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1995-2020



PRELIMINARY ASSESSMENT BY THE ENVIRONMENTAL MANAGEMENT AUTHORITY OF TRINIDAD AND TOBAGO'S AIR QUALITY DURING COVID-19

1.0 Introduction

The Environmental Management Authority (EMA) has three (3) Ambient Air Quality Monitoring Stations (AAQMS) to measure air quality in Trinidad and Tobago (T&T) (see Figure 1). In Trinidad, these are located at the WASA Wastewater Treatment Plant in Beetham, Port of Spain (POS) and the Point Lisas Industrial Estate, Point Lisas. The third is situated at Signal Hill in Tobago. All of the EMA's monitoring stations conform to the United States Environmental Protection Agency (US EPA) Reference Methods. It is intended to expand this to a total of ten (10) stations, eight (8) in Trinidad and two (2) in Tobago.

Data from these AAQMS as well as expanded Air Quality Monitoring Systems will allow the EMA to continue its work regarding air quality assessment. This includes further developing inventories to inform revision of the ambient air quality standards and establish an ambient baseline for air quality. Data from the AAQMS can further assist the public in obtaining a visual representation of air quality in their area.

This is a preliminary report on air quality observations, further independent analysis will be conducted with continued data collection and evaluation in the second and third quarter of 2020.

On March 16, 2020 the Government of the Republic Trinidad and Tobago (GORTT) began implementing measures to minimise the spread of Covid-19. This first phase entailed the closure of all schools and universities. The second phase commenced on March 30, 2020, with stay-at-home requirements where only essential workers reported to work. This resulted in a decrease in road transport throughout the country.

To assess the impact of the stay at home measures on concentrations of air pollutants, the EMA evaluated the average concentrations of pollutants. Data from the EMA's three (3) AAQMS were analysed, two (2) weeks prior to (March 02 to March 13, 2020), and two (2) weeks after (March 16 to March 27, 2020). Concentrations of Nitrogen Dioxide (NO₂), Carbon Monoxide (CO) and Particulate Matter (PM₁₀ and PM_{2.5}), were analysed, where data was available. One of the main sources of these pollutants are emissions from vehicular combustion.

Another contributor is Saharan dust. It was noted that these episodes were moderate for the period March 02 to March 27, 2020. Ambient air quality monitoring conducted by the EMA for 2018, shows that the air quality for Trinidad and Tobago is generally acceptable with the occasional exceedances of PM in comparison with the Air Pollution Rules, 2014, Schedule 1- Maximum Permissible Levels for Ambient Air. These exceedances are directly related to Saharan dust occurrences. Although no exceedances of Ozone (O₃), CO, Sulfur Dioxide (SO₂) and NO₂ were observed during 2018, trends relating to the increase of air pollutants during peak traffic times were observed.

The EMA further assessed the Air Quality Index (AQI) to determine if there was a change in the number of good air quality days. The AQI is a beneficial tool in assessing air quality, as it links the concentrations of air pollutants to human health effects. The generation of an AQI value involves a conversion of measured pollutant concentrations, obtained from the AAQMS, to a number on a scale of 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern.

Figure 1: EMA’s Ambient Air Quality Monitoring Stations



2.0 Analysis of Air Quality Data

2.1 Point Lisas, Trinidad

The Point Lisas area, in addition to traffic flow has emission contributions from the industrial estate. From the data (see Table 1), there is an observed decrease in the average concentrations of PM₁₀, PM_{2.5}, NO₂ and CO for the period March 02 to March 27, 2020. The largest decrease of 32.0% was observed for CO.

Table 1: Average Concentrations of Pollutants for Point Lisas, Trinidad, for the period March 02-27, 2020

	Pollutants- Average Concentration µg/m ³			
	PM ₁₀	PM _{2.5}	NO ₂	CO
March 02-13, 2020	31.5	13.0	11.3	192.1
March 16-27, 2020	22.5	9.5	8.9	130.7
<i>% Difference</i>	<i>28.6</i>	<i>26.9</i>	<i>21.2</i>	<i>32.0</i>

This trend was further observed in the AQI daily readings (See Table 2), for the period March 02 to March 27, 2020. For example, on March 02, 2020 the daily AQI value for PM_{2.5} was 28 and for NO₂ was 18. Conversely, on March 16, 2020 the daily AQI values for PM_{2.5} and NO₂ were 8 and 10, respectively. The lower the AQI value, the lower the level of air pollution and the lower the health concern.

