# Air Quality Monthly Report

## June, 2018

Department of Environment
Ministry of Environment, Forest and Climate Change
Bangladesh

# Content

1. Introduction ..... 1
2. Monitoring Network ..... 2
3. Monthly Air Quality ..... 3
4. Summary and conclusion ..... 4
5. ANNEX……9

## 1. Introduction

Air quality management plans based on knowledge of sources, appropriate air quality standards, accurate air quality data, and effective incentives; and enforcement policies is therefore needed to be adopted.

At this backdrop, real-time measurements of ambient level pollutants were made at 8 major cities (Namely, Dhaka, Narayangonj, Gazipur, Chittagong, Rajshahi, Khulna, Barisal and Sylhet) of Bangladesh. The data generated will be used to define the nature and severity of pollution in the cities; identify pollution trends in the country; and develop air models and emission inventories.

The program encompasses operation of the sampling and monitoring network, and quality assurance activities to ensure the quality of the data collected and disseminated by the CASE project.

CASE project monitors the criteria pollutants such as carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, PM10 and PM2.5. Monitoring is performed to demonstrate attainment or non-attainment of national ambient air quality standards to assess the trends of air pollution levels.

The main purpose of this report is to present, analyze and make available of these data to the general public, stakeholders, researchers and policy makers to develop effective air pollution abatement strategies. This report summarizes the air quality data collected at the different CAMS in operation under the Department of Environment (DoE) air quality monitoring network.

The basis for discussion of air quality has been the data collected from the Air Quality monitoring Network stations under DoE. The data have been quality controlled and the air pollution levels have been compared to the Bangladesh Ambient Air Quality Standard as adopted in 2005. Table 1 represents the current and approved air quality standards for Bangladesh.

Table 1: National Ambient Air Quality Standards for Bangladesh

| Pollutant | Objective | Average |
|---|---|---|
| CO | 10 mg/m$^3$ (9 ppm) | 8 hours(a) |
| | 40 mg/m$^3$ (35 ppm) | 1 hour(a) |
| Pb | 0.5 µg/m$^3$ | Annual |
| $NO_x$ | 100 µg/m$^3$ (0.053 ppm) | Annual |
| PM10 | 50 µg/m$^3$ | Annual (b) |
| | 150 µg/m$^3$ | 24 hours (c) |
| PM2.5 | 15 µg/m$^3$ | Annual |
| | 65 µg/m$^3$ | 24 hours |
| $O_3$ | 235 µg/m$^3$ (0.12 ppm) | 1 hour (d) |
| | 157 µg/m$^3$ (0.08 ppm) | 8 hours |
| $SO_2$ | 80 µg/m$^3$ (0.03 ppm) | Annual |
| | 365 µg/m$^3$ (0.14 ppm) | 24 hours (a) |

Notes:
(a) Not to be exceeded more than once per year
(b) The objective is attained when the annual arithmetic mean is less than or equal to 50 ug/m$^3$
(c) The objective is attained when the expected number of days per calendar year with a 24-hour average of 150 µg/m$^3$ is equal to or less than 1
(d) The objective is attained when the expected number of days per calendar year with the maximum hourly average of 0.12 ppm is equal to or less than 1 (Source: AQMP, DOE).

## 2. Monitoring Network

The main objective of the Bangladesh AQM network is to provide reliable information to the authorities and to the public about the air quality in most populous cities of Bangladesh.

As a part of the air quality monitoring strategy, several objectives can be achieved, including:

- Establish source/receptor relationships;
- Identify which are the pollutants of concern and their current status;
- Show how widespread air pollution problems are and indicate the general extent of the public exposure;
- Provide benchmarks against which trends in overall air quality can be compared and devise performance indicators for assessing the impact of an air quality management plan or strategy;
- Provide a data base for evaluation of effects; of urban, land use management, and transportation planning; of development and evaluation of abatement strategies; and of development and validation of atmospheric processes and models.

Another objective in the monitoring and management programme is to provide input data for modeling. These data will serve as a background for performing air quality planning and abatement studies. Model results may also serve as input to other studies such as health related investigations and exposure assessments.

The ambient air quality monitoring network Bangladesh consists of eleven (11) fixed Continuous Air Monitoring Stations (CAMS). The locations of the 11 CAMS are shown in Figure 1. Brief description of the monitoring stations and the list of measured parameters recorded at each station are provided inTable 2.

