Air Quality Monthly Report
February, 2019

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

Content

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 August 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.

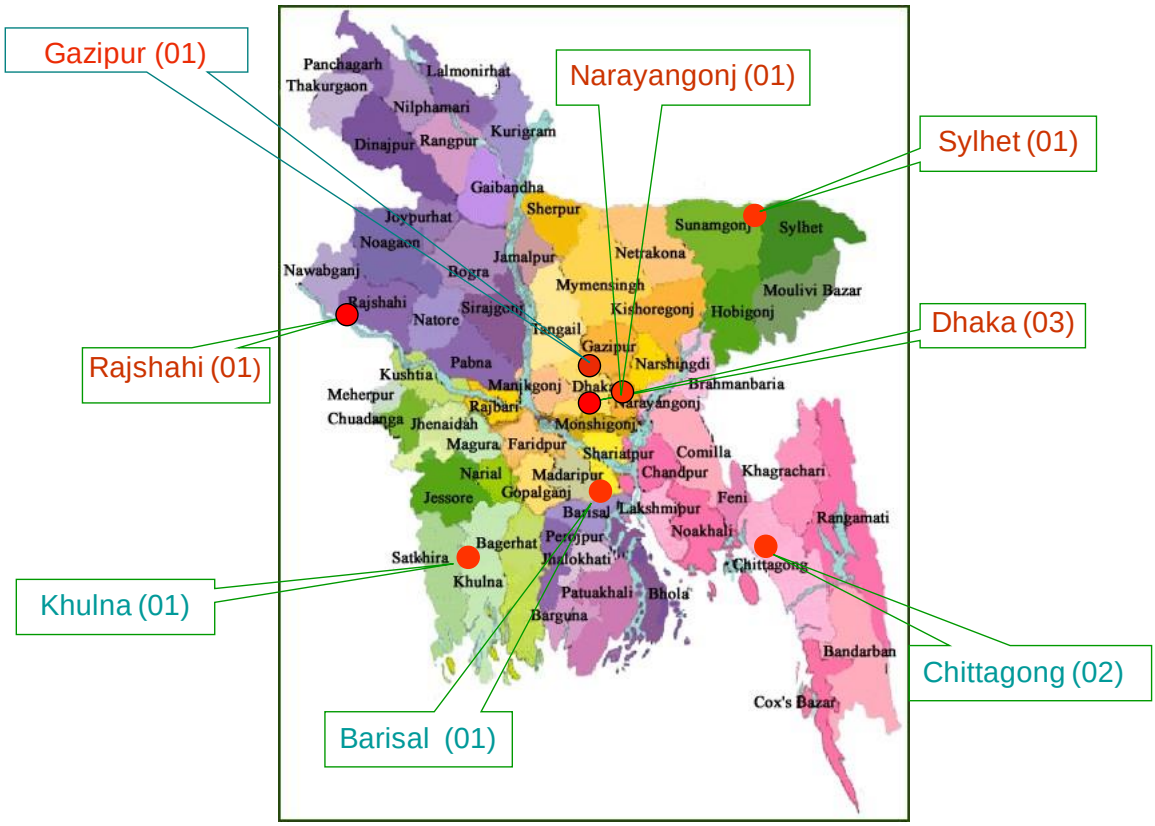


Figure 1: CAMS Location in Bangladesh

Monitoring data from network stations are transferred to a central data centre at the Department of Environment office in Dhaka and simultaneously transferred to Air Quality Management System based on NILU AIRQUIS system established under BAPMAN project. The data are stored in AIRQUIS database for quality check, control, evaluation, validation, 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 February, 2019 from 11 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 3rd and 97th 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. 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 occurrences of non-compliance for PM10& PM2.5 levels at all monitoring stations during the month of February, 2019. It is observed that the 24 hr average concentration level of PM2.5 exceeded BNAAQS for 21-25 days in CDA Chittagong CAMS, BARC CAMS, Gazipur CAMS, Sylhet CAMS, Narayonganj CAMS, Khulna CAMS and Barishal CAMS and 15-19 days in Sangsad CAMS, Darussalam CAMS, and Rajshahi CAMS. On the other hand, 24 hr average concentration level of PM10 from the BNAAQS exceeded for 20-24 days in Darussalam, BARC, Gazipur, Rajshahi, Narayanganj, Sylhet CAMS &, 10-17 days in and in Khulna CAMS and Barishal CAMS. The range of monthly average concentration of PM2.5 and PM10 measured at different CAMS were 90-174 µg/m3 and 121-318 µg/m^3 respectively during the monitoring month of February, 2019. From BNAAQS point of view, concentrations of PM cross their standards most of the days (Fig-3). 24-hours average PM levels in all cities demonstrate similar trends compared to January 2019 due to decrease the precipitation. It is also observed that gaseous pollutants measured at different CAMS did not exceed the BNAAQS during the month of February, 2019.

In general PM pollution levels in the cities monitored during the reporting month found higher 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 February, 2019.

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 that AQI values were Extremely Unhealthy to Very Unhealthy along with few Unhealthy in couple of CAMS.

4. Summary and conclusion

Data obtained from CAMS operated under DoE air quality monitoring network during February, 2019 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. From BNAAQS point of view, 24-hour average for both PM10 and PM2.5 concentrations were found higher in this month. It is observed that the average concentration level of PM2.5 and PM10 measured at different CAMS were 90-174 µg/m3 and 121-318 µg/m^3 respectively during the monitoring month of February, 2019.
