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ESTIMATION OF THE PETROCHEMICAL EVAPORATION LOSS FROM FIXED ROOF STORAGE TANK

SAMPLE CALCULATION FOR ISO-OCTANE STORAGE TANK

DATA OF TANK AND CONTENT

1.	Internal diameter of the tank	D	= 36 m	= 118 ft
2.	Straight height of the tank	H	= 15.875 m	= 52 ft
3.	Tank content	ISO-OCTANE [$(CH_3)_3CCH_2CH(CH_3)_2$]		
4.	Average daily ambient temperature	T	= 85 ºF = 29.3 ºC	
5.	Average daily ambient temperature change	ΔT	= 20 ºF = 11.1 ºC	
6.	True vapor pressure of isooctane at 90 ºF	P	= 1.392 psia (Ref.no.1 – page no.10)	
	(Assume liquid surface is 5 ºF above average ambient temperature)			
7.	Average outage	H_o	= 26 ft	
	(Assume average outage = ½ tank height)			
8.	Turnovers per year	K_T	= 36	
9.	Paint factor (assumed)	F_P	= 1.3	
10.	Adjustment factor for small-diameter tanks	C	= 1	
	(C is unity for tanks 30 ft in diameter or larger.)			

CALCULATION OF BREATHING LOSSES PER YEAR

Referring to the (Ref. no.1, equation (5) of page no.7), the breathing losses per year, L_y, is given by as following:-

$$L_y = \frac{24}{1000}\times\left(\frac{P}{14.7-P}\right)^{0.68}\times D^{1.73}\times H_O^{0.51}\times\Delta T^{0.5}\times F_P\times C$$

$$= \frac{24}{1000}\times\left(\frac{1.392}{14.7-1.392}\right)^{0.68}\times 118^{1.73}\times 26^{0.51}\times 20^{0.5}\times 1.3\times 1$$

= 608 bbl per year

= 608 bbl * 42 gal / bbl = **25536 gallon / year**

CALCULATION FOR WORKING LOSSES PER YEAR

Referring to the (Ref. no.1 equation (6) of page no.7), the breathing losses per year, F, is given by as following:-

Tank Capacity, $V = \left[\frac{\pi}{4}\times 118^2\times 52\right]\times\frac{7.48}{42} = 101277$ bbl

$$F = \left(\frac{3PV}{10000}\right) \times K_T = \frac{3 \times 1.392 \times 101277}{10000} \times 36$$

= 1523 bbl per year

= 1523 bbl * 42 gal / bbl = **63966 gallon / year**

CALCULATION FOR TOTAL EQUIVALENT LOSS OF GASOLINE, L_g

Then equivalent loss of gasoline is given by as follows:-

$L_g = L_y + F = 25536 + 63966 =$ **89502 gal / year**

CALCULATION FOR LOSS OF ISO-OCTANE PER YEAR, L

Referring to the (Ref. no.1 equation (4) of page no.7), the loss of ISO-OCTANE can be calculated as following:-

$$L = \left(\frac{0.08M}{W}\right) L_g$$

Where, M/W = 19.713 (Gal per lb-Mole) (Ref.no.1 page no.7)

Then, $L = 0.08 \times 19.713 \times 89502 = 141148$ gal per year

Then, $\rho = 5.794$ (lb per gallon)

ρ is the liquid density of ISO-OCTANE (ref.no.1 page no.6)

Therefore, $L = 141148 \times 5.794 =$ **817812 lb / year**

Regarding the crude oil, the working loss is about 75% of all other organic liquids under same conditions. (Please review Ref. no.2 page 12)

REFERENCES:

No.1:- API Bulletin on Petrochemical Evaporation Loss From Storage Tanks
(API Bull 2523 – First Edition, November 1969)

No.2:- Emissions Calculations
(As per attached)