GUIDELINES AND EXAMPLES FOR MANUAL DATA INPUT OF LIQUID STORAGE TANKS

NOTE:

IN ADDITION TO VOC EMISSIONS, YOU MUST CALCULATE AND REPORT EMISSIONS OF TOXIC AIR CONTAMINANTS AND/OR OZONE DEPLETING COMPOUNDS (TAC/ODC) CONTAINED IN THE MIXTURE.

IF THE PRODUCT CONTAINS SOME TAC/ODC, REPORT THE VOC EMISSIONS ON ONE OF THE SPECIFIC TANK FORMS AND THE TAC/ODC FRACTIONS ON FORM TAC.

IF THE SOLVENT IN THE PRODUCT IS A PURE EXEMPT COMPOUND (NOT VOC) AND IS A TOXIC COMPOUND OR IS AN OZONE DEPLETER (i.e. METHYLENE CHLORIDE, PERCHLOROETHYLENE, 111-TRICHLOROETHANE, CFCs), REPORT ZERO VOC EMISSIONS ON FORM B4 OR B4U AND REPORT 100% TAC/ODC ON FORM TAC (SEE EXAMPLE 7).

The following examples will assist users in calculating and reporting **manually** calculated emissions from storage tanks on the correct forms.

Parameters and factors needed for the calculation can be found either in the "Help & Support" manual or in the "Supplemental Instructions for Liquid Organic Storage Tanks and References", Dec 2011.

Service Station With Fuel Storage and Dispensing System:

The California Air Resources Board has identified four major contributors to gasoline storage and refueling losses. The composite emission factor is comprised of the sum of working losses (L_w), breathing losses (L_s), refueling losses (L_{rf}), and spillage losses (L_{spill}) on a per 1,000 gallons throughput basis (Mgal) and uncontrolled:

$EF_{uncontrolled} = L_w + L_s + L_{rf} + L_{spill} = 9.5 + 1 + 10 + 0.7 = 21.2$ lb/Mgal

Through Phase 1 enhanced vapor recovery, the working (filling) losses are controlled by 98%. Breathing and refueling losses are controlled at 95%. Spillages are not controlled. Therefore,

$EF_{controlled} = (9.5)(1-0.98) + (1)(1-0.95) + (10)(1-0.95) + 0.7 =$ **1.44 lb VOC/Mgal**

THE DEFAULT EMISSION FACTOR FOR SERVICE STATION WITH GASOLINE STORAGE AND DISPENSING SYSTEM IS = 1.44 POUND VOC PER THOUSAND GALLONS OF FUEL DISPENSED.

The total losses (L_T) are a function of the controlled default emission factor and the throughput per 1000 gallons.

$L_T = (EF_{controlled})(Q)$

Gasoline contains benzene, a toxic air contaminant. The default emission factor for gasoline is 1% by weight of the VOC emissions and must be reported on Form TAC.

Example 1:
A service station delivered 1,500,000 gallons of gasoline last year. Calculate the annual emissions for the AER from the service station and include benzene TAC emissions.

L_T = (1.44 lb VOC/Mgal)(1,500 Mgal) = 2,160 lb VOC/yr

TAC = (0.01 lb benzene/lb VOC)(2,160 lb VOC/yr) = 21.60 lb benzene/yr

HOW TO REPORT

Use Form B4 to input the data.

- **Select the activity code of 2A from the drop down list,**
- **Select the unit code of 1000 gallons from its drop down list,**
- **Enter the throughput as 1500,**
- **Make sure to check the box for TAC (benzene),**
- **The rule number is 461,**
- **Enter the application number associated with the permit,**
- **Enter 1.44 as the emission factor for organic gasses,**
- **Enter emission factor of 0.0 for all other air contaminants,**
- **Add the record,**
- **Go to Form TAC and add the data for the toxic component of benzene.**

Default Organic Emission Factor for Diesel Storage and Dispensing **= 0.028 lb/Mgal**

Follow the similar procedures as above for diesel tank.