Table 2: Description of Monitoring Network:

| City | ID | Location | Lat/Lon | Monitoring capacity |
|---|---|---|---|---|
| Dhaka | CAMS-1 | SangshadBhaban, Sher-e-Bangla Nagar | 23.76N 90.39E | PM10, PM2.5, CO, SO2, NOX, O3, and HC concentrations with meteorological parameters. |
| | CAMS-2 | Firmgate | 23.76N 90.39E | PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters. |
| | CAMS-3 | Darus-Salam | 23.78N 90.36E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |
| Gazipur | CAMS-4 | Gazipur | 23.99N 90.42E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |
| Narayangonj | CAMS-5 | Narayangonj | 23.63N 90.51E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |
| Chittagong | CAMS-6 | TV station, Khulshi | 22.36N 91.80E | PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters. |
| | CAMS-7 | Agrabad | 22.32N 91.81E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |
| Khulna | CAMS-8 | Baira | 22.48N 89.53E | PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological parameters |
| Rajshahi | CAMS-9 | Sopura | 24.38N 88.61E | PM10, PM2.5, CO, SO2, NOX, O3, and HC with meteorological |

| City | ID | Location | Lat/Lon | Monitoring capacity |
|---|---|---|---|---|
| | | | | parameters. |
| Sylhet | CAMS-10 | Red Crecent Campus | 24.89N 91.87E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |
| Barisal | CAMS-11 | DFO office campus | 22.71N 90.36E | PM10, PM2.5, CO, SO2, NOX and O3 with meteorological parameters. |

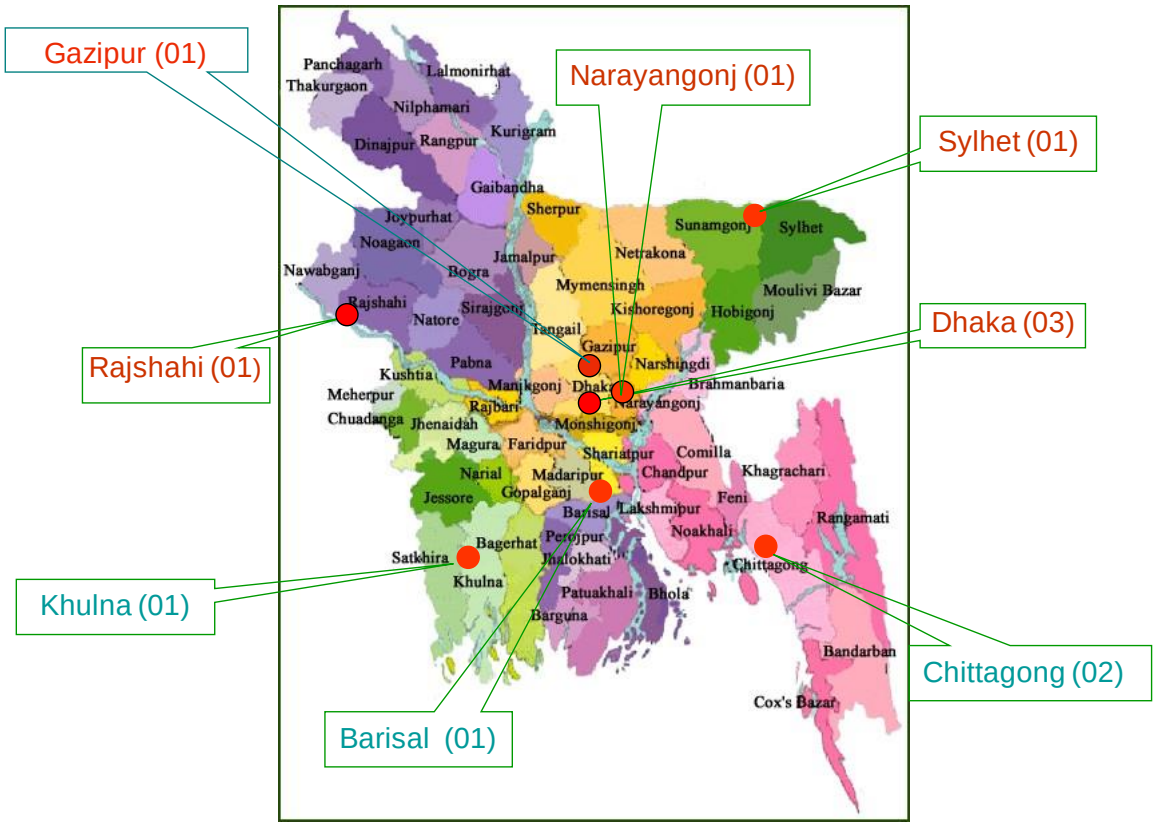



Figure 1: CAMS Location in Bangladesh

Monitoring data from network stations are transferred to a central data centre at the Department of Environment office in Dhaka and simultaneously database maintained by the designated officials for quality check, control, evaluation, validation and statistical analysis. Quality controlled data are then stored in the final database for further analysis, reporting, presentations and future use.

