

Report on Impact of Lockdown on Air Quality in the state of Goa.

In order to combat the threatening spread of COVID-19 pandemic, nationwide lockdown was imposed by the Central Government from 23-03-2020. The result of lockdown has been favourable in terms of Air pollution, which is indicated by significant reduction in AIR Quality reported at most of the states. The major reason being reduction in vehicular and industrial activities.

The major sectors contributing to air pollution are transport, industries, construction activities, road dust re-suspension and residential activities.

GSPCB has 18 NAMP locations in the state of Goa and one additional AAQM location at MPT. The NAMP stations are namely Panaji, Mapusa, Baina, Vasco, Margao, Ponda, Assanora, Amona, Bicholim, Honda, Usgao, Sanguem, Codli, Tilamol, Cuncolim, Kundaim, Tuem and the additional AAQM location at MPT.

**Out of 18 NAMP locations Curchorem station is not operational as the permission granting process is underway for installation of station at Ravindra Bhavan, Curchorem.*

GSPCB stations were put into operations from 01-04-20 while the NAMP stations operated by M/s Choksi Laboratories were operated from 16-04-20 onwards. In order to do a comparative study, the data generated from these 18 stations before and within the lockdown period is compared.

The comparative study is focused on % **reduction** in AQI and specific pollutant concentration, for

Pre lockdown period 1st March to 21st March 2020 and

During Lockdown period 1st April to 30th April 2020

Annexure 1	Comparison of Air Quality Index for Pre lockdown and during lockdown
Annexure 2	Comparison of AQI during lockdown period (April 2020) and April 2019
Annexure 3	Comparison of PM10 for Pre lockdown and during lockdown
Annexure 4	Comparison of PM2.5 for Pre lockdown and during lockdown
Annexure 5	Observations and Conclusions

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Outsourced NAMP stations monitored by M/s Choksi Laboratories Ltd.

Analysis of Air Quality Data in terms of Air Quality Index (AQI)

Comparison of AQI for Pre lockdown (1st March to 21st March 2020) and during lockdown period (1st April to 30th April 2020) (Annexure I)

To study the impact of lockdown on AQI, the data of AQI for pre-lockdown and during lockdown days was analysed and a comparative statement of AQI of 17 NAMP locations along with additional AAQM location at MPT has been summarized. The table also include comparison of average AQI of each monitoring station for both these periods.

The comparative table along with plot reflects that there has been significant reduction in average AQI at all 17 locations except Panaji where it shows increase in AQI during lockdown compared to Pre lockdown. The % decrease at these 17 stations without Panaji, has ranged between 11% (Codli and Tilamol) to 58% (Baina).

Comparison of AQI for April 2019 and April 2020(lockdown period) (Annexure II)

