of Air Toxics, Pg. 21

Table 7-1. Modeled Buildings

Building ID	Elevation (m)	Height (m)	Length (m)	Width (m)	Rotated Angle (degrees)
TK_10	4.33	2.44	4.88	2.44	0
OFFICE [a]	3.74	9.14	18.00	18.00	-38
BOILER	3.11	9.14	8.10	5.50	0
LAB	3.24	3.05	6.90	19.50	0

[a] Building structures in AREA 1 (northwest of facility), including the office building, are not included in the modeling analysis. The Office building is the structure closest to the MVCU stack in the area. The GEP 5L of this building is approximately 46 meters, which is substantially lower than the distance from the building to the MVCU stack (approximately 220 meters). Therefore, the building structures in AREA 1 will not have building downwash effect to the MVCU stack.

Table 7-2. Modeled Vertical Tanks as Buildings

Building ID [a]	Diameter (m)	Height (m)	Building ID [a]	Diameter (m)	Height (m)
T-1	15.8	12.4	T-22	12.8	12.2
T-2	15.8	15.0	T-23	3.0	4.5
T-3	15.8	12.6	T-25	3.0	4.5
T-4	15.2	10.7	T-26	24.4	14.8
T-5	15.2	10.7	T-27	24.4	12.4
T-6	9.8	8.0	T-28	30.5	13.6
T-7	9.8	8.0	T-29	13.7	14.8
T-8	3.0	4.5	T-150	12.8	14.0
T-9	2.7	6.6	T-151	26.2	18.1
T-10	2.4	4.9	T-152	26.2	18.1
T-11	7.3	5.7	T-153	15.2	14.6
T-12	7.3	5.6	T-154	15.2	15.2
T-13	7.3	5.5	T-155	18.3	15.6
T-14	7.3	5.7	T-156	18.3	15.6
T-15	7.3	5.6	T-157	27.4	16.5
T-16	10.7	9.3	T-161	27.4	15.6
T-17	7.6	7.5	T-162	27.4	16.5
T-18	24.4	12.3	T-163	18.3	15.2
T-19	30.5	12.4	T-164	18.3	15.2
T-20	12.8	12.3	T-165	18.3	15.2
T-21	12.8	12.3	T-26	24.4	14.8

[a] Building structures in AREA 1 (northwest of facility), including the office building and 200 series storage tanks, are not included in the modeling analysis. The Office building is the structure closest to the MVCU stack in the area. The GEP 5L of this building is approximately 46 meters, which is substantially lower than the distance from the building to the MVCU stack (approximately 220 meters). Therefore, the building structures in AREA 1 will not have building downwash effect to the MVCU stack.

7.7. EMISSION SOURCE PARAMETERS

VOC emissions occur from several point and volume sources at the terminal. The MVCU is modeled as a point source. The storage tanks are modeled as volume sources with a release height set to reflect the results of downwash effects presented in a paper on stack-tip downwash by Snyder and Lawson (1991). In the Snyder and Lawson study, downwash of neutrally buoyant effluent on the lee side of a circular stack was modeled using

a wind-tunnel simulation. In 2013, Clint Bowman with the Department of Ecology, reviewed the applicability of this paper's findings to dispersion modeling of the Terminal storage tanks. Based on findings made in the paper, Mr. Bowman summarized specific modeling guidance for cylindrical tanks at the Terminal in a technical memo. Mr. Bowman's technical memo serves as the basis for two volume source parameters for storage tanks in this dispersion modeling analysis.[10]

The Snyder and Lawson paper suggests that the distribution of the plume from a circular tank may be divided into an upper and lower volume source, which contains 90 percent and 10 percent of the total emissions, respectively. Applying this approach to the Terminal dispersion model suggests that the upper source should be centered at 0.3 times the diameter of the tank above the height of the tank, and should have an initial vertical dimension of 0.14 times the diameter. The lower source should be centered at 1.0 times the diameter of the tank below the height of the tank and should have an initial vertical dimension of 0.51 times the diameter. For tanks that have a height to diameter ratio of less than one, the lower volume source is centered at ground level. According to Mr. Bowman's technical memo, the emission rate from the upper volume source should be 90% of the total emissions with the remainder emissions in the lower volume source. Table 7-3, Table 7-4, and Table 7-5 provide the modeled point and volume source parameters and emission rates.

Table 7-3. Modeled Point Source Release Parameters

Source ID	UTM X [a] (m)	UTM Y [a] (m)	Elevation (m)	Stack Height (m)	Stack Temp (K)	Stack Velocity (m/s)	Stack Diameter (m)
MARINEVC	546,434	5,236,126	3.32	15.24	977.59	14.94	2.74

[a] Stack location is adjusted based on Google Earth aerial image to account for the as-built difference compared to the submitted NOC 10554 application.

[10] The technical memo was submitted as Appendix E of the NOC 10554 application (May 2013).

Table 7-4. Modeled Volume Source Release Parameters

Source ID	UTM X (m)	UTM Y (m)	Elevation (m)	Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)
Fugitive Sources						
MFUG_1	546,248	5,236,098	0.00	4.81	0.50	0.47
MFUG_2	546,247	5,236,096	0.00	4.81	0.50	0.47
MFUG_3	546,246	5,236,094	0.00	4.81	0.50	0.47
BFUG_1 [a]	546,183	5,236,096	0.00	2.75	5.25	1.28
BFUG_2 [a]	546,200	5,236,090	0.00	2.75	5.25	1.28
BFUG_3 [a]	546,217	5,236,085	0.00	2.75	5.25	1.28
BFUG_4 [a]	546,233	5,236,079	0.00	2.75	5.25	1.28
BFUG_5 [a]	546,250	5,236,073	0.00	2.75	5.25	1.28
BFUG_6 [a]	546,267	5,236,067	0.00	2.75	5.25	1.28
BFUG_7 [a]	546,283	5,236,061	0.00	2.75	5.25	1.28
RFUG_1	546,280	5,235,905	1.49	4.72	3.49	2.20
RFUG_2	546,280	5,235,890	1.53	4.72	3.49	2.20
RFUG_3	546,280	5,235,875	1.59	4.72	3.49	2.20
RFUG_4	546,280	5,235,860	1.65	4.72	3.49	2.20
RFUG_5	546,280	5,235,845	1.70	4.72	3.49	2.20
RFUG_6	546,280	5,235,830	1.75	4.72	3.49	2.20
RFUG_7	546,280	5,235,815	1.80	4.72	3.49	2.20
RFUG_8	546,280	5,235,800	1.85	4.72	3.49	2.20
RFUG_9	546,280	5,235,785	1.90	4.72	3.49	2.20
RFUG_10	546,280	5,235,770	1.94	4.72	3.49	2.20
RFUG_11	546,280	5,235,755	1.99	4.72	3.49	2.20
RFUG_12	546,280	5,235,740	2.04	4.72	3.49	2.20
RFUG_13	546,286	5,235,726	2.09	4.72	3.49	2.20
RFUG_14	546,293	5,235,713	2.13	4.72	3.49	2.20
RFUG_15	546,300	5,235,699	2.16	4.72	3.49	2.20
RFUG_16	546,306	5,235,686	2.17	4.72	3.49	2.20
Upper Sources						
T208H_1	546,111	5,236,420	3.71	24.88	5.11	3.08
T209H_1	546,132	5,236,442	4.31	25.24	5.39	3.24
T210H_1	546,179	5,236,424	3.67	26.98	6.74	4.06
T211H_1	546,205	5,236,399	3.33	25.24	5.39	3.24
Lower Sources						
T208H_2	546,111	5,236,420	3.71	0.00	5.11	11.21
T209H_2	546,132	5,236,442	4.31	0.00	5.39	11.81
T210H_2	546,179	5,236,424	3.67	0.00	6.74	14.78
T211H_2	546,205	5,236,399	3.33	0.00	5.39	11.81

[a] These volume sources are added to represent the uncaptured vapors from inert barge loading, which were included in the Technical Revision to NOC 10554 in May 2015.

Table 7-5. Modeled Source Emission Rates

Source ID	n-Hexane Emission Rate (Max Daily) [a] (g/s)	Benzene Emission Rate (Annual Average) [b] (g/s)
Point Source		
MARINEVC	3.266E-01	1.082E-03
Fugitive Sources		
MFUG_1	6.204E-06	6.204E-07
MFUG_2	6.204E-06	6.204E-07
MFUG_3	6.204E-06	6.204E-07
BFUG_1	4.675E-03	1.549E-05
BFUG_2	4.675E-03	1.549E-05
BFUG_3	4.675E-03	1.549E-05
BFUG_4	4.675E-03	1.549E-05
BFUG_5	4.675E-03	1.549E-05
BFUG_6	4.675E-03	1.549E-05
BFUG_7	4.675E-03	1.549E-05
RFUG_1	3.295E-05	3.295E-06
RFUG_2	3.295E-05	3.295E-06
RFUG_3	3.295E-05	3.295E-06
RFUG_4	3.295E-05	3.295E-06
RFUG_5	3.295E-05	3.295E-06
RFUG_6	3.295E-05	3.295E-06
RFUG_7	3.295E-05	3.295E-06
RFUG_8	3.295E-05	3.295E-06
RFUG_9	3.295E-05	3.295E-06
RFUG_10	3.295E-05	3.295E-06
RFUG_11	3.295E-05	3.295E-06
RFUG_12	3.295E-05	3.295E-06
RFUG_13	3.295E-05	3.295E-06
RFUG_14	3.295E-05	3.295E-06
RFUG_15	3.295E-05	3.295E-06
RFUG_16	3.295E-05	3.295E-06
Upper Sources		
T208H_1	1.082E-01	1.504E-04
T209H_1	1.131E-01	1.571E-04
T210H_1	1.858E-01	2.548E-04
T211H_1	1.131E-01	1.571E-04
Lower Sources		
T208H_2	1.203E-02	1.671E-05
T209H_2	1.257E-02	1.745E-05
T210H_2	2.064E-02	2.832E-05
T211H_2	1.257E-02	1.745E-05

[a] Maximum daily emission rates are based on daily product throughputs. Maximum daily emission rates are modeled to demonstrate compliance for TAPs with 24-hour averaging periods.

7.8. TAP COMPLIANCE DEMONSTRATION

A modeling analysis is performed to determine if emissions of TAPs due to the proposed project have a significant impact on ambient air quality. For this type of analysis, if emission increases associated with the proposed project have demonstrated ambient impacts that are less than the ASILs, no further evaluation is required. The results of this dispersion modeling analysis are compared to the ASILs for each pollutant and averaging period.

Modeled emission rates used in the modeling analysis correspond to the maximum throughput of each source at its design capacity. Ambient concentrations of TAPs are based on the AERMOD modeling results using the emission rates presented in Table 7-5. This analysis uses the highest modeled TAP concentration to evaluate compliance with the toxics standards. Table 7-6 compares modeling results to the corresponding ASILs. As shown in Table 7-6, concentrations of both TAPs are less than the associated ASILs. Therefore, further analysis of TAPs is not required.

Table 7-6. Modeling Results

Pollutant	Averaging Period	Modeling Results ($\mu g/m^3$)	ASIL ($\mu g/m^3$)	Below ASIL?
Benzene	Annual	0.0260	0.0345	Yes
n-Hexane	24-hour	57.86	700	Yes

APPENDIX A: APPLICATION FORMS

pscleanair.org
Puget Sound Clean Air Agency

PUGET SOUND CLEAN AIR AGENCY
1904 3rd Ave Ste 105
Seattle WA 98101-3317
(206) 689-4052 Fax: (206) 343-7522 www.pscleanair.org

NOTICE OF CONSTRUCTION AND APPLICATION FOR APPROVAL

Incomplete applications delay Agency review, so please fill out your application thoroughly. Instructions for filling out the application are available on the NOC Permit Application Instructions webpage.

GENERAL EQUIPMENT FORM — FORM P

AGENCY USE ONLY Date: Reg No.: NOC No.:

Type of business: (check)
☐ new
☒ existing

Status of equipment (check):
☐ new ☐ altered
☒ existing ☐ relocation

Applicant Name & Mailing Address:
Matthew Kolata
4130 East 11th Street, Tacoma, WA 98421
Phone No.: (253) 272-9348
Fax No.: NA
Email Address: mkolata@targaresources.com

North American Industry Classification System (NAICS) Code:
424710

Company (or owner) name & mailing address:
Targa Sound Terminal LLC, 4130 East 11th Street, Tacoma, WA 98421

Nature of Business / Type of Process:
Petroleum Bulk Terminal

Installation address (Include city & zip code):
4130 East 11th Street, Tacoma, WA 98421

PROCESS EQUIPMENT AND CONTROL EQUIPMENT

Process Equipment		Air Pollution Control Equipment	
# Units	Equipment Type	# Units	Equipment Type
4	Tanks		
Multiple	Rail unloading components		
Multiple	Marine loading components		

☐ Attach a process flow diagram
☒ Attach a project description

PREPARER'S CERTIFICATION STATEMENT

I, the undersigned, certify that the information contained in this application and the accompanying forms, plans, and supplemental data described herein is to the best of my knowledge, accurate and complete.

Signature: Vincent DiCosimo Date: 10/21/16

Type or print name: Vincent DiCosimo Title: Sr. Vice President Phone: (713) 584-1422

Prepared by (signature and title): Tammy H Wallace Sr. Environmental Specialist

Your application will not be processed unless you mail a $1,150 filing fee payment *along with this application*. Additional fees may apply after application review. An Environmental Checklist form and additional equipment specific forms may also be needed. These forms are available on the Agency's Regulatory Forms webpage. See the NOC Permit Application Instructions webpage for instructions on filling out the permit application. To pay by credit card, check here ☐ and an accounting technician will contact you.

Application for Notice of Construction for:
Organic Liquid Storage Tanks

A. General

Description of Equipment

Targa Sound Terminal LLC is not installing any new equipment but requesting to install internal floating roofs to existing Tanks 208H, 209H, 210H and 211H. Targa is also requesting flexibility to receive, store, and load gasoline, natural gasoline, ethanol, isooctane to Tanks 208H, 209H, 210H and 211H. Previously, these tanks were exempt from permitting requirements for receiving, storing, and loading diesel and fuel oil only. Targa wishes to maintain the flexibility for Tanks 208H, 209H, 210H and 211H for current tank services (i.e. diesel and fuel oils) as well.

Type of Construction

Modification

Date of Equipment Manufacture

2013

Estimated Hours of Operation

24 hours per day, 7 days per week, 52 weeks per year.

Estimated Installation Date

Existing Tanks

B. Liquid Properties

Product Stored

Diesel, Fuel Oils, Isooctane, Gasoline, Natural Gasoline, Ethanol

Maximum Storage Temperature

Ambient for diesel, isooctane, gasoline, natural gasoline and ethanol. Maximum temperature 140 °F for fuel oil.

Vapor Pressure at Maximum Storage Temperature (psia)

Gasoline/Ethanol 6.41
Natural Gasoline: 7.95
Diesel < 1.0
Fuel Oil < 1.0
Isooctane <1.0

Estimated Annual Throughput (gal/yr)
191,106,419 gal/yr gasoline, ethanol, diesel or fuel oil
151,500,000 gal/yr natural gasoline
126,000,000 gal/yr isooctane
For annual throughput by tank, please refer to the Appendix B of the application.

C. Design of Internal Floating Roof Tanks

Tank Diameter
Tank 208H: 72.08 ft; Tanks 209H and 211H: 76 ft; Tank 210H: 95.08 ft

Working Capacity (gal)
Tank 208H: 1,592,518 gal; Tank 209H: 1,767,452 gal; Tank 210H: 2,824,034 gal; Tank 211H: 1,778,764 gal

External Shell Color / Shade
Aluminum/Diffuse

External Shell Condition
Good

Roof Color / Shade
Aluminum/Diffuse

Roof Paint Condition
Good

Number of Columns Supporting Fixed Roof
1 for Tanks 208H, 209H and 211H. 6 for Tank 210H.

