

## ENVIRONMENTAL STANDARDS FOR PETROLEUM OIL REFINERIES

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### EMISSIONS

➤ **Standards for emissions from furnaces, boilers and Power Plant**

S. No.	Parameter		Limiting concentration in mg/Nm <sup>3</sup> , unless stated	
			Existing refineries	New refineries, furnaces, boilers
1	Sulphur Dioxide (SO <sub>2</sub> )	Gas firing	50	50
		Liquid firing	1700	850
2	Oxides of Nitrogen (NO <sub>x</sub> )	Gas firing	350	250
		Liquid firing	450	350
3	Particulate Matter (PM)	Gas firing	10	5
		Liquid firing	100	50
4	Carbon Monoxide (CO)	Gas firing	150	100
		Liquid firing	200	150
5	Nickel + Vanadium (Ni + V)	Liquid firing	5	5
6	Hydrogen Sulphide (H <sub>2</sub> S) in fuel gas	-	150	150
7	Sulphur content in liquid fuel, weight %	-	1.0	0.5

Notes:

1. In case of mixed fuel (gas and liquid) use, the limit is to be computed based on heat supplied by gas and liquid fuels.
2. All the furnaces/boilers with heat input of 10 million kilo calories/hour or more shall have continuous systems for monitoring of SO<sub>2</sub> and NO<sub>x</sub>. Manual monitoring for all the emission parameters in such furnaces/boilers shall be carried out once in two months.
3. All the emission parameters in furnaces/boilers having heat input less than 10 million kilo calories/hour will be monitored once in a quarter.
4. In case of continuous monitoring, one hourly average concentration values shall be met 98% of the time in a month. Any concentration value obtained through manual monitoring, if exceeds the limiting concentration value, shall be considered as non-compliance.
5. Data on Ni and V content in the liquid fuel (in ppm) shall be reported. Ni and V content in the liquid fuel could be monitored once in six months, if liquid fuel source & quality are not changed. In case of changes, measurement is necessary after every change.

➤ **Standards for emissions from FCC regenerators**

S. No.	Parameter	Limiting concentration in mg/Nm <sup>3</sup> , unless stated		
		Existing refineries		New refineries or FCC
		Hydro-processing of FCC feed	Other than Hydro-processing of FCC feed	
1	Sulphur Dioxide (SO <sub>2</sub> )	500	1700	500 (for hydro-processed feed) 850 (for other feed)
2	Oxides of Nitrogen (NO <sub>x</sub> )	400	450	350
3	Particulate Matter (PM)	100	100	50
4	Carbon Monoxide (CO)	400	400	300
5	Nickel + Vanadium (Ni + V)	2	5	2
6	Opacity, %	30	30	30

Notes:

1. In case part feed is hydro-processed, the emission values will be calculated proportional to the feed rates of untreated and treated feeds.
2. FCC regenerators shall have continuous systems for monitoring of SO<sub>2</sub> and NO<sub>x</sub>. One hourly average concentration values shall be met 98% of the time in a month, in case of continuous monitoring. Manual monitoring for all the emission parameters shall be carried out once in two months.
3. Any concentration value obtained through manual monitoring, if exceeds the limiting concentration value, shall be considered as non-compliance.
4. Data on Sulphur (weight %), Ni (ppm) and V (ppm) content in the feed to FCC shall be reported.
5. Limit of CO emissions shall be met except during annual shut down of CO boiler for statutory maintenance.

➤ **Standards for emissions from Sulphur Recovery Units**

S. No.	Plant capacity (Tonnes/day)	Parameter	Existing refineries	New refineries or SRU
1	Above 20	Sulphur recovery, %	98.7	99.5
		H <sub>2</sub> S, mg/Nm <sup>3</sup>	15	10
2	5 – 20	Sulphur recovery, %	96	98
3	1 – 5	Sulphur recovery, %	94	96
4	All Capacity	Oxides of Nitrogen (NO <sub>x</sub> )	350	250
5	All Capacity	Carbon Monoxide (CO)	150	100

Notes:

1. Sulphur recovery units having capacity above 20 TPD shall have continuous systems for monitoring of SO<sub>2</sub>. Manual monitoring for all the emission parameters shall be carried out once in a month.
2. Data on sulphur dioxide emissions (mg/Nm<sup>3</sup>) shall be reported.
3. Sulphur recovery efficiency shall be calculated on monthly basis, using quantity of sulphur in the feed to SRU and quantity of sulphur recovered.

