ES209

Term Project Paper on

DATA ANALYSIS AND INTERPRETATION

Submitted by:

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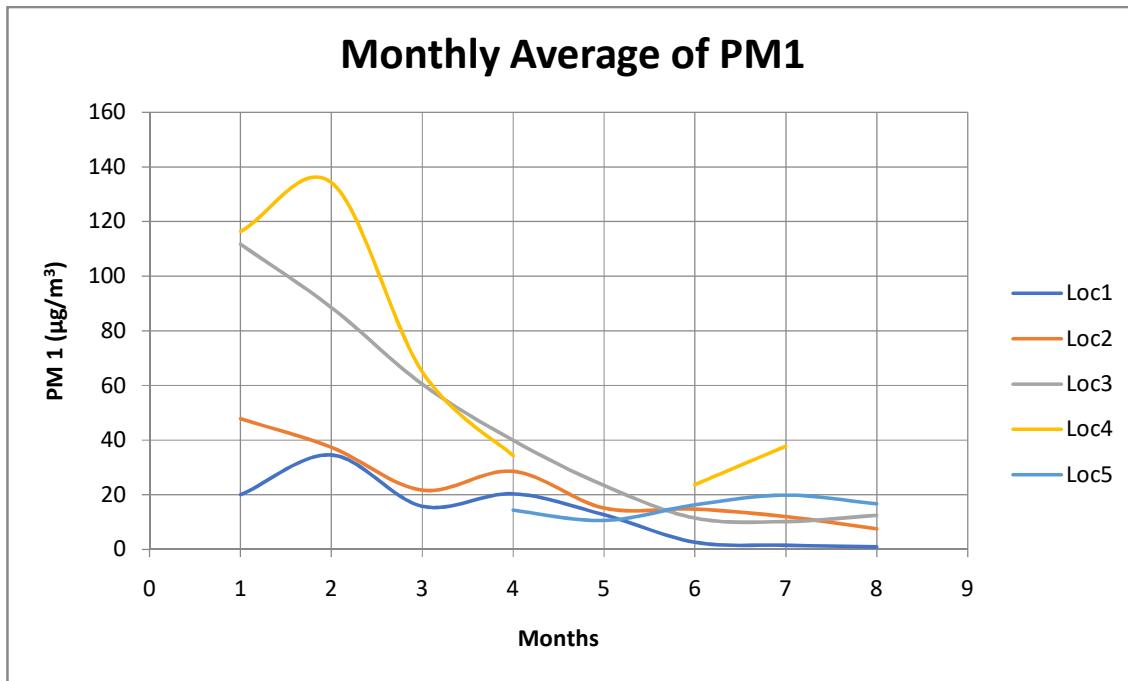Roll number: 20D180023

Under the supervision of

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Question 1:

Monthly Average of PM1

Here in the above graph, monthly averaged data set for PM1 concentration is plotted. (The gaps in between is because the data is not present for that period of time.) The ANOVA test is done below.

Hypothesis :

H_0 = all the group means are equal

H_a = Not all the group means are equal

| ANOVA: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Loc1	8	108.2852	13.53565	136.141		
Loc2	8	184.3894	23.04868	192.6029		
Loc3	8	357.9127	44.73908	1493.987		
Loc4	6	411.238	68.53966	2147.333		
Loc5	5	77.61219	15.52244	11.84566		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	14024.38	4	3506.095	4.467659	0.005961	2.689628
Within Groups	23543.17	30	784.7722			
Total	37567.55	34				

Here we have taken the significance level (α) = 0.05. So as the *P-value* is less than significance level we can reject our null hypothesis(H_0) and conclude that it is statistically significant that the mean of at least one of the population is different from other population means.

Next we have to look for location pair having maximum correlation. We did this in excel.

	Loc1	Loc2	Loc3	Loc4	Loc5
Loc1	1				
Loc2	0.812371	1			
Loc3	0.808539	0.949909	1		
Loc4	0.803505	0.832131	0.915458	1	
Loc5	-0.66363	-0.3559	-0.56857	0.396947	1

We see that location 2 and 3 have maximum correlation (about 0.95) among all the locations. Moreover we can see that except location5 all the locations are significantly correlated with each other (at least 0.8 correlated).

Question 2:

**Phase Comparision for Location 1**
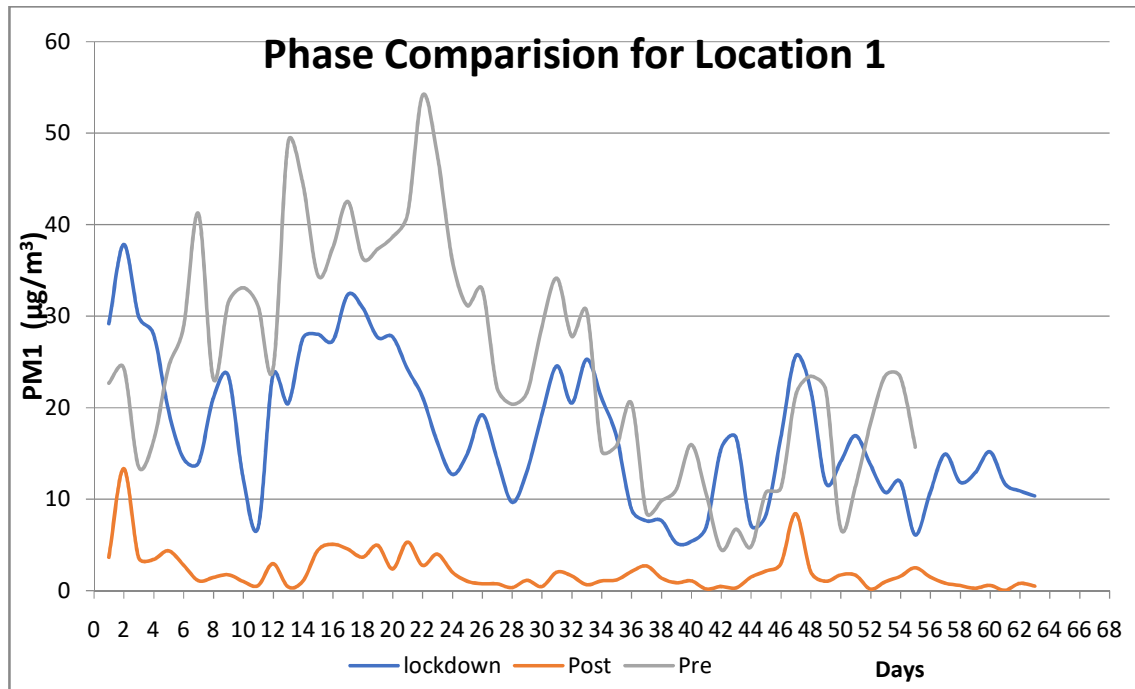
This graph compares the different phases for location 1. We can see that the PM concentrations are somewhat same for pre-lockdown phase and the lockdown phase, which means that the location was active during lockdown.


