

AIR QUALITY ANALYSIS IN SURROUNDING OF A REFINERY PLANT- IOCL PANIPAT REFINERY AND PETROCHEMICAL COMPLEX (CASE STUDY)

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Abstract: A Petroleum refinery is a plant where crude oil is refined into useful products such as Petroleum, kerosene, Diesel, LPG etc. Further, the refining process releases a number of different chemicals into the atmosphere and makes it polluted. Apart from air pollution there are also wastewater concerns, risk of industrial accident such as fire and explosion, and noise pollution. So, as a concern of Environmental and safety, the analysis of various environmental impacts on the surrounding of a refinery plant is necessary. In my study report, I have analyzed various parameters as per to check the quality of air in the surrounding of a refinery plant. IOCL Panipat Refinery and Petrochemical Complex is taken as case study. Parameters are observed to check the quality of air in the surrounding of this refinery plant. 10 KM radius is considered as a study area. Total eight sites (Khandra, Baholi, Rajapur, Baljatan, Assankalan, Untala, Bhalsi, Sherah) are selected to analyze Air Quality. Samples are collected from these sites at weekly interval of time basis in three months period i.e from 1 January 31 March in the average of at least four times from each site. Collected air samples from different eight locations are analyzed for SO₂, NO₂, PM₁₀, PM_{2.5} & CO in the laboratory and observed within limit as prescribed by Central Pollution Control Board (CPCB) & Haryana State Pollution Control Board (HSPCB).

Keyword: air pollution, EIA, refinery plant, petrochemical complex, IOCL Panipat surrounding.

1.0 Introduction As per the Ministry of Petroleum & Natural Gas, Government of India, there are total 23 refineries in India. The Surrounding of Panipat Refinery and Petrochemical Complex is selected as a case study and to analyze the quality of air. Panipat Refinery is the 7th refinery of IOCL, located at Village- Baholi in Panipat (Haryana). At Present, it has holds a refining capacity of 15 MMT/yr. The chief processing units of this Refinery Plant are: Hydrocracker unit, Catalytic Reformer Unit, Bitumen blowing unit, Resid Fluidised Catalytic Cracking unit, Visbreaker unit, Sulphur block and associated Auxiliary facilities. Various types of waste generated from a refinery plant by different process involve in the productions of various petroleum products from crude oil are known as refinery wastes.

2.0 Objective of the Research

1. Determination and calculation of different Air quality parameters in the surrounding of IOCL Panipat Refinery and Petrochemical Complex.
2. Comparing and analyzing different quality parameters with the standards prescribed by CPCB, HPCB.
3. Summarize the all to reduce the negative impacts, if any.

3.0 METHODOLOGY FOR AIR QUALITY ANALYSIS

The methodology selected to analyze air quality on the surrounding of IOCL Panipat is based on the Guidelines issued by Ministry of Environment, and past experience of similar jobs. The various steps followed to prepare this report are following:

3.1 Reconnaissance Survey

In this section, Primary information of the existing refinery and details of proposed facilities will be defined. The description also gives details of effluents (gaseous) generation sources

3.2 Site selection and Sampling

After gathering the primary information, the next step is to identify the suitable sites in the surrounding of Panipat refinery within 10KM radius. Total eight sites (Khandra, Baholi, Rajapur, Baljatan, Assankalan, Untala, Bhalsi, Sherah) are selected to analyze Air Quality. After the identification of sites, air samples are collected (4 times) at weekly interval of time.

3.3. Laboratory work

After sampling, the next step is to determine various air quality parameters like: SO₂, NO₂, PM₁₀, PM_{2.5} & CO in the laboratory.

3.4. Analysis

After getting results for different parameters in the previous step, the final step is to compare and analyze all parameters with standards prescribed by CPCB and HPCB by bar chart.