- The gaseous pollutants measured at different CAMS did not exceed limit values of the BNAAQS.
- As a month of winter during February, 2019, the pollution concentration level was higher although there was no remarkable variation of average wind speed.
- Monthly summary of calculated AQI values based on data from different CAMS showed that during this month most of day's air quality was in all categories with the majority of Extremely Unhealthy to Very Unhealthy along with few Unhealthy in couple of CAMS and in most of the cases responsible pollutant was PM2.5.

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

ANNEX

Table 3: Summary Air Quality and Meteorological data measured during February,2019 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	7.79	2.77	12.4	DNA	29.2	DNA	DNA	2.60	DNA	8.13	1.82
			Max	10.4	4.75	31.8	DNA	64.5	DNA	DNA	4.15	DNA	13.2	2.71
			Min	6.38	1.25	1.99	DNA	11.4	DNA	DNA	0.87	DNA	2.43	0.91
			Excedance(Days)	0	0	0	DNA	0	DNA	DNA	0	DNA	0	0
			Data capture(%)	53	83	89	DNA	86	DNA	DNA	90	DNA	47	45
NO_2 -24 hr	ppb	53 (Annual)	Average	66.1	111	71.0	45.5	64.9	DNA	27.8	36.9	33.4	43.2	17.5
			Max	167	200	201	103	126	DNA	40.9	54.6	48.9	68.7	41.6
			Min	30.4	7.09	10.9	15.5	25.7	DNA	13.7	17.3	18.2	17.1	2.41
			Excedance(Days)	0	0	0	0	0	DNA	0	0	0	0	0
			Data capture(%)	53	84	88	60	71	DNA	88	90	90	69	85
CO- 1 hr	ppm	35	Average	3.61	0.69	1.59	3.07	1.94	DNA	0.85	1.05	0.88	1.22	1.58
			Max	6.01	1.25	5.82	6.62	4.85	DNA	3.22	7.79	2.85	7.20	5.14
			Min	2.10	0.08	0.58	1.60	0.84	DNA	0.05	0.14	0.06	0.05	0.87
			Excedance(Hour)	0	0	0	0	0	DNA	0	0	0	0	0
			Data capture(%)	53	89	48	80	86	DNA	87	90	73	64	90
CO-8hr	ppm	9	Average	3.60	0.69	1.60	3.07	1.95	DNA	0.84	1.04	0.88	1.26	1.58
			Max	5.80	1.00	4.51	5.46	4.16	DNA	2.09	3.98	2.48	4.66	3.79
			Min	2.33	0.38	0.65	1.89	0.95	DNA	0.10	0.24	0.16	0.09	0.90
			Excedance(Hour)	0	0	0	0	0	DNA	0	0	0	0	0
			Data capture(%)	52	90	47	76	83	DNA	86	90	72	59	90
O_3-1hr	ppb	120	Average	DNA	4.65	5.66	16.4	7.38	DNA	8.04	15.0	DNA	18.2	22.5
			Max	DNA	28.7	31.9	53.5	39.2	DNA	25.9	62.3	DNA	60.4	73.2
			Min	DNA	0.09	0.20	0.59	0.85	DNA	2.45	0.15	DNA	0.26	0.06
			Excedance(Hour)	DNA	0	0	0	0	DNA	0	0	DNA	0	0
			Data capture(%)	DNA	85	89	52	78	DNA	83	46	DNA	58	74
O_3-8hr	ppb	80	Average	DNA	4.69	5.70	16.1	7.59	DNA	8.09	15.4	DNA	18.6	23.2
			Max	DNA	14.8	24.9	37.6	27.1	DNA	18.7	50.2	DNA	50.6	59.6
			Min	DNA	0.55	0.54	2.17	1.20	DNA	4.49	0.47	DNA	0.57	1.20
			Excedance(Hour)	DNA	0	0	0	0	DNA	0	0	DNA	0	0
			Data capture(%)	DNA	85	88	41	76	DNA	82	45	DNA	50	67