Phase Comparision for Location 2
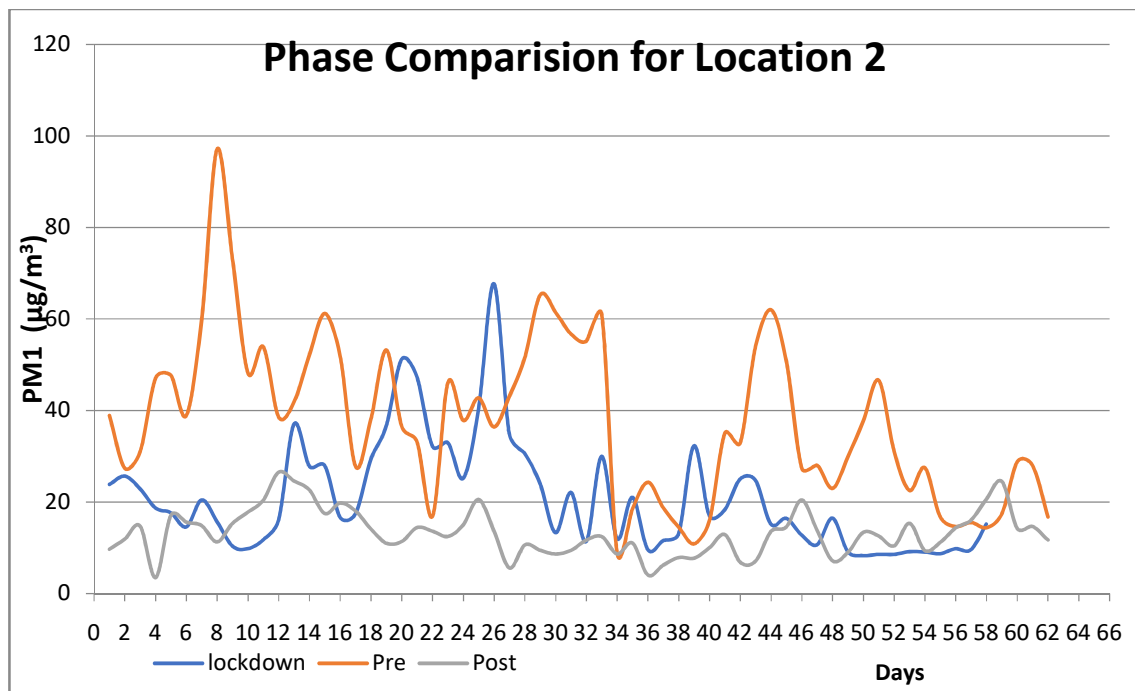
This graph compares the different phases for location 2. The PM concentration has decreased in the lockdown period and further decreased during the post lockdown period.

This might suggest that the location had some factories which were working during the pre-lockdown period then partially working during the lockdown period and further got closed during the lockdown due to which the PM concentration further decreased during the post lockdown period.
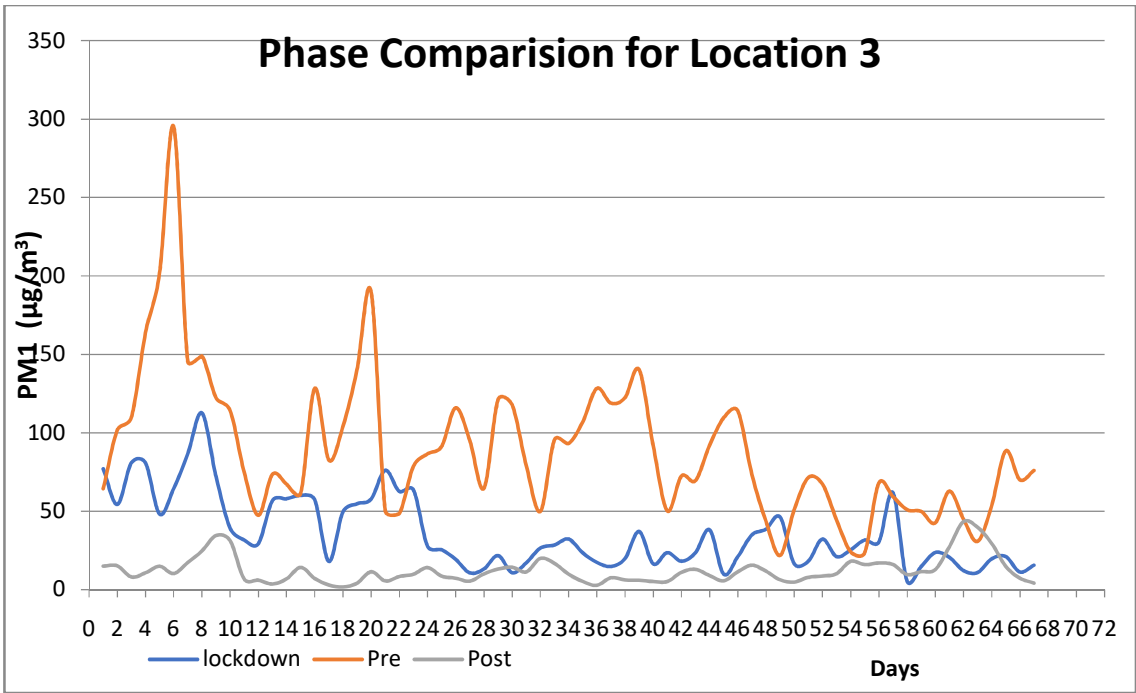
This graph compares the different phases for location3. This location is similar to location 2 where the PM concentration has decreased during the lockdown period and further decreased post lockdown.
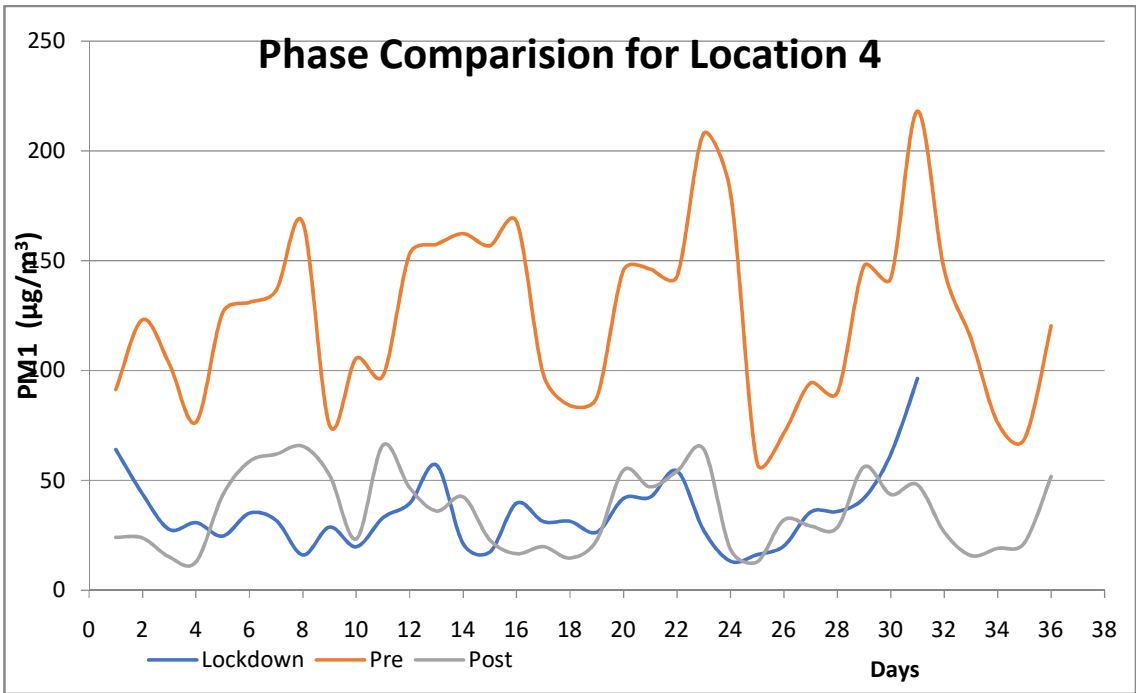
This graph compares the different phases for location 4. Here the pre-lockdown PM concentration was very high which suggest this location was an industrial area. During lockdown the PM concentration decreased as usual due to the reduced activity. But after lockdown the activity did not increase as the PM concentration post lockdown is nearly same as during lockdown.