Underground Liquid Storage Tanks:

For other underground tanks, assume that no standing losses (breathing losses) occur (L_S = 0) because the insulating nature of the earth limits the temperature change. Underground tank is classified as fixed roof tank. Use the following equation to estimate working loss (total loss) for underground storage tanks.

$$L_W = 0.024 * M_V * P_{VA} * Q * K_N * K_P$$

Where:

L_W = working loss, lbs/yr

M_V = average vapor molecular weight, lb/lb-mole

[See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks" for vapor molecular weight of selected materials]

P_{VA} = true vapor pressure of stored liquid at average liquid surface temperature, psia

[See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks" for true vapor pressure of selected materials]

Q = annual throughput, Mgal/yr

K_N = turn over factor, dimensionless, dependent of annual throughput, Q *(Mgal/yr)*, and tank capacity, C *(Mgal)*. K_N is calculated as follows:

If $Q/C \leq 36$ then $K_N = 1.0$

If $Q/C > 36$ then

$$K_N = \frac{180 * C + Q}{6 * Q}$$

K_P = working loss product factor, dimensionless, K_P = 0.75 for **crude oil** and K_P = 1.0 for **other materials**

Example 2:

A 25,000 gallon underground storage tank contains ethyl acetate and has been filled 4 times throughout the year and remains a constant 50 degrees F. What are the annual emissions?

M_V = 88.1, lb/lb-mole

P_{VA} = 0.831 psia

Q = 100 Mgal/yr

Q/C = 100/25 = 4, which is less than 36, therefore

K_N = 1.0

K_P = 1.0

EF = (0.024 lb-mol/psia-Mgal)(88.1 lb/ lb mol)*(0.831 psia)*(1.0)*(1.0)*

= 1.757 lb VOC/Mgal

The total or working losses (L_W) are a function of the controlled default emission factor and the throughput per 1000 gallons.

*L_W = Q * EF = 100 Mgal/yr * 1.757 lb/Mgal = 1.757 lb VOC/yr*

HOW TO REPORT:

Select Form B4 in the web-based application

- **Enter the data on Form B4,**
- **Select the activity code of 2D from the drop down list,**
- **Select the unit code of 1000 gallons from its drop down list,**
- **Enter the throughput as 100.**
- **The rule number is 463.**
- **Do not check the TAC/ODC box.**
- **Enter the application number associated with the permit.**
- **Enter 1.757 as the emission factor for organic gasses,**
- **Enter an emission factor of 0.0 for all other air contaminants, and**
- **Add the record.**

Aboveground Small Liquid Storage Tanks:

A small liquid storage tank is defined as a tank with a ***storage capacity of less than 10,000 gallons and operated at ambient temperature and pressure***. Total emissions or losses from small tanks are equal to the sum of the working losses and standing losses:

$$L_T = L_W + L_S = Q * EF_{Total} = EF_{Standing} + EF_{Working}$$

Where:

L_S = standing loss, lbs/yr

L_W = working loss, lbs/yr

$$EF_{Total} = \frac{a * \left(\frac{H * D^2}{Q} \right)}{\left[1 + (b * H) \right]} + f$$

a, b = small tank standing loss factors (*See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks"*)

f	=	small tank working loss factors (*See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks"*)
H	=	tank height, ft
D	=	tank diameter, ft
Q	=	annual tank throughput, Mgal/yr

Example 3:
An aboveground 8,500 gallon storage tank with a diameter of 8 feet and height of 7 feet contains THF. The annual throughput is 20,000 gallons for the tank which is vented to a control device that operates continuously at 90% control. Calculate the annual losses.

a	=	0.347
b	=	0.062
f	=	4.019
H	=	7 ft
D	=	8 ft
Q	=	20 Mgal/yr

$$EF_{controlled} = \left[\frac{0.347 * (\frac{7 * 8^2}{20})}{[1 + (0.062 * 7)]} + 4.019 \right] * (1 - 0.90) = 0.944\ lb / Mgal$$

HOW TO REPORT

Select Form B4 in the web-based application

- **Select the activity code of 2D from the drop down list,**
- **Select the unit code of 1000 gallons from its drop down list,**
- **Enter the throughput as 20,**
- **The rule number is 463.**
- **Do not check the TAC/ODC box,**
- **Enter the application number associated with the permit,**
- **Enter 0.944 as the emission factor for organic gasses,**
- **Enter an emission factor of 0.0 for all other air contaminants, and**
- **Add the record.**

The emissions are calculated as:

L_T = *0.944 lb/Mgal * 20 Mgal/yr = 18.88 lbs VOC/yr*

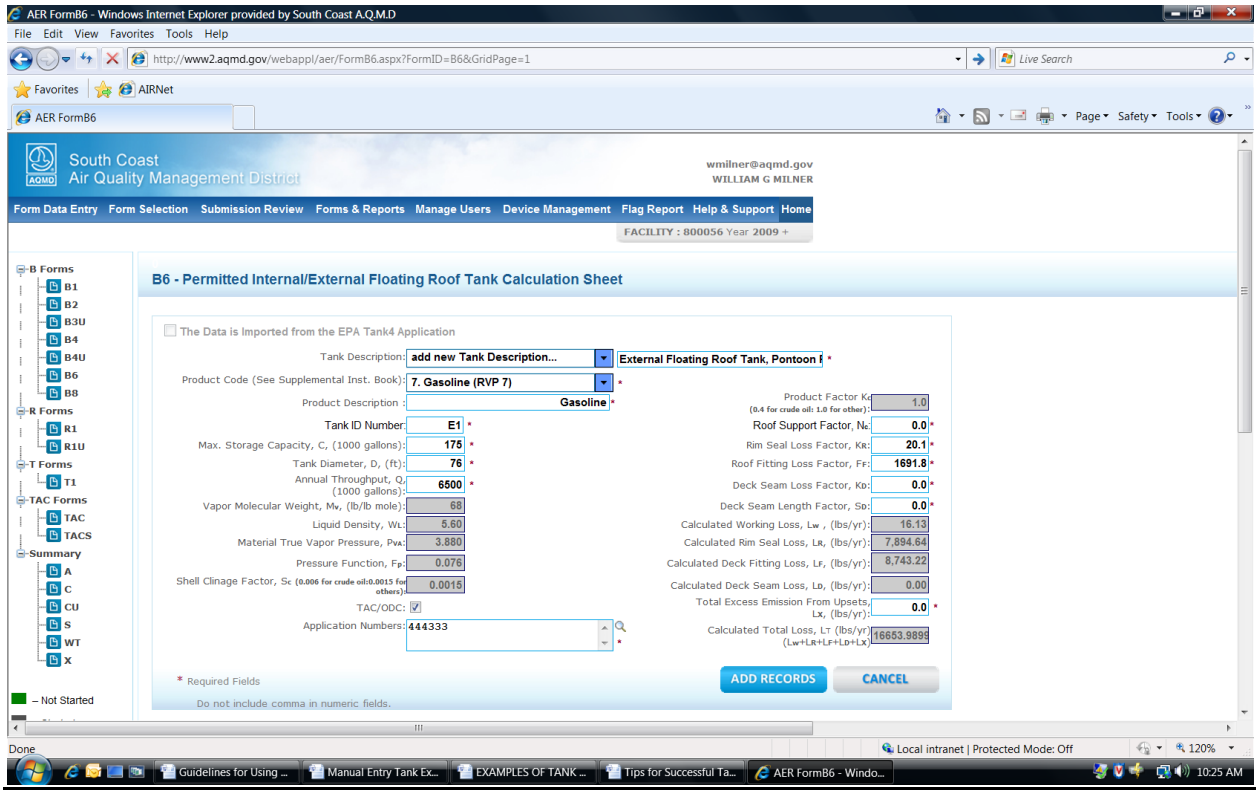
Internal Floating Roof Tanks (Form B6)

Example 4:
An external floating roof tank 76 feet in diameter is made of welded steel with a capacity of 175,000 gallons and has a pontoon-type roof. The tank was used all year to store 6,500,000 gallons of gasoline (RVP 7). The noted Appendix 2 is found in the Supplemental Instructions for Liquid Organic Storage Tanks and References.

Avoid all comma separators when entering data.

Step1:	Select Form B6 in the AER web-based application in Form Data Entry	
Step 2.	Click the down arrow and select "add new Tank Description"	
Step 3.	Wait for pop-up box and enter in the tank description as an internal floating roof tank with a bolted deck	
Step 4.	Click down arrow and select the product code from the list	
Step 5.	Enter product description as crude oil	
Step 6.	Enter tank ID	E1
Step 7.	Enter tank capacity, C, in 1,000 of gallons (Mgal)	175
Step 8.	Enter tank diameter, D, (ft)	76
Step 9.	Enter annual throughput, Q, in 1,000 of gallons (Mgal)	6500
Step 10.	Check the TAC/ODC box (gasoline contains toxic compounds)	
Step 11.	Fill in the associated application no. or click on the magnifying glass and select the application number with a check mark, select O.K.	
Step 12.	Enter the roof support factor, N_C [Appendix 2]	0.0
Step 13.	Enter rim-seal loss factor, K_R [Appendix 2]	20.1
Step 14.	Enter total roof fitting loss factor, F_F [Appendix 2]	1691.8
Step 15.	Enter deck seam loss factor, K_D [Appendix 2]	0.0
Step 16.	Enter deck seam length factor, S_D [Appendix 2]	0.0
Step 17.	Enter evaporative loss from upset, L_x (lb), no upset losses	0.0

All other necessary factors and calculations are provided for you.
Do not forget to add the toxic air contaminant(s) to Form TAC.