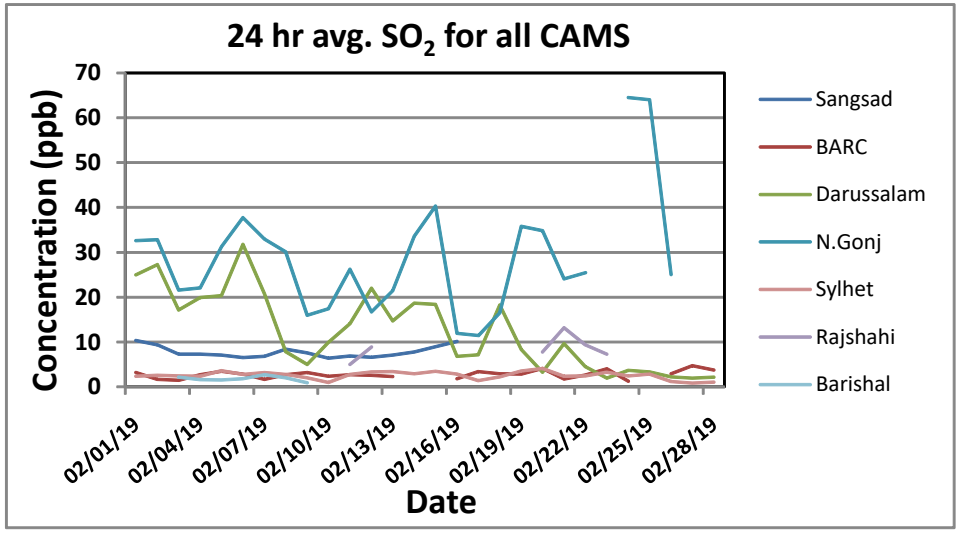
CAMS= Continuous Air Monitoring Station, NAAQS=National Ambient Air Quality Standard, a=Refurbisment CAMS, PM= Particulate Matter
DNA= Data Not Available,