Effective Column Diameter
1 ft

Internal Shell Condition
Light Rust

Type of Primary Seal
Mechanical Shoe

Type of Secondary Seal
Shoe-Mounted

Type of Deck
Welded

Number of Each Type of Deck Fitting (per tank)

Access Hatch (24")-Unbolted Cover, Ungasketed	1
Automatic Gauge Float Well-Unbolted Cover, Ungasketed	1
Column Well (24")	Number of Columns
Ladder Well (36") – Sliding Cover, Ungasketed	1
Roof Leg or Hanger Well (Adjustable)	Variable
Sample Pipe or Well (24")-Slit Fabric Seal 10% Open	1
Vacuum breaker (10")-Weighted Mechanical Actuation, Gasketed	1

D. Operation and Maintenance

Method Used to Fill Tank
Truck, railcar, barge, ship, and pipeline

Method Used to Drain Tank
Barge, ship, or truck.

Describe Preventative Maintenance
N/A

APPENDIX B: EMISSION CALCULATIONS

Table 1. Project Emission Summary

Emission Unit	Maximum Hourly VOC Emission Rate (lb/hr)	Annual VOC Emission Rate (tpy)
Tank 208H [a]	17.84	1.88
Tank 209H [a]	18.64	1.96
Tank 210H [a]	30.72	3.23
Tank 211H [a]	18.64	1.96
Tanks Fugitives [a]	0.01	0.04
MVCU [b]	54.27	14.62
Marine Barge Loading Fugitives [b]	1.48E-03	6.47E-03
Rail Fugitives [b]	0.04	0.18
Total VOC	**140.17**	**23.87**

[a] Tanks emissions (including Tanks 208H, 209H, 210H and 211H) are evaluated for the worst-case for storing diesel, gasoline, natural gasoline and isooctane. Ethanol is not expected to have VOC emissions higher than any of these products; therefore, emissions for storing ethanol are not evaluated.

[b] Permitting Tanks 208H-211H to have the capability to store gasoline, ethanol and isooctane does not affect current throughput limits, nor cause additional VOC emissions at the marine dock and rail unloading. Therefore, emissions for MVCU and rail unloading are only evaluated for natural gasoline.

Table 2. Product Throughputs

Product	Post-Project Maximum Hourly Throughput (gal/hr)	(bbl/hr)	Annual Facility-Wide Throughput Limit (gal/yr)
Isooctane [a]	210,000	5,000	126,000,000
Gasoline [b]	294,000	7,000	609,185,000
Natural Gasoline [c]	294,000	7,000	151,500,000
Fuel Oil/ULSD [b]	294,000	7,000	NA

[a] The annual throughput for isooctane is limited to 126,000,000 gal/yr at the marine dock according to NOC 11069.

[b] Gasoline, ethanol and diesel will be loaded from truck rack and can be unloaded to the marine docks (shown below). The maximum loading rate is based on the MVCU loading capacity of 4900 gpm. The facility does not have a facility-wide throughput limit for diesel.

Total gasoline throughput at truck rack (NOC 10956) in gal/yr:	501,875,000
Total gasoline and ethanol throughput at MVCU (NOC 10956) in gal/yr:	107,310,000

[c] The annual throughput is determined based on Targa's business projection for natural gasoline.

Table 3a. Tanks Throughputs for Fuel Oil and ULSD

Tank ID	Tank Diameter [a] (ft)	Tank Height [a] (ft)	Capacity [a] (gal)	Project Max Monthly Turnovers [b] (per month)	Project Max Monthly Throughput [b] (gal/month)	Project Annual Throughput [b] (gal/yr)	Project Max Daily Throughput [c] (max gal/day)
T-208H	72.08	56.17	1,592,518	2	3,185,037	38,220,441	3,185,037
T-209H	76.00	56.08	1,767,452	2	3,534,904	42,418,845	3,534,904
T-210H	95.08	57.17	2,824,034	2	5,648,067	67,776,808	5,648,067
T-211H	76.00	56.42	1,778,764	2	3,557,527	42,690,325	3,557,527
Total						**191,106,419**	**15,925,535**

[a] Tank diameter and tank height are provided by Targa. According to Targa, the storage capacity may reduce by 4 ft of the height by converting the fixed roof tanks to internal floating roof tanks. The new capacities are calculated based on the tank diameter and tank height minus 4 ft.

[b] The maximum monthly turnover for these tanks is 2 according to Targa.

[c] The maximum daily throughput is calculated the less of the daily rate based on the loading rate for the products above or the tank monthly throughput.

Table 3b. Tanks Throughputs for Gasoline

Tank ID	Tank Diameter (ft)	Tank Height (ft)	Capacity (gal)	Project Annual Throughput [a] (gal/yr)	Project Max Monthly Turnovers [b] (per month)	Project Max Monthly Throughput [b] (gal/month)	Project Max Daily Throughput [b] (max gal/day)
T-208H	72.08	56.17	1,592,518	47,592,750	2.54	4,042,124	4,042,124
T-209H	76.00	56.08	1,767,452	52,820,675	2.54	4,486,140	4,486,140
T-210H	95.08	57.17	2,824,034	84,396,847	2.54	7,167,951	7,167,951
T-211H	76.00	56.42	1,778,764	53,158,727	2.54	4,514,851	4,514,851
Total				**237,968,999**			**20,211,066**

[a] The annual throughput for these tanks storing gasoline is determined by assuming the same turnovers for all tanks and apportioning the gal/yr throughput accordingly. The facility-wide throughput limit on gasoline will not change due to this project. Average monthly throughput is the annual throughput divided by 12.

[b] The maximum monthly turnover for these tanks is 2.54, according to a distribution of total gasoline throughput among Tanks 151, 155, 156, 201, 202, 203, 205, 208H, 209H, 210H, 211H, and 212. The maximum short-term emissions assume that the throughput based on 2.54 turnovers per month will occur in one day.

Tank capacities:	Tanks 208H-211H	7,962,767	gal
	Other Gasoline Tanks	12,421,394	gal
	Total	20,384,161	gal

Table 3c. Tanks Throughputs for Natural Gasoline

Tank ID	Tank Diameter (ft)	Tank Height (ft)	Capacity (gal)	Project Annual Throughput [a] (gal/yr)	Project Max Monthly Turnovers [b] (per month)	Project Max Monthly Throughput [b] (gal/month)	Project Max Daily Throughput [b] (max gal/day)
T-208H	72.08	56.17	1,592,518	30,299,332	2	3,185,037	3,185,037
T-209H	76.00	56.08	1,767,452	33,627,625	2	3,534,904	3,534,904
T-210H	95.08	57.17	2,824,034	53,730,201	2	5,648,067	5,648,067
T-211H	76.00	56.42	1,778,764	33,842,842	2	3,557,527	3,557,527
Total				**151,500,000**			**15,925,535**

[a] The annual throughput for these tanks storing natural gasoline is determined by assuming the same turnovers for all tanks and apportioning the gal/yr throughput accordingly. Natural gasoline throughput is calculated separately since the annual turnovers required to store the maximum amount of natural gasoline is less than 24 per year. Average monthly throughput is the annual throughput divided by 12.

[b] The maximum monthly turnover for these tanks is 2 according to Targa. The maximum short-term emissions assume that the throughput based on 2 turnovers per month will occur in one day.

Table 3d. Tanks Throughputs for Isooctane

Tank ID	Tank Diameter (ft)	Tank Height (ft)	Capacity (gal)	Project Annual Throughput [a] (gal/yr)	Project Max Monthly Turnovers [b] (per month)	Project Max Monthly Throughput [b] (gal/month)	Project Max Daily Throughput [b] (max gal/day)
T-208H	72.08	56.17	1,592,518	25,199,444	2	3,185,037	3,185,037
T-209H	76.00	56.08	1,767,452	27,967,530	2	3,534,904	3,534,904
T-210H	95.08	57.17	2,824,034	44,686,504	2	5,648,067	5,648,067
T-211H	76.00	56.42	1,778,764	28,146,522	2	3,557,527	3,557,527
Total				**126,000,000**			**15,925,535**

[a] The annual throughput for these tanks storing isooctane is determined by assuming the same turnovers for all tanks and apportioning the gal/yr throughput accordingly. Isooctane throughput is calculated separately since the annual turnovers required to store the maximum amount of isooctane is less than 24 per year.

[b] The maximum monthly turnover for these tanks is 2 according to Targa. The maximum short-term emissions assume that the throughput based on 2 turnovers per month will occur in one day.

Table 4. Tanks Emissions

	Fuel Oil [a]		ULSD [b]		Gasoline [c]		Natural Gasoline [c]		Isooctane		Worst-Case VOC Emissions [d]	
	Maximum Daily		Maximum Daily		Maximum Daily		Maximum Daily		Maximum Daily		Maximum Daily	
Tank ID	VOC (lb/hr)	Annual VOC (tpy)	VOC (lb/hr)	Annual VOC (tpy)	VOC (lb/hr)	Annual VOC (tpy)	VOC (lb/hr)	Annual VOC (tpy)	VOC (lb/hr)	Annual VOC (tpy)	VOC (lb/hr)	Annual VOC (tpy)
T-208H	0.61	0.09	0.48	0.07	13.98	1.87	17.84	1.88	3.02	0.30	17.84	1.88
T-209H [e]	0.64	0.09	0.51	0.07	14.61	1.96	18.64	1.96	3.16	0.31	18.64	1.96
T-210H	0.90	0.13	0.69	0.10	24.02	3.22	30.72	3.23	5.10	0.50	30.72	3.23
T-211H [e]	0.64	0.09	0.51	0.07	14.61	1.96	18.64	1.96	3.16	0.31	18.64	1.96

[a] These tanks have the flexibility of heating and insulation when storing heavy products such as fuel oil. Targa expects to use the heating system when necessary, and the heating system generally will keep the temperature of the products between 110 to 140 °F. Therefore, the tanks emissions represent the maximum possible emissions when these tanks are heated at 140 °F. Fuel oil vapor pressure based on Antoine two-constant equation, with vapor pressure constants from TCEQ, "Storage Tank Emissions Determination Challenges," slide 16, "API Recommendations for Vapor Pressure Determinations," which bases the constants on 20% kerosene or 25% diesel as cutter stock in the fuel oil.

[b] ULSD will not be heated; therefore, the emissions from storing ULSD are calculated separately from fuel oil.

[c] The emission rates presented here represent the maximum VOC emission rates when the tanks store gasoline or natural gasoline without tank heating. Ethanol is not evaluated because the emissions from storing ethanol are not expected to be higher than gasoline.

[d] The worst-case VOC emissions are determined as the highest when storing heated fuel oil, diesel, gasoline, natural gasoline or isooctane.

[e] Tanks 209H and 211H have the same diameter and similar storing capacities (< 1% in the difference). The emissions from Tank 209H are assumed to be the same as Tank 211H.

Table 5. MVCU Capacity

MVCU	Capacity [a] (bph)	Capacity [a] (gpm)	Max Daily Throughput [b] (max gal/day)	Annual Throughput [c] (gal/yr)
Natural Gasoline	7000	4,900	7,056,000	151,500,000

[a] John Zink provided a maximum product loading connected to the MVCU of 7,000 bph in the system proposal (provided in May 2013 submittal).

[b] The total daily capacity for the MVCU is the maximum short-term (daily) throughput of product of 7,056,000 gal/day (4,900 gpm).

[c] The annual throughput is determined based on Targa's business projection for natural gasoline.

Table 6. Marine Loading - Total VOC to John Zink Vapor Combustion Unit

Fuel Loaded	Capture Efficiency [b] (%)	Maximum Short-Term Uncontrolled Loading Loss Emission Factor [a] (lbs/10^3 gal)	Annual Uncontrolled Loading Loss Emission Factor [a] (lbs/10^3 gal)	Average Uncontrolled MVCU Emissions [b] (lb/hr)	Maximum Short-Term Uncontrolled MVCU Emissions [b] (lb/hr)	Annual Uncontrolled MVCU Emissions [b] (tpy)	Annual Average Captured Emissions (lb/hr)	Maximum Short-Term Captured Emissions (lb/hr)	Annual Captured Emissions (tpy)	Destruction Efficiency (%)	Annual Average Uncombusted VOC Emissions [c,d] (lb/hr)	Maximum Uncombusted VOC Emissions [c,d] (lb/hr)	Annual Uncombusted VOC Emissions [c,d] (tpy)
Natural Gasoline	99.8%	8.4	8.8	152.0	2,471.4	665.6	151.7	2,466.5	664.3	98%	3.03	49.33	13.29

[a] The loading loss emission factor is calculated based on Equation 1 from U.S. EPA AP-42, Fifth Edition, Volume I, Chapter 5: Petroleum Industry, Section 5.2, Transportation and Marketing of Petroleum Liquids, Final Section, June 2008, as follows:
Loading loss (lb/103 gal) = 12.46 × Saturation Factor × Molecular Weight of Vapors × True Vapor Pressure (psia)/Temperature of Bulk Liquid (°R).
These parameters are determined as following:

True Vapor Pressure	11.11	psia, the maximum vapor pressure allowed to be stored in tanks with an internal floating roof subject to NSPS Kb according to 40 CFR 60.112b(a) without additional controls such as controlled vent systems.
Saturation Factor	0.50	Submerged loading for barges, Table 5.2-1, AP-42
Molecular Weight	65.00	Gasoline (RVP11) Profile, TANKS 4.09d default value
Maximum Short-Term Temperature	75.20	° F, SEA-TAC Airport, WA, July Maximum Daily Temperature, TANKS 4.09d database
Temperature for Annual	52.00	° F, SEA-TAC Airport, WA, Daily Annual Average Temperature, TANKS 4.09d database

[b] A capture efficiency of 99.8% is used for the MVCU based on source test results using TCEQ approved protocol. The uncontrolled emissions are multiplied by the capture efficiency to obtain the captured emissions at the MVCU, which then have the MVCU destruction efficiency applied to determine the uncombusted VOC emissions at the MVCU.

[c] John Zink, the MVCU equipment vendor, provided a minimum performance guarantee stating that 98% of total hydrocarbon vapor emissions routed through the MVCU will be destroyed.

[d] The uncombusted emissions from marine loading account for emissions captured but not combusted by the MVCU.

Table 7. Marine Loading Emission Summary

Fuel Loaded	Captured and Pre-Combustion VOC Emissions [a]			Uncaptured VOC Emissions [b]			Uncombusted VOC Emissions [c]		
	Annual Average (lb/hr)	Maximum Short-Term (lb/hr)	Annual (tpy)	Annual Average (lb/hr)	Maximum Short-Term (lb/hr)	Annual (tpy)	Annual Average (lb/hr)	Maximum Short-Term (lb/hr)	Annual (tpy)
Natural Gasoline	148.63	2417.12	651.00	0.30	4.94	1.33	3.03	49.33	13.29

[a] The captured and pre-combustion emissions are the VOC emissions captured by the MVCU which are then then combusted by the MVCU.

[b] The uncaptured VOC emissions are the VOC emissions not captured by the MVCU (i.e. fugitives at the barge loading).

[c] The uncombusted VOC emissions are the VOC emissions captured but not combusted at the MVCU.

Table 8. Total HAP Emitted from MVCU Captured VOC when loading Natural Gasoline

Pollutant	Uncombusted VOC Emissions (Post-Control) [a]		
	Annual Average MVCU Emissions (lb/hr)	Maximum Short-Term MVCU Emissions [b] (lb/hr)	Annual MVCU Emissions (tpy)
Benzene	9.45E-03	0.18	4.14E-02
n-Hexane	0.16	2.85	0.68

[a] The uncombusted VOC emissions include the uncaptured VOC and the portion not combusted at the pilot.

[b] The maximum short-term emissions are estimated based on the pump capacity of 4900 gpm.