Table 2: AQI by Day: Point Lisas, Trinidad, for the period March 02-27, 2020

Date	PM _{2.5}	NO ₂		Date	PM _{2.5}	NO ₂
02-Mar-2020	28	18		16-Mar-2020	8	10
03-Mar-2020	21	16		17-Mar-2020	20	11
04-Mar-2020	35	N/A*		18-Mar-2020	27	8
05-Mar-2020	35	N/A		19-Mar-2020	37	15
06-Mar-2020	N/A	N/A		20-Mar-2020	31	10
07-Mar-2020	34	16		21-Mar-2020	24	13
08-Mar-2020	33	17		22-Mar-2020	14	7
09-Mar-2020	39	9		23-Mar-2020	16	7
10-Mar-2020	37	17		24-Mar-2020	18	9
11-Mar-2020	22	16		25-Mar-2020	17	8
12-Mar-2020	N/A	13		26-Mar-2020	27	9
13-Mar-2020	19	15		27-Mar-2020	20	21

*NA- Not applicable, as a complete data set was not available

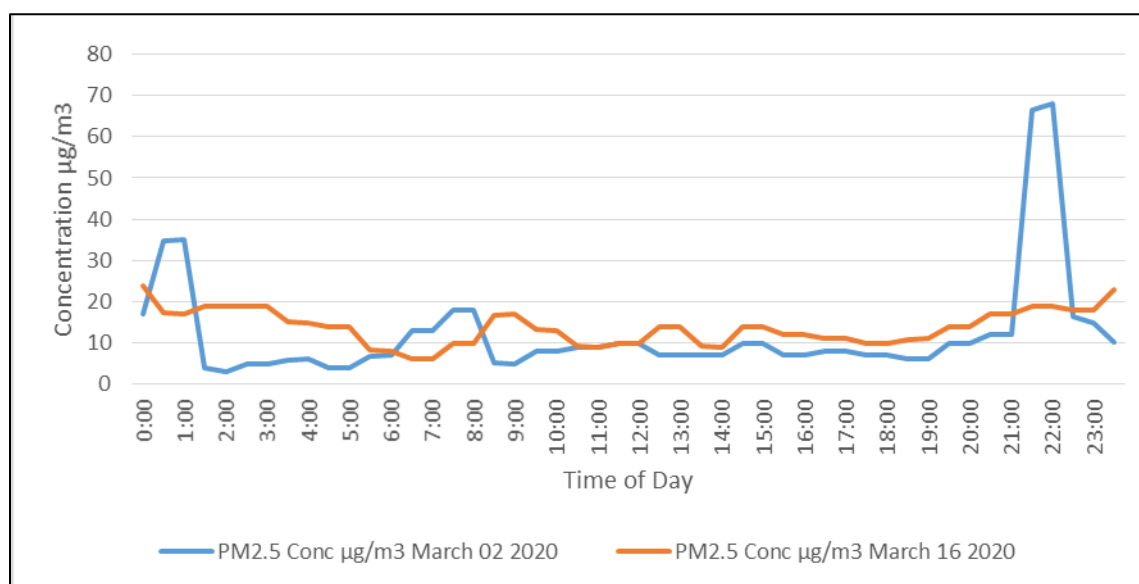
The average number of good AQI days improved from the period March 02 to March 13, 2020 to the period March 16 to March 27, 2020 (See Table 3). For example, the number of good AQI days for PM₁₀ for the period March 02 to March 13, 2020 was 2. Conversely, for the period March 16 to March 27, 2020, the number of good AQI days for PM₁₀ increased to 8.

Table 3: AQI Summary Point Lisas, Trinidad, for the period March 02-13, 2020 and March 16 to 27, 2020 (AQI by No. of Observations)