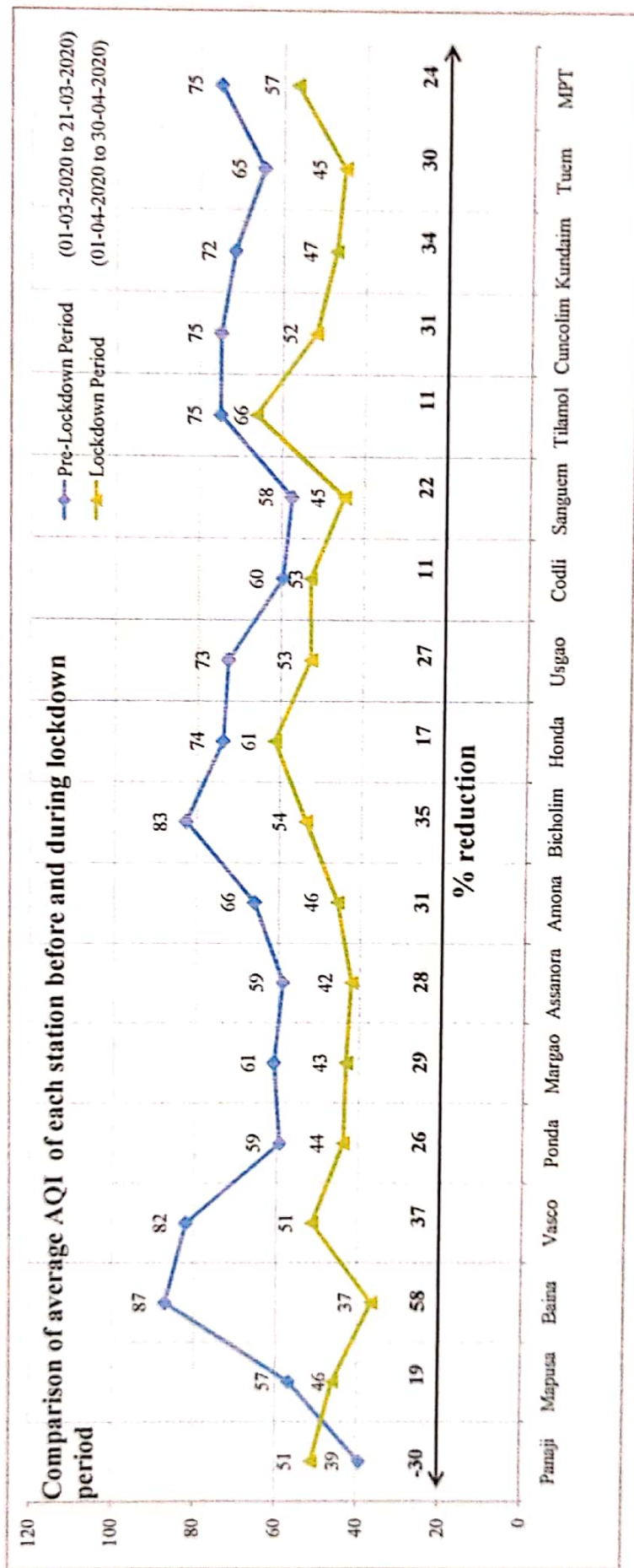
Similarly a comparative table is also prepared for AQI and Average AQI for the month of April 2019 vs April 2020.

The table along with plot also signifies a reduction in average AQI at all the 17 locations. The % decrease at these stations has ranged between 6% (Honda) to 65% (MPT).

AIR QUALITY WITH INDEX AND HEALTH IMPACTS:

Good (G) (0–50)	Minimal Impact	Poor (P) (201–300)	Breathing discomfort to people on prolonged exposure
Satisfactory (S) (51–100)		Very Poor (VP) (301–400)	
Moderate (M) (101–200)	Breathing discomfort to the people with lung, heart disease in children and older adults	Severe (SEV) (>401)	Respiratory effects even on healthy people