## 3. Monthly Air Quality

The data presented in this report are based on monitoring results of air quality parameters during the month of June, 2018 from11 CAMS operated by CASE-DoE monitoring network. Table-3 summarizes the basic statistics of the data along with the data capture rate and the number of days for which specific pollutant exceeded the Bangladesh National Ambient Air Quality Standard (BNAAQS). Since NOx have only annual standard, so for this pollutant daily 24-hours average concentration levels were compared with the annual average. During data quality control some data, which are outliers (beyond 3$^{rd}$ and 97$^{th}$ percentile) and inconsistent data, were flagged as invalid and those were not included in the analysis. Time series plots based on the data generated in the CAMS are also given in Annexes.

In general the data capture rate found little bit low compare to the previous month except few parameters in some CAMS in operation. During the reporting month several analyzers were not functional for some days due to routine preventive/corrective maintenance.

Inspection of the available data shows that there were few occurrences of non-compliance for PM10& PM2.5 levels at all monitoring stations during the month of June, 2018.It is observed that the 24 hr average concentration level of PM2.5 exceeded BNAAQS for 03 days in BARC and 01 days in D.salam CAMS, 03 day at Gazipur CAMS during the month of June, 2018. For PM10 non-attainment with respect to BNAAQS occurred for 03 days at Rajshahi CAMS only during the reporting month. The monthly average concentration level of PM2.5 and PM10 measured at different CAMS were found 18.50-47.08µg/m3 and 35.60-96.20 µg/$m^3$ respectively during the monitoring month of May, 2018.The concentration level of those was found 15.25-59.49 µg/m3 and 35-110 µg/$m^3$ in the month of May, 2018. From the time series plot of both PM10 and PM2.5, it is seen in most cases PM concentrations less than the BNAAQS. 24-hours average PM levels in all cities monitored are decreasing compared to previous month because of increasing average wind speed and good number of rainy days along with some other emission situations. It is also observed that gaseous pollutants measured at different CAMS did not exceed the BNAAQS during the month of June, 2018.

In general PM pollution levels in the cities monitored during the reporting month found lower compared to previous month in respect of public health. Usually in the dry seasons the pollution level reached highest peak compare to the wet season, which is reflected in the data monitored in all CAMS during the month of June, 2018. It is observed that average wind speed and precipitation compared to previous month has an increasing tendency, which increases the rate of deposition and dispersion of the pollutants and this might be a reason for observed lower PM concentration.

Daily air quality index (AQI) values were calculated based on the available air quality data and summary of the AQI by categories are presented in annex Figure 5. Summary data shows majority of the days AQI values were Good and Moderate along with some Caution days and few Unhealthy in some cities.

# 4. Summary and conclusion

Data obtained from CAMS operated under DoE air quality monitoring network during June, 2018 have been analyzed and reported. Data availability was 60-90% for all the criteria pollutants monitored at different CAMS with few exceptions. Air quality data for few pollutants were not reported because either the analyzer was not functional or the data capture rate was too low. From the analysis of the data following conclusion can be drawn:

- $PM_{10}$ and $PM_{2,5}$ are the most critical pollutants. 24-hour average for both PM10 and PM2.5concentrations were found lower than the BNAAQS during the month of June, 2018 with few exceptions. It is observed that the average concentration level of PM2.5 and PM10 measured at different CAMS were 18.50-47.08µg/m3 and 35.60-96.20 µg/$m^3$ respectively during the monitoring month of June, 2018
- The gaseous pollutants measured at different CAMS did not exceed limit values of the BNAAQS.
- Due to increasing average wind speed and some precipitation during June, 2018, the pollution concentration levels showed lower than the previous month.
- Monthly summary of calculated AQI values based on data from different CAMS showed that during this month most of day's air qualities were Good and Moderate along with some Caution days and few Unhealthy in some cities and in all cases most frequent responsible pollutant was PM2.5.

During the reporting month number of analyzer especially gaseous analyzers of some CAMS did not produced data because of their repair and maintenance activities.

## ANNEX

Table 3: Summary Air Quality and Meteorological data measured during June, 2018 at different CAMS operated under DoE