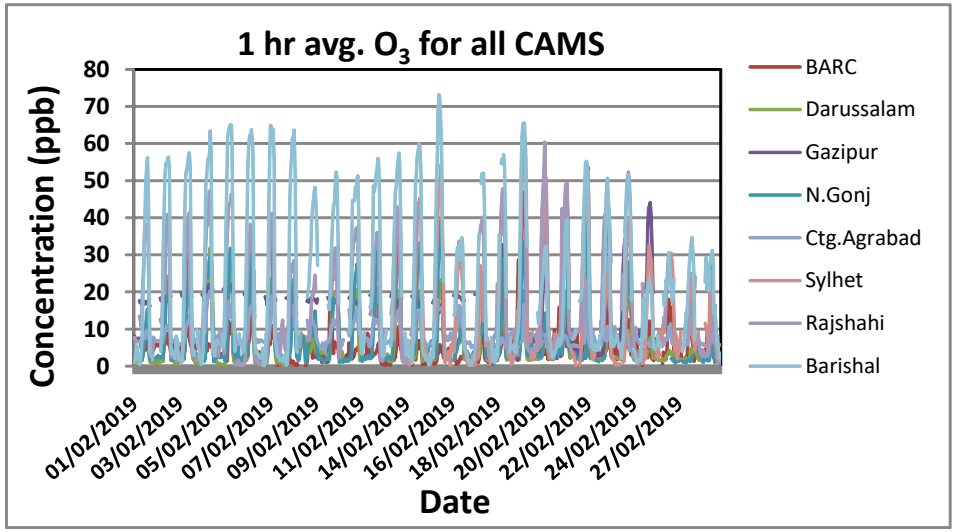
Table 3: Summary Air Quality and Meteorological data measured during February, 2019 at different CAMS operated under DoE (Cont'd)

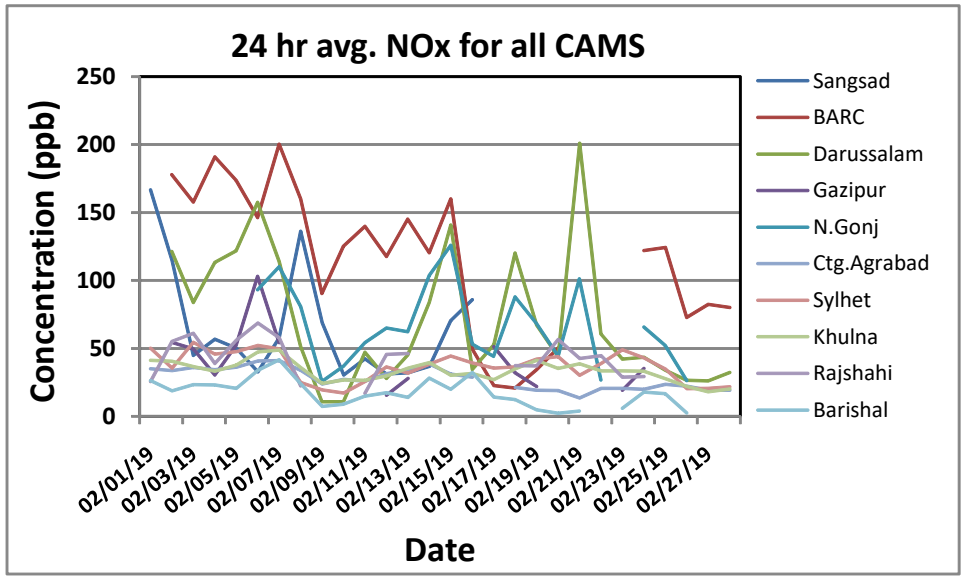
Parameter	unit	NAAQS	Summary	CAMS-1 (S-Bhaban)	CAMS-2 (BARC)[a]	CAMS-3 (D-salam)	CAMS-4 (Gazipur)	CAMS-5 (Narayonganj)	CAMS-6 TV-St (Chittagong)[a]	CAMS-7 Agrabad-(Chittagong)	CAMS-8 (Sylhet)	CAMS-9 (Khulna)[a]	CAMS-10 (Rajshahi)[a]	CAMS-11 (Barisal)
$PM_{2.5}$ -24hr	µg /m^3	65	Average	124	134	144	152	174	DNA	110	91.0	90.0	149	96.6
			Max	204	212	343	273	282	DNA	196	135	164	268	186
			Min	40.4	40.8	52.0	36.2	48.0	DNA	29.4	26.6	13.3	50.8	23.4
			Excedance(Days)	15	24	17	24	25	DNA	24	24	21	19	21
			Data capture(%)	48	89	61	73	81	DNA	87	90	88	50	88
PM_{10} -24hr	µg /m^3	150	Average	DNA	235	244	288	318	DNA	219	168	121	225	165
			Max	DNA	553	458	460	532	DNA	335	268	209	447	319
			Min	DNA	68.6	66.7	85.8	61.6	DNA	53.5	45.6	19.8	75.5	39.1
			Excedance(Days)	DNA	21	23	22	21	DNA	24	20	10	22	17
			Data capture(%)	DNA	83	83	68	60	DNA	87	84	68	65	89
Solar rad. 1hr	watt/m^2	NA	Average	121	DNA	DNA	DNA	238	DNA	140	158	DNA	218	146
			Max	599	DNA	DNA	DNA	998	DNA	617	773	DNA	706	782
			Min	4.86	DNA	DNA	DNA	29.2	DNA	6.16	6.77	DNA	0.14	8.05
			Data capture(%)	53	DNA	DNA	DNA	16	DNA	88	90	DNA	33	90
Relative Humidity 1hr	(%)	NA	Average	57.9	DNA	48.4	DNA	60.6	DNA	63.2	70.4	91.1	DNA	71.6
			Max	91.4	DNA	54.2	DNA	92.7	DNA	93.6	97.4	99.6	DNA	99.5
			Min	23.2	DNA	41.3	DNA	21.4	DNA	27.2	28.5	68.1	DNA	23.5
			Data capture(%)	53	DNA	89	DNA	86	DNA	88	90	89	DNA	90
Ambient Temp. 1hr	(°c)	NA	Average	18.8	24.8	20.0	DNA	23.9	DNA	23.5	21.3	18.4	21.7	23.5
			Max	27.1	34.1	25.3	DNA	32.1	DNA	26.8	29.0	23.4	33.3	34.5
			Min	11.5	13.7	11.6	DNA	17.0	DNA	20.5	14.5	14.3	13.3	14.2
			Data capture(%)	53	79	89	DNA	86	DNA	88	90	90	71	90
Rainfall 1hr	(m.m.)	NA	Average	1.33	0.24	7.99	1.73	0.37	DNA	DNA	0.09	0.04	DNA	DNA
			Max	10.6	10.2	16.0	3.43	1.65	DNA	DNA	3.41	0.11	DNA	DNA
			Min	0.02	0.02	0.98	0.04	0.02	DNA	DNA	0.02	0.02	DNA	DNA
			Data capture(%)	51	82	89	81	84	DNA	DNA	38	45	DNA	DNA