Table 9. VOC Emission Speciations

Pollutant	CAS Number [a]	HAP [b]	TAP [a]	Estimated Concentrations								
				Gasoline Liquid Fraction [c] wt%	Annual Gasoline Vapor [d] wt%	Max Daily Gasoline Vapor [e] wt%	Natural Gasoline Liquid Fraction [f] wt%	Annual Natural Gasoline Vapor [d] wt%	Max Daily Natural Gasoline Vapor [e] wt%	Fuel Oil/ULSD Liquid Fraction [g] wt%	Fuel Oil/ULSD Annual Vapor [g] wt%	Max Daily Fuel Oil/ULSD Vapor [g] wt%
1,2,4-Trimethylbenzene	95-63-6	No	No	2.50	0.013	0.021	-	-	-	1.00	3.682	5.768
2,2,4 Trimethylpentane	540-84-1	Yes	No	4.00	0.592	0.824	-	-	-	-	-	-
Benzene	71-43-2	Yes	Yes	0.82	0.236	0.323	1	0.28	0.33	0.01	1.05	1.72
Carbon Monoxide	630-08-0	No	Yes	-	-	-	-	-	-	-	-	-
Cyclohexane	110-82-7	No	Yes	0.24	0.072	0.098	-	-	-	-	-	-
Ethyl benzene	100-41-4	Yes	Yes	1.40	0.038	0.058	-	-	-	0.013	0.21	0.33
Heptane	142-82-5	No	No	-	-	-	-	-	-	-	-	-
n-Hexane	110-54-3	Yes	Yes	1.00	0.474	0.632	10.00	4.65	5.25	0.001	0.20	0.33
Hydrogen Sulfide	7783-06-4	No	Yes	-	-	-	-	-	-	-	-	-
Isopropyl benzene	98-82-8	Yes	Yes	0.50	0.006	0.010	-	-	-	-	-	-
Iso-Pentane	78-78-4	No	No	-	-	-	-	-	-	-	-	-
Nitrogen Dioxide	101022-44-0	No	Yes	-	-	-	-	-	-	-	-	-
n-Pentane	109-66-0	No	No	-	-	-	-	-	-	-	-	-
Octane	111-65-9	No	No	-	-	-	-	-	-	-	-	-
Sulfur Dioxide	7446-09-5	No	Yes	-	-	-	-	-	-	-	-	-
Sulfuric Acid Mist	7664-93-9	No	Yes	-	-	-	-	-	-	-	-	-
Toluene	108-88-3	Yes	Yes	7.00	0.576	0.831	-	-	-	0.03	1.35	2.18
Xylenes (mixed isomers)	108-38-3, 106-42-3, 95-47-6	Yes	Yes	7.00	0.159	0.243	-	-	-	0.29	3.91	6.21
Unidentified Compounds				75.54	97.83	96.96	89.00	95.07	94.42	98.66	89.60	83.46
Total				100	100	100	100	100	100	100	100	100

[a] WAC 173-460-150 Table of TAPs

[b] 40 CFR 63 Subpart C - List of Hazardous Air Pollutants, Petitions Process, Lesser Quantity Designations, and Source Category List references 42 USC 7412 (b) for the list of hazardous air pollutants.

[c] The default speciation profile for gasoline in TANKS was used with the exception of benzene. The concentration of benzene is based on the limit of 0.62 percent benzene by volume in liquid per 40 CFR 80.1230(a)(1). TANKS 4.0.9d lists the density of benzene to be 7.365 lb/gal at 60 F and the density of gasoline at any RVP to be 5.6 lb/gal at 60 F. Using these densities, the 0.62 percent benzene by volume is converted to a per percent by weight basis in order to be used in the speciation profile in TANKS.

[d] The annual gasoline vapor fraction is based on the outputs from tank calculations using the Seattle-TAC AP, Washington default meteorological profile. Tank calculations included the vapor weight percent based on a Gasoline RVP 13 profile from January through April and October through December and a Gasoline RVP 9 profile from May through September. The Gasoline RVP 9 for May through September is per 40 CFR 80.27(a)(2) which lists the maximum RVP (Psia) during the summer months.

[e] The maximum daily gasoline speciation is based on the month in the tank calculations which produces that maximum speciated emissions so as to conservatively represent the worst-case short-term emissions.

[f] The speciation profile for natural gasoline is based the upper limit for each component from the Safety Data Sheet. Only HAP or TAP compounds are listed.

[g] ULSD/Fuel oil speciation data is the default values from TANKS 4.09d for distillate oil No. 2. Annual vapor fractions are determined based on the vapor fractions of all months, while the max daily vapor fractions are determined to the highest of all months.

Table 10. Project Fugitive VOC Emissions from Equipment Leaks

Component Type [a]	Service	Estimated Number of Components	Emission Factor [b] Factor	Units	Potential Emissions [c] (lb/hr)	(tpy)
Tanks						
Valves	Light Liquid	56	4.30E-05	kg/comp-hr	5.31E-03	2.33E-02
Flanges	Light Liquid	160	8.00E-06	kg/comp-hr	2.82E-03	1.24E-02
MVCU/Natural Gasoline [d]						
Valves	Light Liquid	10	4.30E-05	kg/comp-hr	9.48E-04	4.15E-03
Flanges	Light Liquid	30	8.00E-06	kg/comp-hr	5.29E-04	2.32E-03
Rail Unloading/Natural Gasoline [d]						
Valves	Light Liquid	105	4.30E-05	kg/comp-hr	9.95E-03	4.36E-02
Flanges	Light Liquid	178	8.00E-06	kg/comp-hr	3.14E-03	1.38E-02
Pumps	Light Liquid	2	5.40E-04	kg/comp-hr	2.38E-03	1.04E-02
Other	Light Liquid	92	1.30E-04	kg/comp-hr	2.64E-02	1.15E-01
				Total:	**0.05**	**0.23**

[a] Fugitive equipment leaks are calculated for Tanks 208H, 209H, 210H, 211H, the MVCU, and rail unloading. Currently each tank has 10 valves and 30 flanges. It's assumed that 4 valves and 10 flanges will be needed per tank dedictaed to isooctane, natural gasoline, gasoline and ethanol lines.

[b] Emission factors are the marketing terminal average emission factors provided in the EPA document, Protocol for Equipment Leak Emission Estimates, EPA-453,R-95-017, dated November 1995. These emission factors assume that the emission leaks are composed of 100% VOC.

[c] Potential emissions are based on continuous operating of 8,760 hours per year.

[d] Fugitive component emissions for MVCU and Rail Unloading are only evaluated for natural gasoline, because the throughput for other products are not affected by this project. The MVCU is assumed to have 10 valves and 30 flanges. The fugitive components for the rail unloading presented here include all 36 unloading spots, and it's assumed that the natural gasoline will be unloaded at any unloading spot.

Table 11. Post-Project TAP and HAP Annual Potential Emissions

Pollutant [a,b]	CAS #	HAP	TAP	Tank 208H [c] (lb/hr)	Tank 209H [c] (lb/hr)	Tank 210H [c] (lb/hr)	Tank 211H [c] (lb/hr)	Tanks Fugitives [d] (lb/hr)	MVCU [e] (lb/hr)	Marine Barge Loading Fugitives [e] (lb/hr)	Rail Fugitives [e] (lb/hr)	Total HAP (lb/hr)	Total TAP (lb/hr)
2,2,4 Trimethylpentane (Isooctane)	540-84-1	Yes	No	0.07	0.07	0.11	0.07	8.13E-03	--	-	-	0.33	--
Benzene	71-43-2	Yes	Yes	1.31E-03	1.36E-03	2.23E-03	1.36E-03	8.13E-05	9.45E-03	1.48E-05	4.18E-04	0.0162	0.02
Cyclohexane	110-82-7	No	Yes	3.32E-04	3.47E-04	5.63E-04	3.47E-04	1.95E-05	--	-	-	--	1.61E-03
Ethyl benzene	100-41-4	Yes	Yes	3.59E-04	3.78E-04	5.57E-04	3.78E-04	1.14E-04	--	-	-	1.79E-03	1.79E-03
Isopropyl benzene	98-82-8	Yes	Yes	9.72E-05	1.03E-04	1.45E-04	1.03E-04	4.07E-05	--	-	-	4.88E-04	4.88E-04
n-Hexane	110-54-3	Yes	Yes	0.02	0.02	0.04	0.02	8.13E-04	0.16	1.48E-04	4.18E-03	0.26	0.26
Toluene	108-88-3	Yes	Yes	3.39E-03	3.55E-03	5.53E-03	3.55E-03	5.69E-04	--	-	-	0.02	0.02
Xylenes (mixed isomers)	108-38-3, 106-42-3, 95-47-6	Yes	Yes	1.67E-03	1.75E-03	2.56E-03	1.75E-03	5.69E-04	--	-	-	8.30E-03	8.30E-03
											Total (lb/hr)	**0.64**	**0.30**
											Total (tpy)	**2.78**	**1.34**

[a] Annual and hourly potential emissions are calculated assuming a continuous operation of 8,760 hours/yr.

[b] Since all three isomers of xylene have the same WAC 173-460-150 TAP factors, all were combined and one combined emission rate was presented for all three isomers. If the total emissions of all three xylene isomers is below the thresholds for HAPs and TAPs, then each of the individual isomers will be as well.

[c] Tanks emissions are determined as the maximum possible emissions from storing ULSD/fuel oil, gasoline/natural gasoline or isooctane (2,2,4 Trimethylpentane).

[d] Tanks fugitives emissions are calculated by multiplying the total VOC fugitive losses by the annual speciated vapor weight percent from diesel, gasoline or natural gasoline, whichever is the greatest. For isooctane, the worst-case emissions would be from loading isooctane and all VOC emissions will be isooctane emissions.

[e] The speciated fugitive for marine loading and rail loading, and MVCU emissions are calculated by multiplying the total fugitive VOC losses by the annual speciated vapor weight percent from natural gasoline, because marine loading of other products are not affected by this project.

Table 12. Post-Project TAP and HAP Maximum Daily Potential Emissions

Pollutant [a,b]	CAS #	HAP	TAP	Tank 208H [c] (lb/hr)	Tank 209H [c] (lb/hr)	Tank 210H [c] (lb/hr)	Tank 211H [c] (lb/hr)	Tanks Fugitives [d] (lb/hr)	MVCU [e] (lb/hr)	Marine Barge Loading Fugitives [e] (lb/hr)	Rail Fugitives [e] (lb/hr)	Total HAP (lb/hr)	Total TAP (lb/hr)
2,2,4 Trimethylpentane (Isooctane)	540-84-1	Yes	No	3.02	3.16	5.10	3.16	8.13E-03	--	-	-	14.45	--
Benzene	71-43-2	Yes	Yes	0.06	0.06	0.10	0.06	8.13E-05	0.18	1.48E-05	4.18E-04	0.47	0.47
Cyclohexane	110-82-7	No	Yes	1.43E-02	1.49E-02	0.02	1.49E-02	1.95E-05	--	-	-	--	0.07
Ethyl benzene	100-41-4	Yes	Yes	1.41E-02	1.48E-02	0.02	1.48E-02	1.14E-04	--	-	-	0.07	0.07
Isopropyl benzene	98-82-8	Yes	Yes	3.53E-03	3.72E-03	5.39E-03	3.72E-03	4.07E-05	--	-	-	0.02	0.02
n-Hexane	110-54-3	Yes	Yes	0.95	1.00	1.64	1.00	8.13E-04	2.85	1.48E-04	4.18E-03	7.44	7.44
Toluene	108-88-3	Yes	Yes	0.14	0.15	0.24	0.15	5.69E-04	--	-	-	0.68	0.68
Xylenes (mixed isomers)	108-38-3, 106-42-3, 95-47-6	Yes	Yes	0.06	0.07	0.10	0.07	5.69E-04	--	-	-	0.30	0.30
										-	**Total (lb/hr)**	**23.43**	**9.05**

[a] The tank and MVCU potential emissions are calculated using the maximum daily throughput and turnovers. Fugitive component potential emissions are calculated assuming a continuous operation of 8,760 hours/yr.

[b] Since all three isomers of xylene have the same WAC 173-460-150 TAP factors, all were combined and one combined emission rate was presented for all three isomers. If the total emissions of all three xylene isomers is below the thresholds for HAPs and TAPs, then each of the individual isomers will be as well.

[c] Tanks emissions are determined as the maximum possible emissions from storing ULSD/fuel oil, gasoline/natural gasoline or isooctane (2,2,4 Trimethylpentane).

[d] Tanks fugitives emissions are calculated by multiplying the total VOC fugitive losses by the annual speciated vapor weight percent from diesel, gasoline or natural gasoline, whichever is the greatest. For isooctane, the worst-case emissions would be from loading isooctane and all VOC emissions will be isooctane emissions.

[e] The speciated fugitive for marine loading and rail loading, and MVCU emissions are calculated by multiplying the total fugitive VOC losses by the annual speciated vapor weight percent from natural gasoline, because marine loading of other products are not affected by this project.

Table 13. Project TAP Modeling Analysis [a]

Pollutant	CAS #	TAP	ASIL ($\mu g/m^3$)	Averaging Period	SQER (lb/averaging period)	Total TAP (lb/averaging period)	Modeling Required? [b]
Benzene	71-43-2	Yes	0.0345	Year	6.62	142.13	Yes
Cyclohexane	110-82-7	Yes	6000	24-Hour	789	1.65	No
Ethyl benzene	100-41-4	Yes	0.4	Year	76.8	15.65	No
Isopropyl benzene	98-82-8	Yes	400	24-Hour	52.6	0.39	No
n-Hexane	110-54-3	Yes	700	24-Hour	92	178.64	Yes
Toluene	108-88-3	Yes	5000	24-Hour	657	16.41	No
Xylenes (mixed isomers)	108-38-3, 106-42-3, 95-47-6	Yes	221	24-Hour	29	7.21	No

[a] Obtained from WAC 173-460-150.

[b] Modeling is required if the TAP emission rate per the appropriate averaging period exceeds the SQER. The annual potential emission rates are used for the TAPs with an annual averaging period while the maximum daily emission rates are used for the TAPs with a 24-hour and 1-hour averaging period.

APPENDIX C: NATURAL GASOLINE SDS

Safety Data Sheet

Section 1 Identification

Manufacturer Information:

Uticia East Ohio Midstream, LLC
1099 Main Ave, Suite 210
Durango, CO 81301
(970) 247-4423
www.m3midstream.com

Emergency Phone #:

Chemtrec (800) 424-9300
Utica East Ohio Midstream (800)873-0562

Product Identification: NATURAL GASOLINE

Trade Name/Synonyms:

M-Grade, 14# Gasoline

Chemical Family:

Mixture

Recommended Use/Restrictions:

Industrial

Section 2 Hazard(s) Identification

GHS Classification:

Flammable Liquid
Liquefied Gas
Classified as hazardous under OSHA regulations

GHS Label Elements:

Signal Word:

Danger

Hazard Statement:

Extremely flammable Liquid.
Colorless liquid with a distinct hydrocarbon odor.
May cause damage to central nervous, respiratory and cardiovascular systems.

Precautionary Statement:

Extremely flammable, can be ignited by heat, spark or flame. May release explosive vapors that can travel, be ignited at remote locations, and flash back.

Section 3 Composition/ Info on Ingredients

Component	Cas No.	Typical%
Mixed-Butanes	NA	1-5%
n-Pentane	109-66-0	35-45%
Iso-Pentane	78-78-4	30-40%
Hexanes	110-54-3	5-10%
Heptanes-Decanes	NA	2-10%
Benzene	71-43-2	0-1%

*Values based on material tested but may vary from sample to sample.

Section 4 First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, institute cardiopulmonary resuscitation (CPR). If breathing is difficult, ensure clear airway and give oxygen. Get immediate medical attention.

Skin:
Flush area with tepid water. Do not use hot water. Do not rub affected area.

Eyes:
Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Exposed individuals may experience redness, tearing and discomfort.

Ingestion:
Although risk of ingestion is extremely unlikely, seek immediate medical attention. Do not induce vomiting. Do not give liquids.

Immediate Symptoms:
Irritation of eyes and mucous membranes. Skin irritation. May irritate and cause stomach pain, vomiting, diarrhea and nausea.

Section 5 Fire Fighting Measures

Extinguishing Equipment:
In case of fire use foam, carbon dioxide, dry powder, or water fog.

Fire and Explosion Data:
Flash Point: -45°F (-43°C)
Auto-ignition: 495°F (257°C)
Flammability Limits in Air: LEL: 1.4% UEL: 7.6%

Specific Hazards:
Containers can build up pressure if exposed to heat (fire). Stay away from storage tank ends. Withdraw immediately in case of rising sound from venting safety device or any discoloration of storage tank due to fire.

Protective Equipment:
Firefighters must wear MSHA/NIOSH approved positive pressure breathing apparatus (SCBA) with full-face mask and full protective equipment.

Basic Fire Fighting Procedure:
Gas fires should not be extinguished unless flow of gas can be stopped. Liquid pool fires should be extinguished with fire-fighting foam or BC rated fire extinguisher. If leak or spill of liquids has not ignited, ventilate area and use fire-fighting foam to smother gas or vapors and protect personnel attempting to stop a leak. Use water spray to cool adjacent structures and to protect personnel. Shut off source flow if possible. Do not enter confined spaces without proper equipment.