AER FormB6 - Windows Internet Explorer provided by South Coast A.Q.M.D
South Coast
Air Quality Management District
wmilner@aqmd.gov
WILLIAM G MILNER
Form Data Entry
Form Selection
Submission Review
Forms & Reports
Manage Users
Device Management
Flag Report
Help & Support
Home
FACILITY : 800056 Year 2009
B6 - Permitted Internal/External Floating Roof Tank Calculation Sheet
The Data is Imported from the EPA Tank4 Application
Tank Description:
add new Tank Description...
External Floating Roof Tank, Pontoon R
Product Code (See Supplemental Inst. Book):
7. Gasoline (RVP 7)
Product Description :
Gasoline
Tank ID Number:
E1
Max. Storage Capacity, C, (1000 gallons):
175
Tank Diameter, D, (ft):
76
Annual Throughput, Q, (1000 gallons):
6500
Vapor Molecular Weight, Mv, (lb/lb mole):
68
Liquid Density, WL:
5.60
Material True Vapor Pressure, Pva:
3.880
Pressure Function, Fp:
0.076
Shell Clinage Factor, Sc
0.0015
TAC/ODC:
Application Numbers:
444333
Product Factor Kc
1.0
Roof Support Factor, Ns:
0.0
Rim Seal Loss Factor, Kr:
20.1
Roof Fitting Loss Factor, Ff:
1691.8
Deck Seam Loss Factor, Kd:
0.0
Deck Seam Length Factor, Sd:
0.0
Calculated Working Loss, Lw , (lbs/yr):
16.13
Calculated Rim Seal Loss, LR, (lbs/yr):
7,894.64
Calculated Deck Fitting Loss, LF, (lbs/yr):
8,743.22
Calculated Deck Seam Loss, LD, (lbs/yr):
0.00
Total Excess Emission From Upsets, Lx, (lbs/yr):
0.0
Calculated Total Loss, LT (lbs/yr) (Lw+LR+LF+LD+Lx)
16653.9895
* Required Fields
Do not include comma in numeric fields.
ADD RECORDS
CANCEL
B Forms
B1
B2
B3U
B4
B4U
B6
B8
R Forms
R1
R1U
T Forms
T1
TAC Forms
TAC
TACS
Summary
A
C
CU
S
WT
X
– Not Started
Done
Local intranet | Protected Mode: Off
120%
10:25 AM

