

SURVEY REPORT ON METHANE & NON-METHANE HYDROCARBON IN AMBIENT AIR

FOR

**PROJECT: RESIDUE UP-GRADATION AND DISTILLATE
YIELD IMPROVEMENT PROJECT WITH 11.0 MMTPA
CRUDE PROCESSING AT MATHURA REFINERY OF
INDIAN OIL CORPORATION LTD,
MATHURA**



IndianOil



REPORT NO. A257-SR-III-1741-1301 MAY 2015

This report is prepared for M/s IOCL, Mathura refinery and it is for use by M/s IOCL, Mathura Refinery or their assigned representatives / organizations only. The matter contained in the report is confidential.

EXECUTIVE SUMMARY

The project “Residue Up-Gradation and Distillate Yield Improvement Project with 11.0 MMPTA Crude Processing at Mathura Refinery of M/s Indian Oil Corporation Ltd, Mathura” was considered for Environment Clearance in 18th Reconstituted EAC meeting where 11 nos. of additional clarifications were sought and published vide Minutes of Meeting. A supplementary report covering all the 11 points in comprehensive manner was prepared and submitted to MoEF on 5th Sept’14.

During 24th Reconstituted EAC meeting on 29th Sept’14, the proposed expansion project was re-considered and the committee reviewed the various details submitted for the clarifications of the 11 nos. points. EAC further desired to submit additional information for 3 nos. of points, during meeting held on 29th September 2014. Further, during meeting held on 21st April 2015, committee recommended to carry out environmental survey for establishing levels of methane hydrocarbon and non-methane hydrocarbons in ambient air by IOCL R&D, Faridabad.

In compliance to the desired information, Mathura Refinery, IOC is submitting the environmental survey report. Methane- Hydrocarbons were found in the range of 0.4 to 2.6 ppm and Non-Methane Hydrocarbons were found in the range of 0.11 – 5.7 ppm. Details are given in subsequent sections.

1.0 BACKGROUND

The study area of 10 km radius around Mathura Refinery primarily comprises of well-developed built-up and agricultural land uses. Primarily the sources of emissions for total hydrocarbons include automobile emissions, construction and agriculture activities. Such sources are intermittent in nature and also vary in magnitude at different time intervals. The diurnal variation of temperature and mixing height of the planetary boundary layer will also bring a change in ambient levels of total hydrocarbons. EAC committee during its meeting held on 21st April 2015, advised to carry out environmental survey for establishing hydrocarbon (methane & non-methane) levels by IOCL R&D, Faridabad.

A reconnaissance survey was conducted on 30th April 2015 to assess the field requirements in terms of availability of power with consistent voltage and frequency, logistics, administration and location free from high rise structures. Three locations were selected in the zone of 5 km radius around the Mathura Refinery. Details of environmental survey in terms of description of locations, results and analysis are given in subsequent sections.

2.0 DESCRIPTION OF MONITORING LOCATIONS

Three monitoring locations were selected based on the following factors:

- Availability of power (Continuous)
- Consistent voltage and frequency
- Logistics (security, safety, shelter, food and transportation)
- Free from high rise structures and big trees.

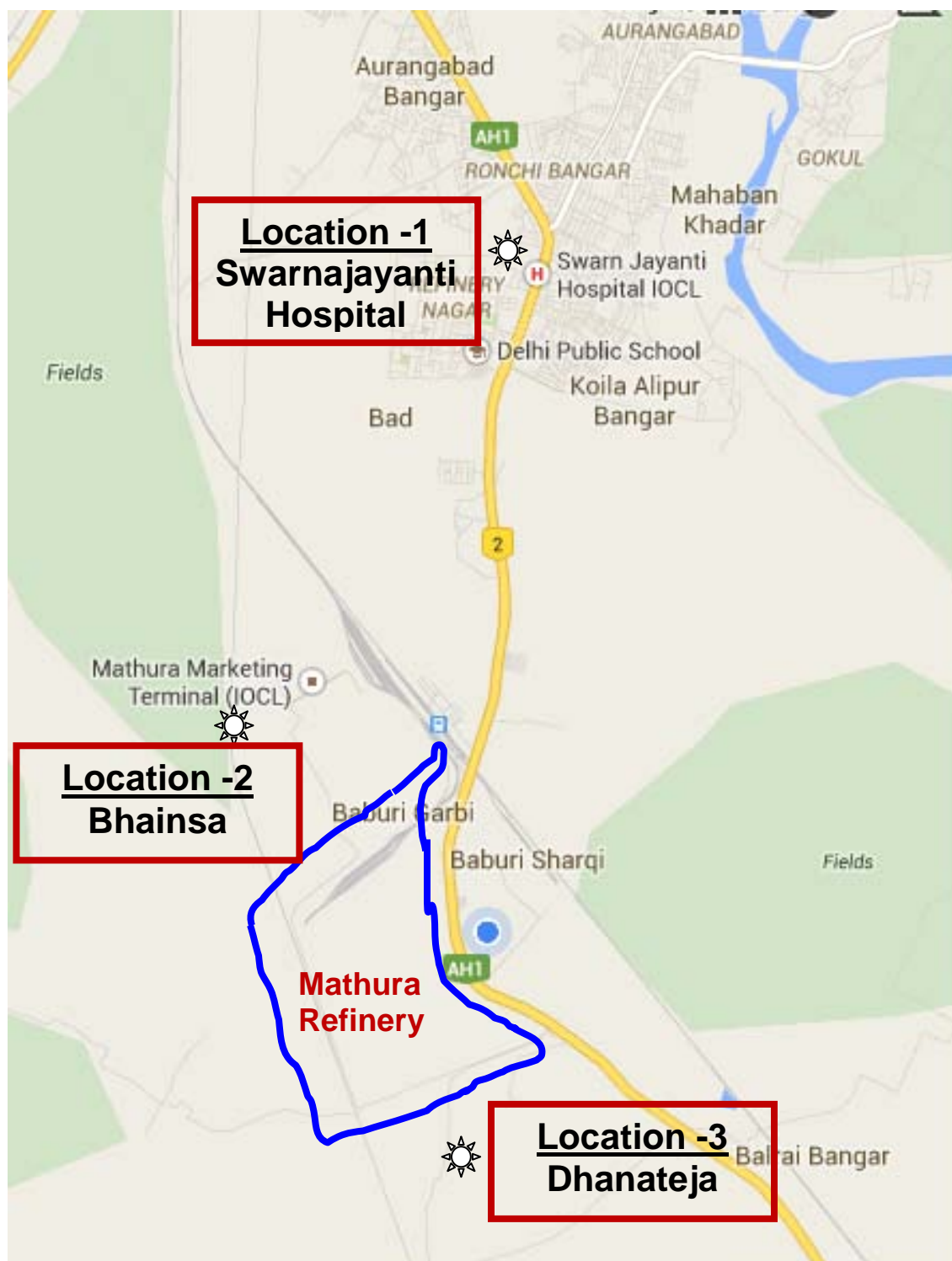
Details of locations are given in **Table 1.0** and are shown in **Figure 1.0**.

Table 1.0: Details of Monitoring Locations

Name of Location	Arial Distance from Mathura Refinery (km)	Direction	Upwind/Downdwind
Swarna Jayanti Samudayik Hospital	5	NW	Upwind
Bhainsa	0.7	NW	Upwind
Dhanateja	0.3	SE	Downwind

Vehicular traffic emissions are the predominant sources of hydrocarbons at all the three monitoring stations. Monitoring was carried out for three days from 01st May to 03rd May at all the three locations.