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

FIGURE 2: TIME SERIES OF ALL PARAMETERS (SO_2, NOx AND O_3) MEASURED IN ALL CAMS DURING FEBRUARY, 2019







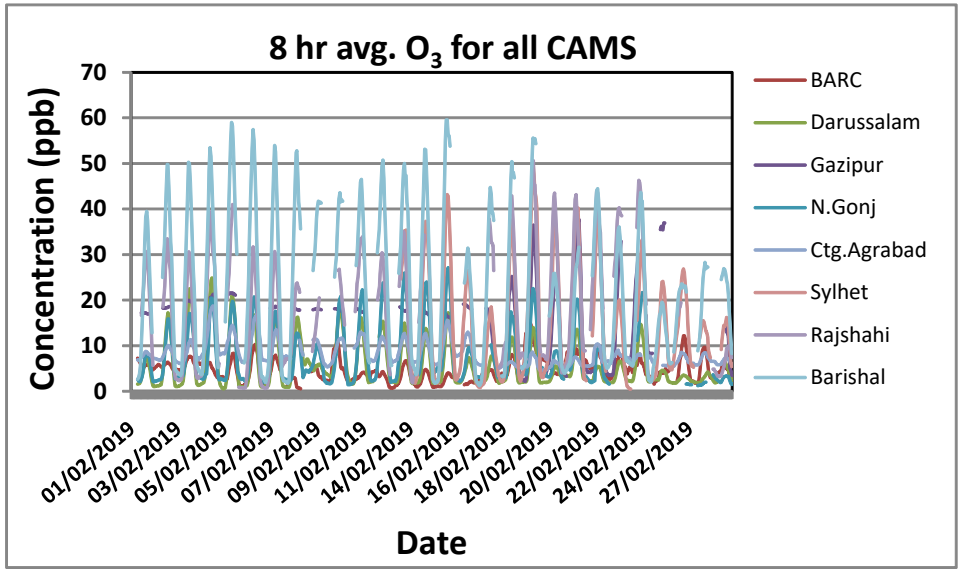
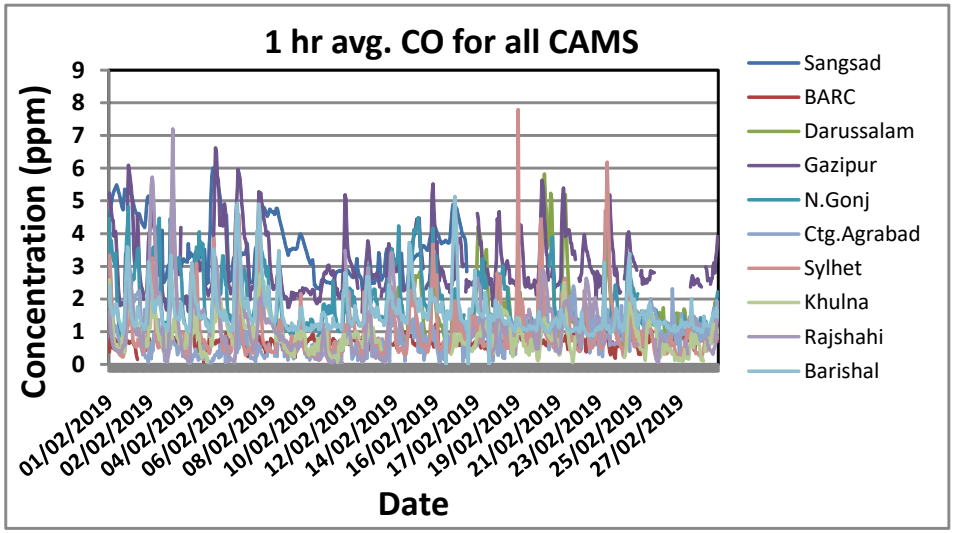
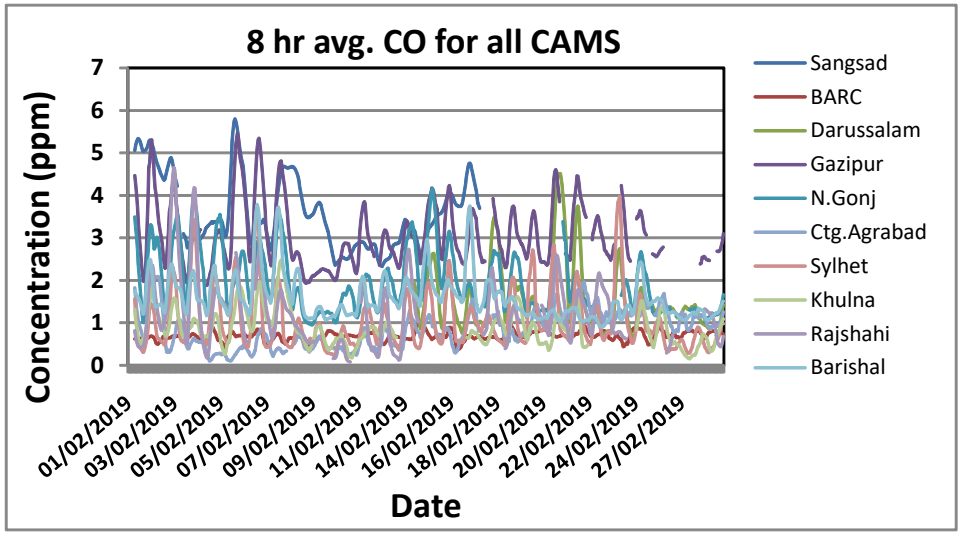
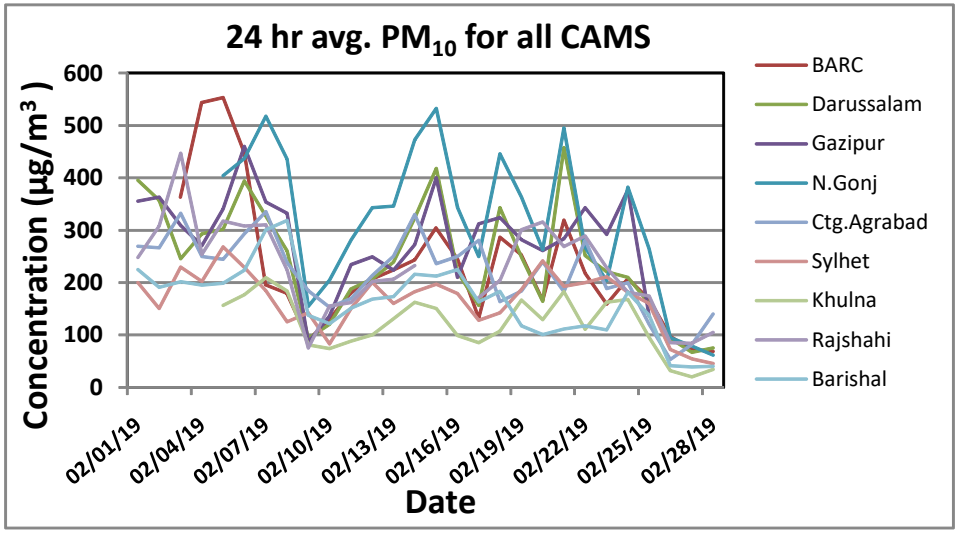