Explosion Hazard(s):
Extremely flammable, can be ignited by heat, spark of flame. Do not expose to sources of ignition. Use non-sparking tools. May release explosive vapors that can travel, be ignited at remote locations, and flash back.

Section 6 Accidental Release Measures

Personal Precautions:
Caution should be exercised regarding personnel safety and exposure to the released product. Notify local authorities and the National Response Center, if required.

Emergency Procedures:
Evacuate area endangered by gas. Keep ignition sources out of the area. Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind. (See Personal Protection Information Section). Isolate for ½ mile in all directions if tank, rail car or tank truck is involved in release.

Methods/Materials for Containment:
Keep ignition sources out of the area and shut off all ignition sources. Use fire- fighting foam to reduce vapors. Shut off leak if safe to do so. Isolate hazard area and deny entry.

Cleanup Procedures:
Isolate area and deny entry. Remove sources of ignition. Ventilate closed in areas.

Section 7 Handling and Storage

Handling Procedures:
Use non-sparking tools. Keep away from heat, spark or flame. Avoid contact with eyes, skin, or clothing. Wash thoroughly if exposed to liquid or vapor. Avoid breathing vapor.

Safe Storage Procedures:
Store in tightly closed containers in a cool, dry, isolated, well-ventilated area away from heat, sources of ignition and incompatibles. Ground lines and equipment used during transfer to reduce the possibility of static spark-initiated fire or explosion.

Empty Containers:
Do not cut, grind, drill, weld or reuse containers unless adequate precautions are taken against these hazards. Empty containers may contain product residue. Do not reuse without adequate precautions.

Section 8 Exposure Controls/PPE

Exposure Limits:
ACGIH: 800 ppm TWA
OSHA(Final): 1000 ppm TWA; 1800mg/m3 TWA
OSHA(vacated): 1000 ppm TWA; 1800 mg/m3 TWA
NIOSH: 1000 ppm TWA; 1800 mg/m3 TWA
May contain Benzene which has a 1ppm TWA and 5 ppm STEL.

Appropriate Engineering Controls:
Use only with adequate ventilation. Use process enclosures, local exhaust ventilation of other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Provide access to water supply and eye wash stations.

Personal Protective Equipment:

Eyes/Face: Wear safety glasses with side shields. Have eye washing facilities readily available where eye contact can occur.

Skin: Avoid skin contact with this material. Use appropriate chemical protective gloves when handling. Use good personal hygiene.

Respiratory: Ventilation and other forms of engineering controls are the preferred means for controlling exposures.

Clothing/Gloves: Wear approved FRC clothing.

Chemical-resistant, impervious gloves with an approved standard should be worn at all times when handling chemical products.

Section 9 Physical and Chemical Properties

Boiling Point:	80-102° F (39°C)
Specific Gravity:	0.65-0.75 (water=1)
Melting Point:	NA
Vapor Pressure:	11.8 psi(100°F)
Evaporation Rate (Water = 1):	≥1
Vapor Density	2.7 (air=1)
Viscosity:	NA
% Solubility in Water:	Slightly
pH:	NA
Freezing Point:	NA
Appearance/Odor:	Colorless liquid with hydrocarbon odor.

Section 10 Stability and Reactivity

Reactivity:

Stable

HMIS Classification for Reactivity: 0

Chemical Stability:

Stable at normal temperature and pressure.

Possibility of Hazardous Reaction:

Will not polymerize.

Conditions to Avoid:

Avoid heat, flames, sparks, and other ignition sources.

Incompatible Materials:

Avoid contact with strong oxidizers.

Hazardous Decomposition:

Combustion may produce carbon monoxide and sulfur monoxide.

Section 11 Toxicological Information

Routes of Exposure:
Skin: Prolonged or repeated exposure with skin may cause redness, itching, irritation, eczema/chapping and oil acne.
Eyes: Direct contact with liquefied material may cause redness, irritation, tearing and discomfort.
Inhalation: Inhalation can cause headache, disorientation, dizziness and possibly unconsciousness. May irritate and cause stomach pain, vomiting, diarrhea and nausea.
Ingestion: Not a normal route of exposure.

Immediate Effects:
Irritating to skin. May cause eye and respiratory tract irritation.
Chronic Effects:
Acute or chronic overexposure to this material or its components may cause systemic toxicity, including adverse effects to the following: central nervous, respiratory and cardiovascular systems.
Measure of Toxicity:
HMIS Classification for Health: 2

Description of Symptoms:
Symptoms include headache, excitation, dizziness, un-coordination, drowsiness, light-headedness, blurred vision, fatigue, tremors, convulsions, loss of consciousness, coma respiratory arrest. Skin and eye irritation.
Target Organs:
Central nervous system, respiratory and cardiovascular systems.

Carcinogenicity: Contains more than 0.1% by weight of a material listed as a potential carcinogen.
NTP: Yes **IARC**: Yes **OSHA:** Yes

Section 12 Ecological Information

Aquatic Toxicity:
Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Persistence and Degradability:
No information available.

Mobility/Absorption:
The product is mostly insoluble in water. It will spread on the water surface while some of its components will eventually sediment in water systems. The volatile components will spread in the atmosphere.
Bioaccumulative Potential:
No information available.

Section 13 Disposal Considerations

Disposal Methods:
Dispose of contents in accordance with local/regional/national/international regulations.
See section 7 for Handling Procedures. See section 8 for Personal Protective Equipment recommendations.

Section 14 Transport Information

General Transportation Information:	
DOT Proper Shipping Name (49 CFR 172.101):	Gasoline
DOT Hazard Classes (49 CFR 172.101):	3
UN/NA Code (49 CFR 172.101):	UN 1203
Packing Group (49 CFR 172.101):	II
Bill of Lading Description (49 CFR 172.202):	
DOT Labels Required (49 CFR 172.101):	Flammable
DOT Placards Required (49 CFR 172.504):	

Section 15 Regulatory Information

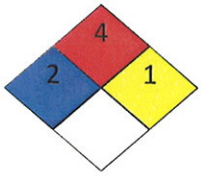
Sara Title III Information: Listed below are the hazard categories for the Superfund Amendments and Reauthorization Act (SARA) Section 313 (40 CFR 370):
Sara Section 311/312-Hazard Classes:

Immediate Hazard: Y Delayed Hazard: Y Fire Hazard: Y
Pressure Hazard: y Reactivity Hazard:

(SARA) Section 313 (40 CFR 372.65): Yes
Hazardous Chemical under OSHA Hazard Communication Standard: Yes

Section 16 Other Information

NFPA Rating:	Health: 2
	Fire: 4
	Reactivity: 1



Manufacturer assumes no responsibility for injury to third party proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, manufacturer assumes no responsibility for injury to third party proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, third party assumes the risk in their use of the material.

Aug 6, 2013

RBLCID	FACILITY_NAME	PERMIT ISSUANCE DATE	PROCESS NAME	PROCCESS TYPE	THROUGHPUT	THROUGHPUT UNIT	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT_1	EMISSION LIMIT 1 UNIT	CASE-BY-CASE BASIS	OTHER APPLICABLE REQUIREMENTS
LA-0211	GARYVILLE REFINERY	12/27/2006	EXTERNAL FLOATING ROOF STORAGE TANKS	42.006			Volatile Organic Compounds (VOC)	EXTERNAL FLOATING ROOFS; COMPLY WITH 40 CFR 63 SUBPART CC	0		BACT-PSD	MACT , SIP , OPERATING PERMIT
LA-0211	GARYVILLE REFINERY	12/27/2006	INTERNAL FLOATING ROOF STORAGE TANKS	42.006			Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOFS; COMPLY WITH 40 CFR 63 SUBPART CC	0		BACT-PSD	MACT , OPERATING PERMIT
LA-0212	ZACHARY STATION	02/01/2007	11.75 MM GAL GASOLINE/DISTIL LATES TANKS (T-1 & T-14)	42.006	423	MM GALS/YR	Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOFS	3.16	LB/H	BACT-PSD	NSPS , SIP , OPERATING PERMIT
LA-0212	ZACHARY STATION	02/01/2007	6.61 MM GAL GASOLINE/DISTIL LATES TANK (T-4)	42.006	238	MM GALS/YR	Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOF	2.17	LB/H	BACT-PSD	NSPS , SIP , OPERATING PERMIT
LA-0212	ZACHARY STATION	02/01/2007	6.61 MM GAL GASOLINE/DISTIL LATES TANK (T-9)	42.006	238	MM GALS/YR	Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOF	2.11	LB/H	BACT-PSD	NSPS , SIP , OPERATING PERMIT
LA-0212	ZACHARY STATION	02/01/2007	394,813 GAL TRANSMIX TANK (T-13)	42.006	14.21	MM GALS/YR	Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOF	0.66	LB/H	BACT-PSD	NSPS , SIP , OPERATING PERMIT
LA-0213	ST. CHARLES REFINERY	11/17/2009	TANKS - FOR BENZENE, XYLENE, SULFOLANE, PAREX, INTERMEDIATE	42.009			Volatile Organic Compounds (VOC)	EQUIPPED WITH INTERNAL FLOATING ROOFS FOLLOWED BY THERMAL OXIDIZERS	0		BACT-PSD	OPERATING PERMIT
LA-0213	ST. CHARLES REFINERY	11/17/2009	TANKS - FOR HEAVY MATERIALS	42.005			Volatile Organic Compounds (VOC)	EQUIPPED WITH FIXED ROOF AND COMPLY WITH 40 CFR 63 SUBPART CC	0		BACT-PSD	OPERATING PERMIT
LA-0228	BATON ROUGE JUNCTION FACILITY	11/02/2009	EQT026-EQT030 FIVE GASOLINE TANKS (T001-T005)	42.006	240000	BBL (EACH)	Volatile Organic Compounds (VOC)	INTERNAL FLOATING ROOFS AND SUBMERGED FILL PIPES	59.7	T/YR	BACT-PSD	NSPS , NSPS , NESHAP , NESHAP , OPERATING PERMIT , OPERATING PERMIT
LA-0228	BATON ROUGE JUNCTION FACILITY	11/02/2009	EQT031-EQT035 FIVE DISTILLATE TANKS (T006-T010)	42.005	240000	BBL (EACH)	Volatile Organic Compounds (VOC)	SUBMERGED FILL PIPES AND PRESSURE/VACUUM VENTS	45	T/YR	BACT-PSD	OPERATING PERMIT
LA-0265	ST. CHARLES REFINERY	10/02/2012	FR Storage Tanks EQT0087 and EQT0088	42.005	0		Volatile Organic Compounds (VOC)	Comply with 40 CFR 63 Subpart CC (Group 2)	0		BACT-PSD	

RBLCID	FACILITY_NAME	PERMIT ISSUANCE DATE	PROCESS NAME	PROCCESS TYPE	THROUGHPUT	THROUGHPUT UNIT	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT_1	EMISSION LIMIT 1 UNIT	CASE-BY-CASE BASIS	OTHER APPLICABLE REQUIREMENTS
TX-0592	CORPUS CHRISTI WEST REFINERY	03/29/2010	Tanks	42.006	0		Volatile Organic Compounds (VOC)	Land roof <24 hr without control, drain and degas to control until no standing liquid in the tank is left and VOC concentration less than 10,000 ppmv, vent to control when refilling landed tank until tank roof floating again to minimize impacts	1027	LB/H	OTHER CASE-BY-CASE	
TX-0595	CORPUS CHRISTI EAST REFINERY	08/19/2010	Tanks	42.006	0		Volatile Organic Compounds (VOC)	Land roof and keep it landed no more than 24 hrs without control, drain and degas to control until no standing liquid remains in the tank and the VOC<10,0000 ppmv in the vent stream. During refilling, vent to control until tank roof is floating to minimize impacts.	1482	LB/H	OTHER CASE-BY-CASE	
TX-0745	TEXAS DOCK & RAIL	06/03/2015	Petroleum Liquids Storage in Floating Roof Tanks - 50 MMBbl	42.006	60	turnovers/yr/tank	Volatile Organic Compounds (VOC)	Required floating roof with welded deck seams if the tank will store products with VOC vapor pressure of 0.5 psia or greater. Proper fitting and seal integrity for the floating roof is ensured through visual inspections and any seal gap measurements specified in 40 CFR § 60.113b. The vapor space under the floating roof must be routed to a control device during standing idle periods until the vapor space VOC concentration is 10,000 ppmv or less. The tank roof must be landed on its lowest legs unless tank entry is planned. Refilling must also be controlled if the product stored has a VOC vapor pressure of 0.5 psia or greater.	4.18	TONS/YR/TANK	BACT-PSD	NSPS
TX-0745	TEXAS DOCK & RAIL	06/03/2015	Petroleum Liquids Storage in Floating Roof Tanks -115 MMBbl	42.006	60	turnovers/yr/tank	Volatile Organic Compounds (VOC)	Required floating roof with welded deck seams if the tank will store products with VOC vapor pressure of 0.5 psia or greater. Proper fitting and seal integrity for the floating roof is ensured through visual inspections and any seal gap measurements specified in 40 CFR § 60.113b. The vapor space under the floating roof must be routed to a control device during standing idle periods until the vapor space VOC concentration is 10,000 ppmv or less. The tank roof must be landed on its lowest legs unless tank entry is planned. Refilling must also be controlled if the product stored has a VOC vapor pressure of 0.5 psia or greater.	3.71	TONS/YR/TANK	BACT-PSD	NSPS
TX-0745	TEXAS DOCK & RAIL	06/03/2015	Petroleum Liquids Storage in Floating Roof Tanks - 285 MMBbl	42.006	36	turnovers/yr/tank	Volatile Organic Compounds (VOC)	Required floating roof with welded deck seams if the tank will store products with VOC vapor pressure of 0.5 psia or greater. Proper fitting and seal integrity for the floating roof is ensured through visual inspections and any seal gap measurements specified in 40 CFR § 60.113b. The vapor space under the floating roof must be routed to a control device during standing idle periods until the vapor space VOC concentration is 10,000 ppmv or less. The tank roof must be landed on its lowest legs unless tank entry is planned. Refilling must also be controlled if the product stored has a VOC vapor pressure of 0.5 psia or greater.	7.32	TONS/YR/TANK	BACT-PSD	NSPS
TX-0752	INGLESIDE TERMINAL	06/22/2015	Storage Tanks	42.006	110	MBBL/YR	Volatile Organic Compounds (VOC)		81.57	T/YR	BACT-PSD	NSPS , MACT , SIP

