VERTICAL FIXED ROOF
ORGANIC LIQUID STORAGE
TANK SUMMARY FORM-04A

(This form must be submitted for each equipment item)

GENERAL

1. Manufacturer: _____ Model No.: _____

2. Serial No.: _____ Operator Id: _____

SCC No: _____
(Leave blank if not known)

3. Type of Organic Liquid Stored: *(Check one)*

☐ Crude Oil ☐ Diluent ☐ Wastewater ☐ Other _____

4. Primary Use: *(Check one)*

☐ Storage Tank ☐ Diluent Storage ☐ Wastewater storage
☐ Test Tank ☐ LACT Tank ☐ Reject Tank
☐ Wash Tank ☐ Other *(Describe)* _____

5. Reason for Application:

☐ New Tank ☐ Alteration to Tank
☐ Increase in Throughput ☐ Change Liquid Stored
☐ Non-Routine Replacement ☐ Other _____

6. Location at Plantsite (brief description of exact location):

_____

_____

_____

_____ _____
Company Name *Facility Name*

_____ _____
Person Completing This Form (please print) *Date*

7. Attach a list of all electric motors (by purpose and horsepower) used in conjunction with the tank.

Horsepower	Purpose

8. Tank Detail: Please fill in Table 1, **Vertical Fixed Roof Storage Tank Contents Data**, completely. Also, refer to the District's Excel Spreadsheet and its availability on the Internet.

EMISSION CONTROL DEVICES

9. Are Emission Control Devices Used?

☐ YES: Complete Supplemental Information Section ☐ NO

Type That Applies	Supplemental Information Form
☐ Vapor Recovery Compressor (VRC)	APCD-04A
☐ A Vapor Incinerator (VI)	APCD-04B
☐ Other (Describe fully; provide P&IDs, Process Flow Diagrams, and process Descriptions)	

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Table 1.
VERTICAL FIXED ROOF STORAGE TANK CONTENTS DATA
(Reference AP-42, Chapter 7, 2/96 version)

GENERAL INFORMATION				Crude Oil Default Values
1	Tank Number			
2	Tank Description			Crude Oil Separation/Storage
4	Tank SCC Number			4-04-003
6	Tank Location			
7	Expected Start Date			
8	Permit Exempt per Rule 202?			no
9	Specific Rule 202 Exemption			
DEVICE SPECIFIC INFORMATION		Symbol		
1	Tank Construction (Bolted/Welded)			bolted
2	Connected to a Vapor Recovery System? (yes/no) If yes, please complete attached supplemental forms A-B as they apply.			
3	Service/Use			Crude oil storage/processing
4	Liquid Stored			Crude oil
5	Tank Capacity, Barrels			
6	Roof Type: Cone or Dome			cone
7	Paint Color (Shell and Roof)			medium gray
8	Paint Condition (Shell and Roof)			good
9	Tank Heated (yes/no)			yes
10	Tank Temperature (^{0}F)			180
11	Upstream Pressure,psig			
12	API Gravity			
13	Tank Diameter, Feet	D		
14	Roof Height, Feet	H_R		1.0
15	Shell Height, Feet	H_S		
16	Average Liquid Height (Feet)	H_L		1/2 shell height
17	Vapor Space Outage (Feet)	H_{VO}		***see note 1.***
18	Roof Outage (Feet)	H_{RO}		***see note 1.***
19	Tank Paint Solar Absorptance, (Shell)	α		0.68
20	Tank Paint Solar Absorptance, (Roof)	α		0.68
21	Solar Insolation Factor, = (Btu/ft^2 day)	I		1608.00

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Table 1. (Continued)
VERTICAL FIXED ROOF STORAGE TANK CONTENTS DATA
(Reference AP-42, Chapter 7, 2/96 version)