4.0 The Experimental Work

The sources of air pollution in the region are: **Refinery emissions, vehicular traffic, dust arising from unpaved village roads and fuel burning etc.** The aim of the air quality study is to set up the existing ambient air quality of the area. This will be helpful for assessing the consistency to standards of the ambient air quality around the refinery site. The monitoring locations for establishing the baseline status of ambient air quality has been selected on the basis of Meteorological conditions, Topography of the study area, Class of the area like habitat, forest etc., Representative of likely affected area. Eight (8) numbers of monitoring stations as given in Table-1 were set up to assess the existing air quality of the area. The locations of the monitoring stations are based on the regular wind directions. Ambient Air Quality Monitoring was conducted for **three months' period (1st January, 2017 – 31st March, 2017)** and different parameters like **PM₁₀, PM_{2.5}, SO₂, NO₂, CO** are calculated.

Table 1: Ambient Air Quality Monitoring Locations

S.no	Location code	Location	Direction	Distance in k.m from iocl Admin block
1	AQ1	Khandra	SW	2.7
2	AQ2	Baholi	NE	0.5
3	AQ3	Rajapur	NE	6.2
4	AQ4	Baljatan	NW	2.3
5	AQ5	Assankalan	S	3.6
6	AQ6	Untala	S	6
7	AQ7	Bhalsi	SW	8.5
8	AQ8	Sherah	W	4.5

4.1. Particulate Matter (PM₁₀)

98th Percentile of the 24-hourly average values of PM₁₀ varied station wise between 66.0 µg/m³ (at Bahauli) and 77.0µg/m³ (at Khandra). The summary is given in Table 2.

Table 2: Ambient Air quality monitoring results for PM₁₀ in µg/m³

Locations	Min	Max.	98 Percentile
Khandra	51	80	77.0
Baholi	40	67	66.0

Rajapur	49	71	69.6
Baljatan	45	67	65.6
Assankalan	47	74	73.0
Untala	45	66	65.5
Bhalsi	47	69	69.0
Sherah	49	67	66.5

4.2. Particulate Matter (PM2.5)

98th Percentile of the 24-hourly average values of PM2.5 varied stationwise between 27.4 µg/m³ (at Untala) and 38.5 µg/m³ (at Rajapur). Summary of results is given in Table 3.

Table 3: Ambient Air quality monitoring results for PM2.5 in µg/m³

Locations	Min	Max.	98 Percentile
Khandra	21	37	37.0
Baholi	17	33	32.5
Rajapur	22	39	38.5
Baljatan	20	34	33.5
Assankalan	19	34	33.3
Untala	20	28	27.4
Bhalsi	19	31	30.9
Sherah	18	30	29.4

4.3. Sulphur Dioxide (SO₂)

98th percentile values of SO₂ over the study area were found between 14.5 µg/m³ (at Assankalan) and 25.5 µg/m³ (at Khandra). Summary of results is given in Table 4.

Table 4: Ambient Air quality monitoring results for SO₂ in µg/m³

Locations	Min	Max.	98 Percentile
Khandra	12	26	25.5
Baholi	10	22	21.5
Rajapur	9	22	21.5
Baljatan	8	21	20
Assankalan	9	15	14.5
Untala	8	17	16.5
Bhalsi	9	19	18
Sherah	9	16	15.5

4.4. Oxides of Nitrogen (NO₂)

98th percentile values of NO₂ ranged between 24.5 µg/m³ (at Sherah) and 41.5 µg/m³ (at Khandra). Summary of results is given in Table 5.

Table 5: Ambient Air quality monitoring results for NO₂ in µg/m³

Locations	Min	Max.	98 Percentile
Khandra	24	42	41.5
Baholi	24	41	39.1
Rajapur	15	34	33.0
Baljatan	22	37	36.0
Assankalan	15	31	30.5
Untala	19	35	34
Bhalsi	17	31	29.6
Sherah	9	25	24.5

4.5. Carbon Monoxide (CO)

98th percentile values of CO ranged between 1.7 mg/m³ (at Untala) and 2.2 mg/m³ (at Rajapur). Summary of results is given in Table 6.