RBLCID	FACILITY_NAME	PERMIT ISSUANCE DATE	PROCESS NAME	PROCCESS TYPE	THROUGHPUT	THROUGHPUT UNIT	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT_1	EMISSION LIMIT 1 UNIT	CASE-BY-CASE BASIS	OTHER APPLICABLE REQUIREMENTS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-101, TK-102, TK-103, TK-104	42.006	3.83E+08	gal/yr/tank	Volatile Organic Compounds (VOC)	Internal floating roof with mechanical shoe primary seal and a rim mounted secondary seal. Deck is welded with gaskets on all deck appurtenances. The tank bottoms shall be drain dry design and any remaining heel will drain to a sump, which in turn can be emptied. The floating roof shall be equipped with a connection to a vapor recovery system such that vapors from under a landed roof may be directed to a control device.	6.44	LB/HR	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-105, TK-106	42.006	3E+08	gal/yr/tank	Volatile Organic Compounds (VOC)	Internal floating roof with mechanical shoe primary seal and a rim mounted secondary seal. Deck is welded with gaskets on all deck appurtenances. The tank bottoms shall be drain dry design and any remaining heel will drain to a sump, which in turn can be emptied. The floating roof shall be equipped with a connection to a vapor recovery system such that vapors from under a landed roof may be directed to a control device.	2.35	LB/R	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks 116, TK-117, TK-118, and TK-119	42.006	7.44E+08	gal/yr/tank	Volatile Organic Compounds (VOC)	Internal floating roof with mechanical shoe primary seal and a rim mounted secondary seal. Deck is welded with gaskets on all deck appurtenances. The tank bottoms shall be drain dry design and any remaining heel will drain to a sump, which in turn can be emptied. The floating roof shall be equipped with a connection to a vapor recovery system such that vapors from under a landed roof may be directed to a control device.	6.38	LB/HR	BACT-PSD	
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-107, TK-108, TK-109, 42.005	42.006	60300	gal/hr	Volatile Organic Compounds (VOC)	Material w/vapor press < 0.5 psia. Tanks are required to be painted white and be equipped with submerged fill pipes	4.2	LB/HR	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-110, TK-111, TK-112	42.005	57960	gal/hr	Volatile Organic Compounds (VOC)	Tanks are required to be painted white and be equipped with submerged fill pipes	3.07	LB/HR	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-113, TK-114, and TK-115	42.005	47000000	gal/yr/tank	Volatile Organic Compounds (VOC)	Tanks are required to be painted white and be equipped with submerged fill pipes	0.85	LB/HR	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Storage Tanks, TK-120 and TK-121	42.006	1.44E+09	gal/yr/tank	Volatile Organic Compounds (VOC)	External floating roof with mechanical shoe primary seal and a rim mounted secondary seal. Deck is welded with gaskets on all deck appurtenances. The tank bottoms shall be drain dry design any remaining heel will drain to a sump, which in turn can be emptied. The floating roof shall be equipped with a connection to a vapor recovery system such that vapors from under a landed roof may be directed to a control device.	5.43	LB/HR	BACT-PSD	NSPS
TX-0756	CCI CORPUS CHRISTI CONDENSATE SPLITTER FACILITY	06/19/2015	Floating Roof Storage Tanks - Controlled Maintenance, Startup and Shutdown (MSS)	42.006	5000	scf/hr	Volatile Organic Compounds (VOC)	Vapor space under the landed floating roof is degassed to a flare meeting the requirements 40CFR60.18 until VOC concentration is 10,000 ppmv or less.	10000	PPMV	BACT-PSD	
TX-0797	CORPUS CHRISTI TERMINAL	05/04/2016	Petroleum Liquid Storage in Floating Roof Tanks	42.006	146	MM BBL / YR	Volatile Organic Compounds (VOC)	Petroleum products are stored in floating roof tanks.	24.37	T/YR	BACT-PSD	NSPS , MACT , SIP

RBLCID	FACILITY_NAME	PERMIT ISSUANCE DATE	PROCESS NAME	PROCCESS TYPE	THROUGHPUT	THROUGHPUT UNIT	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT_1	EMISSION LIMIT 1 UNIT	CASE-BY-CASE BASIS	OTHER APPLICABLE REQUIREMENTS
TX-0799	BEAUMONT TERMINAL	06/08/2016	Storage Tanks -IFR	42.006	0		Volatile Organic Compounds (VOC)	IFR tanks (EPNs 169, 216, 218, 221, 230, 233, 234, 236, and 255) have a liquid-mounted primary seal. IFR tanks (EPNs 396 and 397) have a vapor-mounted primary seal and rim-mounted secondary seal. Methanol tanks (EPNs 300, 301, 302) have a mechanical shoe primary seal and rim-mounted secondary seal. All of these tanks are greater than 25 Mgal and store liquids with a TVP less than 11.0 psia, are painted white, and use submerged fill.	109.17	T/YR	BACT-PSD	NSPS
TX-0799	BEAUMONT TERMINAL	06/08/2016	Storage Tanks - EFR	42.006	0		Volatile Organic Compounds (VOC)	All 68 EFR tanks are greater than 25 Mgal and store liquids with a TVP less than 11.0 psia. They have a mechanical shoe primary seal, rim-mounted secondary seal, and slotted guide poles with gasketed sliding covers pole sleeves, and pole wipers. All EFR tanks are painted white, with the exception of Tank 167, which is currently out of service. Tank 167 will be painted white before it is returned to service. The 37 new tanks have drain dry design.	384.37	T/YR	BACT-PSD	NSPS
TX-0799	BEAUMONT TERMINAL	06/08/2016	Storage Tanks - fixed roof	42.005	0		Volatile Organic Compounds (VOC)	Fixed-roof tanks (EPNs 168, 222, 225, 227,229, 254, 256, 257, 258, 259, 475, and 476) will use submerged fill and have white exterior surfaces. Fuel tanks (EPN DTK01 and GTK01) are horizontal fixed-roof design and will use submerged fill and have white or aluminum exterior surfaces.	72.5	T/YR	BACT-PSD	NSPS
TX-0799	BEAUMONT TERMINAL	06/08/2016	Storage Tanks Floating Roof MSS	42.006	0		Volatile Organic Compounds (VOC)	Landing, degassing, and refilling events will be controlled by a portable VCU or thermal oxidizer meeting TCEQ BACT. Degassing will begin within 24 hours of roof landing. All new tanks have drain dry design.	28.83	T/YR	BACT-PSD	MACT
VA-0313	TRANSMONTAIGNE NORFOLK TERMINAL	04/22/2010	Storage Tank Breathing, Working, and Floating Roof Landing Losses (including emergency roof landings)	42.006	0		Volatile Organic Compounds (VOC)	Floating Roof and Seal Systems meeting NSPS Kb, MACT BBBBBB requirements for Tanks in Gasoline Service	114.1	T/YR	OTHER CASE-BY-CASE	NSPS , MACT
WI-0249	ENBRIDGE ENERGY	08/22/2008	TANK T35	42.006			Volatile Organic Compounds (VOC)	EXTERNAL FLOATING ROOF TANK	0.53	T/MO	BACT-PSD	NSPS , SIP
WI-0251	ENBRIDGE ENERGY	07/21/2009	T36-T40 CRUDE OIL STORAGE TANKS	42.006			Volatile Organic Compounds (VOC)	EXTERNAL FLOATING ROOF TANK	0.53	T/VOC/MO.	BACT-PSD	NSPS , SIP
WI-0251	ENBRIDGE ENERGY	07/21/2009	F01 - NEW AND MODIFIED TANKS, NEW PIPELINES, AND ASSOCIATED FUGITIVE VOC	42.006			Volatile Organic Compounds (VOC)	USE OF AN INSTRUMENT BASED LEAK DETECTION AND REPAIR (LDAR) PROGRAM, COMBINED WITH NON-INSTRUMENTAL METHODS (SIGHT, SOUND AND SMELL), AND GOOD OPERATING PRACTICES.	0		BACT-PSD	
WY-0071	SINCLAIR REFINERY	10/15/2012	Storage Tank	42.006	100	MMbbls	Volatile Organic Compounds (VOC)	External Floating Roof Tank	0		BACT-PSD	NSPS , NESHAP

Note: The RBLC search results were based on VOC BACT searches for storage tanks with floating roof (Process Code 42.006) between January 1, 2006 and August 17, 2016, and filtered by excluding pending determinations, coal/biomass-to-liquid facilities and corn mills, storage tanks not storing products included for Tanks 208 through 211 (including gasoline, ethanol, natural gasoline, isooctane, distillate oil and fuel oil).

Table E-1. Modeling Files Directory

File Name	File Type	Master Folder	Description
BTC_MVCU_YY.ami	AMI	Benzene Annual	Tank Modification Project Benzene annual modeling input file, Year YY
BTC_MVCU_YY.aml	AML	Benzene Annual	Tank Modification Project Benzene annual modeling output file, Year YY
Other_all_annual_BTC_09	PLT	Benzene Annual	Plot file for benzene, ALL source group, Year 09 (worst case model year)
HTC_MVCU_YY.ami	AMI	Hexane 24-hr	Tank Modification Project Hexane 24-hour modeling input file, Year YY
HTC_MVCU_YY.aml	AML	Hexane 24-hr	Tank Modification Project Hexane 24-hour modeling output file, Year YY
Other_all_24-hr_1st_high_HTC_09	PLT	Hexane 24-hr	Plot file for hexane, ALL source group, Year 09 (worst case model year)
BPIP Input File	File	BPIP	MVCU Stack BPIP Inputs
BPIP Output File	File	BPIP	MVCU Stack BPIP Outputs

APPENDIX F: TANKS OUTPUTS

Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208G
Tank Name		TK_{Name}		Post-project, Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**4,042,124**	**Annual**	**2.54**
Annual Emissions, tons	**0.17**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	335.52	0.168
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 9)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	4,042,124	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	--	--	--	--	--	--	383.1	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	67.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	6.4124	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	5.3641	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	--	--	--	--	--	--	0.1148	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	--	--	--	--	--	--	75.16	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	10.72	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= F_F * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	--	--	--	--	--	--	249.64	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_f * M_V * K_C {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**335.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	2.16							2.16					
Benzene	2	78.11	1.14							1.14					
2,2,4-Trimethylpentane (isooctane)	3	114.23	3.11							3.11					
Toluene	4	92.13	3.45							3.45					
Ethylbenzene	5	106.17	0.34							0.34					
Xylenes (mixed isomers)	6	106.17	1.54							1.54					
Isopropyl benzene (Cumene)	7	120.2	0.08							0.08					
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.34							0.34					
Cyclohexane	10	84.16	0.34							0.34					
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209G and 211G
Tank Name		TK_{Name}		Post-project, Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**4,514,851**	**Annual**	**2.54**
Annual Emissions, tons	**0.18**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	350.53	0.175
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 9)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	4,514,851	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	--	--	--	--	--	--	398.9	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	67.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	6.4124	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	5.3641	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	--	--	--	--	--	--	0.1148	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	--	--	--	--	--	--	79.24	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	11.35	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= F_F * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	--	--	--	--	--	--	259.94	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_I * M_V * K_C {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**350.53**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	2.26							2.26					
Benzene	2	78.11	1.19							1.19					
2,2,4-Trimethylpentane (isooctane)	3	114.23	3.25							3.25					
Toluene	4	92.13	3.61							3.61					
Ethylbenzene	5	106.17	0.36							0.36					
Xylenes (mixed isomers)	6	106.17	1.62							1.62					
Isopropyl benzene (Cumene)	7	120.2	0.09							0.09					
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.36							0.36					
Cyclohexane	10	84.16	0.36							0.36					
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210G
Tank Name		TK_{Name}		Post-project, Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**7,167,951**	**Annual**	**2.54**
Annual Emissions, tons	**0.29**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	576.39	0.288
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 9)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	7,167,951	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	709.2	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	67.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	6.4124	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	5.3641	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.1148	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	99.14	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	15.11	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	462.14	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**576.39**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	3.70							3.70					
Benzene	2	78.11	1.94							1.94					
2,2,4-Trimethylpentane (isooctane)	3	114.23	5.23							5.23					
Toluene	4	92.13	5.72							5.72					
Ethylbenzene	5	106.17	0.54							0.54					
Xylenes (mixed isomers)	6	106.17	2.42							2.42					
Isopropyl benzene (Cumene)	7	120.2	0.13							0.13					
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.50							0.50					
Cyclohexane	10	84.16	0.58							0.58					
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208H
Tank Name		TK_{Name}		Post-project, heated, fuel oil, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,185,037**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.01**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	0.00	0.000	
Feb	0.00	0.000	
Mar	0.00	0.000	
Apr	0.00	0.000	
May	0.00	0.000	
Jun	0.00	0.000	
Jul	0.00	0.000	
Aug	14.17	0.007	
Sep	0.00	0.000	
Oct	0.00	0.000	
Nov	0.00	0.000	
Dec	0.00	0.0000	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Petroleum Distillate	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Residual oil no. 6	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	3,185,037	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	383.1	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	190.0	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	--	387.0	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	7.90	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	114.86	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	140.00	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.0085	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.0163	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0003	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	0.52	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	--	11.92	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	1.73	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**14.17**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.04								0.04				
Benzene	2	78.11	0.20								0.20				
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.26								0.26				
Ethylbenzene	5	106.17	0.04								0.04				
Xylenes (mixed isomers)	6	106.17	0.81								0.81				
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.88								0.88				
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209H and 211H
Tank Name		TK_{Name}		Post-project, heated, fuel oil, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,557,527**	**Annual**	**2.00**
Annual Emissions, tons	**0.01**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	0.00	0.000
Aug	14.97	0.007
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Petroleum Distillate	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Residual oil no. 6	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	3,557,527	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	398.9	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	190.0	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	--	387.0	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	7.90	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	114.86	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	140.00	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.0085	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.0163	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0003	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	0.55	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	--	12.62	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	1.81	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**14.97**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{Vi} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{Ti} = Z_{Vi} * (L_R + L_F + L_D) + Z_{Li} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.04								0.04				
Benzene	2	78.11	0.20								0.20				
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.27								0.27				
Ethylbenzene	5	106.17	0.04								0.04				
Xylenes (mixed isomers)	6	106.17	0.85								0.85				
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.92								0.92				
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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--	47														
--	48														
--	49														
--	50														

Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210H
Tank Name		TK_{Name}		Post-project, heated, fuel oil, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**5,648,067**	**Annual**	**2.00**
Annual Emissions, tons	**0.01**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	0.00	0.000
Aug	20.70	0.010
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Petroleum Distillate	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Residual oil no. 6	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	5,648,067	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	709.2	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	190.0	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	--	387.0	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	7.90	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	114.86	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	140.00	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.0085	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.0163	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0003	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	0.69	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	--	16.80	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	3.21	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**20.70**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.06								0.06				
Benzene	2	78.11	0.34								0.34				
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.45								0.45				
Ethylbenzene	5	106.17	0.07								0.07				
Xylenes (mixed isomers)	6	106.17	1.39								1.39				
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	1.49								1.49				
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208GA
Tank Name		TK_{Name}		Post-project, Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

***Annual Throughput*, gal**	**47,592,750**	**Annual Turnovers**	**29.89**
Annual Emissions, tons	**1.87**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	284.15	0.142	
Feb	288.58	0.144	
Mar	324.05	0.162	
Apr	342.49	0.171	
May	265.65	0.133	
Jun	294.04	0.147	
Jul	335.32	0.168	
Aug	337.28	0.169	
Sep	292.02	0.146	
Oct	385.70	0.193	
Nov	311.68	0.156	
Dec	286.52	0.1433	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063	3,966,063
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	62.0	62.0	62.0	62.0	67.0	67.0	67.0	67.0	67.0	62.0	62.0	62.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.9846	5.4442	5.8657	6.5423	5.0519	5.6891	6.4124	6.0943	5.3331	6.6076	5.5629	4.9953
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.9748	5.3169	5.5462	5.9478	4.4061	4.9377	5.3641	5.3897	4.9090	6.3661	5.5138	5.0097
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.1045	0.1136	0.1198	0.1311	0.0902	0.1036	0.1148	0.1155	0.1028	0.1433	0.1189	0.1054
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= ($K_{Ra} + K_{Rb} * v^n$) * D * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	63.31	64.34	72.55	76.82	59.04	65.60	75.16	75.61	65.14	86.81	69.69	63.86
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	10.52	10.52	10.52	10.52	10.52	10.52	10.52	10.52	10.52	10.52	10.52	10.52
Deck Fitting Loss		L_F	lb/month	= F_F * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	210.31	213.72	240.98	255.15	196.10	217.92	249.64	251.15	216.36	288.37	231.48	212.13
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_I * M_V * K_C {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**284.15**	**288.58**	**324.05**	**342.49**	**265.65**	**294.04**	**335.32**	**337.28**	**292.02**	**385.70**	**311.68**	**286.52**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	18.40	1.08	1.14	1.30	1.43	1.60	1.83	2.16	2.14	1.79	1.61	1.23	1.09
Benzene	2	78.11	9.57	0.56	0.59	0.67	0.74	0.84	0.96	1.14	1.12	0.93	0.83	0.63	0.56
2,2,4-Trimethylpentane (isooctane)	3	114.23	26.46	1.58	1.66	1.87	2.06	2.31	2.64	3.10	3.05	2.56	2.28	1.78	1.59
Toluene	4	92.13	29.68	1.81	1.90	2.12	2.31	2.59	2.94	3.43	3.37	2.84	2.53	2.02	1.82
Ethylbenzene	5	106.17	3.15	0.21	0.22	0.24	0.25	0.27	0.30	0.34	0.33	0.29	0.26	0.23	0.21
Xylenes (mixed isomers)	6	106.17	14.59	1.01	1.04	1.10	1.16	1.25	1.37	1.53	1.50	1.33	1.22	1.07	1.01
Isopropyl benzene (Cumene)	7	120.2	0.85	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.07	0.06	0.06
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	3.63	0.28	0.29	0.29	0.30	0.31	0.32	0.33	0.33	0.31	0.30	0.29	0.28
Cyclohexane	10	84.16	2.91	0.17	0.18	0.21	0.23	0.25	0.29	0.34	0.34	0.28	0.25	0.19	0.17
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209GA and 211GA
Tank Name		TK_{Name}		Post-project, Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**53,158,727**	**Annual**	**29.89**
Annual Emissions, tons	**1.96**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	296.88	0.148
Feb	301.51	0.151
Mar	338.55	0.169
Apr	357.80	0.179
May	277.57	0.139
Jun	307.21	0.154
Jul	350.31	0.175
Aug	352.36	0.176
Sep	305.10	0.153
Oct	402.93	0.201
Nov	325.63	0.163
Dec	299.35	0.1497