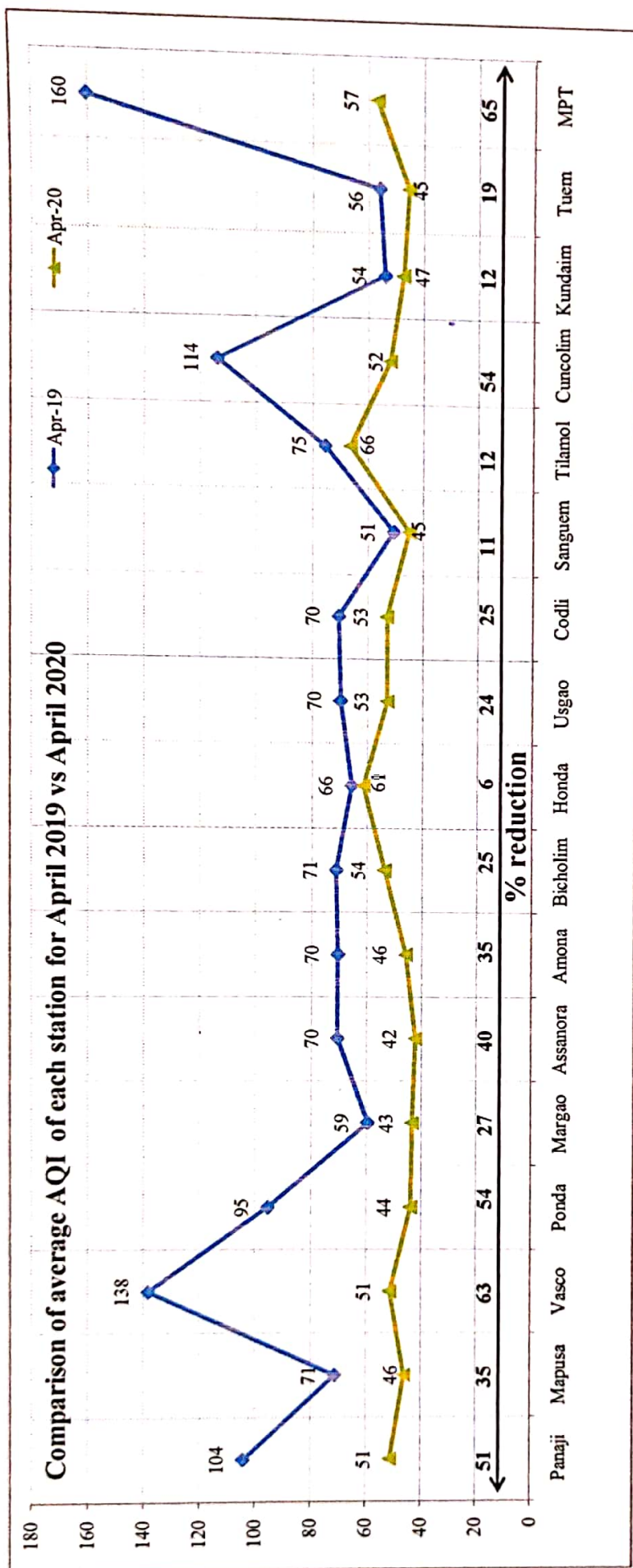
Comparison of Air Quality Index before and during Lockdown																																							
Residential/Commercial Locations										Mining Areas Location																													
Monitoring Days	24 hrly AQI										24 hrly AQI																												
	Panaji	Mapusa	Baina	Vasco	Ponda	Margao	Assanori	Amona	Bicholim	Honda	Usgao	Codli	Sanguem	Tilamol	Cuncolim	Kundaim	Tuem	MPT																					
02-03-2020		38			64		72	70	86	68	78	72				68	67																						
03-03-2020	40		85	99		59	49																																
04-03-2020		56										51	55	77	72	73	66	63																					
05-03-2020	40		47	57	63			67	91																														
06-03-2020						62				71	74			65	71			57																					
07-03-2020		72					57					58	59																										
09-03-2020									80		70			76		73	67	144																					
10-03-2020	44		123	77	57	61		66		71			46																										
11-03-2020		59	96	127			57		77																														
12-03-2020					52			59		78	67	52	53	72	66	70	55	75																					
13-03-2020	36					60																																	
14-03-2020																																							
16-03-2020							51	61	79	82	70	59			90	65	64																						
17-03-2020	43	48	88	62	68								62	85				74																					
18-03-2020		67				62	68		83	72						80	68																						
19-03-2020	33		82	69	52			72			76				77			37																					
20-03-2020																																							
21-03-2020	39	57	87	82	59	61	59	66	83	74	73	60	58	75	75	72	65	75																					
Average	95	92	46	87																																			
01-04-2020	47	58	43	68														43																					
03-04-2020																		42																					
06-04-2020			28	25														35																					
07-04-2020	51	57																																					
08-04-2020			36	59														82																					
09-04-2020	54	48																																					
15-04-2020	47	47	46	59														93																					
16-04-2020																																							
17-04-2020	47	32	21	38				41	72		58							42																					
18-04-2020												58																											
20-04-2020							44		51																														
21-04-2020					28			35		50	44					47	44																						
22-04-2020	44	30	17	37		45			50			50	47	82	57	33	49	65																					
23-04-2020							42	53		66	47																												
24-04-2020	41	32	68	45	47													68																					
25-04-2020						43						52	44		45																								
27-04-2020							49		48							48	47																						
28-04-2020	41	32	33	38	57			54		68	62							66																					
29-04-2020																																							
30-04-2020	45	33	28	57		42	34		47			52	44	51	54			32																					
Average	51	46	37	51	44	43	42	46	54	61	53	53	45	66	52	47	45	57																					
PRE-LOCKDOWN										LOCKDOWN																													
Good										Very Poor										Severe																			
(0-50)										(51-100)										(301-400)										(>401)									



Comparative statement of average AQI for each of the respective 18 stations has been summarized and placed in the form of chart. The chart reflect significant percent drop at NAMP stations ..