FIGURE 3: TIME SERIES OF ALL PARAMETERS (CO,PM10 AND PM2.5) MEASURED IN CAMS DURING FEBRUARY, 2019







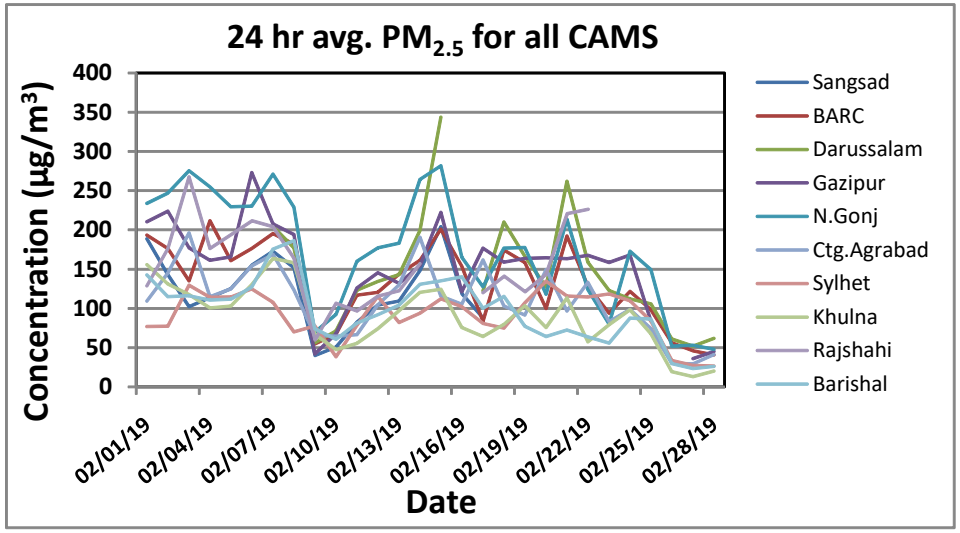


Figure 4: Monthly Summary of AQI for month of FEBRUARY, 2019