Figure 1.0: Location of Monitoring Stations



2.1 METEOROLOGICAL CONDITIONS AT MATHURA DURING SURVEY PERIOD.

Meteorological parameters in terms of temperature, and humidity were taken from continuous weather monitoring station of IOCL. The maximum temperature was recorded as 41 °C (at 14:30) and minimum temperature as 22 °C (at 02:30). The average temperature was 32 °C. Summary of meteorological parameters is given in Table 2.0 and variation of meteorological parameters over a day is given in Table 3.0.

**Table 2.0: Summary of Meteorological Parameters at Mathura
(Period of Monitoring: 01/05/2015 to 04/05/2015)**

	Temperature	Humidity
High	43.4 °C	43.72%
Low	25.4 °C	5.39%
Average	32 °C	46%

3.0 EXPERIMENTAL SET UP

3.1 Test Facility

The test facility i.e. Air Quality Monitoring Van consists of continuous type Total Hydrocarbon (THC) analyzer. The analyzer is capable of measuring the Methylated (CH₄) and Non-methylated (NHMC) emissions in the range of 0.02 ppm to 100 ppm and is based on analytical principle as;

- Analyzers Measurement Principle

THC/NHMC/CH₄ - Flame Ionization Detection

Besides above analyzers AQM van also houses;

- Computerized multi-gas calibrator and zero gas generator and external Span calibration gas cylinders of CH₄ & HC.
- Monitoring System with Data logging and Display Mode.
- PC based Data acquisition system with software for calibration, monitoring and alarms.

3.2 Test Protocol

The data was collected as per standard protocols at 3-5 m height and 24 hours data collected to study diurnal patterns of pollutants especially the non-methylated hydrocarbons. At each site the data were collected for 1 day only. The THC analyzer was calibrated with zero & span for each time before data collection and multiple set (period – 1 minute) of data were collected to ensure the repeatability and accuracy. The instructions for operating the systems as provided by Original Equipment Manufacturer (OEM) and also given in the manuals were strictly followed for each test.

3.3 Total and Non-Methanic by Flame Ionization Detector (FID)

The THC Analyzer is a methane and non-methane hydrocarbon analyzer for the measurement of low contents of emissions in ambient air. It uses the principle of flame ionization and provides many advantages due to recent electronic and physical technologies which require very limited maintenance. Sampling carried out through a Teflon tube (outside diameter 6 mm) connected to the rear of the unit. Sample was taken by an internal pump and the unit required:

- An external hydrogen source (cylinder) was distributed at the analyzer "H2" inlet under a pressure of 2 bars (purity, specification and certificate is attached in Annexure-II).
- A source of air free of any traces of hydrocarbon and humidity also called "zero air" was distributed at "air" inlet under a pressure of 2 bars (purity, specification and certificate is attached in Annexure-II).

With NHMC converter option the analyzer used for measuring the total hydrocarbons (THC), methane (CH₄) and non methanic hydrocarbons (NHMC) cyclically. The measurements were indicated by a liquid crystals display on the front panel.

3.5 Technical Characteristics

Measurement range (programmable):	Auto, 10, 50, 100, 500, 1000 ppm
Units (programmable):	ppm or mg/m ³
Noise (standard deviation σ):	0.025 ppm
Minimum detectable (2σ):	0.05 ppm
Response time:	Automatic (10 sec. in continuous THC mode)
Zero drift:	< 0.1 ppm / 24 hours
Span drift:	< 1 % / 24 hours
Linearity:	+ 1 %
Repeatability:	1 %
FID sample flow rate:	80 cc/mn. (4.8 l/h)
Total sample flow rate:	1300 cc/mn. (80 l/h)
H2 flow rate:	40 cc/mn. (2.4 l/h)
FID air flow rate:	400 cc/mn. (24 l/h)

FID temperature:	150 °C
ZERO air purifier temperature (option):	400 °C
NHMC converter temperature (option):	210 °C
Sample temperature:	55 °C
Display:	LCD
Output signals:	3 analog outputs (ANA1 - ANA2 -ANA3) 0-1 V, 0-10 V, 0-20 mA, 4-20 mA. Outputs 2 and 3 Programmable
Control keyboard:	16 keys
Micro-controller:	8/16 bits
Power supply:	230V; 50Hz (115V; 60Hz on request) + ground
Consumption:	700 VA at startup
Working temperature:	+10°C to 35 °C

3.6 Calibration and Span

To ensure the accuracy of the measurements performed using the THC Analyzer, the unit regularly checked, calibrated and adjusted before the monitoring exercise.

Check of zero and span point

This operation consists of comparing the monitor response, for zero air and a span point of the range used, to the gas standards used. This check is used to measure the monitor drift in time without modifying the adjustment coefficient.

Zero Air: Zero air was free with any component likely to be measured by the analyzer and did not contain more than 0.01 ppm of hydrocarbons (Certificates attached in Annexure-II). The same zero air was used for supplying the flame continuously (oxidant) and for zero checking.

Span gas: With the monitor measuring total hydrocarbons (THC), the span point was obtained by a CH₄ cylinder contained in air (1% precision) at a concentration of about 80% of the full scale of the measurement range used.

Span point: Hydrocarbon cylinder in air with concentration below the full scale of the range normally used (8 ppm for the range of 10 ppm / 40 ppm for the range of 50 ppm).

Two point calibration

This procedure was used to check and correct the monitor response to the zero and a span point located at about 80% of the full scale of the measurement range used.

The devices previously described were the devices used for calibration and were permanently connected to the analyzer "Air" inlet at a pressure of 2 bars. In function with the desired type of measurement (THC, NHMC or CH₄), the cylinders previously described were used.

4.0 RESULTS

The results of monitoring are given in Table 3.0 for various locations.

**Table 3.0: 98 percentile values of HC (Methane & Non-Methane) at three locations
(Period of Monitoring: 01/05/2015 to 04/05/2015)**

	Swarna Jayanti Hospital			Bhainsa			Dhanteja		
Time (hrs)	0-8	8-16	16-24	0-8	8-16	16-24	0-8	8-16	16-24
Methane-Hydrocarbon (ppm)	0.8	1.1	2.9	2.1	2.3	2.6	2.3	2.3	1.8
Non-Methane Hydrocarbon (ppm)	0.8	1.1	1.5	4.9	5.6	5.4	2.9	3.1	3.8

Detailed monitoring data is attached as a separate report

5.0 ANALYSIS

- 5.1 During the monitoring period the temperature varied between 25.4 – 43.4°C.
- 5.2 Methane- Hydrocarbons were found in the range of 0.4 to 2.6 ppm and Non-Methane Hydrocarbons were found in the range of 0.11 – 5.7 ppm.
- 5.3 Lower ranges of Methane & Non-Methane Hydrocarbons were found at Swarna Jayanti Hospital which is away from Refinery and also close to Highway.
- 5.4 Higher ranges were found at Bhainsa which is near to Marketing Terminal.

STUDY OF TOTAL HYDROCARBONS (METHYLATED & NON-METHYLATED) AT MATHURA REFINERY

REPORT NO: TR-15-090

JUNE 2015

VEHICLE TESTING FUELS & EMISSIONS DEPARTMENT



INDIAN OIL CORPORATION LIMITED
Research & Development Centre
Sector 13, FARIDABAD

Submitted to

HEALTH, SAFETY & ENVIRONMENT DEPARTMENT
INDIAN OIL CORPORATION LIMITED
MATHURA REFINERY
MATHURA, U.P.