Area wise comparative averages and % reduction			
AREA	AVG		%RED
	BEFORE	AFTER	
Res/comm	64	45	29
Mining	68	52	23
Industrial	71	50	30

Comparison of Air Quality Index of APRIL 2019 vs APRIL 2020																
Monitoring Days	Residential/Commercial Locations										Mining Areas Location					
	24 hrly AQI										24 hrly AQI					
	Pangli	Mapusa	Vasco	Ponda	Margao	Assanora	Amona	Bicholim	Honda	Usgao	Codli	Sanguem	Tilamol	Cuncolim	Kundaim	Tuem
01-04-2019		79	187	55		84	84	93	74	69					64	53
02-04-2019	198				74						72	51	80	131		
03-04-2019		76	139			71	71	93							47	40
04-04-2019	153			104					73	62		47	62	137		
05-04-2019					69	76	76	55			59				53	40
06-04-2019		92	143	73	49				55	60						
08-04-2019		70				66	66	65	63	57		49			56	
09-04-2019				169	49	64	64	59			57					
10-04-2019	113								58	71				100		
11-04-2019																
12-04-2019	78															
13-04-2019																
15-04-2019	70	71		117	66											
16-04-2019																
17-04-2019	79	61	79		67											
18-04-2019																
19-04-2019																
20-04-2019																
22-04-2019		64	334													
23-04-2019				80												
24-04-2019	110				49											
25-04-2019		51	88													
26-04-2019	77			90	52											
27-04-2019																
29-04-2019	60															
30-04-2019		76	80	93												
Average	104	71	138	95	59	70	70	71	66	70	70	51	75	114	54	56
01-04-2020	95	92	87													
03-04-2020	47	58	68													
06-04-2020			25													
07-04-2020	51	57														
08-04-2020			59													
09-04-2020	54	48														
15-04-2020	47	47	59													
16-04-2020																
17-04-2020	47	32	38													
18-04-2020																
20-04-2020																
21-04-2020	44	30	37													
22-04-2020																
23-04-2020	41	32	45													
24-04-2020																
25-04-2020																
27-04-2020	41	32	38	57												
28-04-2020																
29-04-2020	45	33	57													
30-04-2020																
Average	51	46	51	44	43	42	46	54	61	53	53	45	66	52	47	45
Good	(0-50)										(51-100)					
	Satisfactory										(101-200)					
	Poor										(201-300)					
	Very Poor										(301-400)					
	Severe										(>401)					



Comparative statement of average AQI for April 2019 vs April 2020 for each of the respective 17 stations has been summarized and placed in the form of chart. The chart reflect significant percent drop at Residential/Commercial and Industrial NAMP stations. Note: Baina NAMP station was started from September 2019 onwards.

Areawise comparative averages and % reduction			
AREA	AVG		%RED
	BEFORE	AFTER	
Res/comm	94	47	50
Mining	68	52	23
Industrial	96	50	48