## Fugitive Emissions

### ➤ Standards for emissions from storage of volatile liquids

#### General petroleum products

Requirements on type of storage tanks shall be as follow:

S. No.	Total Vapour Pressure (TVP), kPa	Tank Capacity, m <sup>3</sup>	Type of Storage Tank
1	> 10	4 – 75	Fixed Roof Tank (FRT) with pressure valve vent
2	10 – 76	75 – 500	Internal Floating Roof Tank (IFRT) or External Floating Roof Tank (EFRT) or Fixed Roof Tank with vapour control or vapour balancing system
3	10 – 76	> 500	Internal Floating Roof Tank or External Floating Roof Tank or Fixed Roof Tank with vapour control system
4	> 76	> 75	Fixed Roof Tank with vapour control system

Notes:

- Requirement for seals in Floating Roof Tanks:
  - IFRT & EFRT are to be provided with double seals with minimum vapor recovery of 96%.
  - Primary seal will be liquid or shoe mounted for EFRT and vapour mounted for IFRT. Maximum seal gap width will be 4 cm and maximum gap area will be 200 cm<sup>2</sup>/m of tank diameter.
  - Secondary seal will be rim mounted. Maximum seal gap width will be 1.3 cm and maximum gap area will be 20 cm<sup>2</sup>/m of tank diameter.
  - Material of seal and construction should ensure high performance and durability.
- Fixed Roof Tanks will have vapour control efficiency of 95% and vapour balancing efficiency of 90%.
- Inspection and maintenance of storage tanks should be carried out under strict control. For the inspection, API RP 575 may be adopted. In-service inspection with regard seal gap should be carried out once in every six months and repair to be implemented in short time. In future, possibility of on-stream repair of both seals will be examined.

## Storage of benzene

For storage of benzene, following shall be followed:

1. FRT with vapour to incineration with 99.9% of removal efficiency for volatile organic compounds (VOC).
2. IFRT/EFRT with double seals, emission-reducing roof fitting and fitted with fixed roof with vapor removal efficiency of at least 99%.

## Storage of solvents for lube-base oil production (Furfural, NMP, MEK, Toluene and MIBK)

IFRT with double seals and inert gas blanketing with vapour removal efficiency of at least 97%.

## Standards for emissions from loading of volatile products

S. No.	Item	Standards
1	Applicable products	Gasoline, Naphtha, Benzene, Toluene, Xylene
2	Type of loading: (i) Road tank truck (ii) Rail tank wagon	(i) Bottom loading (ii) Top submerged
3	Vapour collection: Road tank truck/ Rail tank wagon	Annual leak testing
Emission control for Road tank truck/ Rail tank wagon loading		
4	Gasoline and Naphtha: (i) VOC reduction, % (ii) Emission, gm/m <sup>3</sup>	(i) 99.5 or (ii) 5
6	Benzene: (i) VOC reduction, % (ii) Emission, mg/m <sup>3</sup>	(i) 99.99 or (ii) 20
7	Toluene/Xylene: (i) VOC reduction, % (ii) Emission, mg/m <sup>3</sup>	(i) 99.98 or (ii) 150

## Standards Equipment Leaks

1. **Approach:** Approach for controlling fugitive emissions from equipment leaks shall have proper selection, installation and maintenance of non-leaking or leak-tight equipment. Following initial testing after commissioning, the monitoring for leak detection is to be carried out as a permanent on-going Leak Detection and Repair (LDAR) programme. Finally detected leaks are to be repaired within an allowable time frame.
2. **Components to be covered:** Components that shall be covered under LDAR programme include (i) Block valves; (ii) Control valves; (iii) Pump seals; (iv) Compressor seals; (v) Pressure relief valves; (vi) Flanges – Heat Exchangers; (vii) Flanges – Piping; (viii) Connectors – Piping; (ix) Open ended lines; and (x) Sampling connections. Equipment and line sizes more than 1.875 cm or ¾ in are to be covered.
3. **Applicability:** LDAR programme would be applicable to components (given at 2 above) for following products/compounds: (i) hydrocarbon gases; (ii) Light liquid with vapour pressure @ 20°C > 1.0 kPa; and (iii) Heavy liquid with vapour pressure @ 20°C between 0.3 to 1.0 kPa.
4. While LDAR will not be applicable for heavy liquids with vapour pressure < 0.3 kPa, it will be desirable to check for liquid dripping as indication of leak.
5. **Leak definition:** A leak is defined as the detection of VOC concentration more than the values (in ppm) specified below at the emission source using a hydrocarbon analyzer according to measurement protocol (US EPA – 453/R-95-017, 1995 Protocol for equipment leak emission estimates may be referred):