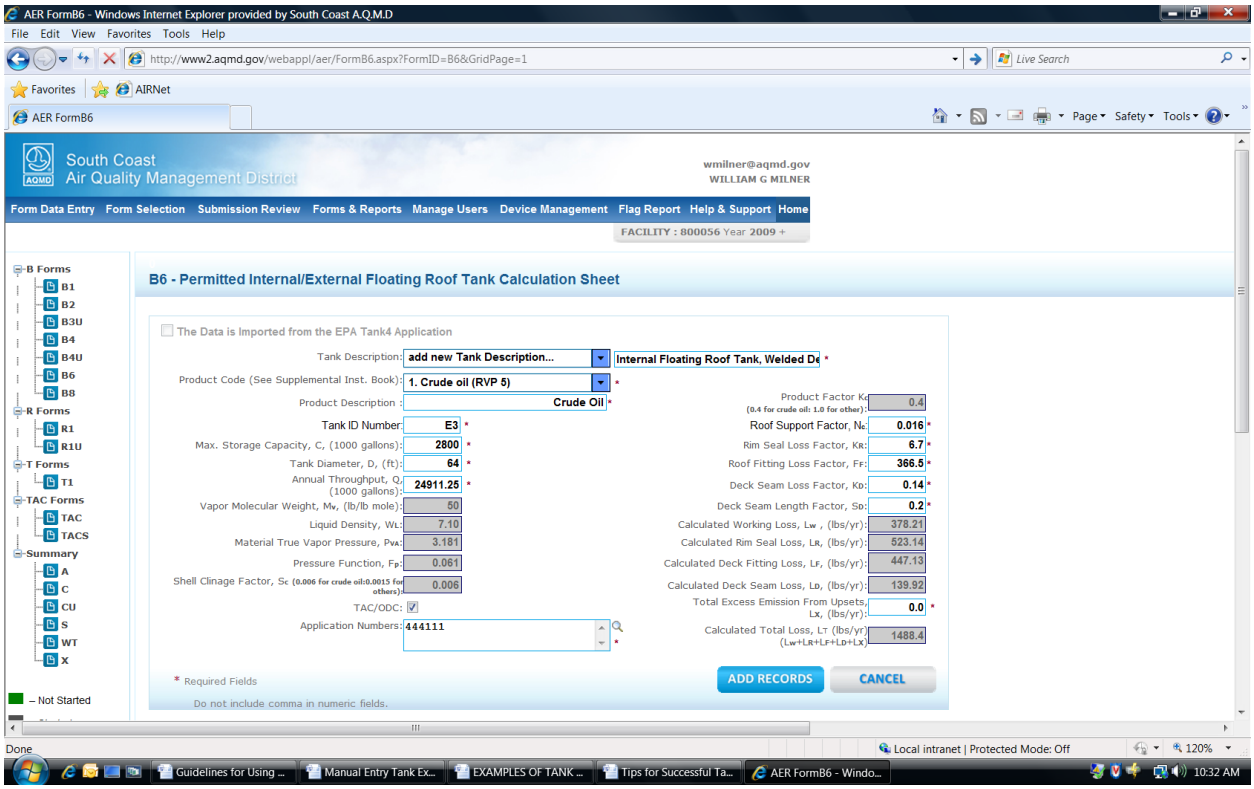
Internal Floating Roof Tanks (Form B6)

Example 5:
An internal floating roof tank with a vapor-mounted resilient seal (primary seal) and rim-mounted secondary seal in good condition is 64 feet in diameter. The tank is lightly rusted and covered by a welded steel deck. Stored product: Crude Oil; 593,125 bbl throughput for the reporting period (42 gals/bbl * 593,125 bbl = 24,911,250 gal). Maximum Tank Capacity for this tank is 2,800,000 gallons. The tank was used to store crude oil all year. The noted Appendix 2 is found in the Supplemental Instructions for Liquid Organic Storage Tanks and References.

Avoid all comma separators when entering data.

Step1:	Select Form B6 in the AER web-based application in Form Data Entry	
Step 2.	Click the down arrow and select "add new Tank Description"	
Step 3.	Wait for pop-up box and enter in the tank description as an internal floating roof tank with a bolted deck	
Step 4.	Click down arrow and select the product code from the list	
Step 5.	Enter product description as crude oil	
Step 6.	Enter tank ID	E3
Step 7.	Enter tank capacity, C, in 1,000 of gallons (Mgal)	2800
Step 8.	Enter tank diameter, D, (ft)	64
Step 9.	Enter annual throughput, Q, in 1,000 of gallons (Mgal)	24911.25
Step 10.	Check the TAC/ODC box (crude oil contains toxic compounds)	
Step 11.	Fill in the associated application no. or click on the magnifying glass and select the application number with a check mark, select O.K.	
Step 12.	Enter the roof support factor, N_C [Appendix 2]	0.016
Step 13.	Enter rim-seal loss factor, K_R [Appendix 2]	6.7
Step 14.	Enter total roof fitting loss factor, F_F [Appendix 2]	366.5
Step 15.	Enter deck seam loss factor, K_D [Appendix 2]	0.14
Step 16.	Enter deck seam length factor, S_D [Appendix 2]	0.20
Step 17.	Enter evaporative loss from upset, L_x (lb), no upset	0.0