| Parameter | unit | NAAQS | Summary | CAMS-1 (S-Bhaban) | CAMS-2 (BARC)[a] | CAMS-3 (D-salam) | CAMS-4 (Gazipur) | CAMS-5 (Narayonganj) | CAMS-6 TV-St (Chittagong)[a] | CAMS-7 Agrabad-(Chittagong) | CAMS-8 (Sylhet) | CAMS-9 (Khulna)[a] | CAMS-10 (Rajshahi)[a] | CAMS-11 (Barisal) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$ -24 hr | ppb | 140 | Average | DNA | DNA | DNA | DNA | 4.30 | DNA | DNA | DNA | 12.0 | 1.75 | 13.6 |
| | | | Max | DNA | DNA | DNA | DNA | 6.47 | DNA | DNA | DNA | 26.7 | 2.78 | 17.1 |
| | | | Min | DNA | DNA | DNA | DNA | 2.73 | DNA | DNA | DNA | 0.87 | 0.91 | 12.1 |
| | | | Excedance(Days) | DNA | DNA | DNA | DNA | 0 | DNA | DNA | DNA | 0 | 0 | 0 |
| | | | Data capture(%) | DNA | DNA | DNA | DNA | 91 | DNA | DNA | DNA | 34 | 80 | 86 |
| $NO_2$ -24 hr | ppb | 53 (Annual) | Average | DNA | DNA | 5.34 | 3.62 | 15.3 | 27.4 | 17.0 | 9.24 | 20.0 | DNA | 26.2 |
| | | | Max | DNA | DNA | 18.7 | 9.37 | 27.5 | 42.4 | 22.1 | 13.1 | 30.8 | DNA | 28.5 |
| | | | Min | DNA | DNA | 0.83 | 1.33 | 5.04 | 16.2 | 12.7 | 6.71 | 11.8 | DNA | 22.9 |
| | | | Excedance(Days) | DNA | DNA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | DNA | 0 |
| | | | Data capture(%) | DNA | DNA | 80 | 46 | 86 | 30 | 68 | 94 | 36 | DNA | 86 |
| CO- 1 hr | ppm | 35 | Average | DNA | 1.54 | 2.81 | DNA | 0.43 | DNA | DNA | DNA | 1.15 | 0.82 | DNA |
| | | | Max | DNA | 6.72 | 5.43 | DNA | 0.99 | DNA | DNA | DNA | 8.75 | 2.18 | DNA |
| | | | Min | DNA | 0.05 | 2.20 | DNA | 0.09 | DNA | DNA | DNA | 0.05 | 0.06 | DNA |
| | | | Excedance(Hour) | DNA | 0 | 0 | DNA | 0 | DNA | DNA | DNA | 0 | 0 | DNA |
| | | | Data capture(%) | DNA | 60 | 91 | DNA | 92 | DNA | DNA | DNA | 29 | 87 | DNA |
| CO-8hr | ppm | 9 | Average | DNA | 1.68 | 2.82 | DNA | 0.43 | DNA | DNA | DNA | 1.24 | 0.84 | DNA |
| | | | Max | DNA | 5.30 | 3.74 | DNA | 0.84 | DNA | DNA | DNA | 8.51 | 1.67 | DNA |
| | | | Min | DNA | 0.19 | 2.36 | DNA | 0.16 | DNA | DNA | DNA | 0.11 | 0.13 | DNA |
| | | | Excedance(Hour) | DNA | 0 | 0 | DNA | 0 | DNA | DNA | DNA | 0 | 0 | DNA |
| | | | Data capture(%) | DNA | 52 | 91 | DNA | 93 | DNA | DNA | DNA | 21 | 85 | DNA |
| $O_3$-1hr | ppb | 120 | Average | DNA | 5.59 | 1.78 | DNA | DNA | 3.56 | DNA | DNA | DNA | 1.68 | DNA |
| | | | Max | DNA | 23.8 | 8.05 | DNA | DNA | 5.43 | DNA | DNA | DNA | 51.9 | DNA |
| | | | Min | DNA | 0.08 | 0.51 | DNA | DNA | 0.29 | DNA | DNA | DNA | 0.05 | DNA |
| | | | Excedance(Hour) | DNA | 0 | 0 | DNA | DNA | 0 | DNA | DNA | DNA | 0 | DNA |
| | | | Data capture(%) | DNA | 84 | 14 | DNA | DNA | 33 | DNA | DNA | DNA | 65 | DNA |
| $O_3$-8hr | ppb | 80 | Average | DNA | 5.62 | 1.88 | DNA | DNA | 3.59 | DNA | DNA | DNA | 1.38 | DNA |
| | | | Max | DNA | 15.1 | 4.69 | DNA | DNA | 4.38 | DNA | DNA | DNA | 13.9 | DNA |
| | | | Min | DNA | 0.35 | 0.60 | DNA | DNA | 2.48 | DNA | DNA | DNA | 0.16 | DNA |
| | | | Excedance(Hour) | DNA | 0 | 0 | DNA | DNA | 0 | DNA | DNA | DNA | 0 | DNA |
| | | | Data capture(%) | DNA | 83 | 13 | DNA | DNA | 31 | DNA | DNA | DNA | 62 | DNA |

**CAMS= Continuous Air Monitoring Station, NAAQS=National Ambient Air Quality Standard, a=Refurbisment CAMS, PM= Particulate Matter**
**DNA= Data Not Available**