	DEVICE SPECIFIC INFORMATION	Symbol		Crude Oil Default Values
22.	Vapor Molecular Weight (lb/lb-mole)	M_V		50
23.	True Vapor Pressure (psia) at Tank Storage Temperature.	P_{VA}		
24.	Daily Throughput (barrels/day)	Q_1		
25.	Annual Net Throughput (Barrels/Year)	Q_2		
26.	Vapor Recovery Efficiency	eff		
27.	Vapor Reactivity (ROC/THC): Working and Breathing Loss	ROC_1		0.885
28.	Vapor Reactivity (ROC/THC): Flashing Loss	ROC_2		0.308
29.	Ideal Gas Constant (psia-ft^3/lb-mole-R)	R		10.731
30.	Vapor Density (lb/ft^3)	W_V		***see note 2***
31.	Gas Oil Ratio (scf/bbl)	GOR		
32.	Daily Average Liquid Surface Temp (^{0}R) for an Unheated tank	T_{LA}		
33.	Daily Average Liquid Surface Temp (^{0}R) for a Heated Tank	T_{LA}		
34.	Vapor Space Expansion Factor	K_E		
35.	Daily Vapor Temperature Range	ΔT_V		***see note 3***
36.	Daily Vapor Pressure Range (psia)	ΔP_V		***see note 4***
37.	Breather Vent Pressure Setting (psi)	ΔP_B		0.06
38.	Atmospheric Pressure (psia)	P_A		14.7
39.	Vented Vapor Saturation Factor	K_S		***see note 5***
40.	Vapor Space Expansion factor			***see note 6***
41.	Turnovers	N		***see note 7***
42.	Turnover Factor	K_N		***see note 8***
43.	Working Loss Product Factor	K_P		0.75
44.	Operating Schedule, Hours/Day	OPH		24
45.	Operating Schedule, Hours/Quarter	OPQ		2190
46.	Operating Schedule, Hours/Years	OPA		8760
47.	Standing Storage Loss (lbs/day)	L_S		***see note 9***
48.	Standing Storage Loss (TPY)	L_S		***see note 9***
49.	Working Loss (lbs/day)	L_W		***see note 10***
50.	Working Loss (TPY)	L_W		***see note 10***
51.	Flashing Loss (lbs/day)	L_F		***see note 11***
52.	Flashing Loss (TPY)	L_F		***see note 11***

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TANK SUMMARY FORM-04A

Table 1. (Continued)
VERTICAL FIXED ROOF STORAGE TANK NOTES
(Reference AP-42, Chapter 7, 2/96 version)

Note 1: Vapor Space and Roof Outage
Determines average height of roof above shell walls. Algorithm depends on whether tank roof is conical or domed.
Equations 1-4, 1-6 and 1-7, AP-42, Chapter 7.1
Algorithm:
For cone roof tanks:
Tank Roof Height × 1/3
For dome roof tanks:
Tank Roof Height × (1/2 + 1/6 × (Roof Height ÷ Tank Shell radius)^2)

Note 2: Vapor Density
Equation 1-9, AP-42, Chapter 7.1, Storage of Organic Liquids
Algorithm:
(Molecular Weight × True Vapor Pressure) ÷ (10.731 × Daily Average Surface Temperature)

Note 3: Diurnal Vapor Temperature Range
Equation 1-17, AP-42, Chapter 7.1, Storage of Organic Liquids. Assuming diurnal ambient temperature range of 23° F and solar insolation of 1608Btu/square foot-day as per Table 7.1-7, entry for Santa Maria, California.
Algorithm:
16.56 + (45.02 × Paint Factor)

Note 4: Daily Vapor Pressure Range
Equation 1-19, AP-42, Chapter 7.1, Storage of Organic Liquids
Algorithm:
0.5 × (7261 - 1216 × ln (Reid Vapor Pressure)) ×
True Vapor Pressure × Diurnal Vapor Temperature Range ÷ (Daily Average Liquid Surface Temperature (^{0}R))^2

Note 5: Vented Vapor Saturation Factor
Equation 1-22, AP-42, Chapter 7.1, Storage of Organic Liquids
Algorithm:
1 ÷ (1 + (0.053 × True Vapor Pressure × (Shell Height - Liquid Height + Roof Outage)))

Note 6: Vapor Space Expansion Factor
Equation 1-16, AP-42, Chapter 7.1, Storage of Organic Liquids
Algorithm:
(Daily Vapor Temperature Range ÷ Daily Average Liquid Surface Temperature) + ((Daily Vapor Pressure Range - Breather Vent Pressure Range (psi)) ÷ (14.7 - True Vapor Pressure))

Note 7: Turnovers
Divides throughput by tank capacity
Algorithm:
Throughput ÷ Tank Capacity

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VERTICAL FIXED ROOF STORAGE TANK NOTES (Continued)
(Reference AP-42, Chapter 7, 2/96 version)

Note 8: Turnover Factor: See Figure 7.1-18
Equation 1-24, AP-42, Chapter 7.1, Storage of Organic Liquids
Algorithm:
if Turnovers < 36: 1
if Turnovers > 36:
(Turnovers + 180) ÷ (6 × Turnovers)

Note 9: Breathing Loss (lbs/day & tons/year)
Equation 1-2, AP-42, Chapter 7.1, Storage of Organic Liquids.
Algorithms:
365 × Vapor Space Volume × Vapor Density × Vapor Expansion Factor × Vapor Saturation Factor ÷ 2000 = TPY
24 × Vapor Space Volume × Vapor Density × Vapor Expansion Factor × Vapor Saturation Factor = lbs/day
Controlled Breathing Loss = (0.05 × Breathing Loss) for tanks with vapor recovery.