All other necessary factors and calculations are provided for you.
Do not forget to add the toxic air contaminant(s) to Form TAC.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Form Data Entry
Form Selection
Submission Review
Forms & Reports
Manage Users
Device Management
Flag Report
Help & Support
Home
FACILITY : 800056 Year 2009
B6 - Permitted Internal/External Floating Roof Tank Calculation Sheet
The Data is Imported from the EPA Tank4 Application
Tank Description:
add new Tank Description...
Internal Floating Roof Tank, Welded D
Product Code (See Supplemental Inst. Book):
1. Crude oil (RVP 5)
Product Description :
Crude Oil
Tank ID Number:
E3
Max. Storage Capacity, C, (1000 gallons):
2800
Tank Diameter, D, (ft):
64
Annual Throughput, Q, (1000 gallons):
24911.25
Vapor Molecular Weight, Mv, (lb/lb mole):
50
Liquid Density, WL:
7.10
Material True Vapor Pressure, Pva:
3.181
Pressure Function, Fp:
0.061
Shell Clinage Factor, Sc
0.006
TAC/ODC:
Application Numbers:
444111
Product Factor Kc
0.4
Roof Support Factor, Ns:
0.016
Rim Seal Loss Factor, Kr:
6.7
Roof Fitting Loss Factor, Ff:
366.5
Deck Seam Loss Factor, Kd:
0.14
Deck Seam Length Factor, Sd:
0.2
Calculated Working Loss, Lw , (lbs/yr):
378.21
Calculated Rim Seal Loss, LR, (lbs/yr):
523.14
Calculated Deck Fitting Loss, LF, (lbs/yr):
447.13
Calculated Deck Seam Loss, LD, (lbs/yr):
139.92
Total Excess Emission From Upsets, Lx, (lbs/yr):
0.0
Calculated Total Loss, LT (lbs/yr) (Lw+LR+LF+LD+Lx)
1488.4
* Required Fields
Do not include comma in numeric fields.
ADD RECORDS
CANCEL
B Forms
B1
B2
B3U
B4
B4U
B6
B8
R Forms
R1
R1U
T Forms
T1
TAC Forms
TAC
TACS
Summary
A
C
CU
S
WT
X
– Not Started
Done
Local intranet | Protected Mode: Off
120%
10:32 AM

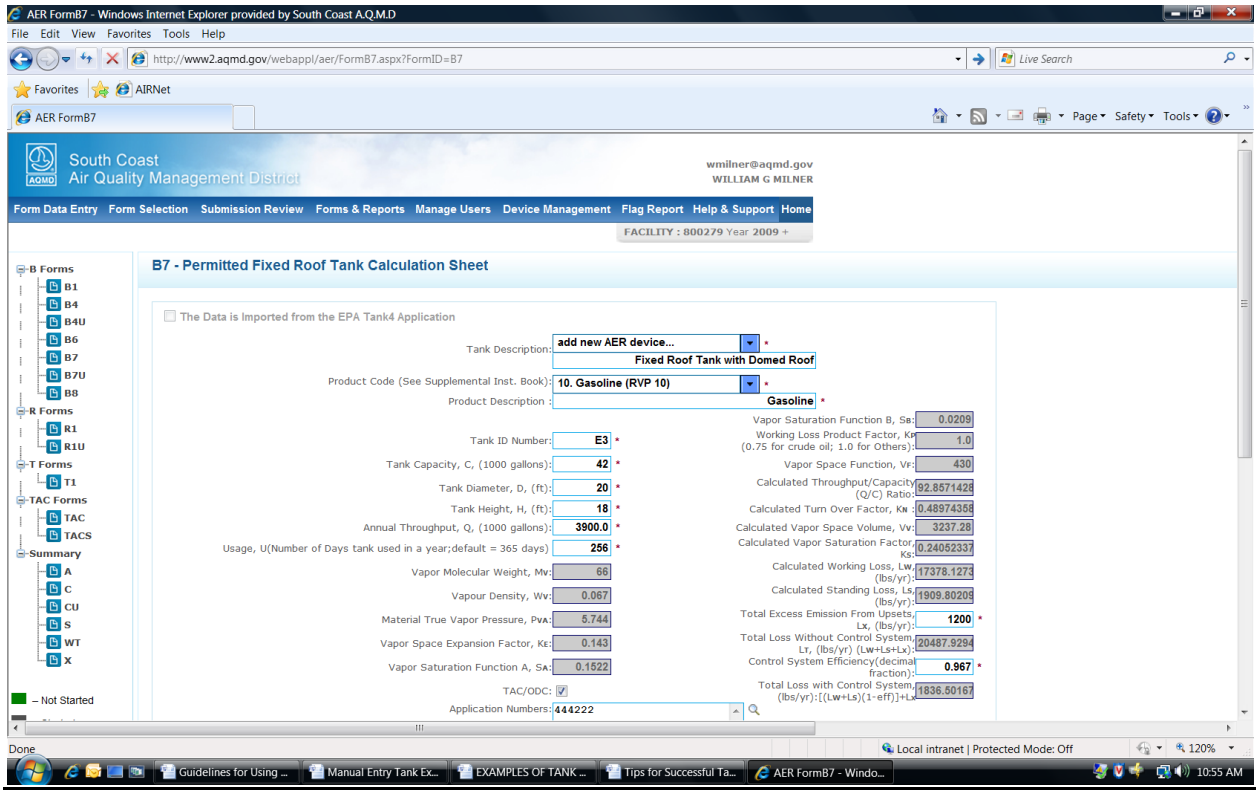
Fixed Roof Tanks (Form B7)

