Ambient Air Quality Monitoring Conducted by the EMA for 2018

Introduction

The Environmental Management Authority established two (2) ambient air quality monitoring stations (AAQMS) in Trinidad in October 2015. These stations, located at the EMA’s Port-of-Spain and Chaguanas Offices, continuously monitor ambient air quality for the following criteria pollutants:

- Particulate Matter of diameter ≤10 µm and ≤2.5 µm (PM$_{10}$ and PM$_{2.5}$);
- Carbon Monoxide (CO);
- Nitrogen Dioxide (NO$_2$);
- Sulphur Dioxide (SO$_2$); and
- Ozone (O$_3$).

Criteria pollutants are the most common air pollutants that cause environmental impacts such as acid rain and smog and affect human health. They are released from the combustion of fossil fuels and industrial processes. All of the EMA’s monitoring stations conform to the United States Environmental Protection Agency (US EPA) Reference Methods. A third station is currently being established at Signal Hill Secondary School in Tobago. The recorded air quality is compared with the standards in the Air Pollution Rules, 2014 (APR). These standards are set to protect public health.

In January 2019, the EMA will launch an Air Quality Index (AQI) based on all criteria pollutants monitored for Trinidad and Tobago. An AQI is an index used by government agencies to communicate to the public the current condition and health of the air we breathe and also predict future trends. The EMA will display real time air quality data (web-based and social media platforms), which can be used to make informed decisions to safeguard human health and issue advisories in consultation with the Ministry of Health and the Trinidad and Tobago Metrological Service.
Summary of Ambient Air Quality Data for 2018

Particulate Matter (PM$_{10}$ and PM$_{2.5}$)

**SUMMARY DATA for CHAGUANAS**

<table>
<thead>
<tr>
<th></th>
<th>PM$_{10}$</th>
<th>PM$_{2.5}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Average</td>
<td>29.80 µg/m$^3$</td>
<td>13.76 µg/m$^3$</td>
</tr>
<tr>
<td>No. of Exceedances with APR Standard</td>
<td>6 days</td>
<td>0 days</td>
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</tbody>
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**SUMMARY DATA for PORT OF SPAIN**

<table>
<thead>
<tr>
<th></th>
<th>PM$_{10}$</th>
<th>PM$_{2.5}$</th>
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<tbody>
<tr>
<td>Annual Average</td>
<td>17.55 µg/m$^3$</td>
<td>13.27 µg/m$^3$</td>
</tr>
<tr>
<td>No. of Exceedances with APR Standard</td>
<td>0 days</td>
<td>0 days</td>
</tr>
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*Note: PM$_{10}$ summary data is for the third and fourth quarters of 2018 only. For the first and second quarters of 2018 the PM$_{10}$ analyzer was down for repairs.*
Graph 1: PM$_{10}$ Concentrations for Chaguanas for 2018

Graph 2: PM$_{2.5}$ Concentrations for Chaguanas for 2018
Graph 3: PM$_{10}$ Concentrations for Port of Spain for 2018

Graph 4: PM$_{2.5}$ Concentrations for Port of Spain for 2018
The APR’s standard for PM$_{2.5}$ is 65 µg/m$^3$ and for PM$_{10}$ is 75 µg/m$^3$ (Schedule 1: Maximum Permissible Levels for Ambient Air). The Met One Instruments, Inc. Model BAM-1020 Beta Attenuation Mass Monitor automatically measures and records hourly ambient particulate mass concentration using the principle of beta attenuation.

For 2018, there were no exceedances of PM$_{2.5}$ at Chaguanas. The maximum PM$_{2.5}$ value recorded for 2018 at this location was 36.59 µg/m$^3$ and was recorded on June 12, 2018.

For 2018 there were six (6) exceedances to the APR’s standard for PM$_{10}$ at Chaguanas. These exceedances were recorded on March 28, 2018 (79.66 µg/m$^3$), June 5 2018 (79.75 µg/m$^3$), June 6 2018 (90.56 µg/m$^3$), June 8 2018 (106.82 µg/m$^3$), June 12 2018 (100.33 µg/m$^3$) and June 29 2018 (77.41 µg/m$^3$).

There were no exceedances of PM$_{2.5}$ with the APR’s standard at Port of Spain for 2018. The highest 24 hour average PM$_{2.5}$ value recorded for 2018 was 36.80 µg/m$^3$ (March 28 2018).

For the first and second quarters of 2018, PM$_{10}$ concentrations were not recorded at the Port of Spain location due to equipment downtime. For the period July – November 2018, there were no exceedances to the APR’s standard for PM$_{10}$. The highest 24 hour average PM$_{2.5}$ and PM$_{10}$ concentrations for the third and fourth quarters of 2018 were 36.70 µg/m$^3$ and 70.20 µg/m$^3$ respectively. Both exceedances occurred on September 20, 2018 and correlated with the highest 24 hour average PM$_{2.5}$ and PM$_{10}$ concentrations for Chaguanas for that period.

In summary, for 2018 the highest 24 hour average for PM$_{10}$ recorded was 106.82 µg/m$^3$ (June 8 2018). For that day the Daily Air Quality Index (AQI), based on particulate matter, recorded was 142.42. The AQI is an index for reporting daily air quality. It gives an indication of how clean or polluted the air is in relation to the permissible levels. An AQI value greater than 100 is considered unhealthy. People with respiratory or heart disease, the elderly and children should avoid prolonged exertion especially while outdoors.
All exceedances with the APR’s standard correlates to days with Saharan dust occurrence. Records show a strong cycle that suggests that dust haze is most prevalent in Trinidad and Tobago during June to August and least during December to February.