Analysis of air Quality Data in terms of PM10 and PM2.5

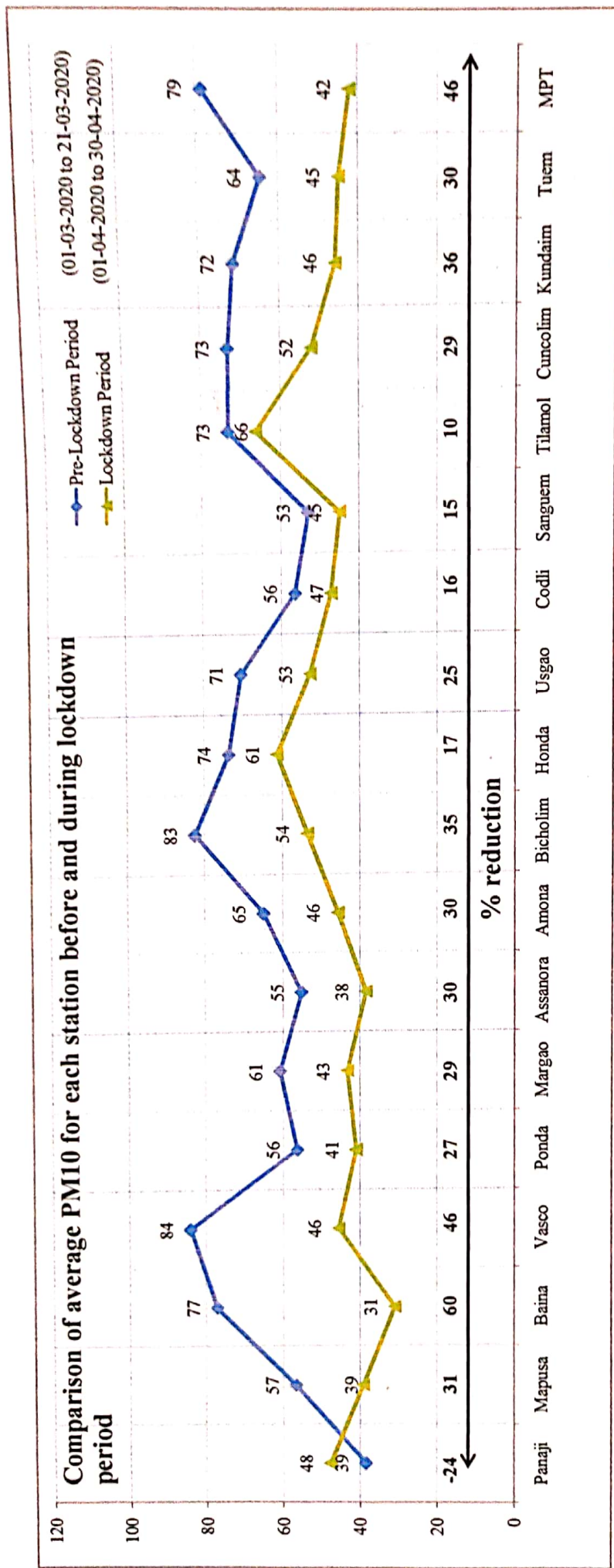
An analysis of PM10 and PM2.5 has been also made to compare the impact of lockdown. Data related to average concentration of these parameters for pre lockdown and during lockdown periods is tabulated and plotted. As compared to the period of Pre lockdown significant percentage decrease in air quality parameters like PM10 and PM2.5 has been observed during the lockdown period for most of stations. For PM10 the decrease is for all stations except for Panaji while PM2.5 the decrease is observed for all locations except Panaji , Mapusa and Vasco.

PM10 (Annexure III) – The percentage decrease of PM10 at all the 17 locations except Panaji ranges between 10% (Tilamol) to 60% (Baina)

PM2.5 (Annexure IV) – The percentage decrease of PM2.5 at all the 15 locations except Panaji, Mapusa and Vasco ranges from 3% (MPT) to 60% (Baina).

Comparison of **PM10** before and during Lockdown

	Residential/Commercial Locations														Mining Areas Location					Industrial Locations				
	24 hrly PM10														24 hrly PM10					24 hrly PM10				
	Monitoring	Panaji	Mapusa	Baina	Vasco	Ponda	Margao	Assanora	Amona	Bicholim	Honda	Usgao	Codli	Sanguem	Tilamol	Cuncolim	Kundaim	Tuem	MPT					
PRE- LOCKD OWN	02-03-2020					51		63		86		78	63											
	03-03-2020		38						70		68													
	04-03-2020	40		85	99		59	48						55	77	72	73	66						
	05-03-2020		56							91			48											
	06-03-2020	40		31	57	63			64		71	69			65	71								
	07-03-2020						62							48										
	09-03-2020		72					51		80		64	51		74		73	67						
	10-03-2020			113	77	57			66		71													
	11-03-2020	44					61							46										
	12-03-2020	36		59	141	52		51	56	77	78	67			71	66	70	55						
	13-03-2020						60						51	41										
	14-03-2020																							
	16-03-2020							49		79														
	17-03-2020		48			63			61		82	69	59			80		64						
	18-03-2020	43		56	62		62							62	79									
	19-03-2020		67																					
	20-03-2020	28		82	69	52		68	72	83	72	76			74	77	80	68						
	21-03-2020						61		72				65	65										
	Average	39	57	77	84	56	61	55	65	83	74	71	56	53	73	73	72	64						
LOCKD OWN	01-04-2020	71	71	46	57																			
	03-04-2020	43	47	43	54																			
	06-04-2020			28	19																			
	07-04-2020	51	57																					
	08-04-2020			36	59																			
	09-04-2020	54	35																					
	15-04-2020	40	32	46	59																			
	16-04-2020																							
	17-04-2020	47	23	21	37				41	72		58												
	18-04-2020																							
	20-04-2020							34		51														
	21-04-2020					20			35		50	44												
	22-04-2020	44	30	17	31		45																	
	23-04-2020							41		50														
	24-04-2020	41	32	15	45	47			53		66	47			66									
	25-04-2020						43							44		45								
	27-04-2020							46		48														
	28-04-2020	41	32	30	38	57			54		68	62												
	29-04-2020						42																	
	30-04-2020	45	33	28	57			33		47					51	54								
	Average	48	39	31	46	41	43	38	46	54	61	53	47	45	66	52	46	45						