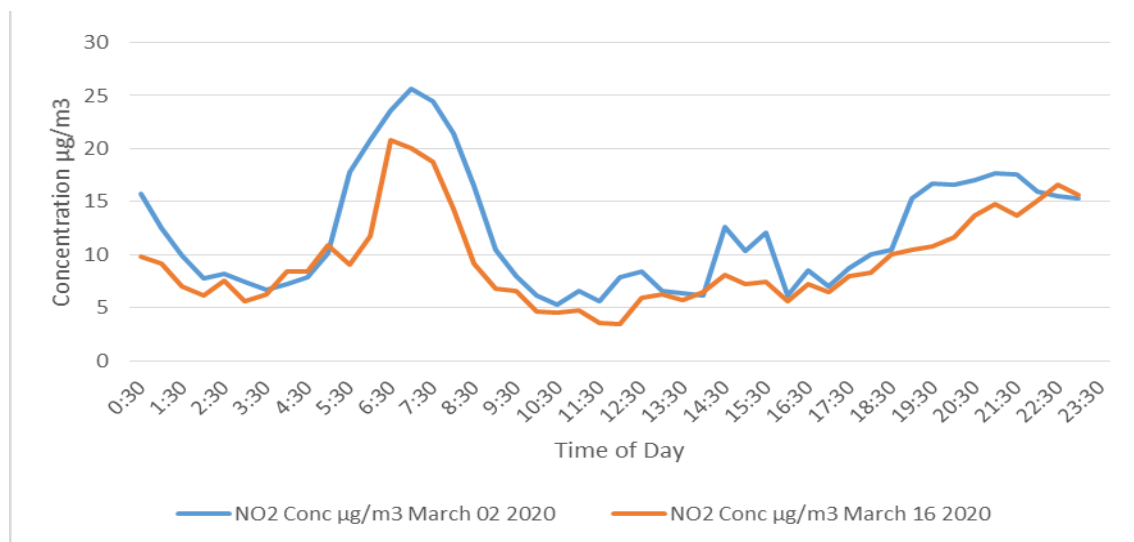
PERIOD	March 02 to 13, 2020				March 16 to 27, 2020			
AQI Category	CO	NO ₂	PM ₁₀	PM _{2.5}	CO	NO ₂	PM ₁₀	PM _{2.5}
Good	10	9	2	10	11	12	8	12
Moderate	0	0	1	0	0	0	2	0
Unhealthy(Sensitive)	0	0	0	0	0	0	0	0
Unhealthy	0	0	0	0	0	0	0	0
Very Unhealthy	0	0	0	0	0	0	0	0
Hazardous	0	0	0	0	0	0	0	0
Not Classified	0	0	0	0	0	0	0	0
TOTAL	10	9	3	10	11	12	10	12

The difference in concentrations of PM_{2.5} and NO₂ for March 02, 2020 (before stay at home measures) and March 16, 2020 (after schools were closed) are illustrated in Graphs 1 and 2. The graphs show the decrease in concentrations of these pollutants on March 16, 2020 (orange line), as compared to March 02, 2020 (blue line).

Graph 1: A Comparison of PM_{2.5} Concentrations for March 02, 2020 and March 16, 2020 at Point Lisas, Trinidad.



Graph 2: A Comparison of NO₂ Concentrations for March 02, 2020 and March 16, 2020 at Point Lisas, Trinidad



The general trend in daily peaks of NO₂ are observed, however, the concentrations are lower on March 16, 2020 (orange line) than on March 02, 2020 (blue line), illustrating the decrease in air pollution.

2.2 Port-of-Spain, Trinidad

The average concentrations of PM₁₀ and NO₂ decreased for the period March 02 to March 27, (See Table 4). The largest decrease of 41.9% was observed for PM₁₀.

Table 4: Average Concentrations of Pollutants for Port-of-Spain, Trinidad, for the period March 02-27, 2020

	Pollutants- Average Concentration µg/m ³	
	PM ₁₀	NO ₂
March 02-13, 2020	42.0	9.0
March 16-27, 2020	24.4	7.5
% Difference	41.9	16.7

The AQI daily readings for this period also saw a decrease, which demonstrates an improvement in air quality (See Table 5). For example, on March 06, 2020 the daily AQI value for PM₁₀ was 76 and for NO₂ was 20. Conversely, on March 20, 2020 the daily AQI values for PM₁₀ and NO₂ were 39 and 17, respectively.