Table 6: Ambient Air quality monitoring results for CO in mg/m³ (January 2017 to March 2017)

Locations	Min	Max.	98 Percentile
Khandra	1.2	2.2	2.1
Baholi	1.2	2.1	2.1
Rajapur	1.4	2.2	2.2
Baljatan	1.0	1.8	1.8
Assankalan	1.0	2.0	2.0
Untala	1.0	1.7	1.7
Bhalsi	1.0	1.9	1.9
Sherah	1.2	1.9	1.9

5.0 Results and Discussion

The various air quality parameters recorded and analyzed in laboratory are summarized and concluded. **Table 15** shows the result with conclusion of the analysis of different Air quality parameters in brief. Further, the comparisons of different quality parameters with standard prescribed by CPCB & HPCB are explained as follow:

5.1. KHANDRA

The Village Khandra is located at 2.7KM distance from IOCL administrative block having latitude of 29.5126372 & Longitude of 76.911335. The comparison of data collected at this site with standards prescribed by CPCB and HSPCB is given bellow:

TABLE 7. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE KHANDRA

Parameters in µg/m ³	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	77.0	100	100
PM2.5 (98 percentile)	37.0	60	60
SO ₂	25.5	80	80
NO ₂	41.5	80	80
CO	2.1	04	04

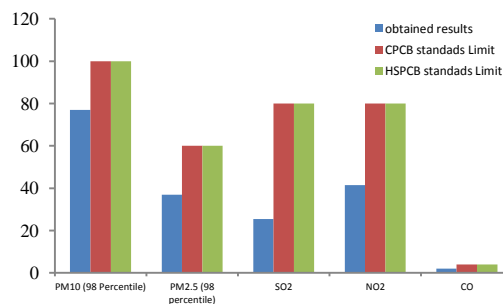


FIGURE 1. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE KHANDRA

5.2. BAHOLI

The Village Baholi is located at 0.5 KM distance from IOCL administrative block having latitude of 29.5126302 & Longitude of 76.911802. The comparison of data collected at this site with standards prescribed by CPCB and HSPCB is given bellow:

TABLE 8. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BAHOLI

PARAMETERS IN MG/M3	OBTAINED RESULTS	STANDARDS LIMIT PRESCRIBED BY CPCB	STANDARDS LIMIT PRESCRIBED BY HSPCB
PM10 (98 Percentile)	40	100	100
PM2.5 (98 percentile)	17	60	60
SO2	10	80	80
NO2	24	80	80
CO	1.2	04	04

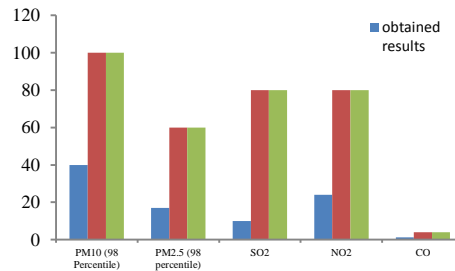


FIGURE 2. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BAHOLI

5.3. RAJAPUR

The Village Rajapur is located at 6.2 KM distance from IOCL administrative block having latitude of 29.5126322 & Longitude of 76.911363. The data collected to check different air quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

TABLE 9. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE RAJAPUR

Parameters in µg/m3	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	69.6	100	100
PM2.5 (98 percentile)	38.5	60	60
SO2	21.5	80	80
NO2	33	80	80
CO	2.2	04	04

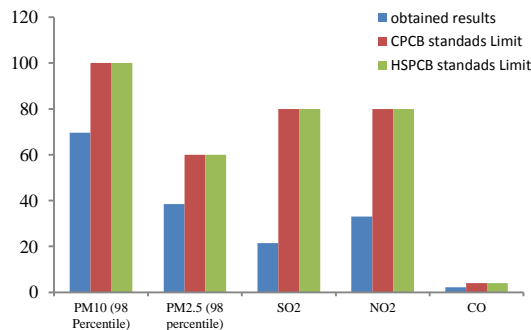


FIGURE 3. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE RAJAPUR

5.4. BALJATAN

The Village Baljatan is located at 2.3 KM distance from IOCL administrative block having latitude of 29.5126475 & Longitude of 76.911344. The data collected to check different air quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