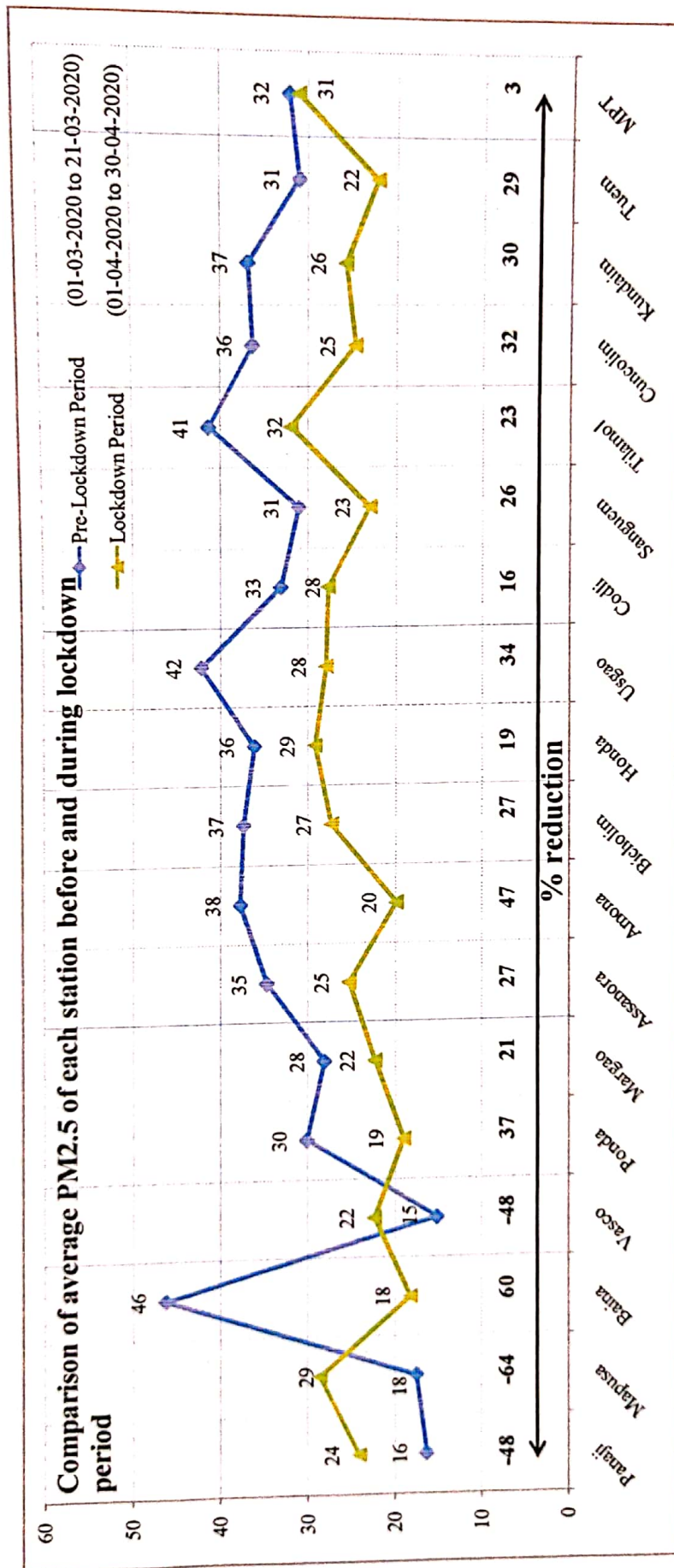


Comparative statement of average PM10 for each of the respective 18 stations has been summarized and placed in the form of chart. The chart reflect significant percent drop at NAMP stations except for Panaji. The average of % reduction at all stations is 27. If we segregate the stations the avg % reduction for Residential/Commercial, Mining and Industrial locations is 34, 23 and 36 respectively.