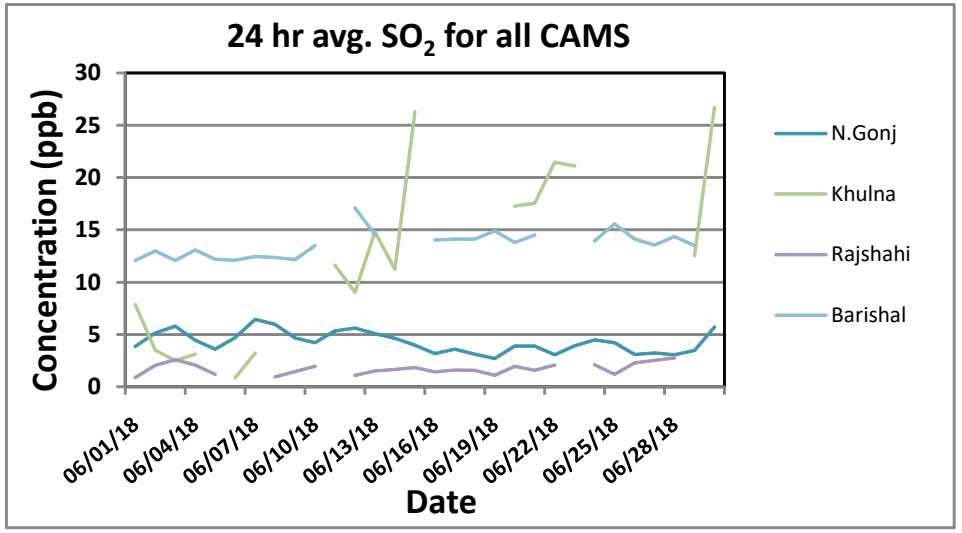
Table 3: Summary Air Quality and Meteorological data measured during June, 2018 at different CAMS operated under DoE (Cont'd)

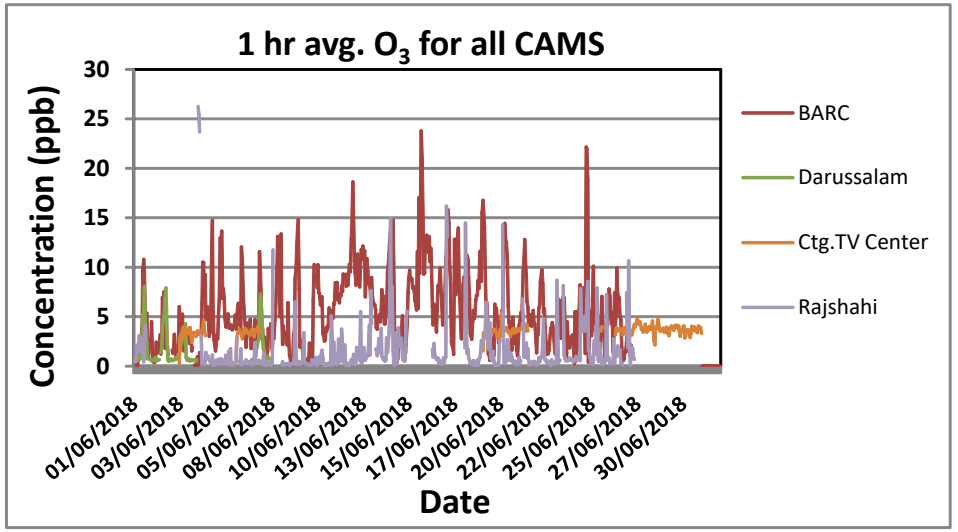
| Parameter | unit | NAAQS | Summary | CAMS-1 (S-Bhaban) | CAMS-2 (BARC)[a] | CAMS-3 (D-salam) | CAMS-4 (Gazipur) | CAMS-5 (Narayonganj) | CAMS-6 TV-St (Chittagong)[a] | CAMS-7 Agrabad-(Chittagong) | CAMS-8 (Sylhet) | CAMS-9 (Khulna)[a] | CAMS-10 (Rajshahi)[a] | CAMS-11 (Barisal) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $PM_{2.5}$ -24hr | µg /$m^3$ | 65 | Average | DNA | 47.8 | 37.7 | 37.5 | 29.7 | 19.1 | DNA | 20.6 | 18.5 | 32.2 | 24.0 |
| | | | Max | DNA | 78.4 | 66.2 | 90.6 | 43.5 | 35.4 | DNA | 40.4 | 47.8 | 47.3 | 46.4 |
| | | | Min | DNA | 26.2 | 16.8 | 9.47 | 14.2 | 9.55 | DNA | 7.85 | 6.74 | 19.1 | 8.91 |
| | | | Excedance(Days) | DNA | 3 | 1 | 3 | 0 | 0 | DNA | 0 | 0 | 0 | 0 |
| | | | Data capture(%) | DNA | 80 | 92 | 38 | 82 | 29 | DNA | 71 | 41 | 82 | 68 |
| $PM_{10}$ -24hr | µg /$m^3$ | 150 | Average | DNA | 71.8 | 77.7 | 56.5 | 92.0 | 35.6 | 66.6 | 47.9 | 39.7 | 96.2 | 44.6 |
| | | | Max | DNA | 122 | 124 | 108 | 147 | 64.0 | 143 | 83.7 | 78.7 | 206 | 108 |
| | | | Min | DNA | 37.4 | 33.7 | 22.9 | 50.4 | 18.9 | 17.1 | 25.6 | 20.2 | 46.0 | 18.8 |
| | | | Excedance(Days) | DNA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | | | Data capture(%) | DNA | 77 | 83 | 42 | 76 | 32 | 53 | 79 | 38 | 86 | 78 |
| Solar rad. 1hr | watt/$m^2$ | NA | Average | DNA | DNA | 188 | DNA | DNA | 79.6 | 190 | 183 | DNA | 164 | 176 |
| | | | Max | DNA | DNA | 994 | DNA | DNA | 97.8 | 901 | 970 | DNA | 372 | 974 |
| | | | Min | DNA | DNA | 5.52 | DNA | DNA | 9.77 | 5.40 | 5.21 | DNA | 120 | 8.05 |
| | | | Data capture(%) | DNA | DNA | 94 | DNA | DNA | 18 | 79 | 94 | DNA | 87 | 86 |
| Relative Humidity 1hr | (%) | NA | Average | DNA | DNA | 77.3 | DNA | DNA | 79.6 | 80.0 | 83.4 | DNA | 82.2 | 85.5 |
| | | | Max | DNA | DNA | 90.5 | DNA | DNA | 97.8 | 95.9 | 98.7 | DNA | 96.2 | 99.3 |
| | | | Min | DNA | DNA | 57.1 | DNA | DNA | 9.77 | 55.7 | 45.9 | DNA | 40.8 | 57.2 |
| | | | Data capture(%) | DNA | DNA | 94 | DNA | DNA | 18 | 79 | 94 | DNA | 63 | 86 |
| Ambient Temp. 1hr | (°c) | NA | Average | DNA | DNA | 29.9 | DNA | DNA | 26.3 | 29.8 | 28.2 | DNA | 28.2 | 30.0 |
| | | | Max | DNA | DNA | 35.4 | DNA | DNA | 31.3 | 36.0 | 36.6 | DNA | 34.7 | 36.0 |
| | | | Min | DNA | DNA | 23.2 | DNA | DNA | 16.7 | 21.7 | 22.6 | DNA | 5.65 | 24.6 |
| | | | Data capture(%) | DNA | DNA | 94 | DNA | DNA | 33 | 79 | 94 | DNA | 76 | 86 |
| Rainfall 1hr | (m.m.) | NA | Average | DNA | DNA | 0.17 | 1.68 | DNA | 0.04 | 0.59 | 0.49 | DNA | 22.58 | DNA |
| | | | Max | DNA | DNA | 4.00 | 3.42 | DNA | 0.15 | 16.1 | 9.05 | DNA | 52.48 | DNA |
| | | | Min | DNA | DNA | 0.02 | 0.03 | DNA | 0.02 | 0.02 | 0.02 | DNA | 1.09 | DNA |
| | | | Data capture(%) | DNA | DNA | 31 | 50 | DNA | 1 | 79 | 56 | DNA | 25 | DNA |