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894	4,429,894
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	62.0	62.0	62.0	62.0	67.0	67.0	67.0	67.0	67.0	62.0	62.0	62.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.9846	5.4442	5.8657	6.5423	5.0519	5.6891	6.4124	6.0943	5.3331	6.6076	5.5629	4.9953
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.9748	5.3169	5.5462	5.9478	4.4061	4.9377	5.3641	5.3897	4.9090	6.3661	5.5138	5.0097
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.1045	0.1136	0.1198	0.1311	0.0902	0.1036	0.1148	0.1155	0.1028	0.1433	0.1189	0.1054
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	66.76	67.84	76.49	80.99	62.24	69.17	79.24	79.72	68.68	91.53	73.47	67.33
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	11.14	11.14	11.14	11.14	11.14	11.14	11.14	11.14	11.14	11.14	11.14	11.14
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	218.99	222.54	250.92	265.68	204.18	226.91	259.94	261.51	225.28	300.26	241.02	220.88
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**296.88**	**301.51**	**338.55**	**357.80**	**277.57**	**307.21**	**350.31**	**352.36**	**305.10**	**402.93**	**325.63**	**299.35**

Speciated Component Emissions	Species ID	Vapor MW M_{Vi} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{Ti} = Z_{Vi} * (L_R + L_F + L_D) + Z_{Li} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	19.23	1.13	1.19	1.36	1.49	1.67	1.91	2.25	2.23	1.87	1.68	1.29	1.14
Benzene	2	78.11	10.01	0.58	0.61	0.70	0.77	0.87	1.00	1.19	1.17	0.97	0.87	0.66	0.59
2,2,4-Trimethylpentane (isooctane)	3	114.23	27.71	1.65	1.74	1.96	2.15	2.42	2.76	3.24	3.19	2.68	2.38	1.86	1.67
Toluene	4	92.13	31.12	1.90	1.99	2.22	2.42	2.71	3.08	3.60	3.53	2.98	2.65	2.11	1.92
Ethylbenzene	5	106.17	3.31	0.23	0.23	0.25	0.26	0.29	0.31	0.35	0.35	0.30	0.28	0.24	0.23
Xylenes (mixed isomers)	6	106.17	15.36	1.07	1.09	1.16	1.22	1.32	1.44	1.60	1.58	1.40	1.29	1.13	1.07
Isopropyl benzene (Cumene)	7	120.2	0.90	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.08	0.07	0.07	0.07
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	3.83	0.30	0.30	0.31	0.31	0.32	0.33	0.35	0.35	0.33	0.32	0.30	0.30
Cyclohexane	10	84.16	3.04	0.18	0.19	0.21	0.24	0.27	0.30	0.36	0.35	0.30	0.26	0.20	0.18
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210GA
Tank Name		TK_{Name}		Post-project, Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**84,396,847**	**Annual Turnovers**	**29.89**
Annual Emissions, tons	**3.22**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	487.68	0.244	
Feb	495.34	0.248	
Mar	556.64	0.278	
Apr	588.50	0.294	
May	455.72	0.228	
Jun	504.78	0.252	
Jul	576.10	0.288	
Aug	579.49	0.290	
Sep	501.28	0.251	
Oct	663.17	0.332	
Nov	535.27	0.268	
Dec	491.78	0.2459	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 9)	Gasoline (RVP 13)	Gasoline (RVP 13)	Gasoline (RVP 13)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa	Gasoline - Targa
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071	7,033,071
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	62.0	62.0	62.0	62.0	67.0	67.0	67.0	67.0	67.0	62.0	62.0	62.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.9846	5.4442	5.8657	6.5423	5.0519	5.6891	6.4124	6.0943	5.3331	6.6076	5.5629	4.9953
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.9748	5.3169	5.5462	5.9478	4.4061	4.9377	5.3641	5.3897	4.9090	6.3661	5.5138	5.0097
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.1045	0.1136	0.1198	0.1311	0.0902	0.1036	0.1148	0.1155	0.1028	0.1433	0.1189	0.1054
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	83.52	84.87	95.70	101.32	77.87	86.54	99.14	99.73	85.92	114.51	91.92	84.24
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	389.33	395.64	446.11	472.35	363.02	403.41	462.14	464.93	400.53	533.83	428.51	392.71
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**487.68**	**495.34**	**556.64**	**588.50**	**455.72**	**504.78**	**576.10**	**579.49**	**501.28**	**663.17**	**535.27**	**491.78**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	31.39	1.84	1.93	2.22	2.44	2.73	3.13	3.69	3.66	3.05	2.75	2.09	1.85
Benzene	2	78.11	16.21	0.94	0.99	1.13	1.25	1.42	1.63	1.94	1.91	1.58	1.41	1.07	0.94
2,2,4-Trimethylpentane (isooctane)	3	114.23	44.12	2.59	2.73	3.11	3.42	3.86	4.42	5.22	5.14	4.28	3.80	2.94	2.61
Toluene	4	92.13	48.48	2.90	3.05	3.42	3.76	4.24	4.84	5.70	5.60	4.68	4.13	3.25	2.92
Ethylbenzene	5	106.17	4.88	0.32	0.33	0.36	0.38	0.42	0.47	0.53	0.52	0.45	0.41	0.35	0.32
Xylenes (mixed isomers)	6	106.17	22.40	1.51	1.56	1.67	1.77	1.93	2.12	2.40	2.36	2.06	1.88	1.61	1.52
Isopropyl benzene (Cumene)	7	120.2	1.27	0.09	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.11	0.11	0.10	0.09
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	5.26	0.41	0.41	0.42	0.43	0.44	0.46	0.49	0.48	0.46	0.44	0.41	0.41
Cyclohexane	10	84.16	4.93	0.29	0.30	0.35	0.38	0.43	0.49	0.58	0.58	0.48	0.43	0.33	0.29
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208NGA
Tank Name		TK_{Name}		Post-project, Natural Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

***Annual Throughput*, gal**	**30,299,332**	**Annual Turnovers**	**19.03**
Annual Emissions, tons	**1.88**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	233.60	0.117	
Feb	236.86	0.118	
Mar	265.88	0.133	
Apr	280.40	0.140	
May	333.30	0.167	
Jun	371.44	0.186	
Jul	426.51	0.213	
Aug	429.17	0.215	
Sep	368.73	0.184	
Oct	315.05	0.158	
Nov	255.70	0.128	
Dec	235.52	0.1178	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944	2,524,944
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.1035	4.4917	4.8483	5.4220	6.3031	7.0747	7.9475	7.5640	6.6439	5.4775	4.5920	4.1126
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.0953	4.3841	4.5779	4.9178	5.5183	6.1645	6.6814	6.7125	6.1297	5.2725	4.5505	4.1248
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0827	0.0897	0.0944	0.1031	0.1190	0.1373	0.1530	0.1540	0.1363	0.1124	0.0938	0.0834
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	52.50	53.26	59.97	63.33	75.57	84.40	97.14	97.76	83.77	71.35	57.62	52.95
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	174.40	176.91	199.21	210.37	251.03	280.34	322.67	324.72	278.26	237.01	191.39	175.88
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**233.60**	**236.86**	**265.88**	**280.40**	**333.30**	**371.44**	**426.51**	**429.17**	**368.73**	**315.05**	**255.70**	**235.52**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	181.73	10.07	10.53	12.09	13.24	16.50	19.08	22.73	22.49	18.55	14.88	11.43	10.15
Benzene	2	78.11	11.44	0.62	0.66	0.75	0.83	1.04	1.21	1.45	1.43	1.17	0.93	0.71	0.63
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209NGA and 211NGA
Tank Name		TK_{Name}		Post-project, Natural Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**33,842,842**	**Annual Turnovers**	**19.03**
Annual Emissions, tons	**1.96**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	244.04	0.122	
Feb	247.45	0.124	
Mar	277.74	0.139	
Apr	292.91	0.146	
May	348.16	0.174	
Jun	387.98	0.194	
Jul	445.49	0.223	
Aug	448.27	0.224	
Sep	385.15	0.193	
Oct	329.10	0.165	
Nov	267.12	0.134	
Dec	246.05	0.1230	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237	2,820,237
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.1035	4.4917	4.8483	5.4220	6.3031	7.0747	7.9475	7.5640	6.6439	5.4775	4.5920	4.1126
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.0953	4.3841	4.5779	4.9178	5.5183	6.1645	6.6814	6.7125	6.1297	5.2725	4.5505	4.1248
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0827	0.0897	0.0944	0.1031	0.1190	0.1373	0.1530	0.1540	0.1363	0.1124	0.0938	0.0834
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	55.36	56.15	63.23	66.77	79.68	88.98	102.42	103.07	88.32	75.23	60.75	55.83
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09	7.09
Deck Fitting Loss		L_F	lb/month	= F_F * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	181.59	184.20	207.42	219.04	261.39	291.90	335.98	338.11	289.73	246.78	199.28	183.13
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_I * M_V * K_C {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**244.04**	**247.45**	**277.74**	**292.91**	**348.16**	**387.98**	**445.49**	**448.27**	**385.15**	**329.10**	**267.12**	**246.05**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	189.90	10.52	11.01	12.64	13.83	17.24	19.93	23.74	23.50	19.38	15.55	11.94	10.61
Benzene	2	78.11	11.96	0.65	0.69	0.79	0.87	1.09	1.27	1.52	1.50	1.22	0.97	0.74	0.66
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210NGA
Tank Name		TK_{Name}		Post-project, Natural Gasoline, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**53,730,201**	**Annual Turnovers**	**19.03**
Annual Emissions, tons	**3.23**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	401.54	0.201
Feb	407.19	0.204
Mar	457.32	0.229
Apr	482.41	0.241
May	573.84	0.287
Jun	639.74	0.320
Jul	734.91	0.367
Aug	739.51	0.370
Sep	635.06	0.318
Oct	542.31	0.271
Nov	439.74	0.220
Dec	404.87	0.2024

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)	Gasoline (RVP 11)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517	4,477,517
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Liquid Molecular Weight		M_L	lb/lb-mole		92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60	5.60
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	4.1035	4.4917	4.8483	5.4220	6.3031	7.0747	7.9475	7.5640	6.6439	5.4775	4.5920	4.1126
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		4.0953	4.3841	4.5779	4.9178	5.5183	6.1645	6.6814	6.7125	6.1297	5.2725	4.5505	4.1248
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0827	0.0897	0.0944	0.1031	0.1190	0.1373	0.1530	0.1540	0.1363	0.1124	0.0938	0.0834
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	69.25	70.25	79.11	83.54	99.69	111.33	128.14	128.95	110.50	94.12	76.00	69.84
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	322.85	327.49	368.77	389.43	464.71	518.97	597.33	601.12	515.11	438.75	354.29	325.59
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**401.54**	**407.19**	**457.32**	**482.41**	**573.84**	**639.74**	**734.91**	**739.51**	**635.06**	**542.31**	**439.74**	**404.87**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	311.49	17.18	17.98	20.68	22.66	28.30	32.76	39.06	38.66	31.84	25.50	19.53	17.33
Benzene	2	78.11	19.51	1.06	1.11	1.28	1.41	1.78	2.07	2.49	2.45	2.00	1.59	1.21	1.06
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208NG
Tank Name		TK_{name}		Post-project, Natural Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{Deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{Deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/$(mph)^n$-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,185,037**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.21**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	428.26	0.214
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 11)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	3,185,037	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	383.1	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	65.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	7.9475	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	6.6814	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.1530	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	97.14	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	8.45	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	322.67	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**428.26**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	22.90							22.90					
Benzene	2	78.11	1.47							1.47					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209NG and 211NG
Tank Name		TK_{name}		Post-project, Natural Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{Deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{Deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,557,527**	**Annual Turnovers**	**2.00**	Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.
Annual Emissions, tons	**0.22**			
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**		
Jan	0.00	0.000		
Feb	0.00	0.000		
Mar	0.00	0.000		
Apr	0.00	0.000		
May	0.00	0.000		
Jun	0.00	0.000		
Jul	447.34	0.224		
Aug	0.00	0.000		
Sep	0.00	0.000		
Oct	0.00	0.000		
Nov	0.00	0.000		
Dec	0.00	0.0000		

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 11)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	3,557,527	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	398.9	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	65.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	7.9475	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	6.6814	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.1530	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	102.42	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	8.94	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	335.98	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**447.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	23.93							23.93					
Benzene	2	78.11	1.54							1.54					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210NG
Tank Name		TK_{name}		Post-project, Natural Gasoline, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{Deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{Deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**5,648,067**	**Annual Turnovers**	**2.00**	Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.
Annual Emissions, tons	**0.37**			
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**		
Jan	0.00	0.000		
Feb	0.00	0.000		
Mar	0.00	0.000		
Apr	0.00	0.000		
May	0.00	0.000		
Jun	0.00	0.000		
Jul	737.38	0.369		
Aug	0.00	0.000		
Sep	0.00	0.000		
Oct	0.00	0.000		
Nov	0.00	0.000		
Dec	0.00	0.0000		

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Gasoline (RVP 11)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline	Natural Gasoline
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	5,648,067	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	709.2	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	65.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole		--	--	--	--	--	--	92.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	5.60	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	7.9475	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	6.6814	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.1530	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	128.14	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	11.91	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	597.33	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**737.38**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	39.31							39.31					
Benzene	2	78.11	2.51							2.51					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208I
Tank Name		TK_{Name}		Post-project, isooctane, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,185,037**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.04**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	0.00	0.000	
Feb	0.00	0.000	
Mar	0.00	0.000	
Apr	0.00	0.000	
May	0.00	0.000	
Jun	0.00	0.000	
Jul	0.00	0.000	
Aug	72.48	0.036	
Sep	0.00	0.000	
Oct	0.00	0.000	
Nov	0.00	0.000	
Dec	0.00	0.0000	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Organic Liquid	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	2,2,4-Trimethylpentane (isooctane)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	3,185,037	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	383.1	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{L,i} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	5.76	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	74.57	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	68.05	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.8939	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.7480	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0132	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	14.76	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	--	8.69	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	49.03	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**72.48**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209I and 211I
Tank Name		TK_{Name}		Post-project, isooctane, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,557,527**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.04**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	0.00	0.000	
Feb	0.00	0.000	
Mar	0.00	0.000	
Apr	0.00	0.000	
May	0.00	0.000	
Jun	0.00	0.000	
Jul	0.00	0.000	
Aug	75.81	0.038	
Sep	0.00	0.000	
Oct	0.00	0.000	
Nov	0.00	0.000	
Dec	0.00	0.0000	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Organic Liquid	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	2,2,4-Trimethylpentane (isooctane)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	3,557,527	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	398.9	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{VA} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{L-i} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	5.76	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	74.57	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	68.05	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.8939	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.7480	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0132	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	15.56	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 \text{ gal/bbl})) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	--	9.20	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	51.05	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**75.81**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
--	16														
--	17														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210I
Tank Name		TK_{Name}		Post-project, isooctane, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**5,648,067**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.06**		
Month	**Normal Operation Loss, lbs**	**Emissions, tpy**	
Jan	0.00	0.000	
Feb	0.00	0.000	
Mar	0.00	0.000	
Apr	0.00	0.000	
May	0.00	0.000	
Jun	0.00	0.000	
Jul	0.00	0.000	
Aug	122.48	0.061	
Sep	0.00	0.000	
Oct	0.00	0.000	
Nov	0.00	0.000	
Dec	0.00	0.0000	