Table 5: AQI by Day: Port-of-Spain, Trinidad, for the period March 02-27, 2020

Date	PM ₁₀	NO ₂		Date	PM ₁₀	NO ₂
02-Mar-2020	59	N/A*		16-Mar-2020	12	14
03-Mar-2020	63	14		17-Mar-2020	N/A	N/A
04-Mar-2020	87	15		18-Mar-2020	52	12
05-Mar-2020	74	13		19-Mar-2020	43	13
06-Mar-2020	76	20		20-Mar-2020	39	17
07-Mar-2020	64	16		21-Mar-2020	19	13
08-Mar-2020	56	N/A		22-Mar-2020	27	9
09-Mar-2020	68	15		23-Mar-2020	40	10
10-Mar-2020	78	9		24-Mar-2020	51	11
11-Mar-2020	59	N/A		25-Mar-2020	61	13
12-Mar-2020	N/A	13		26-Mar-2020	66	14
13-Mar-2020	50	12		27-Mar-2020	53	11

*NA- Not applicable, as a complete data set was not available

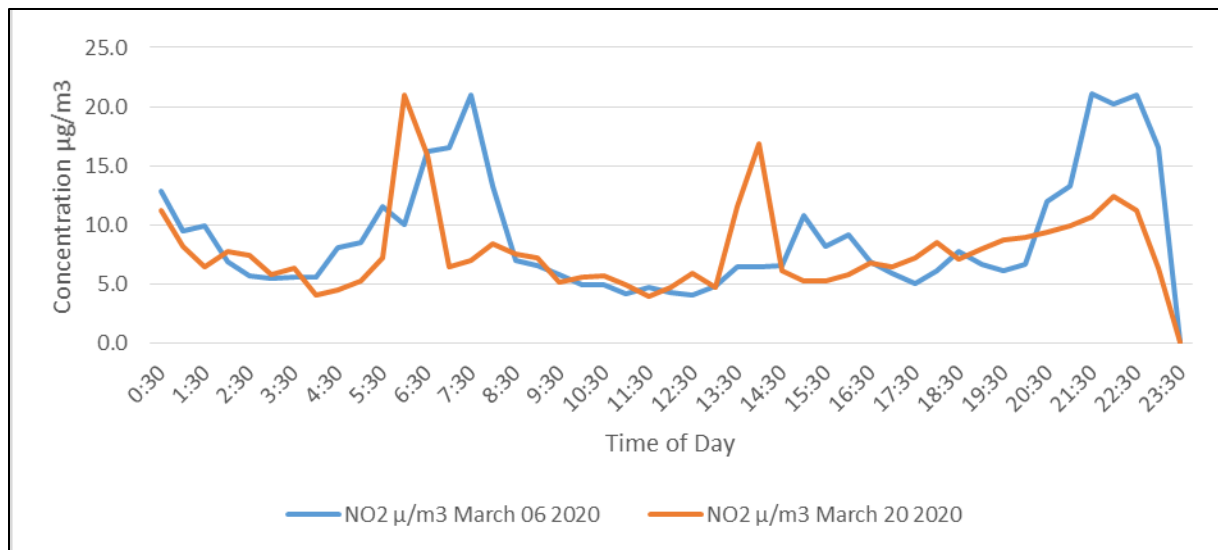
The average number of good AQI days increased from the period March 02 to March 13, 2020 to the period March 16 to March 27, 2020 (See Table 6). For example, the number of good AQI days for PM₁₀ for the period March 02 to March 13, 2020 was 1. Conversely, for the period March 16 to March 27, 2020 the number of good AQI days for PM₁₀ increased to 6.

Table 6: AQI Summary Port-of-Spain, Trinidad, for the period March 02-13, 2020 to March 16 - 27, 2020 (AQI by No. of Observations)