Example 6:
A fixed roof domed tank; 20 ft in diameter and 18 feet tall, is in good condition and stores 3,900,000 gallons of gasoline (RVP 10) for the reporting period. Tank capacity is 42,000 gallons (42 Mgal). The tank was used to store gasoline 256 days in a year and controlled by a vapor recovery system at 96.7 percent efficient. During this reporting period, an upset in the process caused an evaporative loss of 1,200 pounds of gasoline.

Avoid all comma separators when entering data.

Step 1:	Select Form B7 in the AER web-based application in Form Data Entry	
Step 2.	Click the down arrow and select “add new AER device”	
Step 3.	Wait for pop-up box and type in the tank description as a domed tank	
Step 4.	Click down arrow and select the product code from the list	
Step 5.	Enter product description as gasoline	
Step 6.	Enter tank ID	E3
Step 7.	Enter tank capacity, C, in 1,000 of gallons (Mgal)	42.0
Step 8.	Enter tank diameter, D, (ft)	20.0
Step 9.	Enter tank height, H, (ft)	18.0
Step 10.	Enter annual throughput, Q, in 1,000 of gallons (Mgal)	3900.0
Step 11.	Enter the number of days of use, U	256
Step 12.	Check the TAC/ODC box (gasoline is toxic)	
Step 13.	Fill in the associated application no. or click on the magnifying glass and select the application number with a check mark, select O.K.	
Step 14.	Enter evaporative loss from upset, L_x (lb)	1200
Step 15.	Enter the control system efficiency in decimal form	0.967

All other necessary factors and calculations are provided for you.
Do not forget to add the toxic air contaminant(s) to Form TAC.



Emissions from Storage of Non-VOC Pure Exempt and Toxic Materials

For a products that is a pure exempt compound and is toxic, use an appropriate example from above (underground, aboveground, floating or fixed roof) to determine the toxic emissions. Organic gasses will be zero. Example 7 provides sample methodology.

Example 7:

An aboveground 8,500 gallon storage tank with a diameter of 8 feet and 7 ft high contains methylene chloride and undergoes 5 changes per year. It is vented to a control device that operates continuously at 90% control. Calculate the annual losses.

a = 2.636 (*See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks"*)

b = 0.168 (*See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks"*)

f = 12.912 (*See Appendix 1 in "Supplemental Instructions for Liquid Organic Storage Tanks"*)

Q = 8.5 Mgal * 5 = 42.5 Mgal/yr

H = 7 ft

D = 8 ft

$$EF_{controlled} = \left[\frac{2.636 * (\frac{7 * 8^2}{42.5})}{[1 + (0.168 * 7)]} + 12.912 \right] * (1 - 0.90) = 2.568\ lb / Mgal$$

HOW TO REPORT

Select Form B4 in the web-based application

- **Select the activity code of 2D from the drop down list,**
- **Select the unit code of 1000 gallons from its drop down list,**
- **Enter the throughput as 42.5,**
- **The rule number is 463.**
- **Check the TAC/ODC box,**
- **Enter the application number associated with the permit,**
- **Enter an emission factor of 0.0 for all air contaminants including VOC, and**
- **Add the record.**

Go to Form TAC and:

1. Select the TAC Row for Form B4 with row number containing the tank as described above
2. Select the TAC Code as number 16 (Methylene Chloride)
3. Enter the Annual Usage as 42.5 Mgal
4. Select the Units number 4 (1000 gallons)
5. Enter the Application Number associated with the permit
6. Enter the Controlled Emission Factor as 2.568 lb/Mgal
7. Enter the Control Efficiency as 0.0 (the emission factor already includes the effects of control)

The emission is calculated as

*2.568 lb/Mgal * 42.5 Mgal/yr = 109.14 lbs Methylene Chloride per year*