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	--	Organic Liquid	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	2,2,4-Trimethylpentane (isooctane)	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	--	5,648,067	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	--	31	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	--	0.0015	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	--	709.2	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	--	1,616	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	--	1.0	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	--	0.000	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	114.2	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{L,i} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	--	5.76	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	--	55.70	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	--	75.20	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	--	65.45	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	--	74.57	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	--	68.05	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	--	0.8939	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	--	0.7480	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	--	0.0132	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	--	0.0	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	--	19.47	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 \text{ gal/bbl})) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	--	12.25	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	--	90.76	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	--	0.00	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**122.48**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208IA
Tank Name		TK_{Name}		Post-project, isooctane, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**25,199,444**	**Annual**	**15.82**
Annual Emissions, tons	**0.30**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	35.52	0.018
Feb	36.70	0.018
Mar	41.12	0.021
Apr	43.98	0.022
May	52.93	0.026
Jun	59.89	0.030
Jul	69.06	0.035
Aug	69.51	0.035
Sep	59.42	0.030
Oct	49.73	0.025
Nov	39.66	0.020
Dec	35.85	0.0179

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954	2,099,954
Days-In-Service	Input "0" for OOS	t_S	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_S / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{L-i} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.3554	0.4079	0.4581	0.5427	0.6807	0.8091	0.9621	0.8939	0.7366	0.5511	0.4218	0.3566
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.3543	0.3931	0.4199	0.4681	0.5573	0.6584	0.7428	0.7480	0.6528	0.5202	0.4161	0.3582
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0062	0.0069	0.0073	0.0082	0.0098	0.0116	0.0131	0.0132	0.0115	0.0091	0.0073	0.0062
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_S / t_{yr}$ {Eqn. 2-2}	6.89	7.17	8.19	8.85	10.92	12.53	14.65	14.76	12.42	10.18	7.85	6.97
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73	5.73
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_S / t_{yr}$ {Eqn 2-5}	22.90	23.80	27.20	29.40	36.28	41.63	48.68	49.03	41.26	33.82	26.08	23.15
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**35.52**	**36.70**	**41.12**	**43.98**	**52.93**	**59.89**	**69.06**	**69.51**	**59.42**	**49.73**	**39.66**	**35.85**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209IA and 211IA
Tank Name		TK_{Name}		Post-project, isooctane, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**28,146,522**	**Annual Turnovers**	**15.82**
Annual Emissions, tons	**0.31**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	37.18	0.019
Feb	38.40	0.019
Mar	43.02	0.022
Apr	46.01	0.023
May	55.36	0.028
Jun	62.62	0.031
Jul	72.20	0.036
Aug	72.67	0.036
Sep	62.13	0.031
Oct	52.02	0.026
Nov	41.50	0.021
Dec	37.52	0.0188

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543	2,345,543
Days-In-Service	Input "0" for OOS	t_S	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_S / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{L-i} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.3554	0.4079	0.4581	0.5427	0.6807	0.8091	0.9621	0.8939	0.7366	0.5511	0.4218	0.3566
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.3543	0.3931	0.4199	0.4681	0.5573	0.6584	0.7428	0.7480	0.6528	0.5202	0.4161	0.3582
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0062	0.0069	0.0073	0.0082	0.0098	0.0116	0.0131	0.0132	0.0115	0.0091	0.0073	0.0062
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^2) * D * P_f * M_V * K_C * t_S / t_{yr}$ {Eqn. 2-2}	7.27	7.55	8.63	9.33	11.52	13.21	15.45	15.56	13.10	10.74	8.28	7.35
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_S / t_{yr}$ {Eqn 2-5}	23.84	24.78	28.32	30.61	37.78	43.34	50.68	51.05	42.97	35.22	27.16	24.11
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**37.18**	**38.40**	**43.02**	**46.01**	**55.36**	**62.62**	**72.20**	**72.67**	**62.13**	**52.02**	**41.50**	**37.52**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210IA
Tank Name		TK_{Name}		Post-project, isooctane, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**44,686,504**	**Annual**	**15.82**
Annual Emissions, tons	**0.50**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	59.56	0.030
Feb	61.59	0.031
Mar	69.23	0.035
Apr	74.18	0.037
May	89.64	0.045
Jun	101.66	0.051
Jul	117.52	0.059
Aug	118.30	0.059
Sep	100.85	0.050
Oct	84.12	0.042
Nov	66.71	0.033
Dec	60.13	0.0301

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid	Organic Liquid
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)	2,2,4-Trimethylpentane (isooctane)
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	--	--	--	--	--	--	--	--	--	--	--	--
Speciation Profile Type				= User specified	None	None	None	None	None	None	None	None	None	None	None	None
Monthly Throughput		Q	gal/month	= User specified	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875	3,723,875
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + \ldots + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma\ (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma\ (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2	114.2
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma\ (M_{L-i} * Z_{Li})$ {full speciation, Eqn. 1-22}	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}:* Sum of partial true vapor pressures components. *{partial/no speciation profiles}:* Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.3554	0.4079	0.4581	0.5427	0.6807	0.8091	0.9621	0.8939	0.7366	0.5511	0.4218	0.3566
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.3543	0.3931	0.4199	0.4681	0.5573	0.6584	0.7428	0.7480	0.6528	0.5202	0.4161	0.3582
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0062	0.0069	0.0073	0.0082	0.0098	0.0116	0.0131	0.0132	0.0115	0.0091	0.0073	0.0062
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^2) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	9.09	9.45	10.80	11.67	14.41	16.53	19.33	19.47	16.39	13.43	10.36	9.19
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	42.39	44.06	50.36	54.42	67.16	77.06	90.11	90.76	76.39	62.61	48.28	42.86
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**59.56**	**61.59**	**69.23**	**74.18**	**89.64**	**101.66**	**117.52**	**118.30**	**100.85**	**84.12**	**66.71**	**60.13**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00												
Benzene	2	78.11	0.00												
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.00												
Ethylbenzene	5	106.17	0.00												
Xylenes (mixed isomers)	6	106.17	0.00												
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.00												
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208HA
Tank Name		TK_{Name}		Post-project, heated, fuel oil, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**38,220,441**	**Annual**	**24.00**
Annual Emissions, tons	**0.08**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	14.17	0.007
Feb	14.03	0.007
Mar	14.17	0.007
Apr	14.10	0.007
May	14.17	0.007
Jun	14.10	0.007
Jul	14.17	0.007
Aug	14.17	0.007
Sep	14.10	0.007
Oct	14.17	0.007
Nov	14.10	0.007
Dec	14.17	0.0071

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
Liquid Molecular Weight		M_L	lb/lb-mole		387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	97.29	99.86	102.49	106.18	110.77	113.74	117.74	114.86	110.51	104.72	99.93	97.20
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0052	0.0056	0.0060	0.0067	0.0076	0.0082	0.0092	0.0085	0.0076	0.0064	0.0056	0.0052
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	0.52	0.49	0.52	0.51	0.52	0.51	0.52	0.52	0.51	0.52	0.51	0.52
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92
Deck Fitting Loss		L_F	lb/month	= F_F * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	1.73	1.62	1.73	1.68	1.73	1.68	1.73	1.73	1.68	1.73	1.68	1.73
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_f * M_V * K_C {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**14.17**	**14.03**	**14.17**	**14.10**	**14.17**	**14.10**	**14.17**	**14.17**	**14.10**	**14.17**	**14.10**	**14.17**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.46	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Benzene	2	78.11	2.41	0.21	0.20	0.21	0.20	0.20	0.19	0.19	0.20	0.19	0.21	0.20	0.21
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	3.17	0.27	0.26	0.27	0.26	0.27	0.26	0.26	0.26	0.26	0.27	0.26	0.27
Ethylbenzene	5	106.17	0.50	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Xylenes (mixed isomers)	6	106.17	9.56	0.80	0.76	0.81	0.78	0.81	0.79	0.81	0.81	0.79	0.81	0.78	0.80
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	10.13	0.83	0.79	0.84	0.83	0.87	0.86	0.89	0.88	0.85	0.85	0.81	0.83
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209HA and 211HA
Tank Name		TK_{Name}		Post-project, heated, fuel oil, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

***Annual Throughput*, gal**	**42,690,325**	**Annual Turnovers**	**24.00**
Annual Emissions, tons	**0.09**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	14.97	0.007
Feb	14.82	0.007
Mar	14.97	0.007
Apr	14.90	0.007
May	14.97	0.007
Jun	14.90	0.007
Jul	14.97	0.007
Aug	14.97	0.007
Sep	14.90	0.007
Oct	14.97	0.007
Nov	14.90	0.007
Dec	14.97	0.0075

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
Liquid Molecular Weight		M_L	lb/lb-mole		387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	97.29	99.86	102.49	106.18	110.77	113.74	117.74	114.86	110.51	104.72	99.93	97.20
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0052	0.0056	0.0060	0.0067	0.0076	0.0082	0.0092	0.0085	0.0076	0.0064	0.0056	0.0052
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	0.55	0.51	0.55	0.53	0.55	0.53	0.55	0.55	0.53	0.55	0.53	0.55
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	1.81	1.69	1.81	1.75	1.81	1.75	1.81	1.81	1.75	1.81	1.75	1.81
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**14.97**	**14.82**	**14.97**	**14.90**	**14.97**	**14.90**	**14.97**	**14.97**	**14.90**	**14.97**	**14.90**	**14.97**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.48	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Benzene	2	78.11	2.52	0.22	0.21	0.22	0.21	0.21	0.20	0.20	0.20	0.20	0.22	0.21	0.22
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	3.31	0.29	0.27	0.28	0.27	0.28	0.27	0.27	0.27	0.27	0.28	0.28	0.29
Ethylbenzene	5	106.17	0.53	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Xylenes (mixed isomers)	6	106.17	9.99	0.84	0.79	0.84	0.82	0.85	0.82	0.85	0.85	0.82	0.85	0.82	0.84
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	10.60	0.87	0.83	0.88	0.87	0.91	0.90	0.93	0.92	0.89	0.89	0.85	0.87
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210HA
Tank Name		TK_{Name}		Post-project, heated, fuel oil, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		Yes
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	140.0
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**67,776,808**	**Annual Turnovers**	**24.00**
Annual Emissions, tons	**0.12**		

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	20.70	0.010
Feb	20.45	0.010
Mar	20.70	0.010
Apr	20.57	0.010
May	20.70	0.010
Jun	20.57	0.010
Jul	20.70	0.010
Aug	20.70	0.010
Sep	20.57	0.010
Oct	20.70	0.010
Nov	20.57	0.010
Dec	20.70	0.0103

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6	Residual oil no. 6
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
Liquid Molecular Weight		M_L	lb/lb-mole		387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0	387.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	97.29	99.86	102.49	106.18	110.77	113.74	117.74	114.86	110.51	104.72	99.93	97.20
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0052	0.0056	0.0060	0.0067	0.0076	0.0082	0.0092	0.0085	0.0076	0.0064	0.0056	0.0052
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163	0.0163
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	0.69	0.64	0.69	0.67	0.69	0.67	0.69	0.69	0.67	0.69	0.67	0.69
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80	16.80
Deck Fitting Loss		L_F	lb/month	= F_F * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	3.21	3.00	3.21	3.11	3.21	3.11	3.21	3.21	3.11	3.21	3.11	3.21
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_f * M_V * K_C {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**20.70**	**20.45**	**20.70**	**20.57**	**20.70**	**20.57**	**20.70**	**20.70**	**20.57**	**20.70**	**20.57**	**20.70**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.80	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07
Benzene	2	78.11	4.17	0.37	0.34	0.36	0.34	0.34	0.33	0.33	0.34	0.33	0.36	0.35	0.37
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	5.47	0.47	0.44	0.47	0.45	0.46	0.44	0.45	0.45	0.44	0.46	0.46	0.47
Ethylbenzene	5	106.17	0.86	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Xylenes (mixed isomers)	6	106.17	16.39	1.38	1.30	1.38	1.34	1.39	1.35	1.39	1.39	1.35	1.39	1.34	1.38
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	17.06	1.39	1.33	1.42	1.40	1.47	1.44	1.50	1.49	1.42	1.43	1.37	1.39
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208DA
Tank Name		TK_{Name}		Post-project, heated, ULSD, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**38,220,441**	**Annual Turnovers**	**24.00**
Annual Emissions, tons	**0.07**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	11.04	0.006
Feb	11.06	0.006
Mar	11.11	0.006
Apr	11.16	0.006
May	11.28	0.006
Jun	11.39	0.006
Jul	11.51	0.006
Aug	11.52	0.006
Sep	11.38	0.006
Oct	11.24	0.006
Nov	11.10	0.006
Dec	11.05	0.0055

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037	3,185,037
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1	383.1
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Liquid Molecular Weight		M_L	lb/lb-mole		188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0035	0.0041	0.0047	0.0059	0.0077	0.0093	0.0112	0.0104	0.0084	0.0060	0.0043	0.0035
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0035	0.0039	0.0042	0.0049	0.0060	0.0074	0.0085	0.0085	0.0073	0.0056	0.0042	0.0035
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	0.08	0.08	0.09	0.10	0.13	0.16	0.18	0.19	0.15	0.12	0.09	0.08
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	10.71	10.71	10.71	10.71	10.71	10.71	10.71	10.71	10.71	10.71	10.71	10.71
Deck Fitting Loss		L_F	lb/month	= F_F * P_f * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	0.25	0.27	0.31	0.34	0.44	0.52	0.61	0.62	0.51	0.40	0.30	0.26
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_f * M_V * K_C {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**11.04**	**11.06**	**11.11**	**11.16**	**11.28**	**11.39**	**11.51**	**11.52**	**11.38**	**11.24**	**11.10**	**11.05**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzene	2	78.11	0.14	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.19	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
Ethylbenzene	5	106.17	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Xylenes (mixed isomers)	6	106.17	0.74	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.07	0.06	0.05	0.05
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	1.58	0.12	0.12	0.12	0.13	0.13	0.14	0.15	0.15	0.14	0.13	0.12	0.12
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209DA and 211DA
Tank Name		TK_{Name}		Post-project, heated, ULSD, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

***Annual Throughput*, gal**	**42,690,325**	**Annual Turnovers**	**24.00**
Annual Emissions, tons	**0.07**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	11.68	0.006
Feb	11.70	0.006
Mar	11.76	0.006
Apr	11.80	0.006
May	11.94	0.006
Jun	12.04	0.006
Jul	12.17	0.006
Aug	12.18	0.006
Sep	12.04	0.006
Oct	11.89	0.006
Nov	11.74	0.006
Dec	11.69	0.0058

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527	3,557,527
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9	398.9
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Liquid Molecular Weight		M_L	lb/lb-mole		188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0035	0.0041	0.0047	0.0059	0.0077	0.0093	0.0112	0.0104	0.0084	0.0060	0.0043	0.0035
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0035	0.0039	0.0042	0.0049	0.0060	0.0074	0.0085	0.0085	0.0073	0.0056	0.0042	0.0035
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	0.08	0.09	0.10	0.11	0.14	0.16	0.19	0.20	0.16	0.13	0.09	0.08
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34	11.34
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	0.26	0.28	0.32	0.36	0.46	0.54	0.64	0.64	0.53	0.42	0.31	0.27
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**11.68**	**11.70**	**11.76**	**11.80**	**11.94**	**12.04**	**12.17**	**12.18**	**12.04**	**11.89**	**11.74**	**11.69**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzene	2	78.11	0.15	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.20	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
Ethylbenzene	5	106.17	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Xylenes (mixed isomers)	6	106.17	0.78	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.07	0.06	0.06	0.05
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	1.67	0.13	0.13	0.13	0.13	0.14	0.15	0.16	0.16	0.15	0.14	0.13	0.13
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210DA
Tank Name		TK_{Name}		Post-project, heated, ULSD, annual throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

***Annual Throughput*, gal**	**67,776,808**	**Annual Turnovers**	**24.00**
Annual Emissions, tons	**0.10**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	15.67	0.008
Feb	15.70	0.008
Mar	15.79	0.008
Apr	15.87	0.008
May	16.09	0.008
Jun	16.27	0.008
Jul	16.48	0.008
Aug	16.49	0.008
Sep	16.25	0.008
Oct	16.01	0.008
Nov	15.77	0.008
Dec	15.68	0.0078