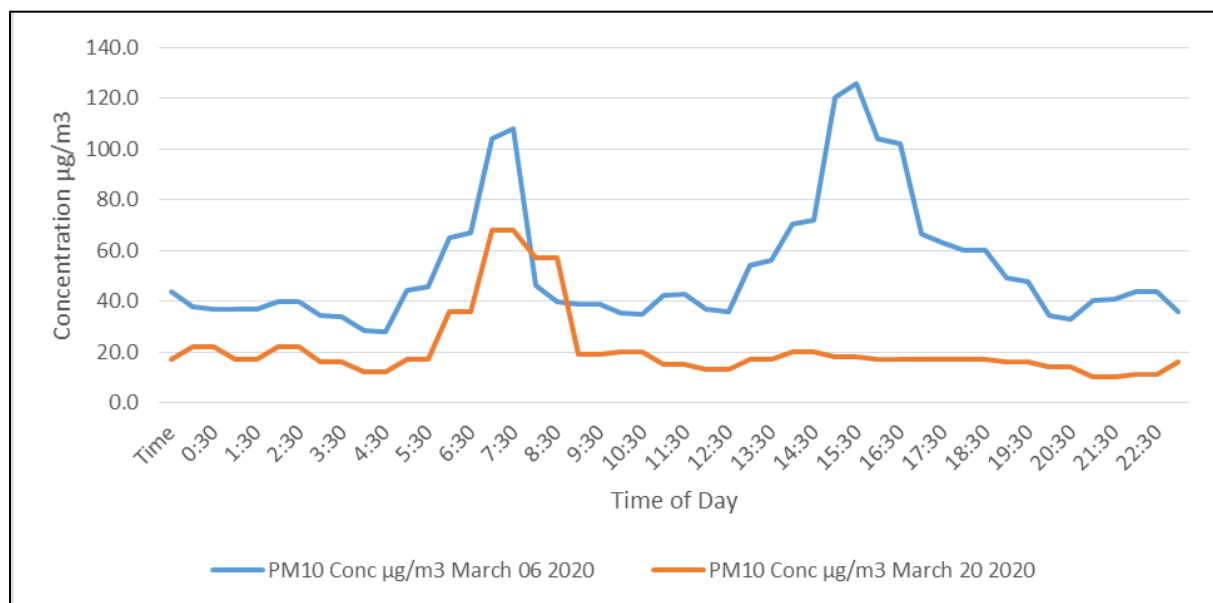
PERIOD	March 02 to 13, 2020		March 16 to 27, 2020	
	NO ₂	PM ₁₀	NO ₂	PM ₁₀
Good	9	1	11	6
Moderate	0	10	0	5
Unhealthy(Sensitive)	0	0	0	0
Unhealthy	0	0	0	0
Very Unhealthy	0	0	0	0
Hazardous	0	0	0	0
Not Classified	0	0	0	0
TOTAL	9	11	11	11

The difference in concentrations of NO₂ and PM₁₀ for March 06, 2020 (before stay at home measures) and March 20, 2020 (after schools were closed) are illustrated in Graphs 3 and 4.

Graph 3: A Comparison of NO₂ Concentrations for March 06, 2020 and March 20, 2020 at Port-of-Spain, Trinidad.



Graph 4: A Comparison of PM₁₀ Concentrations for March 06, 2020 and March 20, 2020 at Port-of-Spain, Trinidad.



The general trends for NO₂ throughout the day were observed, however, the concentrations of NO₂ were lower on March 20, 2020 as compared to March 06, 2020. A decrease in PM₁₀ concentrations is observed when data for March 06, 2020 is compared to March 20, 2020. On March 06, 2020, which represents a typical work day, peaks in PM₁₀ concentrations are observed during peak traffic times. However, with the implementation of stay at home measures, reduced road traffic resulted in lower PM₁₀ concentrations.

2.3 Signal Hill, Tobago

The average concentrations of PM₁₀ and PM_{2.5} decreased from the period March 02 to March 27, 2020 as a result of the implementation of stay at home measures (See Table 7). The % difference in PM₁₀ and PM_{2.5} concentrations between the period March 02 to March 13, 2020 and March 16 to March 27, 2020 were 26.3% and 25.6% respectively.

Table 7: Average Concentrations of Pollutants for Signal Hill, Tobago, for the period March 02-27, 2020

	Pollutants- Average Concentration µg/m ³	
	PM ₁₀	PM _{2.5}
March 02-13, 2020	33.8	12.1
March 16-27, 2020	24.9	9.0
% Difference	26.3	25.6

This trend was further observed in the AQI daily readings (See Table 8). For example, on March 02, 2020 the daily AQI value for PM_{2.5} was 21 and for PM₁₀ was 49. Conversely, on March 16, 2020 the daily AQI values for PM_{2.5} and PM₁₀ were 14 and 31, respectively.

Table 8: AQI by Day: Signal Hill, Tobago, for the period March 02-27, 2020

Date	PM ₁₀	PM _{2.5}		Date	PM ₁₀	PM _{2.5}
02-Mar-2020	49	21		16-Mar-2020	31	14
03-Mar-2020	48	22		17-Mar-2020	60	28
04-Mar-2020	69	38		18-Mar-2020	62	31
05-Mar-2020	76	42		19-Mar-2020	61	31
06-Mar-2020	67	35		20-Mar-2020	50	23
07-Mar-2020	58	29		21-Mar-2020	38	18
08-Mar-2020	N/A*	N/A		22-Mar-2020	36	16
09-Mar-2020	N/A	N/A		23-Mar-2020	38	17
10-Mar-2020	N/A	N/A		24-Mar-2020	39	17
11-Mar-2020	N/A	N/A		25-Mar-2020	42	18
12-Mar-2020	25	11		26-Mar-2020	40	18
13-Mar-2020	27	13		27-Mar-2020	31	15