Phase Comparision for Location 5
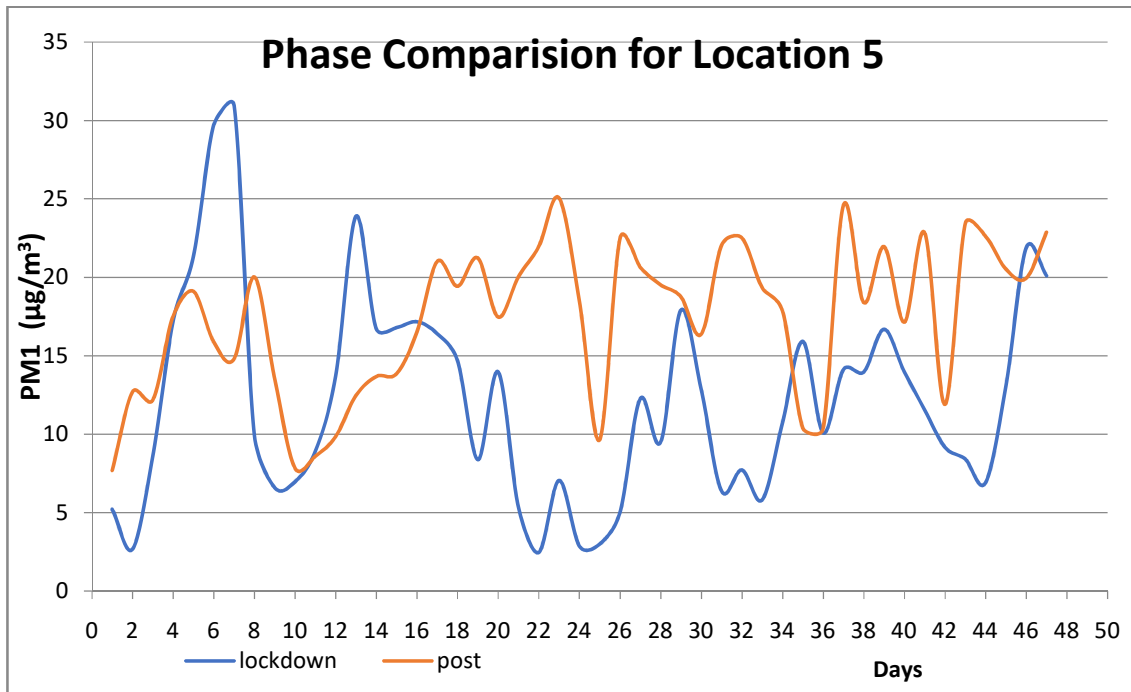
This graph compares the different phases for location 5. This graph does not contain post lockdown curve as the data was not present. In the graph we can see as usual during the lockdown the PM concentration decreased. And nearly at the end of the lockdown there was an increase in the PM concentration which suggests that this might be a residential area.
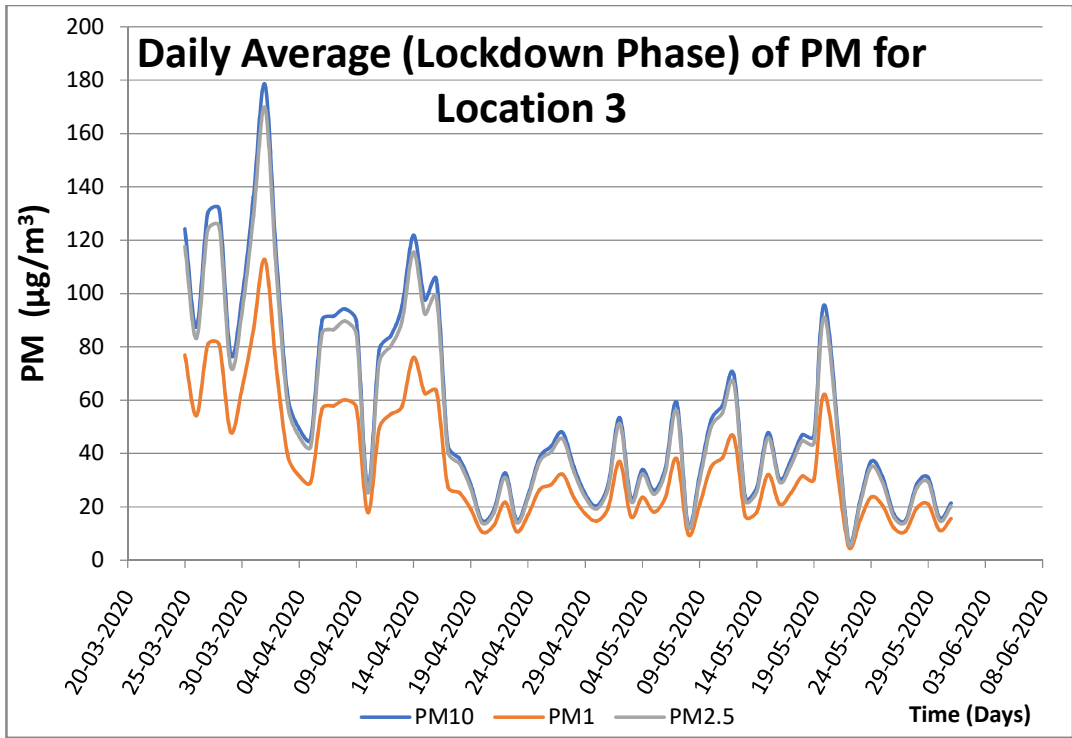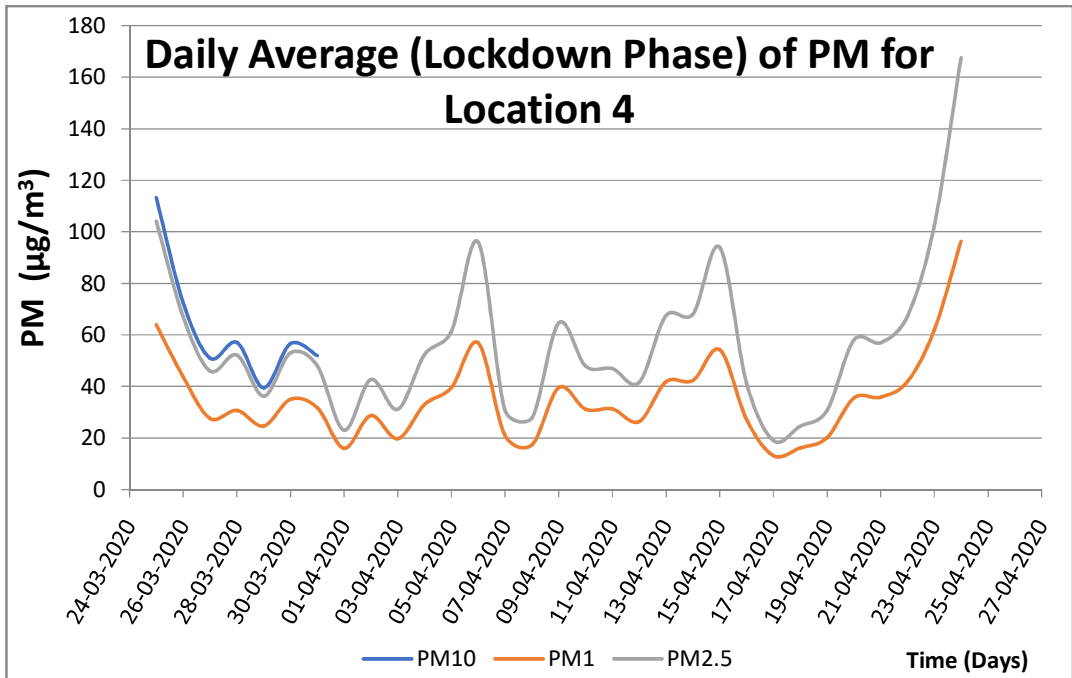
Question 3:
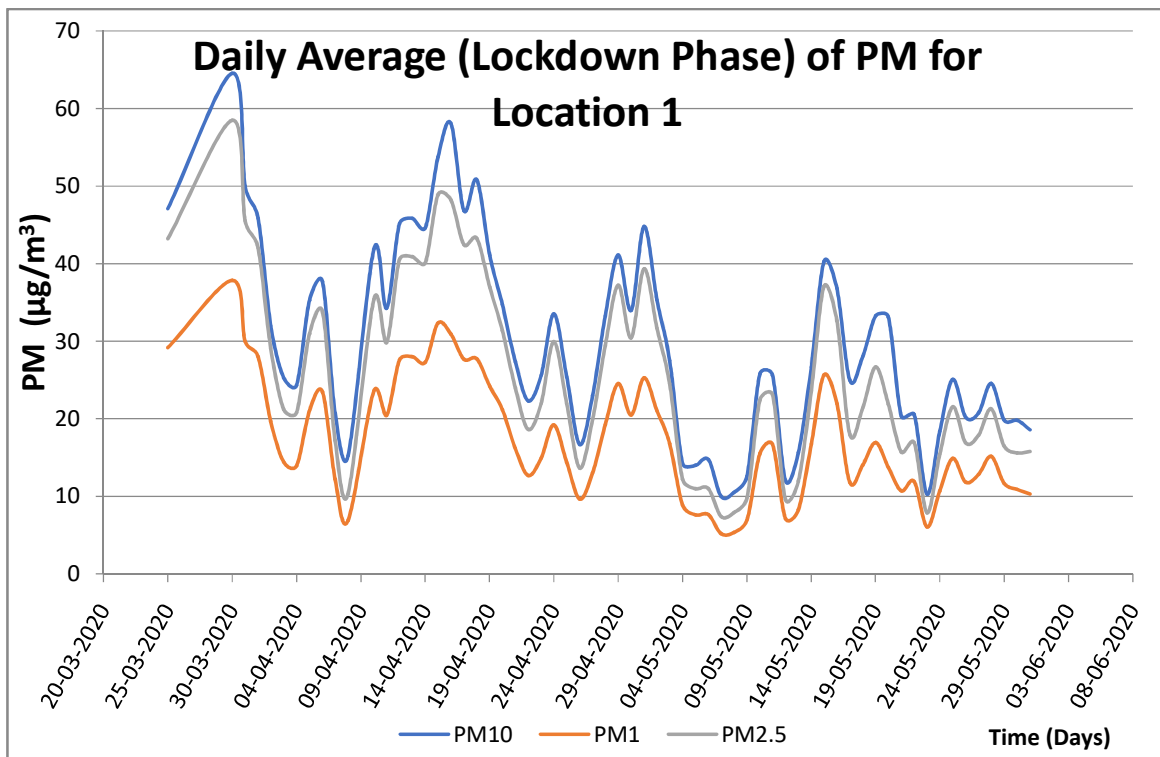