Note 10: Working Loss (lbs/day & tons/year)
Equation 1-23, AP-42, Chapter 7.1, Storage of Organic Liquids. Assumes no workings for wash tanks.
Algorithm:
if (Tank Type = Wash , 0,
0.001 × Molecular Weight × True Vapor Pressure × (Annual throughput in barrels) × Turnover Factor × Product Factor ÷ 2000) = TPY
0.001 × Molecular Weight × True Vapor Pressure × (Daily throughput in barrels) × Turnover Factor × Product Factor) = lbs/day
Controlled Working Loss = (0.05 × Working Loss) for tanks with vapor recovery.

Note 11: Flashing Loss (lbs/day & tons/year)

Reference District Flashing Loss Protocol.

VERTICAL FIXED ROOF
ORGANIC LIQUID STORAGE
Form A. Supplemental Information for Vapor Recovery Compressors (VRCs)

1. ☐ Is the VRC new?
2. ☐ Is the VRC an existing permitted item of equipment?

PTO #_____
Equipment Item #_____

Design Information.

3. Gas flow rate design capacity in standard cubic feet per minute? _____ Scfm

_____ (Min) Scfm

_____ (Max) Scfm

4. Gas composition used for vapor recovery design? *(Attached a separate sheet)*

5. Gas specific gravity? _____ (air = 1.00)

6. Daily and annual throughput data? _____ (scf/day) design
_____ (scf/year) design

_____ (scf/day) actual
_____ (scf/year) actual

7. Crude oil API gravity and true vapor pressure? _____ ^{0} API _____ psia @ _____ ^{0}F Design

_____ ^{0} API _____ psia @ _____ ^{0}F Actual

8. Suction Pressure? _____ _____ (Min/Max)

9. Suction Temperature? _____ _____ (Min/Max)

10. Discharge Temperature? _____ Max _____ After cooling

11. Discharge Pressure? _____ _____ (Min/Max)

12. Discharge relief valve set at_____ oz/sq. inch

13. Tank pressure relief valve set at_____ oz/sq. inch

14. Compressor unit starts at _____ oz/sq. inch tank pressure

15. Partial bypass open at_____ oz/sq. inch tank pressure

16. Full bypass opens at _____ oz/sq. inch tank pressure

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Form A. Supplemental Information for Vapor Recovery Compressors (VRCs)

17. Recycle timer set at_____ minutes

18. Compressor unit stops at _____ oz/sq. inch tank pressure

19. Gas blanket closed at _____ oz/sq. inch tank pressure

20. Gas blanket full open at _____ oz/sq. inch tank pressure

21. Tank vacuum relief set at_____ oz/sq. inch tank pressure

22. What is the size of the vapor recovery piping?_____ Inner diameter in inches

23. How is the suction pressure on the VRC controlled:

- ☐ The VRC discharge recycles back to the suction of the VRC
- ☐ Low pressure, or high vacuum shuts down the VRC
- ☐ Gas makeup on high vacuum or low pressure
- ☐ Other (Describe fully through P&IDs, Process Flow Diagrams, and process Descriptions)

24. Is the VRC suction pressure monitored by:

- ☐ A pressure gauge
- ☐ A pressure alarm system
- ☐ A pressure indicator/recorder system
- ☐ Other (describe)

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Form B. Supplemental Information for Vapor Incinerators (VIs)

1. ☐ Is the VI new?

2. ☐ Is the VI an existing permitted item of equipment?

   PTO #_____
   Equipment Item #_____

3. The VI is:

   ☐ An open pipe flare

   ☐ An enclosed thermal oxidizer

   ☐ A process heater

   ☐ A process boiler

   ☐ Other (Describe)

4. What is the rated design capacity in standard cubic feet per minutes (scfm)? _____scfm

5. What is the rated design capacity in actual cubic feet per minutea (cfm)?
   Acfm @ _____ ^{0}F and _____psia

6. What is the maximum VI inlet vapor delivery pressure? _____psia

7. What is the lowest direct-to-atmosphere pressure relief setpoint for any of the equipment serviced by the VI?

   (units of pressure) ☐ psia ☐ psig ☐ inches of water

8. Is the VI suction pressure monitored by:

   ☐ A pressure gauge

   ☐ A pressure alarm system

   ☐ A pressure indicator/recorder system

   ☐ Other (describe)

9. Please provide a completed APCD Form-33 (External Combustion) for the vapor incinerator