*NA- Not applicable, as a complete data set was not available

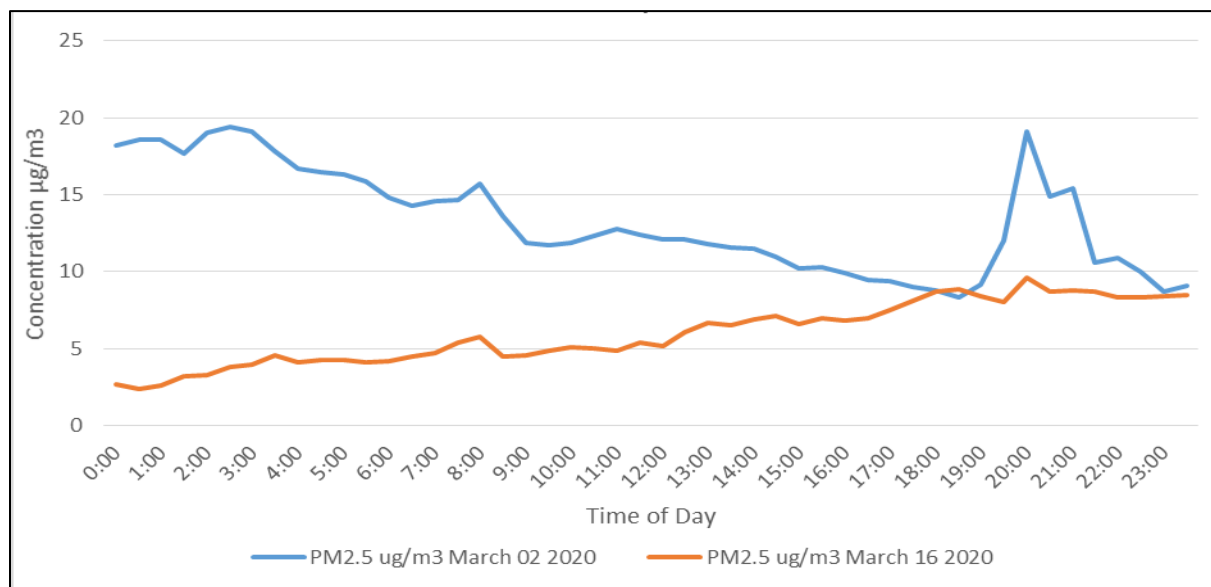
The average number of good AQI days increased from the period March 02 to March 13, 2020 to the period March 16 to March 27, 2020 (See Table 9). For example, the number of good AQI days for the period March 02 to March 13, 2020 for PM₁₀ was 4. Conversely, for the period March 16 to March 27, 2020 the number of good AQI days for PM₁₀ increased to 9.

Table 9: AQI Summary Signal Hill, Tobago, for the period March 02-13, 2020 to March 16-27 (AQI by No. of Observations)