EXECUTIVE SUMMARY

Indian Oil Corporation Ltd., R&D Centre has taken-up monitoring of total hydrocarbons (THC) both methane & non-methane (CH₄ & NMHC) at Mathura Refinery which covers ambient air quality at different locations namely Swarna Jayanti Hospital, Bhainsha & Dhanateja Village at Mathura. Hydrocarbons are comprised of both methane (CH₄) and non-methane hydrocarbons (NMHC). Total Hydrocarbons in ambient air are those which may appear due to presence of power sector, industries, domestic and natural sources like vehicular emissions, liquid fuel storage & delivery systems etc.

For taking up the subject exercise, an air quality monitoring (AQM) facility has been deputed by Indian Oil Corporation Limited, R&D Centre, Faridabad to monitor the THC in ambient air quality at three different locations namely Swarna Jayanti Hospital, Bhainsha & Dhanateja Village at Mathura.

The present study is taken up primarily for determination of THC (Both CH₄ & NMHC) levels at downstream & upstream scenario in the vicinity of oil refinery.

1.0 Introduction

Air pollutants are added in the atmosphere from variety of sources that change the composition of air and affect the environment. The concentration of air pollutants depend not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions. The pollution concentration vary spatially and temporarily causing the air pollution pattern to change with different locations and time due to changes in meteorological and topographical condition. The sources of air pollutants include power sector, industry, domestic and natural sources. The presence of air pollutants in the ambient air adversely affects the health of the population.

Air quality monitoring requires proper selection of pollutants, selection of monitoring stations, frequency and duration of sampling, sampling techniques, infrastructural facilities, man power and operation & maintenance. The areas selected for monitoring are based on high traffic density, industrial growth, human population and its distribution, emission source, public complaints, the land use pattern etc. The criteria pollutants measured are Particulate Matter (PM), Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), and Carbon Monoxide (CO) etc.

The purpose of the present study is to determine the Total Hydrocarbons (THC) in the vicinity of Mathura Refinery with help of data collected from

the mobile air quality monitoring (AQM) van. The work is primarily focused on collection of data at various locations namely Swarna Jayanti Hospital, Bhainsha & Dhanateja Village at Mathura (downstream & upstream with respect to refinery) to study the contribution of hydrocarbon emission source.

2.0 Experimental Set Up

2.1 Test Facility

The test facility i.e. Air Quality Monitoring Van consists of continuous type Total Hydrocarbon (THC) analyzer. The analyzer is capable of measuring the Methylated (CH₄) and Non-methylated (NMHC) emissions in the range of 0.02 ppm to 100 ppm and is based on analytical principle as;

- Analyzers Measurement Principle

THC/NMHC/CH₄ - Flame Ionization Detection

Besides above analyzers AQM van also houses;

- Computerized multi-gas calibrator and zero gas generator and external Span calibration gas cylinders of CH₄ & HC.
- Monitoring System with Data logging and Display Mode.
- PC based Data acquisition system with software for calibration, monitoring and alarms.

2.2 Air Quality Monitoring Stations

For collecting air quality data at the vicinity of Mathura Refinery three (03) different locations were selected. These sites were selected based on upstream and downstream locations with reference to wind speed, refinery operation, different activities taking place in close by so that representative data could be collected. Further, among three (03) sites one site was 8 km away from the refinery and considered to be the residential zone.

a. Swarna Jayanti (Upstream Location)

This site was actually a community hospital fitted with around 15/20 KVA Diesel Genset for the power back up. The power backup for the hospital during the monitoring exercise was usually given for 8 to 10 hours and the Air Quality Monitoring (AQM) Van was stationed around 100 meters away from Genset. The National Highway No. 2 was around 300 meters away from the monitoring site and the peak loading on the highways were during morning & day time.

b. Bhainsa Village (Downstream Location)

The entry gate of LPG bottling plant was selected and there were some operations going on while ambient air monitoring was done. There as a continuous power supply from the Thermal Power Station of Refinery and the Air Quality Monitoring (AQM) Van was stationed around 100 meters away from bottling plant.

The National Highway No. 2 was around 1.5 kilometers away from the monitoring site and Mathura Refinery was located around less than a kilometer away from the monitoring site.

c. Dhanateja Village (Downstream Location)

The site is unique in its location as it is just besides the refinery but actually an administrative office set up utilized as sitting place & office work. The site was just adjacent to the marketing terminal and there were huge line up of product lorries in morning for the loading operations. There was a continuous power supply from Thermal Power Station and National Highway was around a kilometre away from the monitoring site.

2.3 Test Protocol

The data was collected as per standard protocols at 3-5 m height and 24 hours data collected to study diurnal patterns of pollutants especially the non-methylated hydrocarbons. At each site the data were collected for 1 day only. The THC analyzer was calibrated with zero & span for each time before data collection and multiple set (period – 1 minute) of data were collected to ensure the repeatability and accuracy. The instructions for operating the systems as provided by Original Equipment Manufacturer (OEM) and also given in the manuals were strictly followed for each test

with details of operational & calibration gases given in Annexure-II for ready reference.

2.4 Total and Non-Methanic by Flame Ionization Detector (FID)

The THC Analyzer is a methane and non methane hydrocarbon analyzer for the measurement of low contents of emissions in ambient air. It uses the principle of flame ionization and provides many advantages due to recent electronic and physical technologies which require very limited maintenance. Sampling carried out through a Teflon tube (outside diameter 6 mm) connected to the rear of the unit. Sample was taken by an internal pump and the unit required:

- An external hydrogen source (cylinder) was distributed at the analyzer "H₂" inlet under a pressure of 2 bars (purity, specification and certificate is attached in Annexure-II).
- A source of air free of any traces of hydrocarbon and humidity also called "zero air" was distributed at "air" inlet under a pressure of 2 bars (purity, specification and certificate is attached in Annexure-II).

With nMHC converter option the analyzer used for measuring the total hydrocarbons (THC), methane (CH₄) and non methanic hydrocarbons (nMHC) cyclically. The measurements were indicated by a liquid crystals display on the front panel.

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Measurement range (programmable):	Auto, 10, 50, 100, 500, 1000 ppm
Units (programmable):	ppm or mg/m ³
Noise (standard deviation σ):	0.025 ppm
Minimum detectable (2σ):	0.05 ppm
Response time:	Automatic (10 sec. in continuous THC mode)
Zero drift:	< 0.1 ppm / 24 hours
Span drift:	< 1 % / 24 hours
Linearity:	+ 1 %
Repeatability:	1 %
FID sample flow rate:	80 cc/min. (4.8 l/h)
Total sample flow rate:	1300 cc/min. (80 l/h)
H ₂ flow rate:	40 cc/min. (2.4 l/h)
FID air flow rate:	400 cc/min. (24 l/h)
FID temperature:	150 °C
ZERO air purifier temperature (option):	400 °C
nMHC converter temperature (option):	210 °C
Sample temperature:	55 °C
Display:	LCD

Output signals:	3 analog outputs (ANA1 - ANA2 - ANA3) 0-1 V, 0-10 V, 0-20 mA, 4-20 mA. Outputs 2 and 3 Programmable
Control keyboard:	16 keys
Micro-controller:	8/16 bits
Power supply:	230V; 50Hz (115V; 60Hz on request) + ground
Consumption:	700 VA at startup
Working temperature:	+10°C to 35 °C

2.6 Calibration and Span

To ensure the accuracy of the measurements performed using the THC Analyser, the unit regularly checked, calibrated and adjusted before the monitoring exercise.

Check of zero and span point

This operation consists of comparing the monitor response, for zero air and a span point of the range used, to the gas standards used. This check is used to measure the monitor drift in time without modifying the adjustment coefficient.

Zero air: Zero air was free with any component likely to be measured by the analyzer and did not contain more than 0.01 ppm of hydrocarbons

(Certificates attached in Annexure-II). The same zero air was used for supplying the flame continuously (oxidant) and for zero checking.