This graph shows PM concentration during lockdown phase for location1. We can see that the PM concentration has overall decreased but with spikes in between. This shows that the location might contain some factories which were partially working.
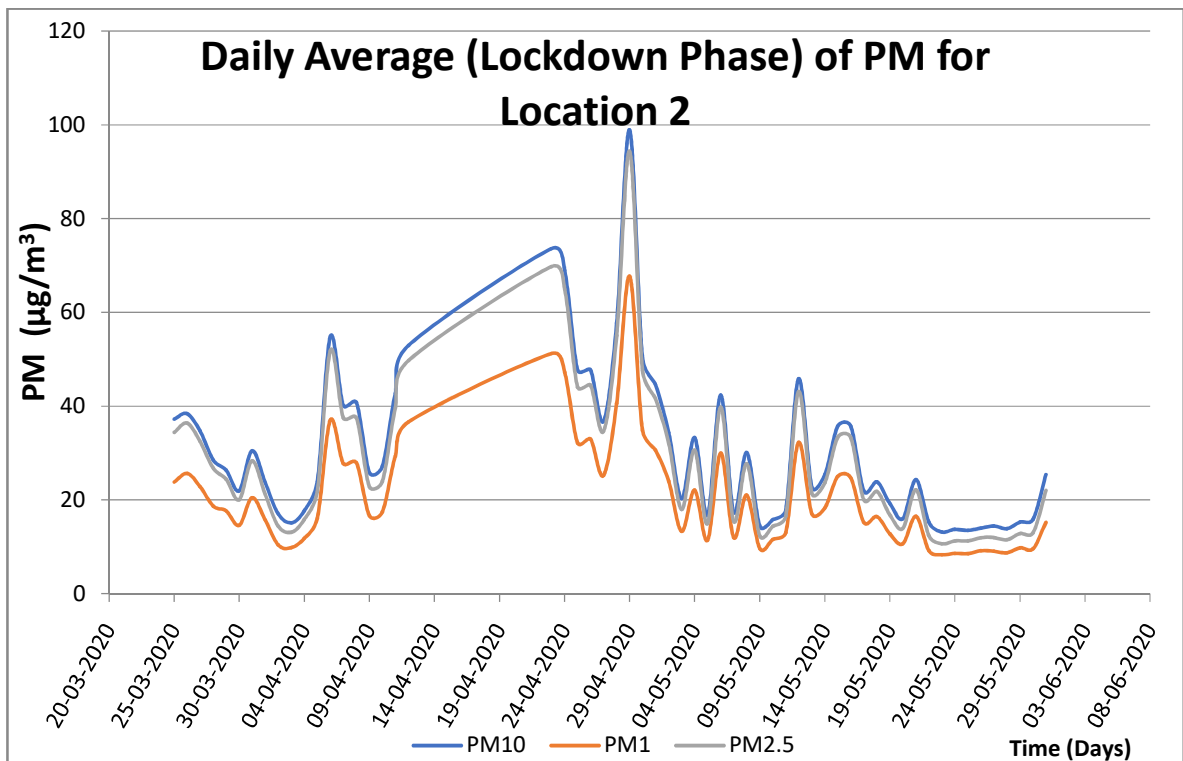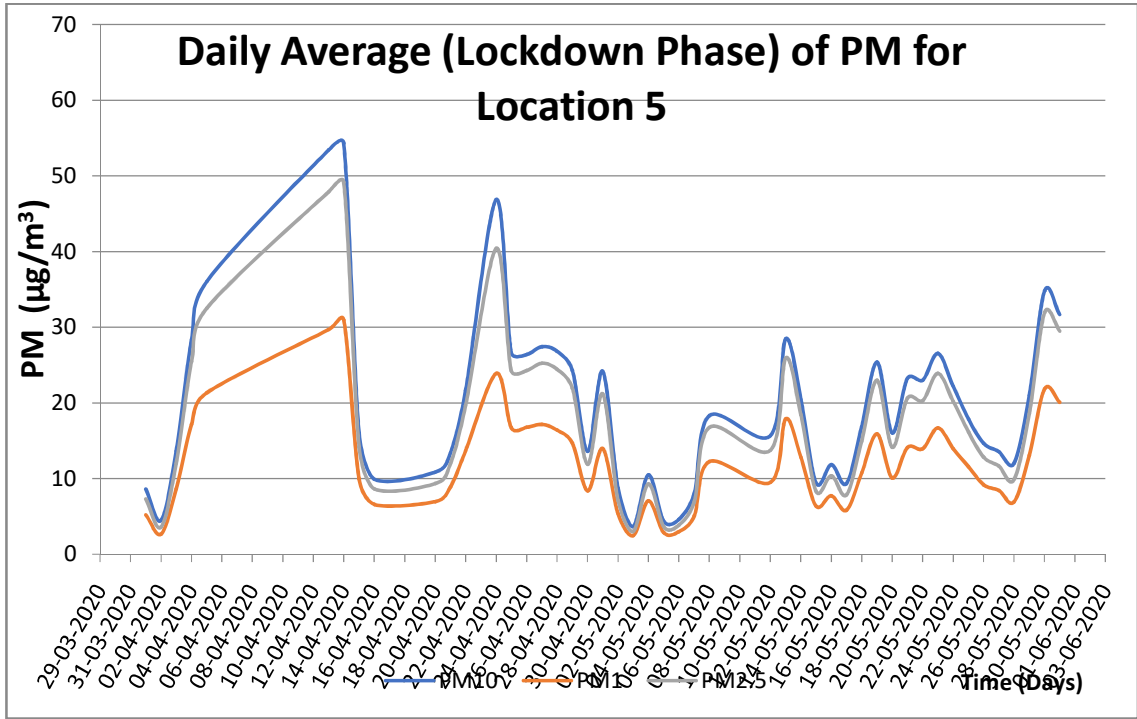
This graph shows PM concentration during lockdown phase for location2. There is an increase in the PM concentration. This shows that this location might contain factories which were more active during the lockdown phase than pre-lockdown phase for e.g. pharmaceutical factories.