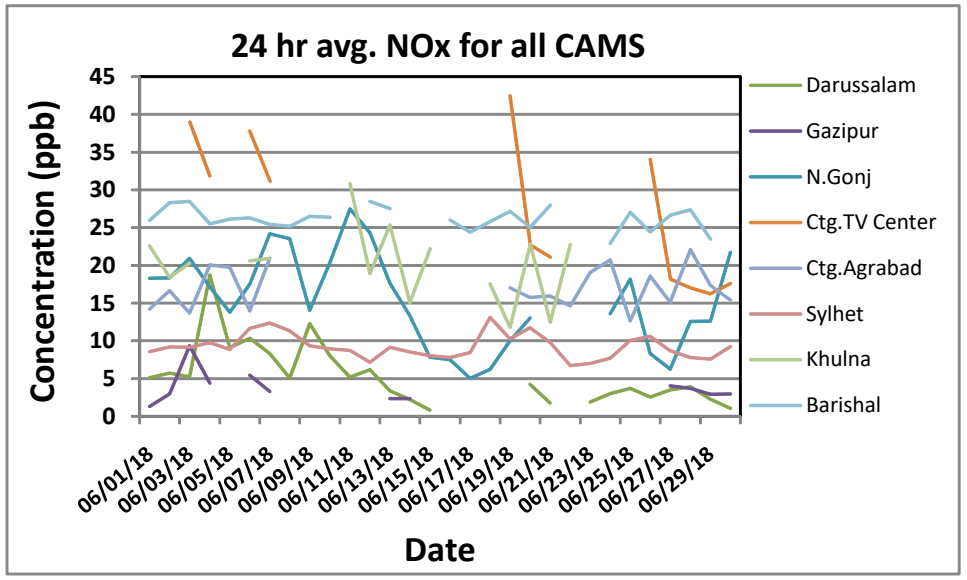
**CAMS= Continuous Air Monitoring Station, NAAQS=National Ambient Air Quality Standard, a=Refurbisment CAMS, PM= Particulate Matter**