Span gas: With the monitor measuring total hydrocarbons (THC), the span point was obtained by a CH₄ cylinder contained in air (1% precision) at a concentration of about 80% of the full scale of the measurement range used.

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Two point calibration

This procedure was used to check and correct the monitor response to the zero and a span point located at about 80% of the full scale of the measurement range used.

The devices previously described were the devices used for calibration and were permanently connected to the analyzer "Air" inlet at a pressure of 2 bars. In function with the desired type of measurement (THC, nMHC or CH₄), the cylinders previously described were used.

2.7 Parameters Studies

As the mobile AQM facility has analyzer for Total Hydrocarbons (CH₄ & NMHC). During the monitoring exercise special emphasis were given on levels and variations of hydrocarbons namely methane, non methanated

hydrocarbons & total hydrocarbons and volatile organic compounds namely benzene, toluene, ethyl benzene, o;m;p xylene which were recorded with the help of GC based continuous analyser fitted in the AQM van. The metrological parameters recorded with the help of weather station located at Mathura Refinery.

3.0 Test Results

The tabulated test results on per 1 minute basis for methane, total hydrocarbons and non-methane hydrocarbon is given in Annexure-I. The variations of these pollutants with respect to time are being plotted with the reference data stored for approximately 24 hours of time at given location.

The data acquisition for Total Hydrocarbons (THC) including methane and non-methane hydrocarbons through Air Quality Monitoring (AQM) van started at 1700 Hrs on 01.05.2015 and stopped at 15:30 hrs on 04/05/2015. The plot for said emissions in ppm Vs. Time in hours is given below:

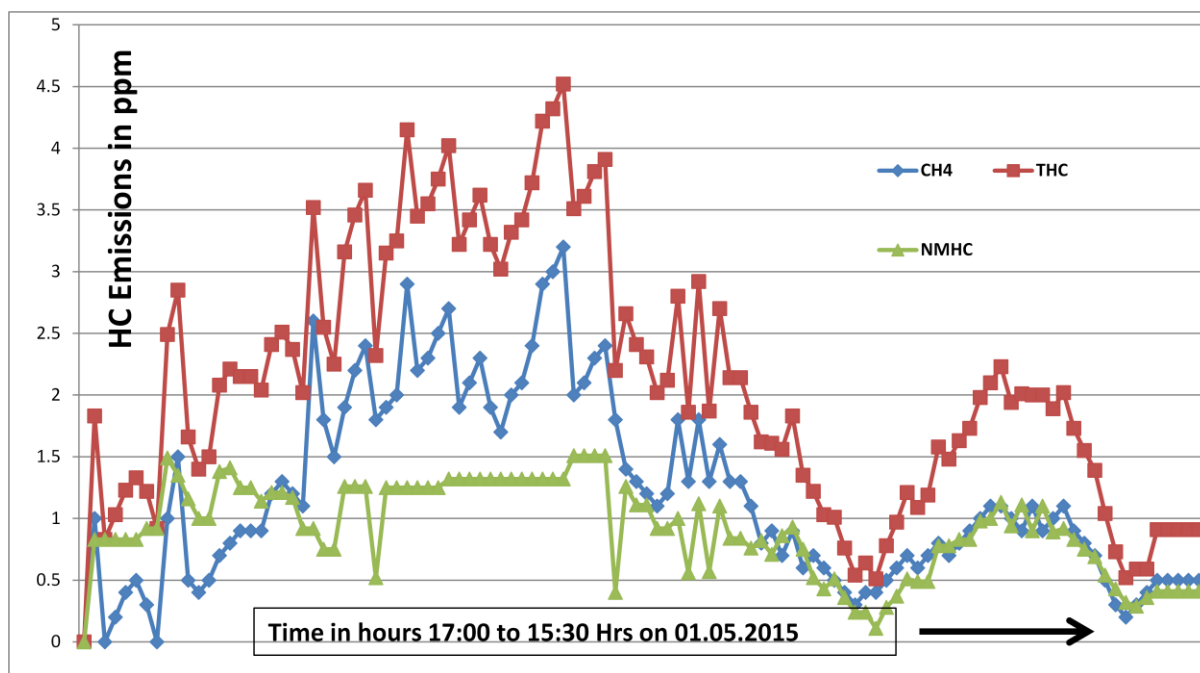


Figure 1. Site 1 - Swarna Jayanti Hospital (Upstream Location)

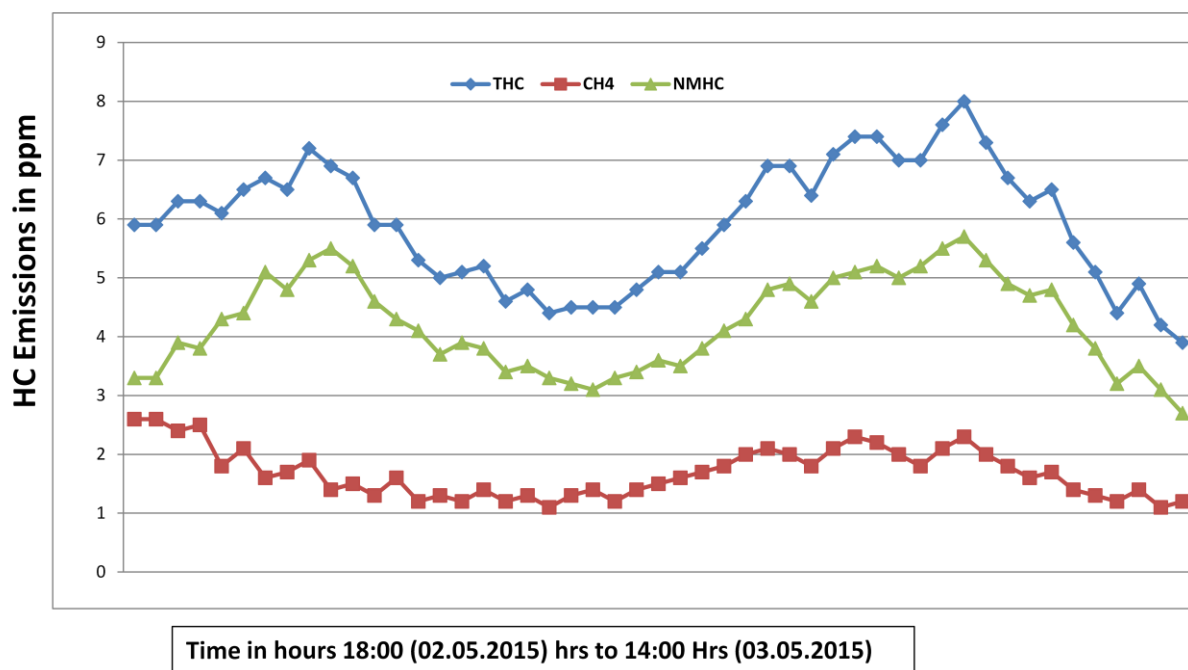


Figure 2. Site 2 – Bhainsha Village (Downstream Location)