Daily Average (Lockdown Phase) of PM for Location 3

This graph shows PM concentration during lockdown phase for location3. We see that there is an overall decrease in the PM concentrations. This suggests that this location is a residential area.


Daily Average (Lockdown Phase) of PM for Location 4

This graph shows PM concentration during lockdown phase for location4. This location is similar to location 1 as they both have spikes of PM concentrations in between. The data did not have PM10 concentration from April.


This graph shows PM concentration during lockdown phase for location 5. This location is similar to location 1 as they both have spikes of PM concentrations in between.

Question 4:

Daily Average of PM for Location 1
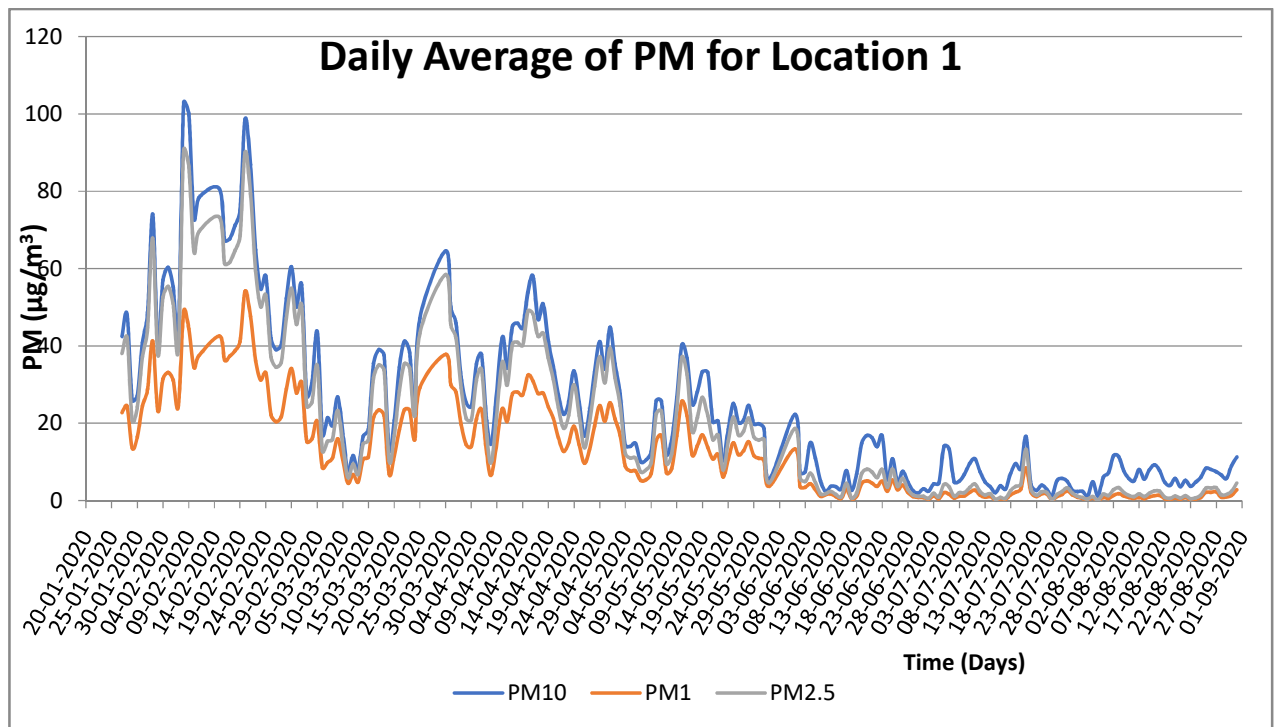
This graph is for location 1. After lockdown starts (after 25th March) we can see that the PM concentrations have reduced. This shows that it is a residential location where mostly private cars are present. Due to lockdown the people of the residential area were locked in their houses so the PM concentrations were drastically reduced.