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate	Petroleum Distillate
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2	Distillate fuel oil no. 2
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067	5,648,067
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	31	29	31	30	31	30	31	31	30	31	30	31
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2	709.2
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		262	495	849	1,294	1,714	1,802	2,248	1,616	1,148	656	337	211
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$ $M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Liquid Molecular Weight		M_L	lb/lb-mole		188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0	188.0
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10
Average Daily Minimum Ambient Temperature		T_{AN}	°F		35.20	37.40	38.50	41.20	46.30	51.90	55.20	55.70	51.90	45.80	40.10	35.80
Average Daily Maximum Ambient Temperature		T_{AX}	°F		45.00	49.50	52.70	57.20	63.90	69.90	75.20	75.20	69.30	59.70	50.50	45.10
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	40.10	43.45	45.60	49.20	55.10	60.90	65.20	65.45	60.60	52.75	45.30	40.45
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	42.80	47.25	51.08	56.79	64.68	70.90	77.31	74.57	67.50	57.32	48.35	42.91
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	42.70	46.05	48.20	51.80	57.70	63.50	67.80	68.05	63.20	55.35	47.90	43.05
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	0.0035	0.0041	0.0047	0.0059	0.0077	0.0093	0.0112	0.0104	0.0084	0.0060	0.0043	0.0035
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		0.0035	0.0039	0.0042	0.0049	0.0060	0.0074	0.0085	0.0085	0.0073	0.0056	0.0042	0.0035
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	0.10	0.11	0.12	0.14	0.17	0.21	0.24	0.25	0.20	0.16	0.12	0.10
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	0.47	0.50	0.57	0.63	0.81	0.96	1.14	1.15	0.95	0.75	0.55	0.47
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**15.67**	**15.70**	**15.79**	**15.87**	**16.09**	**16.27**	**16.48**	**16.49**	**16.25**	**16.01**	**15.77**	**15.68**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Benzene	2	78.11	0.24	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.01
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.31	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.02
Ethylbenzene	5	106.17	0.06	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Xylenes (mixed isomers)	6	106.17	1.16	0.08	0.08	0.08	0.09	0.10	0.11	0.13	0.13	0.11	0.10	0.08	0.08
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	2.32	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.22	0.21	0.19	0.18	0.17
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			208D
Tank Name		TK_{Name}		Post-project, heated, ULSD, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,592,518
Diameter		D	ft	72.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,080.9
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,185,037**	**Annual**	**2.00**
Annual Emissions, tons	**0.01**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	11.51	0.006
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Distillate fuel oil no. 2	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	3,185,037	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	383.1	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	130.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	188.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	7.10	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	0.0112	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	0.0085	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_f		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.0001	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	0.18	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	10.71	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_f * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	0.61	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_f * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**11.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00							0.00					
Benzene	2	78.11	0.02							0.02					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.02							0.02					
Ethylbenzene	5	106.17	0.00							0.00					
Xylenes (mixed isomers)	6	106.17	0.08							0.08					
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.15							0.15					
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
--	16														
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.

Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			209D and 211D
Tank Name		TK_{Name}		Post-project, heated, ULSD, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	1,778,764
Diameter		D	ft	76.0
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		1
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	4,536.5
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**3,557,527**	**Annual Turnovers**	**2.00**
Annual Emissions, tons	**0.01**		

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	12.17	0.006
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Distillate fuel oil no. 2	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	3,557,527	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= [(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})] {Eqn. 2-6}	--	--	--	--	--	--	398.9	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	130.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	188.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	7.10	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= (T_{AX} + T_{AN}) / 2 {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= (0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * α_{Tot} * I) {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = T_{AA} + 6 * α_{Tot} - 1 {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	0.0112	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	0.0085	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= ($P_{VA,Tb}$ / P_A) / (1 + (1 - $P_{VA,Tb}$ / P_A)$^{0.5}$)^2 {Eqn. 2-3}	--	--	--	--	--	--	0.0001	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= (K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn. 2-2}	--	--	--	--	--	--	0.19	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= 0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D)) {Eqn. 2-4}	--	--	--	--	--	--	11.34	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= F_F * P_I * M_V * K_C * t_{IS} / t_{yr} {Eqn 2-5}	--	--	--	--	--	--	0.64	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = K_D * S_D * D^2 * P_I * M_V * K_C {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= L_R + L_{WD} + L_F + L_D {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**12.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{Vi} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{Ti} = Z_{Vi} * (L_R + L_F + L_D) + Z_{Li} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.00							0.00					
Benzene	2	78.11	0.02							0.02					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.02							0.02					
Ethylbenzene	5	106.17	0.00							0.00					
Xylenes (mixed isomers)	6	106.17	0.08							0.08					
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.16							0.16					
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
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Floating Roof Tank Emissions

Based on AP-42, November 2006, Section 7.1.3.2.
Tool Last Updated: 12/14/15 *Click Here to Go Back to Cover Page*

Reporting Year	*2016*

Tank Reference Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Tank ID	Enter only Tank ID in this tab.			210D
Tank Name		TK_{Name}		Post-project, heated, ULSD, short-term throughput
Actual Location		Loc_{Act}		Tacoma
Location for Calculation Purposes		Loc_{Calc}		Seattle-TAC AP, Washington
Tank Roof Type		TK_{Roof}		IFR - Column Supported Roof
Normal Capacity		Cap	gal	2,824,034
Diameter		D	ft	95.1
Shell Height or Length		H_S	ft	60.0
External Shell Color		SC_{Ext}		Aluminum/Diffuse
External Shell Paint Condition		PC_{Shell}		Good
Roof Color/Shade		RC		Aluminum/Diffuse
Roof Paint Condition		PC_{Roof}		Good
Tank Shell Solar Absorbance		α_{Shell}		0.60
Tank Roof Paint Solar Absorbance		α_{Roof}		0.60
Total Tank Paint Solar Absorbance	= (α_{Shell} + α_{Roof}) / 2 {Note A, Table 7.1-6}	α_{Tot}		0.60
Ideal Gas Constant,		R	psia ft^3 / lbmole °R	10.731
Ambient Pressure		P_A	psia	14.515
Rim-Seal System		$TK_{RimSeal}$		Mechanical-shoe/Shoe-mounted
Tank Fittings		$TK_{Fittings}$		Default

Floating Roof Parameters

Parameter Title	Notes	Parameter Symbol	Units	Value
Heated Tank?		HT		No
Liquid Bulk Temperature	Heated Tanks Only	T_B	Degrees F	--
Number of fixed roof support columns		N_{Col}		6
Effective Column Diameter	1.1 for 9" by 7" built-up column 0.7 for 8" diameter pipe column 1.0 for unknown pipe column	F_C	(col perimeter/π) ft	1.0
Internal Shell Condition		SC_{Int}		Light Rust
Tank Construction		TK_{Const}		--
Deck Type		TK_{Deck}		Welded
Total Length of Deck Seams		L_{Seam}	ft	--
Area of deck	= π * D^2 / 4 {Eqn. 2-9}	A_{deck}	ft^2	7,100.7
Deck Seam Length Factor	= L_{Seam} / A_{deck} {Eqn. 2-9} = 0.20 ft/ft^2 {5' wide sheet} = 0.17 ft/ft^2 {6' wide sheet} = 0.14 ft/ft^2 {7' wide sheet} = 0.33 ft/ft^2 {5' x 7.5' panels} = 0.28 ft/ft^2 {5' 12' panels} = 0.20 ft/ft^2 {most common type}	S_D	ft/ft^2	--
Deck Construction (IFR w/Bolted Decks Only)	Not applicable if L_{Seam} specified.	$TK_{DeckConst}$		--
Zero wind speed rim seal loss factor	AP-42 Table 7.1-8	K_{RA}	lb-mole/ft-yr	1.6
Wind speed dependent rim seal loss factor	AP-42 Table 7.1-8	K_{RB}	lb-mole/(mph)^n-ft-yr	0.3
Fitting Wind Speed Correction Factor	= 0.7 {EFR Tanks Only} = 0.0 {IFR and Domed EFR Tanks Only} {Eqn. 2-7}	K_V		0.0
Seal related wind speed exponent		n		1.6
Days per Year	For leap years, days = 366	t_{yr}	days/yr	366

Emission Summary

Annual Throughput, gal	**5,648,067**	**Annual**	**2.00**
Annual Emissions, tons	**0.01**	**Turnovers**	

Month	Normal Operation Loss, lbs	Emissions, tpy
Jan	0.00	0.000
Feb	0.00	0.000
Mar	0.00	0.000
Apr	0.00	0.000
May	0.00	0.000
Jun	0.00	0.000
Jul	16.48	0.008
Aug	0.00	0.000
Sep	0.00	0.000
Oct	0.00	0.000
Nov	0.00	0.000
Dec	0.00	0.0000

Note: The emission summary table is pulled into the Tank Emissions tab using cell references A31:B42. The emission summary must remain at this cell reference to function properly.

Calculations					1	2	3	4	5	6	7	8	9	10	11	12
Parameter Title	**Notes**	**Parameter Symbol**	**Units**	**Reference or Equation**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Service					**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**	**Main Service**
Type of Substance	Select Organic Liquid, Petroleum Distillate, or Crude Oil				--	--	--	--	--	--	Petroleum Distillate	--	--	--	--	--
Contents of Tank	Select from list (add new compounds in 'VOLs' tab):			= User specified	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Distillate fuel oil no. 2	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS	Empty - OOS
Speciation Profile	Select from list (add new in 'Speciation Input' tab):			= User specified	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)	Distillate Fuel Oil No. 2 (Diesel)
Speciation Profile Type				= User specified	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation	Partial Speciation
Monthly Throughput		Q	gal/month	= User specified	--	--	--	--	--	--	5,648,067	--	--	--	--	--
Days-In-Service	Input "0" for OOS	t_{IS}	days	= User specified	--	--	--	--	--	--	31	--	--	--	--	--
Shell Clingage Factor		C_S	bbl / 1000 ft^2	{Table 7.1-10}	--	--	--	--	--	--	0.0015	--	--	--	--	--
Total Deck Fitting Loss Factor	Eqn. 2-6	F_F	lb-mole/yr	= $[(N_{F1} * K_{F1}) + (N_{F2} * K_{F2}) + ... + (N_{Fnf} * K_{Fnf})]$ {Eqn. 2-6}	--	--	--	--	--	--	709.2	--	--	--	--	--
Daily Total Solar Insolation Factor		I	Btu / ft^2 day		--	--	--	--	--	--	2,248	--	--	--	--	--
Product Factor	Eqn. 2-3	K_C		= 0.4 {crude oils} = 1.0 {all other org. liquids}	--	--	--	--	--	--	1.0	--	--	--	--	--
Deck Seam Loss per Unit Seam Length Factor	Converted K_D into monthly emissions by scaling by the time in service for the month.	K_D	lb-mole / ft-month	= 0.0 {IFR Tank with welded deck and all EFR Tanks} = 0.14 * t_{IS} / t_{yr} {bolted deck}	--	--	--	--	--	--	0.000	--	--	--	--	--
Vapor Molecular Weight	When using full speciation profiles, calculated as the weighted average of the M of each component.	M_V	lb/lb-mole	= VOL data of tank contents {partial speciation} $M_V = \Sigma (M_{Vi} * (P_{VA,Tla}/P_{VA,Tla}))$	--	--	--	--	--	--	130.0	--	--	--	--	--
Liquid Molecular Weight		M_L	lb/lb-mole	$M_L = 1 / \Sigma (Z_{Li} / M_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	188.0	--	--	--	--	--
Liquid Density at 60 °F		W_L	lb/gal	= VOL data of tank contents {partial speciation} = $\Sigma (M_{Li} * Z_{Li})$ {full speciation, Eqn. 1-22}	--	--	--	--	--	--	7.10	--	--	--	--	--
Average Daily Minimum Ambient Temperature		T_{AN}	°F		--	--	--	--	--	--	55.20	--	--	--	--	--
Average Daily Maximum Ambient Temperature		T_{AX}	°F		--	--	--	--	--	--	75.20	--	--	--	--	--
Daily Average Ambient Temperature		T_{AA}	°F	= $(T_{AX} + T_{AN}) / 2$ {Eqn. 1-27}	--	--	--	--	--	--	65.20	--	--	--	--	--
Daily Average Liquid Surf. Temperature	Constant 0.0079 has units of (°R-ft^2-day/btu).	T_{LA}	°F	= $(0.44 * T_{AA}) + (0.56 * T_B) + (0.0079 * \alpha_{Tot} * I)$ {Eqn. 1-26}	--	--	--	--	--	--	77.31	--	--	--	--	--
Liquid Bulk Temperature	If T_B is unknown, see AP-42 7.1-23 Note 3. Not included here as T_B is always calculated.	T_B	degrees F	= specified by user {heated tanks only} = $T_{AA} + 6 * \alpha_{Tot} - 1$ {Eqn. 1-28}	--	--	--	--	--	--	67.80	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Surf. Temp.	Used for speciated emissions and most vapor pressures. $P_{VA,Tla}$ uses T_{LA}.	$P_{VA,Tla}$	psia	*{full speciation profiles, Eqn. 1-22}*: Sum of partial true vapor pressures components. *{partial/no speciation profiles}*: Vapor pressures at T (°F) based on P_{VA} values in VOLs tab at ΔT (°F) increments by interpolating between the P_{VA} values at the next highest/lowest T. $P_{VA,T} = (T - T_{Low}) / (T_{High} - T_{Low}) * (P_{VA,T,High} - P_{VA,T,Low}) + P_{VA,T,Low}$	--	--	--	--	--	--	0.0112	--	--	--	--	--
Vapor Pressure at Daily Av. Liquid Bulk Temp.	Used for vapor space expansion factor. $P_{VA,Tb}$ uses T_B.	$P_{VA,Tb}$	psia		--	--	--	--	--	--	0.0085	--	--	--	--	--
Vapor Pressure Function	Use T_B for calculating P_{VA} per Eqn. 2-3 Note 3.	P_I		= $(P_{VA,Tb} / P_A) / (1 + (1 - P_{VA,Tb} / P_A)^{0.5})^2$ {Eqn. 2-3}	--	--	--	--	--	--	0.0001	--	--	--	--	--
Average Ambient Wind Speed	Monthly Average	v	mph	= 0 {Domed EFR and all IFR tanks, Eqn. 2-3 Note 3}	--	--	--	--	--	--	0.0	--	--	--	--	--
Rim Seal Loss		L_R	lb/month	= $(K_{Ra} + K_{Rb} * v^n) * D * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn. 2-2}	--	--	--	--	--	--	0.24	--	--	--	--	--
Withdrawal Loss	Constant 0.943 has units of (1,000 ft^3 gal / bbl^2)	L_{WD}	lb/month	= $0.943 * (Q / (42 gal/bbl)) * C_S * W_L / D * (1 + (N_{Col} * F_C / D))$ {Eqn. 2-4}	--	--	--	--	--	--	15.10	--	--	--	--	--
Deck Fitting Loss		L_F	lb/month	= $F_F * P_I * M_V * K_C * t_{IS} / t_{yr}$ {Eqn 2-5}	--	--	--	--	--	--	1.14	--	--	--	--	--
Deck Seam Loss		L_D	lb/month	= 0 {welded IFR and all EFR tanks} = $K_D * S_D * D^2 * P_I * M_V * K_C$ {Eqn. 2-9}	--	--	--	--	--	--	0.00	--	--	--	--	--
Total Emission from Normal Operation		**L_T**	**lb/month**	**= $L_R + L_{WD} + L_F + L_D$ {Eqn. 2-1}**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**16.48**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Speciated Component Emissions	Species ID	Vapor MW M_{VI} (lb/lb-mol)	Annual Emissions	Monthly Emissions (lb/month) $L_{TI} = Z_{VI} * (L_R + L_F + L_D) + Z_{LI} * L_{WD}$											
Component Name			lb/yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hexane (-n)	1	86.17	0.01							0.01					
Benzene	2	78.11	0.03							0.03					
2,2,4-Trimethylpentane (isooctane)	3	114.23	0.00												
Toluene	4	92.13	0.04							0.04					
Ethylbenzene	5	106.17	0.01							0.01					
Xylenes (mixed isomers)	6	106.17	0.13							0.13					
Isopropyl benzene (Cumene)	7	120.2	0.00												
Methyl-tert-butyl ether (MTBE)	8	88.15	0.00												
1,2,4-Trimethylbenzene	9	120.19	0.22							0.22					
Cyclohexane	10	84.16	0.00												
Gasoline (RVP 13)	11	62	0.00												
Ethyl alcohol	12	46.07	0.00												
Acetaldehyde	13	44	0.00												
--	14														
--	15														
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