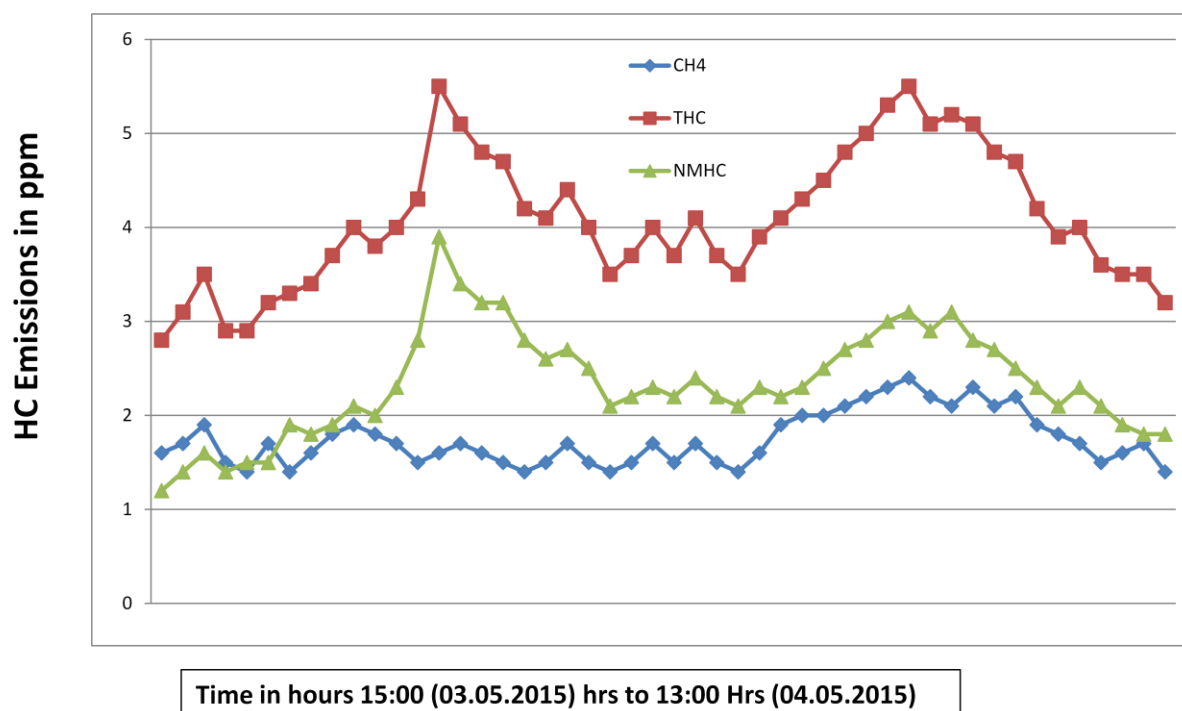


Figure 3. Site 3 – Dhanateja Village (Downstream Location)

4.0 Final Result

	Methane (CH ₄)			Non-Methane Hydrocarbons (NMHC)		
	Min.	Max.	Daily Avg.	Min.	Max.	Daily Avg.
Site 1	0.2 ppm	3.2 ppm	1.195 ppm	0.2 ppm	1.5 ppm	0.913 ppm
Site 2	1.2 ppm	2.6 ppm	1.693 ppm	2.7 ppm	5.7 ppm	4.224 ppm
Site 3	1.4 ppm	2.3 ppm	1.743 ppm	1.2 ppm	3.9 ppm	2.341 ppm

Annexure - I

Variation of hydrocarbons at Site 1 (Swarna Jayanti Hospital) from 01.05.2014 (17:00 Hrs.) to 02.05.2015 (15:30 Hrs.)

01/05/2015 16:54	CH4	0	PPM	THC	0	PPM	NMHC	0	PPM
01/05/2015 17:08	CH4	1	PPM	THC	1.83	PPM	NMHC	0.83	PPM
01/05/2015 17:09	CH4	0	PPM	THC	0.83	PPM	NMHC	0.83	PPM
01/05/2015 17:10	CH4	0.2	PPM	THC	1.03	PPM	NMHC	0.83	PPM
01/05/2015 17:21	CH4	0.4	PPM	THC	1.23	PPM	NMHC	0.83	PPM
01/05/2015 17:26	CH4	0.5	PPM	THC	1.33	PPM	NMHC	0.83	PPM
01/05/2015 17:47	CH4	0.3	PPM	THC	1.22	PPM	NMHC	0.92	PPM
01/05/2015 17:48	CH4	0	PPM	THC	0.92	PPM	NMHC	0.92	PPM
01/05/2015 17:57	CH4	1	PPM	THC	2.49	PPM	NMHC	1.49	PPM
01/05/2015 17:58	CH4	1.5	PPM	THC	2.85	PPM	NMHC	1.35	PPM
01/05/2015 18:00	CH4	0.5	PPM	THC	1.66	PPM	NMHC	1.16	PPM
01/05/2015 18:05	CH4	0.4	PPM	THC	1.4	PPM	NMHC	1	PPM
01/05/2015 18:07	CH4	0.5	PPM	THC	1.5	PPM	NMHC	1	PPM
01/05/2015 18:09	CH4	0.7	PPM	THC	2.08	PPM	NMHC	1.38	PPM
01/05/2015 18:11	CH4	0.8	PPM	THC	2.21	PPM	NMHC	1.41	PPM
01/05/2015 18:12	CH4	0.9	PPM	THC	2.15	PPM	NMHC	1.25	PPM
01/05/2015 18:24	CH4	0.9	PPM	THC	2.15	PPM	NMHC	1.25	PPM
01/05/2015 18:29	CH4	0.9	PPM	THC	2.04	PPM	NMHC	1.14	PPM
01/05/2015 18:40	CH4	1.2	PPM	THC	2.41	PPM	NMHC	1.21	PPM
01/05/2015 18:41	CH4	1.3	PPM	THC	2.51	PPM	NMHC	1.21	PPM
01/05/2015 18:52	CH4	1.2	PPM	THC	2.37	PPM	NMHC	1.17	PPM
01/05/2015 19:06	CH4	1.1	PPM	THC	2.02	PPM	NMHC	0.92	PPM
01/05/2015 19:20	CH4	2.6	PPM	THC	3.52	PPM	NMHC	0.92	PPM
01/05/2015 19:21	CH4	1.8	PPM	THC	2.55	PPM	NMHC	0.75	PPM
01/05/2015 19:22	CH4	1.5	PPM	THC	2.25	PPM	NMHC	0.75	PPM
01/05/2015 19:29	CH4	1.9	PPM	THC	3.16	PPM	NMHC	1.26	PPM
01/05/2015 19:30	CH4	2.2	PPM	THC	3.46	PPM	NMHC	1.26	PPM
01/05/2015 19:31	CH4	2.4	PPM	THC	3.66	PPM	NMHC	1.26	PPM
01/05/2015 19:32	CH4	1.8	PPM	THC	2.32	PPM	NMHC	0.52	PPM
01/05/2015 19:45	CH4	1.9	PPM	THC	3.15	PPM	NMHC	1.25	PPM
01/05/2015 19:46	CH4	2	PPM	THC	3.25	PPM	NMHC	1.25	PPM