TABLE 10. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BALJATAN

Parameters in µg/m3	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	65.6	100	100
PM2.5 (98 percentile)	33.5	60	60
SO2	20	80	80
NO2	36	80	80
CO	1.8	04	04

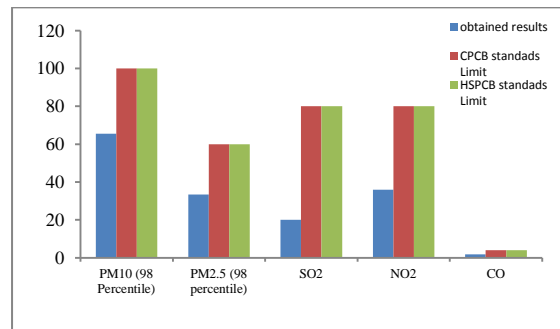


FIGURE 4. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BALJATAN

5.5. ASSANKALAN

The Village Assankalan is located at 3.6 KM distance from IOCL administrative block having latitude of 29.5126802 & Longitude of 76.911632. The data collected to check different air quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

TABLE 11. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE ASSANKALAN

Parameters in µg/m3	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	73	100	100
PM2.5 (98 percentile)	33.3	60	60
SO2	14.5	80	80
NO2	30.5	80	80
CO	2	04	04

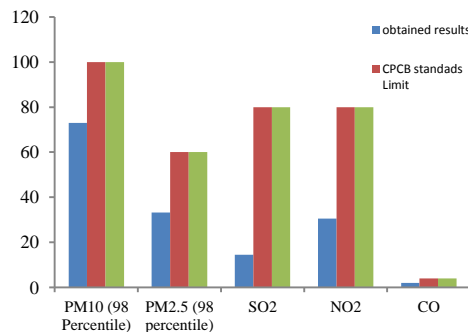


FIGURE 5. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE ASSANKALAN

5.6. UNTALA

The Village Untala is located at 6 KM distance from IOCL administrative block having latitude of 29.5126392 & Longitude of 76.911532. The data collected to check different air quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

TABLE 12. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE UNTALA

Parameters in $\mu\text{g}/\text{m}^3$	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	65.5	100	100
PM2.5 (98 percentile)	27.4	60	60
SO2	16.5	80	80
NO2	34	80	80
CO	1.7	04	04

5.7. BHALSI

The Village Bhalsi is located at 8.5 KM distance from IOCL administrative block having latitude of 29.5126864 & Longitude of 76.911635. The data collected to check different air quality parameters & Ground Water Quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

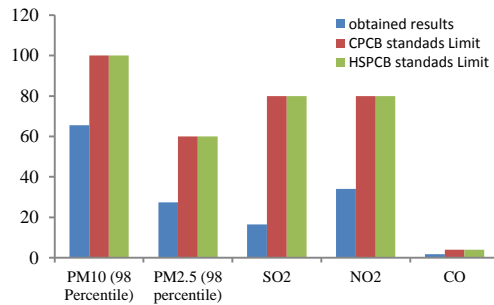


FIGURE 6. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE UNTALA

TABLE 13. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BHALSI

Parameters in $\mu\text{g}/\text{m}^3$	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	69	100	100
PM2.5 (98 percentile)	30.9	60	60
SO2	18	80	80
NO2	29.6	80	80
CO	1.9	04	04

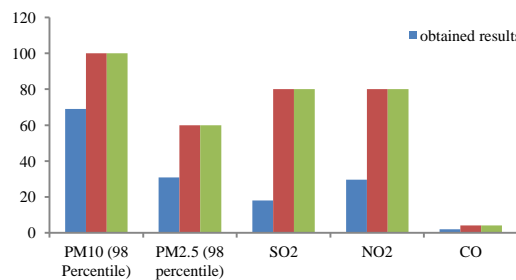


FIGURE 7. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE BHALSI

5.8. SHERAH

The Village Sherah is located at 4.5 KM distance from IOCL administrative block having latitude of 29.5126872 & Longitude of 76.911652. The data collected to check different air quality parameters at this site are given below and compared with standards prescribed by CPCB and HSPCB.