**Daily Average of PM for Location 2**
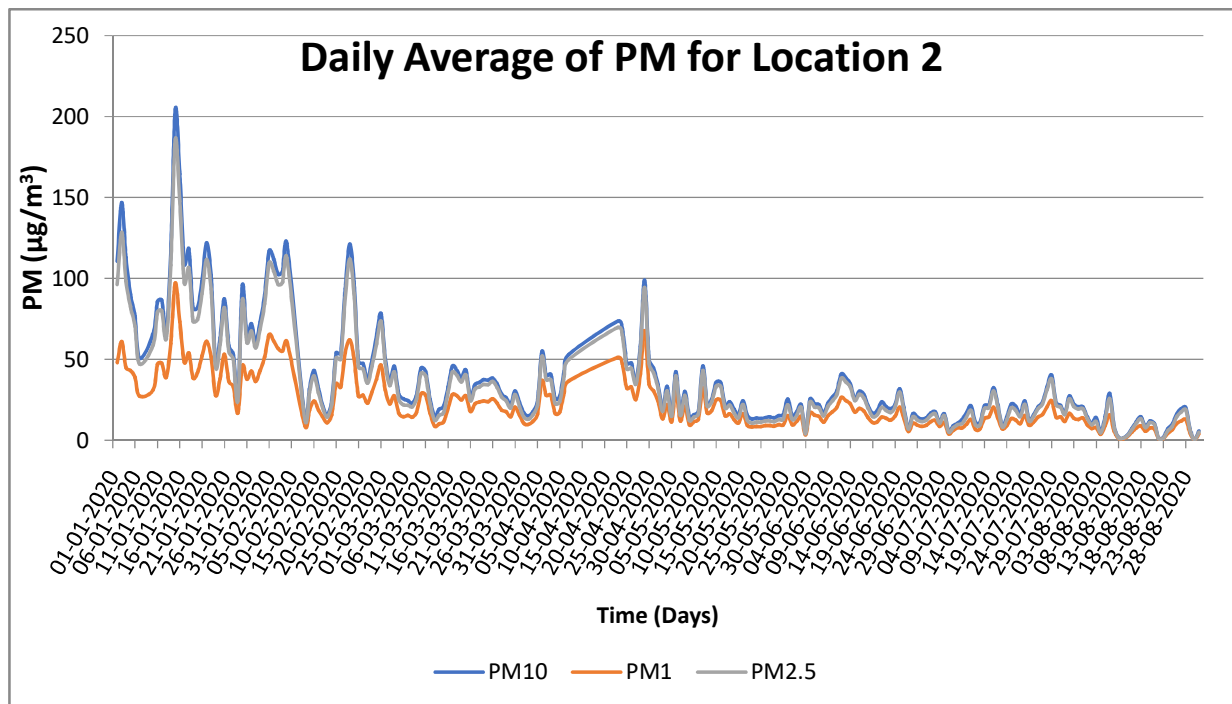
This is the graph for location 2. We can see a decrease in the PM concentration but not as much as seen in location 1. This shows that the location may contain factories which were partially functional after the lockdown started.
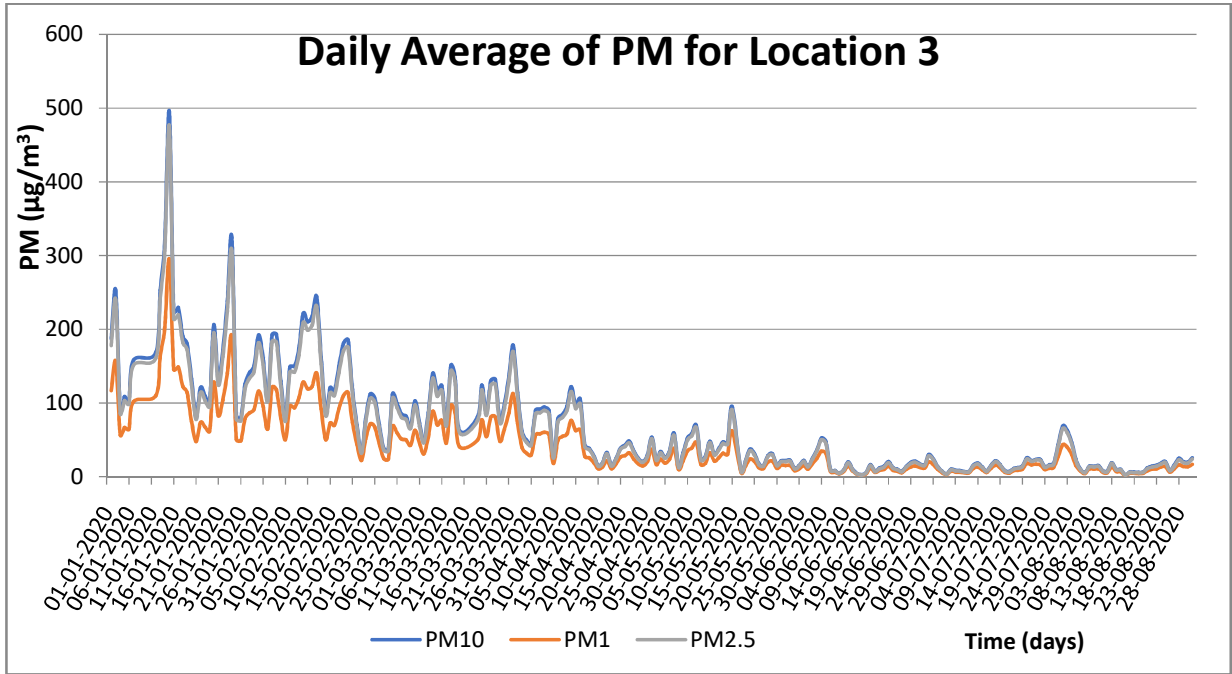
This is the graph for location 3. We can see a decrease in the PM concentration. This location is similar to location 1.
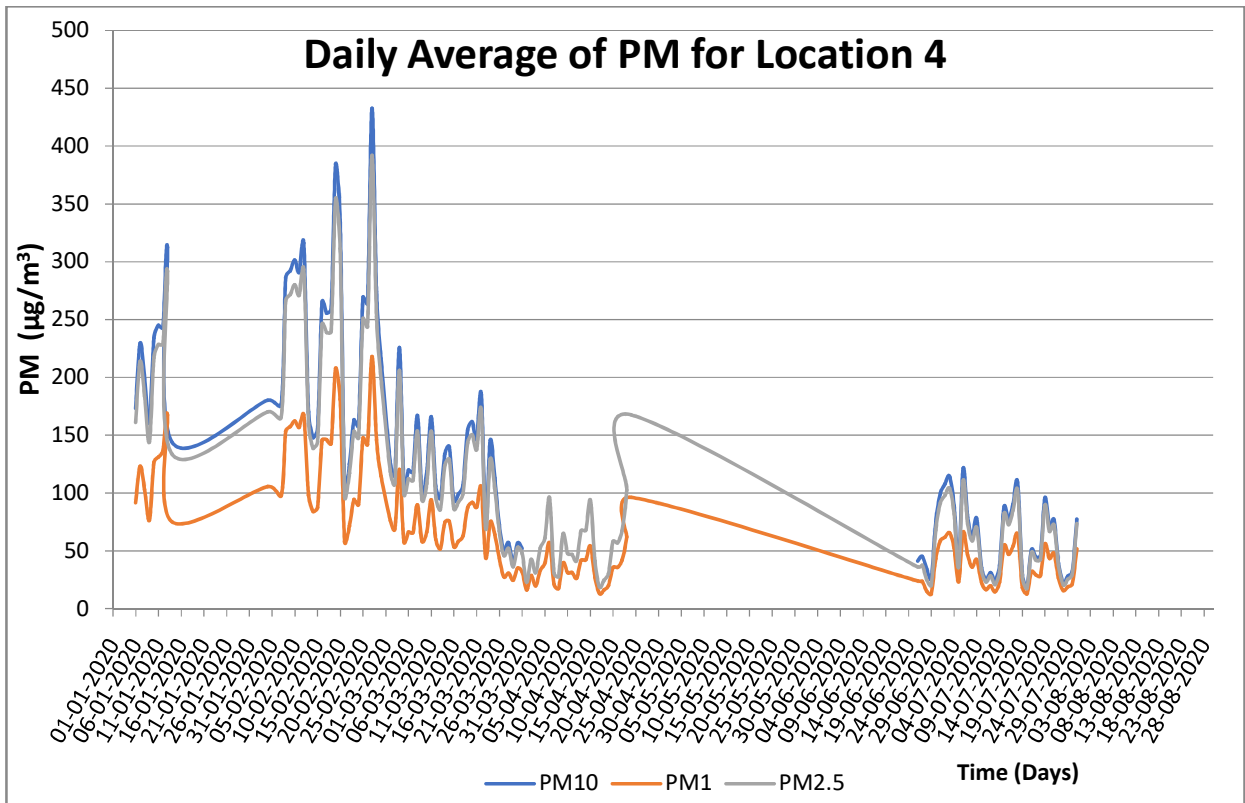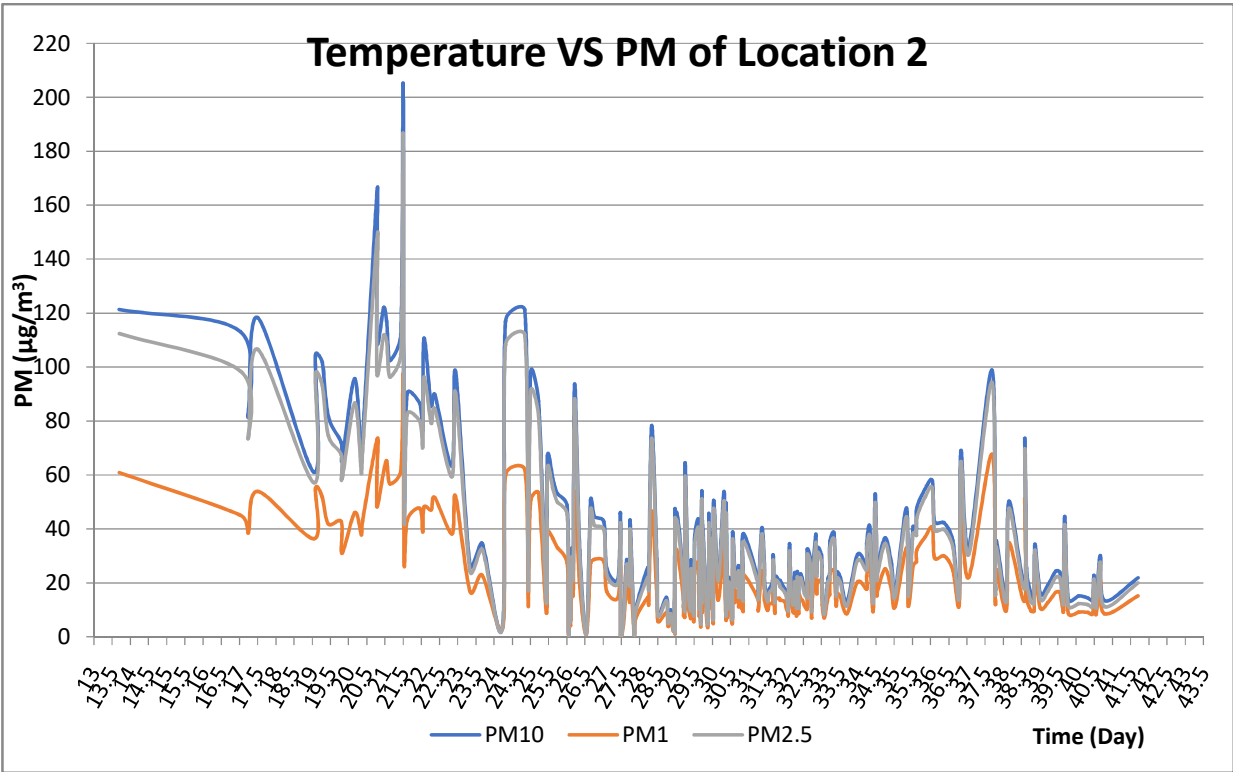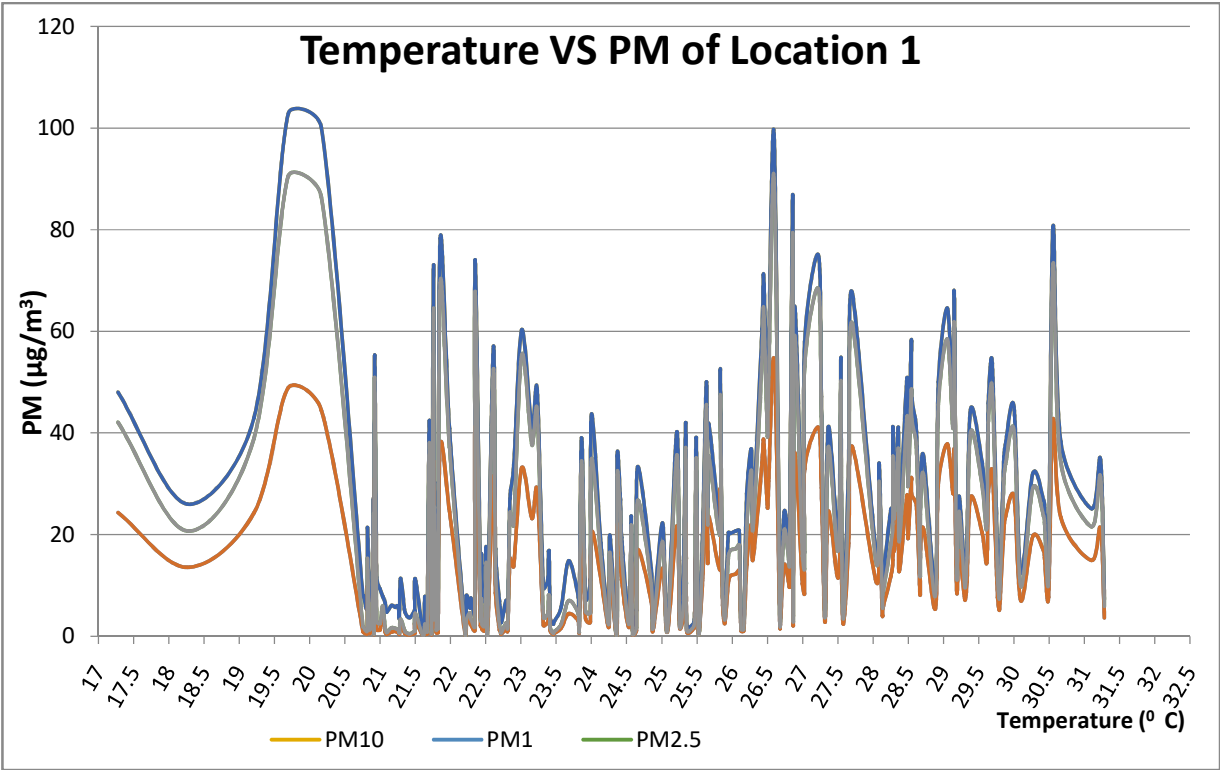
This graph is for location 4. We can see that there was a decrease in the PM concentration. But after 25th April, we can see that there was an increase in the PM concentration. This shows that some part of the location were active during that period of time.