**DNA= Data Not Available**

FIGURE 3: TIME SERIES OF ALL PARAMETERS ($SO_2$, NOx AND $O_3$) MEASURED IN ALL CAMS DURING JUNE, 2018



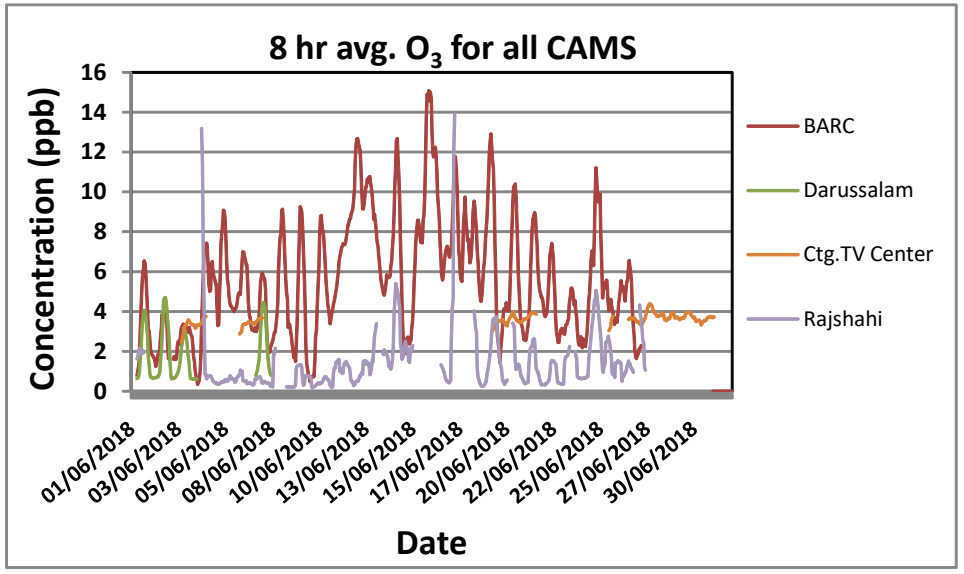
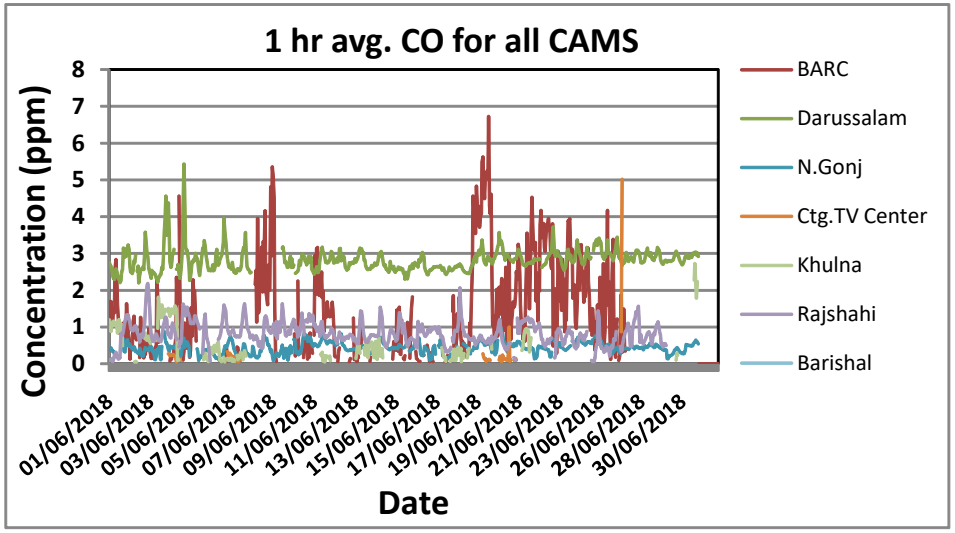
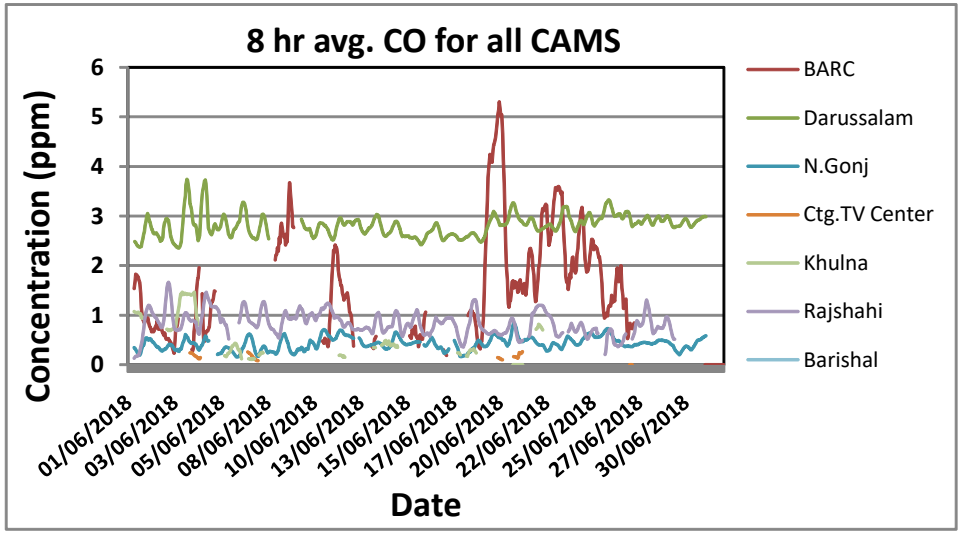
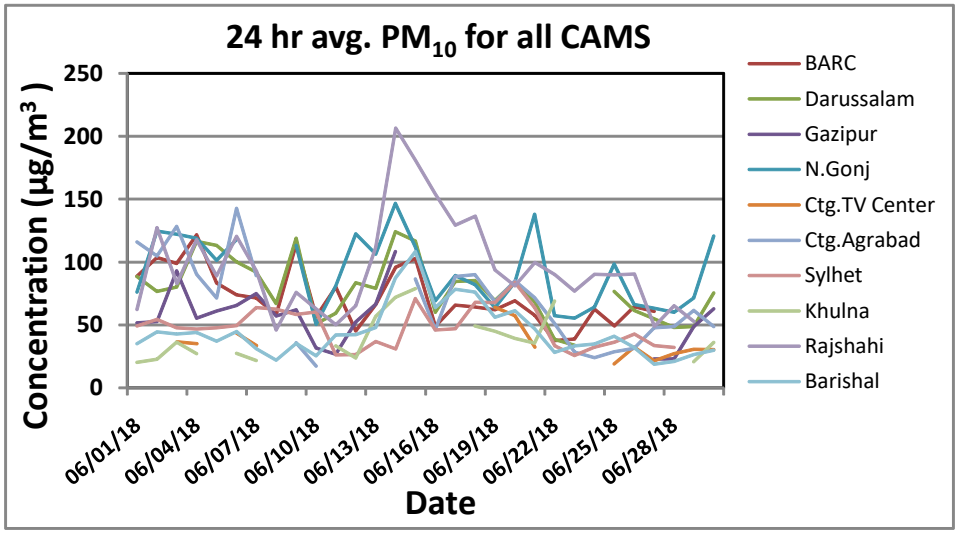