TABLE 14. AIR QUALITY PARAMETERS ANALYZED AT VILLAGE SHERAH

Parameters in µg/m ³	Obtained results	Standards limit prescribed by CPCB	Standards limit prescribed by HSPCB
PM10 (98 Percentile)	66.5	100	100
PM2.5 (98 percentile)	29.4	60	60
SO ₂	15.5	80	80
NO ₂	24.5	80	80
CO	1.9	04	04

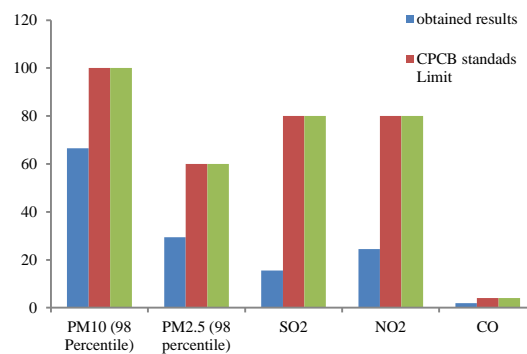


FIGURE 8. GRAPHICAL RESULTS OF AIR QUALITY PARAMETERS ANALYZED AT VILLAGE SHERAH

6.0 Summary

The overall summary with final remarks about the air quality in the surrounding of IOCL Panipat refinery and Petrochemical Complex are given in table 15.

Table 15: Analysis with conclusion of different Air quality parameters

Parameters	UNIT	Analyzed Result	Conclusion	FINAL REMARKS
PM10	µg/m ³	varies between 66.0 µg/m ³ (at Bahauli) and 77.0µg/m ³ (at Khandra).	Found well within standards prescribed by NAAQS (100 µg/m ³ , 24 hourly).	THE ANALYSIS OF AIR QUALITY PARAMETERS SHOWS THAT AIR QUALITY IN THE SURROUNDING OF THE PANIPAT REFINERY PLANT IS AT SATISFACTORY LEVEL
PM2.5	µg/m ³	varies between 27.4 µg/m ³ (at Untala) and 38.5 µg/m ³ (at Rajapur).	Found well within standards prescribed by NAAQS (60 µg/m ³ , 24 hourly).	
SO ₂	µg/m ³	Varies between 14.5 µg/m ³ (at Assankalan) and 25.5 µg/m ³ (at Khandra).	Found well within standards prescribed by NAAQS (80 µg/m ³ , 24 hourly).	
NO ₂	µg/m ³	Varies between 24.5 µg/m ³ (at Sherah) and 41.5 µg/m ³ (at Khandra)	Found well within standards prescribed by NAAQS (80 µg/m ³ , 24 hourly).	
CO	mg/m ³	Varies between 1.7 mg/m ³ (at Untala) and 2.2 mg/m ³ (at Rajapur).	Found well within standards prescribed by NAAQS (1mg/m ³ , 24 hourly).	

7.0 Future Scope of the Work

Different air quality parameter i.e. Sulphur dioxide, Nitrogen dioxide, PM10, PM2.5 and Carbon monoxide are observed and analyzed in this research work in the surrounding of IOCL Panipat refinery and petrochemical complex. Further, other air quality parameters like Lead, Petrochemical Oxidants etc can also be analyzed.

8.0 References

1. Guidelines for the Measurement of Ambient Air Pollutants, Volume-I, CENTRAL POLLUTION CONTROL BOARD (Ministry of Environment & Forests, Govt. of India)
2. National ambient air quality monitoring, series: naaqms//2009-10, central pollution control board ministry of environment & forests.
3. Air Pollution Sampling and Analysis, Department of Civil Engineering, Indian Institute of Technology Guwahati – 781039, Assam, India
4. Ministry of Environment and Forest, GoI – Charter on Corporate Responsibility for Environment Protection Action Points for 17 Categories of Industries, CPCB, March 2003.
5. Ministry of Environment and Forest, GoI – Environment (Protection) Act
6. Ministry of Environment and Forest, GoI – Comprehensive Industry Document Oil Refineries: COINDS/3/1980-81