01/05/2015 19:47	CH4	2.9	PPM	THC	4.15	PPM	NMHC	1.25	PPM
01/05/2015 19:48	CH4	2.2	PPM	THC	3.45	PPM	NMHC	1.25	PPM
01/05/2015 19:49	CH4	2.3	PPM	THC	3.55	PPM	NMHC	1.25	PPM
01/05/2015 19:50	CH4	2.5	PPM	THC	3.75	PPM	NMHC	1.25	PPM
01/05/2015 19:54	CH4	2.7	PPM	THC	4.02	PPM	NMHC	1.32	PPM
01/05/2015 19:55	CH4	1.9	PPM	THC	3.22	PPM	NMHC	1.32	PPM
01/05/2015 19:56	CH4	2.1	PPM	THC	3.42	PPM	NMHC	1.32	PPM
01/05/2015 19:57	CH4	2.3	PPM	THC	3.62	PPM	NMHC	1.32	PPM
01/05/2015 19:58	CH4	1.9	PPM	THC	3.22	PPM	NMHC	1.32	PPM
01/05/2015 19:59	CH4	1.7	PPM	THC	3.02	PPM	NMHC	1.32	PPM
01/05/2015 20:01	CH4	2	PPM	THC	3.32	PPM	NMHC	1.32	PPM
01/05/2015 20:02	CH4	2.1	PPM	THC	3.42	PPM	NMHC	1.32	PPM
01/05/2015 20:03	CH4	2.4	PPM	THC	3.72	PPM	NMHC	1.32	PPM
01/05/2015 20:07	CH4	2.9	PPM	THC	4.22	PPM	NMHC	1.32	PPM
01/05/2015 20:08	CH4	3	PPM	THC	4.32	PPM	NMHC	1.32	PPM
01/05/2015 20:09	CH4	3.2	PPM	THC	4.52	PPM	NMHC	1.32	PPM
01/05/2015 20:14	CH4	2	PPM	THC	3.51	PPM	NMHC	1.51	PPM
01/05/2015 20:15	CH4	2.1	PPM	THC	3.61	PPM	NMHC	1.51	PPM
01/05/2015 20:16	CH4	2.3	PPM	THC	3.81	PPM	NMHC	1.51	PPM
01/05/2015 20:17	CH4	2.4	PPM	THC	3.91	PPM	NMHC	1.51	PPM
01/05/2015 20:24	CH4	1.8	PPM	THC	2.2	PPM	NMHC	0.4	PPM
01/05/2015 20:41	CH4	1.4	PPM	THC	2.66	PPM	NMHC	1.26	PPM
01/05/2015 20:45	CH4	1.3	PPM	THC	2.41	PPM	NMHC	1.11	PPM
01/05/2015 20:49	CH4	1.2	PPM	THC	2.31	PPM	NMHC	1.11	PPM
01/05/2015 21:05	CH4	1.1	PPM	THC	2.02	PPM	NMHC	0.92	PPM
01/05/2015 21:09	CH4	1.2	PPM	THC	2.12	PPM	NMHC	0.92	PPM
01/05/2015 21:10	CH4	1.8	PPM	THC	2.8	PPM	NMHC	1	PPM
01/05/2015 21:11	CH4	1.3	PPM	THC	1.86	PPM	NMHC	0.56	PPM
01/05/2015 21:12	CH4	1.8	PPM	THC	2.92	PPM	NMHC	1.12	PPM
01/05/2015 21:16	CH4	1.3	PPM	THC	1.87	PPM	NMHC	0.57	PPM
01/05/2015 21:17	CH4	1.6	PPM	THC	2.7	PPM	NMHC	1.1	PPM
01/05/2015 21:25	CH4	1.3	PPM	THC	2.14	PPM	NMHC	0.84	PPM
01/05/2015 21:38	CH4	1.3	PPM	THC	2.14	PPM	NMHC	0.84	PPM
01/05/2015 21:39	CH4	1.1	PPM	THC	1.86	PPM	NMHC	0.76	PPM
01/05/2015 22:03	CH4	0.8	PPM	THC	1.62	PPM	NMHC	0.82	PPM

01/05/2015 22:32	CH4	0.9	PPM	THC	1.61	PPM	NMHC	0.71	PPM
01/05/2015 22:56	CH4	0.7	PPM	THC	1.56	PPM	NMHC	0.86	PPM
01/05/2015 23:27	CH4	0.9	PPM	THC	1.83	PPM	NMHC	0.93	PPM
02/05/2015 0:17	CH4	0.6	PPM	THC	1.35	PPM	NMHC	0.75	PPM
02/05/2015 0:57	CH4	0.7	PPM	THC	1.22	PPM	NMHC	0.52	PPM
02/05/2015 1:29	CH4	0.6	PPM	THC	1.03	PPM	NMHC	0.43	PPM
02/05/2015 1:47	CH4	0.5	PPM	THC	1.01	PPM	NMHC	0.51	PPM
02/05/2015 2:38	CH4	0.4	PPM	THC	0.76	PPM	NMHC	0.36	PPM
02/05/2015 3:02	CH4	0.3	PPM	THC	0.54	PPM	NMHC	0.24	PPM
02/05/2015 3:27	CH4	0.4	PPM	THC	0.64	PPM	NMHC	0.24	PPM
02/05/2015 4:00	CH4	0.4	PPM	THC	0.51	PPM	NMHC	0.11	PPM
02/05/2015 5:23	CH4	0.5	PPM	THC	0.78	PPM	NMHC	0.28	PPM
02/05/2015 5:49	CH4	0.6	PPM	THC	0.97	PPM	NMHC	0.37	PPM
02/05/2015 6:17	CH4	0.7	PPM	THC	1.21	PPM	NMHC	0.51	PPM
02/05/2015 6:41	CH4	0.6	PPM	THC	1.09	PPM	NMHC	0.49	PPM
02/05/2015 7:03	CH4	0.7	PPM	THC	1.19	PPM	NMHC	0.49	PPM
02/05/2015 7:24	CH4	0.8	PPM	THC	1.58	PPM	NMHC	0.78	PPM
02/05/2015 8:19	CH4	0.7	PPM	THC	1.48	PPM	NMHC	0.78	PPM
02/05/2015 9:01	CH4	0.8	PPM	THC	1.63	PPM	NMHC	0.83	PPM
02/05/2015 10:05	CH4	0.9	PPM	THC	1.73	PPM	NMHC	0.83	PPM
02/05/2015 10:06	CH4	1	PPM	THC	1.98	PPM	NMHC	0.98	PPM
02/05/2015 10:27	CH4	1.1	PPM	THC	2.1	PPM	NMHC	1	PPM
02/05/2015 10:58	CH4	1.1	PPM	THC	2.23	PPM	NMHC	1.13	PPM
02/05/2015 11:18	CH4	1	PPM	THC	1.94	PPM	NMHC	0.94	PPM
02/05/2015 11:50	CH4	0.9	PPM	THC	2.01	PPM	NMHC	1.11	PPM
02/05/2015 12:12	CH4	1.1	PPM	THC	2	PPM	NMHC	0.9	PPM
02/05/2015 12:28	CH4	0.9	PPM	THC	2	PPM	NMHC	1.1	PPM
02/05/2015 12:39	CH4	1	PPM	THC	1.89	PPM	NMHC	0.89	PPM
02/05/2015 13:08	CH4	1.1	PPM	THC	2.02	PPM	NMHC	0.92	PPM
02/05/2015 13:13	CH4	0.9	PPM	THC	1.73	PPM	NMHC	0.83	PPM
02/05/2015 13:37	CH4	0.8	PPM	THC	1.55	PPM	NMHC	0.75	PPM
02/05/2015 13:49	CH4	0.7	PPM	THC	1.39	PPM	NMHC	0.69	PPM
02/05/2015 14:10	CH4	0.5	PPM	THC	1.04	PPM	NMHC	0.54	PPM
02/05/2015 14:27	CH4	0.3	PPM	THC	0.73	PPM	NMHC	0.43	PPM
02/05/2015 14:51	CH4	0.2	PPM	THC	0.52	PPM	NMHC	0.32	PPM

02/05/2015 15:12	CH4	0.3	PPM	THC	0.59	PPM	NMHC	0.29	PPM
02/05/2015 15:19	CH4	0.4	PPM	THC	0.59	PPM	NMHC	0.36	PPM
02/05/2015 15:26	CH4	0.5	PPM	THC	0.91	PPM	NMHC	0.41	PPM

Variation of hydrocarbons (HC) at ~ རྩལ་ཤོར་ལྷན་ཁང་ (LPG Bottling Plant Entry Gate) from 02.05.2015 (18:00 Hrs.) to 03.05.2015 (14:00 Hrs.)