FIGURE 4: TIME SERIES OF ALL PARAMETERS (CO, PM10 AND PM2.5) MEASURED IN CAMS DURING JUNE, 2018



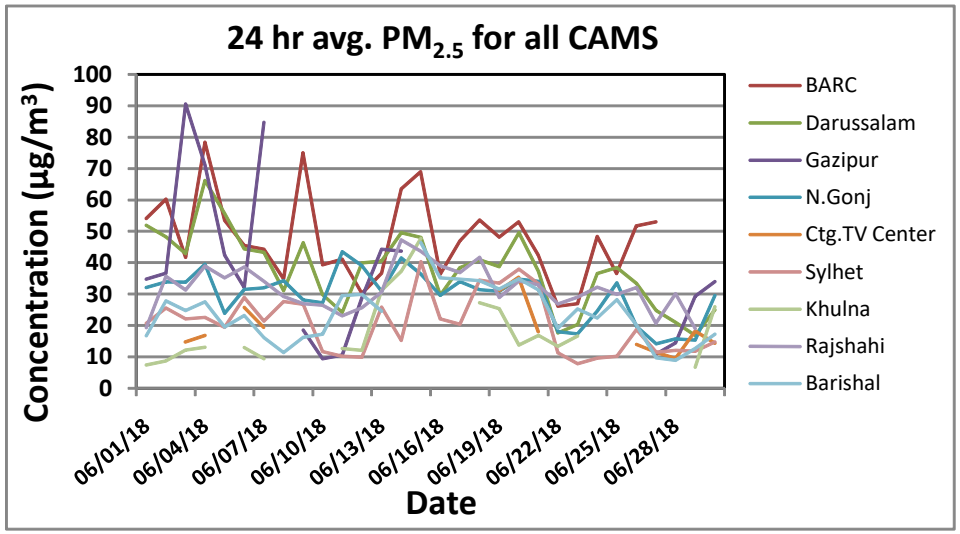



Figure 5: Monthly Summary of AQI for month of June, 2018