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# ESTIMATION OF THE PETROCHEMICAL EVAPORATION LOSS FROM FIXED ROOF STORAGE TANK

## SAMPLE CALCULATION FOR ISO-OCTANE STORAGE TANK

**Presented by Dynaglass Reinforced Plastic Pte Ltd**

Dynagläss

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## 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)

$\rho$ 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)