02/05/2015 18:00	CH4	2.6	PPM	THC	5.9	PPM	NMHC	3.3	PPM
02/05/2015 18:06	CH4	2.6	PPM	THC	5.9	PPM	NMHC	3.3	PPM
02/05/2015 18:16	CH4	2.4	PPM	THC	6.3	PPM	NMHC	3.9	PPM
02/05/2015 18:36	CH4	2.5	PPM	THC	6.3	PPM	NMHC	3.8	PPM
02/05/2015 19:00	CH4	1.8	PPM	THC	6.1	PPM	NMHC	4.3	PPM
02/05/2015 19:32	CH4	2.1	PPM	THC	6.5	PPM	NMHC	4.4	PPM
02/05/2015 20:07	CH4	1.6	PPM	THC	6.7	PPM	NMHC	5.1	PPM
02/05/2015 20:30	CH4	1.7	PPM	THC	6.5	PPM	NMHC	4.8	PPM
02/05/2015 21:31	CH4	1.9	PPM	THC	7.2	PPM	NMHC	5.3	PPM
02/05/2015 22:14	CH4	1.4	PPM	THC	6.9	PPM	NMHC	5.5	PPM
02/05/2015 22:38	CH4	1.5	PPM	THC	6.7	PPM	NMHC	5.2	PPM
02/05/2015 22:59	CH4	1.3	PPM	THC	5.9	PPM	NMHC	4.6	PPM
02/05/2015 23:24	CH4	1.6	PPM	THC	5.9	PPM	NMHC	4.3	PPM
02/05/2015 23:53	CH4	1.2	PPM	THC	5.3	PPM	NMHC	4.1	PPM
03/05/2015 0:30	CH4	1.3	PPM	THC	5	PPM	NMHC	3.7	PPM
03/05/2015 0:52	CH4	1.2	PPM	THC	5.1	PPM	NMHC	3.9	PPM
03/05/2015 1:12	CH4	1.4	PPM	THC	5.2	PPM	NMHC	3.8	PPM
03/05/2015 1:40	CH4	1.2	PPM	THC	4.6	PPM	NMHC	3.4	PPM
03/05/2015 2:22	CH4	1.3	PPM	THC	4.8	PPM	NMHC	3.5	PPM
03/05/2015 2:48	CH4	1.1	PPM	THC	4.4	PPM	NMHC	3.3	PPM
03/05/2015 3:09	CH4	1.3	PPM	THC	4.5	PPM	NMHC	3.2	PPM
03/05/2015 3:33	CH4	1.4	PPM	THC	4.5	PPM	NMHC	3.1	PPM
03/05/2015 3:59	CH4	1.2	PPM	THC	4.5	PPM	NMHC	3.3	PPM
03/05/2015 4:24	CH4	1.4	PPM	THC	4.8	PPM	NMHC	3.4	PPM
03/05/2015 5:09	CH4	1.5	PPM	THC	5.1	PPM	NMHC	3.6	PPM
03/05/2015 5:33	CH4	1.6	PPM	THC	5.1	PPM	NMHC	3.5	PPM
03/05/2015 5:52	CH4	1.7	PPM	THC	5.5	PPM	NMHC	3.8	PPM
03/05/2015 6:11	CH4	1.8	PPM	THC	5.9	PPM	NMHC	4.1	PPM
03/05/2015 6:34	CH4	2	PPM	THC	6.3	PPM	NMHC	4.3	PPM
03/05/2015 6:57	CH4	2.1	PPM	THC	6.9	PPM	NMHC	4.8	PPM
03/05/2015 7:18	CH4	2	PPM	THC	6.9	PPM	NMHC	4.9	PPM
03/05/2015 7:40	CH4	1.8	PPM	THC	6.4	PPM	NMHC	4.6	PPM
03/05/2015 7:59	CH4	2.1	PPM	THC	7.1	PPM	NMHC	5	PPM
03/05/2015 8:26	CH4	2.3	PPM	THC	7.4	PPM	NMHC	5.1	PPM
03/05/2015 8:56	CH4	2.2	PPM	THC	7.4	PPM	NMHC	5.2	PPM
03/05/2015 9:23	CH4	2	PPM	THC	7	PPM	NMHC	5	PPM
03/05/2015 9:42	CH4	1.8	PPM	THC	7	PPM	NMHC	5.2	PPM


03/05/2015 10:01	CH4	2.1	PPM	THC	7.6	PPM	NMHC	5.5	PPM
03/05/2015 10:27	CH4	2.3	PPM	THC	8	PPM	NMHC	5.7	PPM
03/05/2015 10:47	CH4	2	PPM	THC	7.3	PPM	NMHC	5.3	PPM
03/05/2015 11:08	CH4	1.8	PPM	THC	6.7	PPM	NMHC	4.9	PPM
03/05/2015 11:28	CH4	1.6	PPM	THC	6.3	PPM	NMHC	4.7	PPM
03/05/2015 11:56	CH4	1.7	PPM	THC	6.5	PPM	NMHC	4.8	PPM
03/05/2015 12:17	CH4	1.4	PPM	THC	5.6	PPM	NMHC	4.2	PPM
03/05/2015 12:32	CH4	1.3	PPM	THC	5.1	PPM	NMHC	3.8	PPM
03/05/2015 12:50	CH4	1.2	PPM	THC	4.4	PPM	NMHC	3.2	PPM
03/05/2015 13:08	CH4	1.4	PPM	THC	4.9	PPM	NMHC	3.5	PPM
03/05/2015 13:29	CH4	1.1	PPM	THC	4.2	PPM	NMHC	3.1	PPM
03/05/2015 13:48	CH4	1.2	PPM	THC	3.9	PPM	NMHC	2.7	PPM

Variation of hydrocarbons (HC) at ~ ກະຊວງ ສຳ ພັດ (Administrative office at Marketing Terminal) from 03.05.2015 (15:00 Hrs.) to 04.05.2015 (13:00 Hrs.)

15:04	CH4	1.6	PPM	THC	2.8	PPM	NMHC	1.2	PPM
15:15	CH4	1.7	PPM	THC	3.1	PPM	NMHC	1.4	PPM
15:31	CH4	1.9	PPM	THC	3.5	PPM	NMHC	1.6	PPM
15:50	CH4	1.5	PPM	THC	2.9	PPM	NMHC	1.4	PPM
16:11	CH4	1.4	PPM	THC	2.9	PPM	NMHC	1.5	PPM
16:37	CH4	1.7	PPM	THC	3.2	PPM	NMHC	1.5	PPM
17:02	CH4	1.4	PPM	THC	3.3	PPM	NMHC	1.9	PPM
17:31	CH4	1.6	PPM	THC	3.4	PPM	NMHC	1.8	PPM
17:55	CH4	1.8	PPM	THC	3.7	PPM	NMHC	1.9	PPM
18:21	CH4	1.9	PPM	THC	4	PPM	NMHC	2.1	PPM
18:51	CH4	1.8	PPM	THC	3.8	PPM	NMHC	2	PPM
19:11	CH4	1.7	PPM	THC	4	PPM	NMHC	2.3	PPM
19:23	CH4	1.5	PPM	THC	4.3	PPM	NMHC	2.8	PPM
19:45	CH4	1.6	PPM	THC	5.5	PPM	NMHC	3.9	PPM
20:45	CH4	1.7	PPM	THC	5.1	PPM	NMHC	3.4	PPM
21:07	CH4	1.6	PPM	THC	4.8	PPM	NMHC	3.2	PPM
21:29	CH4	1.5	PPM	THC	4.7	PPM	NMHC	3.2	PPM
21:56	CH4	1.4	PPM	THC	4.2	PPM	NMHC	2.8	PPM
22:20	CH4	1.5	PPM	THC	4.1	PPM	NMHC	2.6	PPM
0:39	CH4	1.7	PPM	THC	4.4	PPM	NMHC	2.7	PPM
1:11	CH4	1.5	PPM	THC	4	PPM	NMHC	2.5	PPM
2:11	CH4	1.4	PPM	THC	3.5	PPM	NMHC	2.1	PPM
2:12	CH4	1.5	PPM	THC	3.7	PPM	NMHC	2.2	PPM
2:37	CH4	1.7	PPM	THC	4	PPM	NMHC	2.3	PPM
3:17	CH4	1.5	PPM	THC	3.7	PPM	NMHC	2.2	PPM
3:43	CH4	1.7	PPM	THC	4.1	PPM	NMHC	2.4	PPM
4:04	CH4	1.5	PPM	THC	3.7	PPM	NMHC	2.2	PPM
4:28	CH4	1.4	PPM	THC	3.5	PPM	NMHC	2.1	PPM
4:51	CH4	1.6	PPM	THC	3.9	PPM	NMHC	2.3	PPM