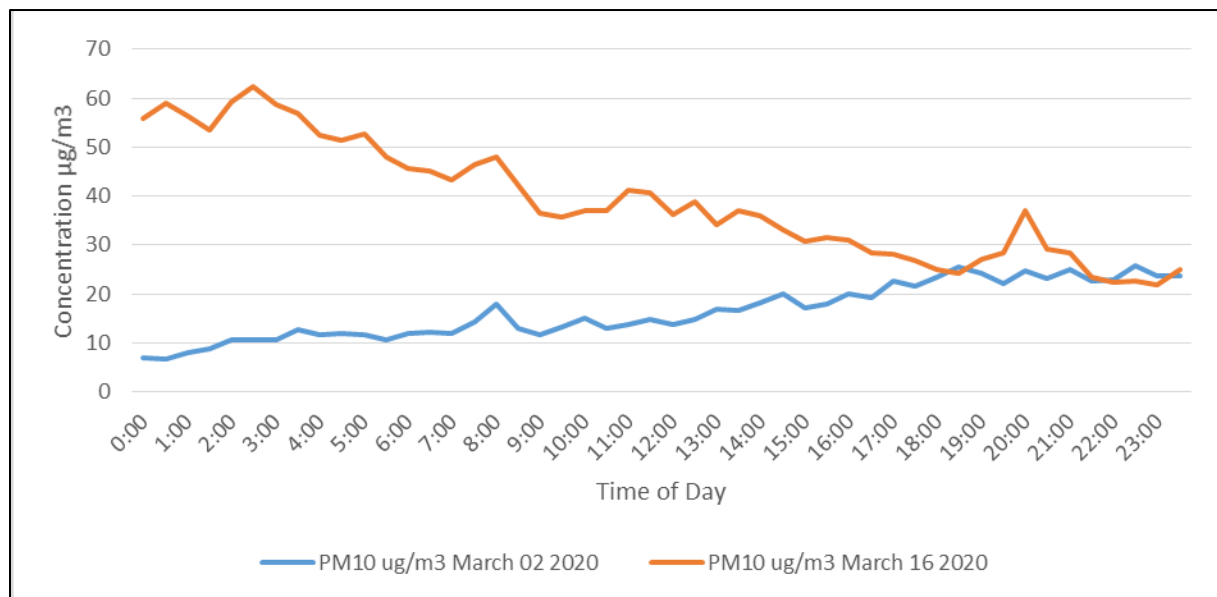
AQI Category	March 02 to 13, 2020		March 16 to 27, 2020	
	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Good	4	8	9	12
Moderate	4	0	3	0
Unhealthy(Sensitive)	0	0	0	0
Unhealthy	0	0	0	0
Very Unhealthy	0	0	0	0
Hazardous	0	0	0	0
Not Classified	0	0	0	0
TOTAL	8	8	12	12

The difference in concentrations of PM₁₀ and PM_{2.5} for March 02, 2020 (before stay at home measures) and March 16, 2020 (after schools were closed) are illustrated in Graphs 5 and 6. The PM_{2.5} and PM₁₀ concentrations for March 16, 2020 as compared to March 02, 2020 showed a decrease in concentrations, as illustrated by the orange line.

Graph 5: A Comparison of PM_{2.5} Concentrations for March 02, 2020 and March 16, 2020 at Signal Hill, Tobago.



Graph 6: A Comparison of PM₁₀ Concentrations for March 02, 2020 and March 16, 2020 at Signal Hill, Tobago.



3.0 Discussion

Emissions from the transport sector is one of the main sources of air pollution. In 2013, two (2) sectors produced nearly two thirds of the global Carbon Dioxide (CO₂) emissions:

1. Electricity and heat generation accounted for 42%;
2. Transport accounted for 23%.

In addition to being a leading source of greenhouse gas (GHG) emissions, the transport sector is also responsible for a large amount of urban air pollution. The World Health Organization’s (WHO) data from 2012 estimated that 4.2 million premature deaths can be attributed to ambient (outdoor) air pollution.

Trinidad and Tobago’s national circumstances is very similar to what is reported worldwide. On November 28, 2017, the Honorable Faris Al-Rawi, Attorney General of Trinidad and Tobago, in his contribution to the Motor Vehicle and Road Traffic (Amendment) (No. 2) Bill, 2017, stated that according to the database at the Ministry of Works and Transport Licensing Division, approximately 1,016,265 registered vehicles are on the nation’s roads. It is most likely that these figures have since increased.