S. No.	Component	General Hydrocarbon		Benzene	
		Till 31 <sup>st</sup> Dec. 2008	w.e.f. January 01, 2009	Till 31 <sup>st</sup> Dec. 2008	w.e.f. January 01, 2009
1	Pump/Compressor	10000	5000	3000	2000
2	Valves/Flanges	10000	3000	2000	1000
3	Other components	10000	3000	2000	1000

6. In addition, any component observed to be leaking by sight, sound or smell, regardless of concentration (liquid dripping, visible vapor leak) or presence of bubbles using soap solution should be considered as leak.
7. **Monitoring requirements and repair schedule:** Following frequency of monitoring of leaks and schedule for repair of leaks shall be followed:

Component	Frequency of monitoring	Repair schedule
Valves/Flanges	Quarterly (semiannual after two consecutive periods with < 2% leaks and annual after 5 periods with < 2% leaks)	Repair will be started within 5 working days and shall be completed within 15 working days after detection of leak for general hydrocarbons. In case of benzene, the leak shall be attended immediately for repair.
Pump seals	Quarterly	
Compressor seals	Quarterly	
Pressure relief devices	Quarterly	
Pressure relief devices (after venting)	Within 24 hours	
Heat Exchangers	Quarterly	
Process drains	Annually	
Components that are difficult to monitor	Annually	
Pump seals with visible liquid dripping	Immediately	Immediately
Any component with visible leaks	Immediately	Immediately
Any component after repair/replacement	Within five days	-

8. The % leaking components should not be more than 2% for any group of components, monitored excluding pumps/compressors. In case of pumps/compressors, it should be less than 10% of the total number of pumps/compressors or three pumps and compressors, whichever is greater.
9. **Emission inventory:** Refinery shall prepare an inventory of equipment components in the plant. After the instrumental measurement of leaks, emission from the components will be calculated using stratified emission factors (USEPA) or any other superior factors. The total fugitive emission will be established.
10. **Monitoring:** Following types of monitoring methods may be judiciously employed for detection of leaks: (i) Instrumental method of measurement of leaks; (ii) Audio, visual and olfactory (AVO) leak detection; and (iii) Soap bubble method.
11. Data on time of measurement & concentration value for leak detection; time of repair of leak; and time of measurement & concentration value after repair of leak should be documented for all the components.

12. Pressure relief and blow down systems should discharge to a vapor collection and recovery system or to flare.
13. Open-ended lines should be closed by a blind flange or plugged.
14. Totally closed-loop should be used in all routine samples.
15. Low emission packing should be used for valves.
16. High integrity sealing materials should be used for flanges.

### **Standards for VOC emissions from wastewater collection and treatment**

1. All contaminated and odorous wastewater streams should be handled in closed systems from the source to the primary treatment stages (oil-water separator and equalization tanks).
2. The collection system should be covered with water seals (traps) on sewers and drains and gas tight covers on junction boxes.
3. Oil-water separators and equalization tanks should be provided with floating/fixed covers. The off-gas generated should be treated to remove at least 90% of VOC and eliminate odor. The system design should ensure safety (prevention of formation of explosive mixture, possible detonation and reduce the impact) by dilution with air/inert gas, installing LEL detector including control devices, seal drums, detonation arrestors, etc. The system should be designed and operated for safe maintenance of the collection and primary treatment systems.
4. Wastewater from aromatics plants (benzene and xylene plants) should be treated to remove benzene & total aromatics to a level of 10 & 20 ppm respectively before discharge to effluent treatment system without dilution.

**Source: EPA Notification  
[G.S.R 186(E), dt. 18<sup>th</sup> March, 2008]**

**Guidelines (Downloadable)**  
**Original Notification (Downloadable)**