5:45	CH4	1.9	PPM	THC	4.1	PPM	NMHC	2.2	PPM
6:14	CH4	2	PPM	THC	4.3	PPM	NMHC	2.3	PPM
6:32	CH4	2	PPM	THC	4.5	PPM	NMHC	2.5	PPM
6:52	CH4	2.1	PPM	THC	4.8	PPM	NMHC	2.7	PPM
7:15	CH4	2.2	PPM	THC	5	PPM	NMHC	2.8	PPM
7:39	CH4	2.3	PPM	THC	5.3	PPM	NMHC	3	PPM
8:05	CH4	2.4	PPM	THC	5.5	PPM	NMHC	3.1	PPM
8:33	CH4	2.2	PPM	THC	5.1	PPM	NMHC	2.9	PPM
9:00	CH4	2.1	PPM	THC	5.2	PPM	NMHC	3.1	PPM
9:27	CH4	2.3	PPM	THC	5.1	PPM	NMHC	2.8	PPM
9:52	CH4	2.1	PPM	THC	4.8	PPM	NMHC	2.7	PPM
10:17	CH4	2.2	PPM	THC	4.7	PPM	NMHC	2.5	PPM
10:37	CH4	1.9	PPM	THC	4.2	PPM	NMHC	2.3	PPM
11:02	CH4	1.8	PPM	THC	3.9	PPM	NMHC	2.1	PPM
11:30	CH4	1.7	PPM	THC	4	PPM	NMHC	2.3	PPM
11:50	CH4	1.5	PPM	THC	3.6	PPM	NMHC	2.1	PPM
12:09	CH4	1.6	PPM	THC	3.5	PPM	NMHC	1.9	PPM
12:31	CH4	1.7	PPM	THC	3.5	PPM	NMHC	1.8	PPM
12:52	CH4	1.4	PPM	THC	3.2	PPM	NMHC	1.8	PPM





CERTIFICATE OF CONFORMITY

GAS NAME	ALPHAGAZ TM - ① H ₂		
SPECIFICATION	N50		
IMPURITY	O ₂	≤	2 PPM
	MOISTURE	≤	3 PPM
	CnHm	≤	0.5 PPM
PRESSURE AT 27° C	200		kg/cm ²
VOLUME	8		Sm ³

FILLING & DISPATCH DETAILS

DATE OF FILLING 18/3/15

BATCH NO. NYP11503002

FILLED BY TC

CHECKED BY [Signature]

AIR LIQUIDE NORTH INDIA PVT. LTD.
 Plot No. 36, Sector-8, Dharuhera Industrial Area
 Dharuhera, Distt. Rewari-123106 (Haryana)
 Ph.: +91 1274 304 902, E-mail : sales.north@airliquide.com

ANNEXURE: SOP/PRD/C2/01/02/ANN/09/02 SA/AL/27

ANALYSIS REPORT

Name of Party : M/S INDIAN OIL CORPORATION LTD.
Invoice No. : 158
Date Of Analysis : 29.04.2015
Purchase Order No. : -
Purchase Order Dt. : -
Batch No : **PROD/15-16/1035**
Material Name : Gas Mixture
Material Code :
Container No./Cyl. No. : 65334
Container Capacity / MOC : 10 Ltr.
Filling Pressure : 125kg/cm²
Stability : 1 Year
Method of Analysis : Gravimetric Value
Method Of Preparation : Volumetric Method
Preparation Tolerance : $\pm 10 \%$
Certification Accuracy : $\pm 1 \%$

S.NO.	Component	Ord. Conc.	Certified Conc.
1	Methane	2.0 PPM	2.10 PPM
2	Propane	2.0 PPM	2.12 PPM
3	Nitrogen	Bal.	Bal.

Traceability Certification

1. The Product is prepared by using Weigh/Pressure Gauge of Accuracy Traceable to National Standards through M/S NATIONAL PHYSICAL LABORATORY (Weights and Measures) Govt. of India.
2. Process Traceability Complying with ISO 9001 Certified System.

For Amit Air product

Authorized Signatory



www.amitairproduct.com

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+91-11-27184641, 27151199, 9313747035, 9811241032
email : sunilshah_06@yahoo.co.in, amitshah_05@yahoo.com
Regd. Office : C-7/111, Keshav Puram, Lawrence Road, Delhi - 35



ANALYSIS REPORT

Name of Party : M/S INDIAN OIL CORPORATION LTD.
Invoice No. : 158
Date Of Analysis : 29.04.2015
Purchase Order No. : -
Purchase Order Dt. : -
Batch No : PROD/15-16/1035
Material Name : Gas Mixture
Material Code :
Container No./Cyl. No. : 138739
Container Capacity / MOC : 10 Ltr.
Filling Pressure : 125kg/cm2
Stability : 1 Year
Method of Analysis : Gravimetric Value
Method Of Preparation : Volumetric Method
Preparation Tolerance : $\pm 10\%$
Certification Accuracy : $\pm 1\%$

S.NO.	Component	Ord. Conc.	Certified Conc.
1	Methane	18 PPM	18.50 PPM
2	Propane	40 PPM	40.30 PPM
3	Nitrogen	Bal.	Bal.

Traceability Certification

1. The Product is prepared by using Weigh/Pressure Gauge of Accuracy Traceable to National Standards through M/S NATIONAL PHYSICAL LABORATORY (Weights and Measures) Govt. of India.
2. Process Traceability Complying with ISO 9001 Certified System.

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email : sunilshah_06@yahoo.co.in, amitshah_05@yahoo.com
Regd. Office : C-7/111, Keshav Puram, Lawrence Road, Delhi - 35



ANALYSIS REPORT

Name Of Party : M/s Indian Oil Corporation Ltd.
Invoice No. : 158
Date : 29.04.15
Purchase Order No. : -
Purchase Order Dt. : -
Batch No. : PROD/15-16/1752
Material Name : Hydrogen Gas (Grade:- UHP)
Material Code : -
Container No. : -
Container Capacity / MOC : 47 ltr. Carbon Steel
Filling Pressure : 130-140 Kg/cm²
Preparation Tolerance : -

S.NO.	CYLINDER No.	PURITY	O2(PPM)	H2O(PPM)
1	52247	99.999%	1.2	1.3

Max Limit : O₂: 2 PPM , H₂O: 2 PPM

Cylinder Basis : Refilling

For Amit Air Product



[IC / QC]

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