Daily Average of PM for Location 5
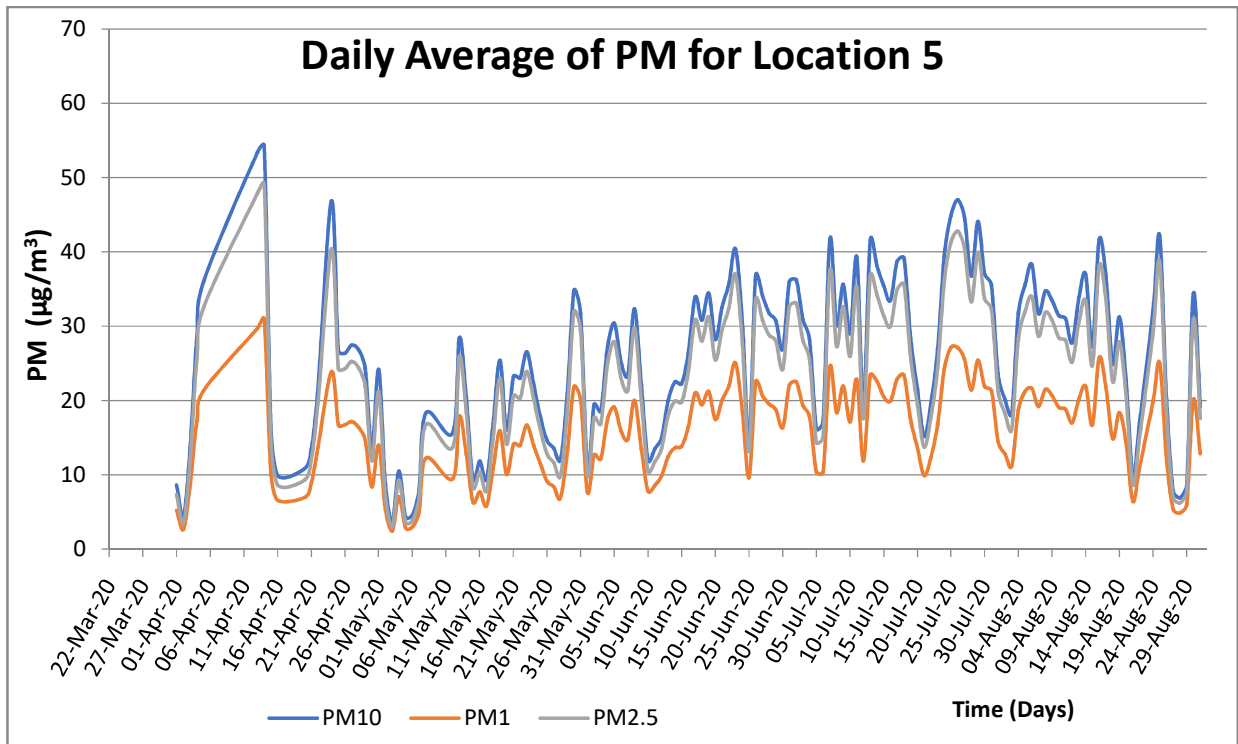
This graph is of location 5. We can see that there is an overall increase in the PM concentration. This shows that this location may contain pharmaceutical factories which were working more actively after the lockdown started.

Question 5:

Temperature VS PM of Location 1

Temperature VS PM of Location 2

Temperature VS PM of Location 3

PM (μg/m³) vs Time (Day)

PM10 — PM1 — PM2.5

Temperature VS PM of Location 4

PM (μg/m³) vs Time (Day)