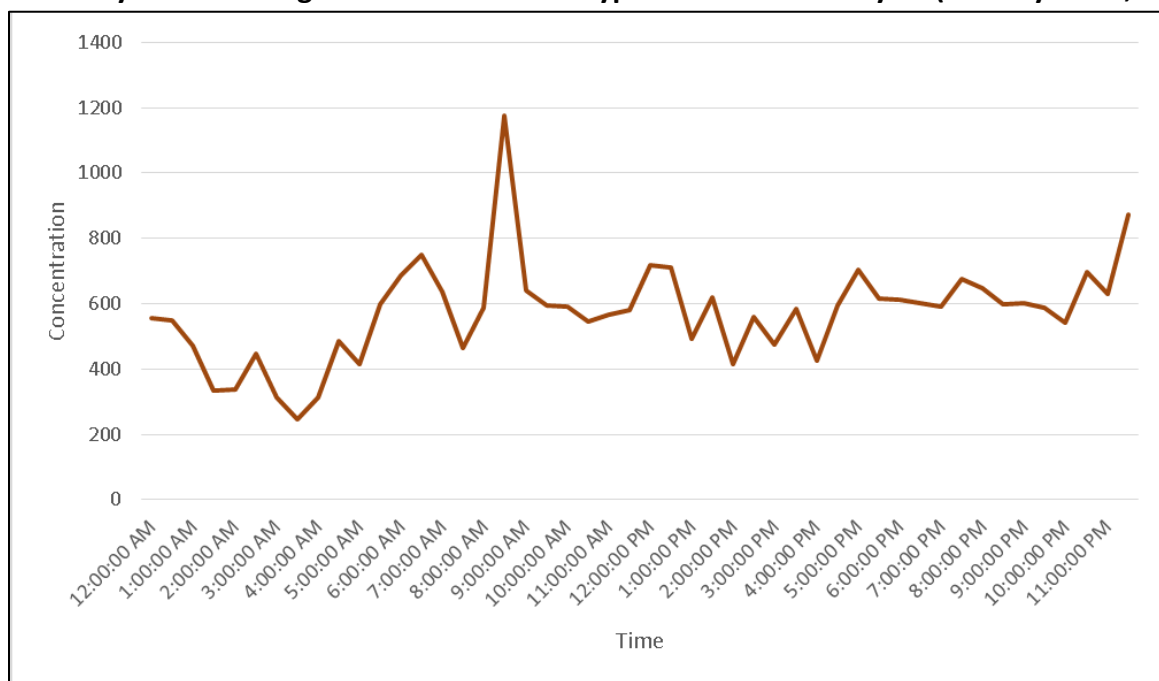
A further assessment of CO contributions assessed from data collected at the EMA’s AAQMS, located at Mulchan Seuchan Road, Chaguanas, in first quarter of 2018. This station was approximately 95 meters downwind of the Uriah Butler Highway. Data from this AAQMS showed a strong correlation between elevated levels of CO and peak traffic times (See Graph 7). The main source of CO is motor vehicle exhaust emissions. This station was relocated from Chaguanas, to PLIPDECO House, Point Lisas Industrial Estate on October 24th, 2019, to capture baseline data in this key sector.

Data analysed during the period March 02 to March13, 2020 and March 16 to March27, 2020 from the three (3) AAWQS demonstrated that there has been a reduction in the concentrations of PM₁₀, PM_{2.5}, NO₂ and CO after stay at home measures were implemented. These measures may be as a result of decreased vehicular traffic. The largest reduction by % was seen for PM₁₀ at the Port-of-Spain AAQMS, which showed a 41.9% reduction in PM₁₀ concentrations. A decrease of vehicular traffic entering Point Lisas, the country’s main industrial estate, may have resulted in the following reductions in concentrations of pollutants:

- PM₁₀ - 28.6%
- PM_{2.5} - 26.9%
- NO₂ - 21.2%
- CO - 32.0

Comparable reductions for particulate matter was observed in Tobago with, PM₁₀ and PM_{2.5} having % differences in concentrations of 26.3 and 25.6 respectively, after the closure of schools.

Graph 7: Graph Showing the Relationship between Carbon Monoxide Concentrations and Time of Day at Chaguanas for a Typical Work Day (January 31, 2018)



Professor Marc Cadotte from the Department of Biological Sciences, at the University of Toronto, Scarborough, analysed the AQI for six (6) COVID-19-affected cities (Wuhan, Hong Kong, Kyoto, Milan, Seoul and Shanghai) that implemented emergency measures in February 2020. He compared the AQI for those cities to February 2019, and found that all six (6) showed a significant reduction in air pollution concentrations. He stated in his study, available on the Environmental Sciences preprint website (to be peer-reviewed) that declines in air pollution levels between 20 to 40 per cent were observed.

The analysis of data prior to and after the implementation of stay at home measures for Trinidad and Tobago shows a correlation with the typical expected decline in air pollution of 20 to 40 percent. An examination of the AQI for Trinidad and Tobago also showed an increase in the number of good air quality days for the period after stay at home measures were implemented. For example, the number of good air quality days for PM₁₀ in Port-of-Spain increased from 1 for the period March 02 to March 13, 2020 to 6 for the period March 16 to March 27, 2020.

3.0 Conclusion

Based on the analysis of ambient air quality data from the EMA's AAQMS during the implementation of stay at home measures, in response to Covid-19, there was an observed decrease in concentrations of air pollutants and an increase in the number of good air quality days for Trinidad and Tobago, during the two-week period analysed. This trend is expected to continue as anthropogenic activity associated with the Covid-19 pandemic has been significantly reduced.

END

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