Comparison of PM2.5 before and during Lockdown																			
Residential/Commercial Locations										Mining Areas Location									
24 hrly PM2.5										24 hrly PM2.5									
Monitoring	Panaji	Mapusa	Baina	Vasco	Ponda	Margao	Assanora	Amona	Bicholim	Honda	Usgao	Codli	Sanguem	Tilamol	Cuncolim	Kundaim	Tuem	MPT	
02-03-2020		17			38		43	39	36	29	44	43				36	40		
03-03-2020			45	33		30	29						30	40	35				
04-03-2020	11	8							39			30				33	34		37
05-03-2020	20		28	15	30			40		32	45			37	35				
06-03-2020						23							35						17
07-03-2020		28					34		38			35							
09-03-2020			67	8	21			39		35	42			46		36	26		
10-03-2020						25							19		37			35	
11-03-2020	20		38	9			34		37							39	22	43	
12-03-2020	18				26			35		38	40			43	23				
13-03-2020						27						31	32						
14-03-2020							30		34							39			
16-03-2020		24			41			35		46	42	29			54		26		
17-03-2020	9		53	20		35							28	51				40	
18-03-2020		13					37		40	37						39	37		
19-03-2020	20		*	6	25			39			41				34			21	
20-03-2020						27						30	42	32					
21-03-2020												33	31	41	36	37	31	32	
Average	16	18	46	15	30	28	35	38	37	36	42	33	31	41	36	37	31	32	
01-04-2020	57	55	*	52														10	
03-04-2020	28	35	*	41														20	
06-04-2020			*	15														21	
07-04-2020	7	31																	
08-04-2020			*	15														49	
09-04-2020	30	29																	
15-04-2020	28	28	*	13														56	
16-04-2020									30		30								
17-04-2020	9	19	*	23				15									24	25	
18-04-2020												35							
20-04-2020							27		28										
21-04-2020					17			13		22	25					25	23		
22-04-2020	23	18	4	22		23						23	20	44				39	
23-04-2020							25		27						25	18	21		
24-04-2020	21	14	41	24	20			25		34	27			25				41	
25-04-2020						24						22	27		26				
27-04-2020							29		29							23	21		
28-04-2020	24	*	20	11	21			26		32	30							31	
29-04-2020						20						31	22	27	23				
30-04-2020	14	*	8	8			20		23							37	22	19	
Average	24	29	18	22	19	22	25	20	27	29	28	28	23	32	25	26	22	31	

PRE-
LOCKD
OWN

LOCKD
OWN



Comparative statement of average PM2.5 for each of the respective 18 stations has been summarized and placed in the form of chart. The chart reflect significant percent reduction at all the stations except Panaji, Mapusa nad Vasco.

Observations and Conclusions:

1. The ambient Air Quality during the lockdown has shown significant improvement in the State of Goa as is indicated by the data from the NAMP stations which may be attributed to very low vehicular density and industrial activities prevailing during lock down period.
2. AQI has improved at almost all stations except Panaji. Maximum improvement has been observed at Baina with 58% decrease which could be attributed to reduction in vehicular traffic and re-suspension of road dust.
3. Average AQI at Mapusa, Baina, Ponda, Margao, Assanora, Amona, Sanguem, Kundaim, Tuem for the lockdown period is "GOOD", which was "SATISFACTORY" during pre lockdown period, with significant decrease in the AQI ranging from 19% (Mapusa) to 58% (Baina).
4. Average AQI for Residential/Commercial areas (Panaji/ Mapusa/ Ponda/ Baina/ Vasco/ Ponda/ Margao), Mining Areas (Assanora/ Amona/ Bicholim/ Honda/ Usgao/ Codli/ Sanguem/ Tilamol) and Industrial areas (Cuncolim/ Kundaim/ Tuem/ MPT) shows an average % reduction of 29%, 23% and 30% respectively.
5. In terms of PM10 and PM2.5 also, Baina has notices very high reduction of around 60% in the concentration for both PM10 and PM2.5 due to lockdown.
6. The AQI data for April 2020 in comparison with AQI for April 2019 shows a very significant %reduction of 50% for Residential/Commercial areas, 23% for Mining areas and 48% for Industrial areas.