PM10 — PM1 — PM2.5

Temperature VS PM of Location 5
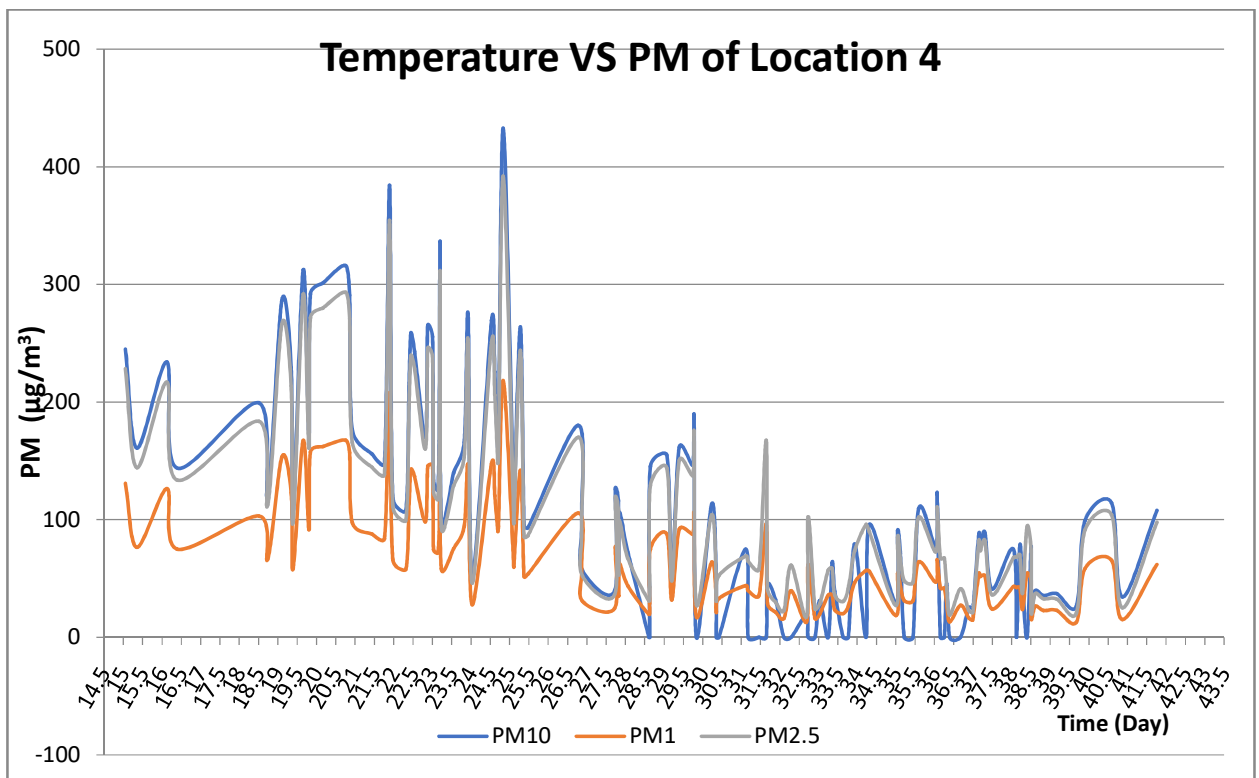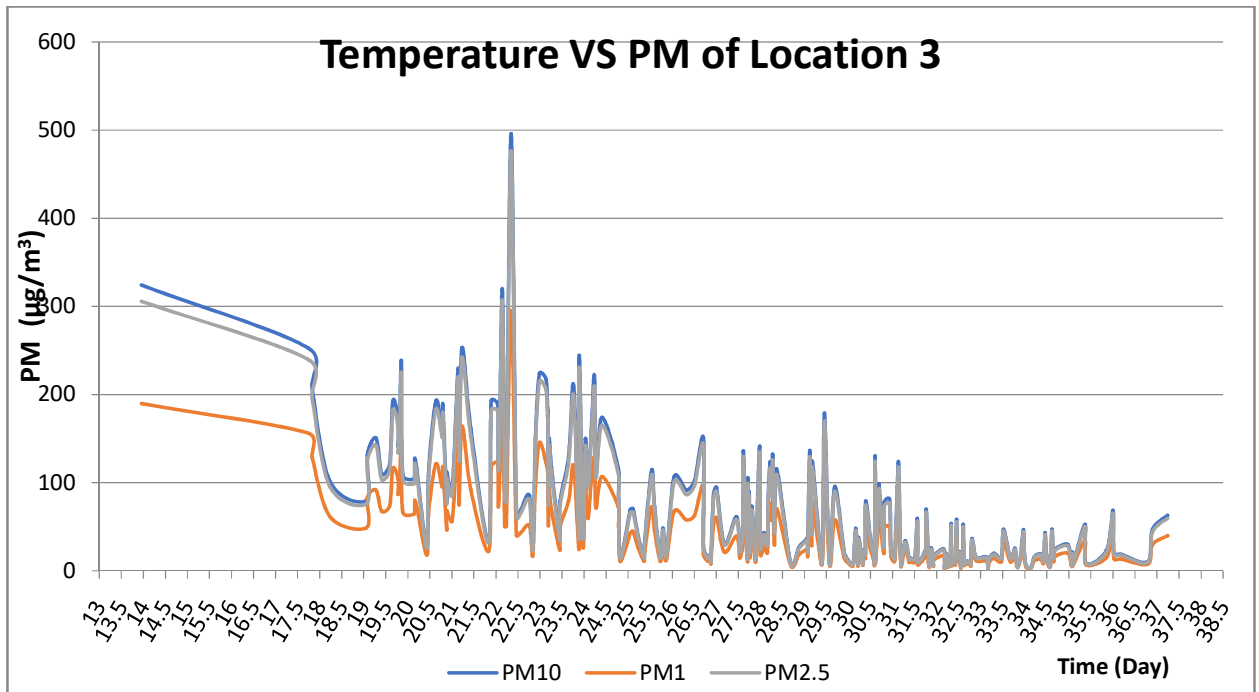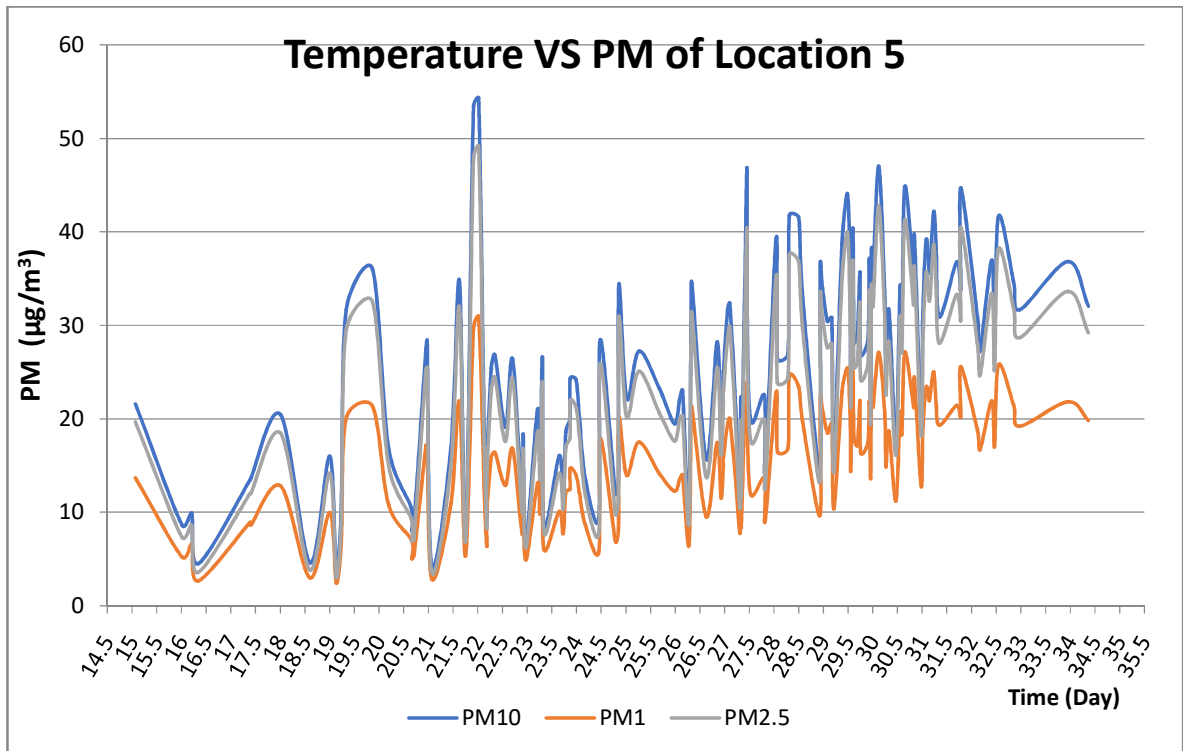
Temp Vs PM for Location 1					Temp Vs PM for Location 2				
	Temp	*PM10*	*PM1*	*PM2.5*		*Temp*	*PM10*	*PM1*	*PM2.5*
Temp	1				Temp	1			
PM10	0.254174	1			PM10	-0.56991	1		
PM1	0.350827	0.986088	1		PM1	-0.48771	0.978283	1	
PM2.5	0.29155	0.995917	0.994347	1	PM2.5	-0.56631	0.999281	0.984133	1

Temp Vs PM for Location 3					Temp Vs PM for Location 4				
	Temp	*PM10*	*PM1*	*PM2.5*		*Temp*	*PM10*	*PM1*	*PM2.5*
Temp	1				Temp	1			
PM10	-0.68149	1			PM10	-0.68648	1		
PM1	-0.6777	0.998522	1		PM1	-0.66977	0.957962	1	
PM2.5	-0.6798	0.999959	0.998771	1	PM2.5	-0.67984	0.956802	0.998635	1

Temp Vs PM for Location 5				
	Temp	*PM10*	*PM1*	*PM2.5*
Temp	1			
PM10	0.586217	1		
PM1	0.594164	0.995267	1	
PM2.5	0.586913	0.999442	0.997459	1

We can see that temperature varies differently with the PM for different locations. For example, temperature and PM1 are positively correlated considering location 5, whereas they are negatively correlated considering location 2. One thing remain constant is that temperature and all the PM are always directly correlated (either positively or negatively).