Small particles, less than 10 micrometers in diameter, can get deep into lungs, and some may even get into the bloodstream. Sensitive groups, such as people with heart or lung disease, children, and older adults are the most likely to be affected by particle pollution exposure.

**Other Criteria Pollutants: Ozone, Carbon Monoxide, Nitrogen Dioxide and Sulfur Dioxide**

For 2018 there were no exceedances to the APR’s standard for Ozone (O₃), Carbon Monoxide (CO), Nitrogen Dioxide (NO₂) and Sulfur Dioxide (SO₂).

<table>
<thead>
<tr>
<th>Criteria Pollutant</th>
<th>US EPA Reference Method</th>
<th>APR Standard</th>
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<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Non-dispersive Infrared (NDIR)</td>
<td>30,000 µg/m³ (1 hour average)</td>
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<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>Chemiluminescence</td>
<td>200 µg/m³ (1 hour average)</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO₂)</td>
<td>Ultraviolet Fluorescence</td>
<td>125 µg/m³ (24 hours average)</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>Ultraviolet Photometry</td>
<td>120 µg/m³ (8 hours average)</td>
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**Ozone:**

Ground level Ozone is formed by chemical reactions [involving Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NOₓ)] that take place in the presence of sunlight. Groups at risk include people with asthma, children, older adults, and people who are active outdoors. A strong relationship is seen between ozone concentrations and temperature. As temperature increases, ozone concentrations also increase.
Carbon Monoxide:

The Chaguanas air monitoring station is located approximately 95 meters downwind of the Uriah Butler Highway. A strong relationship is seen between elevated levels of Carbon Monoxide and peak traffic times. The main source of Carbon Monoxide is motor vehicle exhaust. Research has shown that increased levels of Carbon Monoxide reduce the amount of Oxygen carried by haemoglobin in red blood cells. The result is that vital organs, such as the brain, nervous tissues and the heart, do not receive enough oxygen to work properly.

Graph 5: Typical Ozone Concentrations (January 6, 2018)
Graph 6: Graph Showing the Relationship between Ozone Concentrations and Temperature (February 18, 2018)
Nitrogen Dioxide:

The major source of Nitrogen Dioxide is the burning of fossil fuels. Most of the Nitrogen Dioxide in urban areas comes from motor vehicle exhaust. The main effect of breathing in raised levels of Nitrogen Dioxide is the increased likelihood of respiratory problems. Nitrogen Dioxide inflames the lining of the lungs, and it can reduce immunity to lung infections. This can cause problems such as wheezing, coughing, colds, flu and bronchitis.
Graph 8: Graph Showing the Relationship between Nitrogen Dioxide Concentrations and Time of Day at Chaguanas for a Typical Work Day (May 09, 2018)

Sulfur Dioxide:

Approximately 99% of the Sulfur Dioxide in the air comes from human sources, particularly, industrial activity. Sulfur Dioxide irritates the nose, throat, and airways to cause coughing, wheezing, shortness of breath, or a tight feeling around the chest.
Discussion of Results

The air monitoring conducted by the EMA for 2018, shows that the air quality for Trinidad and Tobago is acceptable with the occasional exceedances of Particular Matter. These exceedances are directly related to Saharan dust occurrences. Although no exceedances of Ozone, Carbon Monoxide, Sulfur Dioxide and Nitrogen Dioxide were observed during 2018, trends relating to the increase of air pollutants during peak traffic times are seen. The increase in air pollutants can be attributed to vehicle emissions.

On November 28, 2017, the Attorney General, Honorable Faris Al-Rawi, in his speech for the Motor Vehicle and Road Traffic (Amendment) (No. 2) Bill, 2017, stated, “it is interesting to note that we are at 1,016,265 registered vehicles on our roads according to the database at the Ministry of Works and Transport Licensing Division. There are 654,895 issued drivers’ permits in Trinidad and Tobago. When you factor it, that is almost two vehicles to every licensed permit that we have in existence.”
A major pollutant from vehicle emissions, particularly diesel driven road vehicles is Black Carbon (BC). BC is a major component of diesel soot, which has been declared as a substance that can cause cancer by the World Health Organization (WHO).

The EMA does not presently monitor Black Carbon (BC), however there are plans to consider incorporating in future air quality monitoring stations.

Although motor vehicles are not regulated under the Air Pollution Rules, there are existing air emissions standards for motor vehicles (Trinidad & Tobago Standard TTS558:2001), which set limits for Carbon Monoxide and Hydrocarbons in exhaust from gasoline vehicles, and smoke value in exhaust from diesel vehicles. This standard is, however, considered to be voluntary and is not enforced.

The Minister with the responsibility for Transport has the powers under the Motor Vehicle and Road Traffic Act Chap. 48:50, to reduce vehicular emissions by specifying the construction of vehicles, specifying the composition of fuels, controlling the movement of traffic and setting of emissions standards for vehicles. The National Environmental Policy (2018) explicitly addresses vehicular emissions under Section 2.02. It advocates for the: (a) strengthening of legislation, (b) enhancing the capacity of governmental entities to enforce legislation, (c) implementation of traffic management plans, (d) development of sustainable mass transit system, (e) enhanced inspection and maintenance programmes and (f) use of cleaner alternative fuels. The Carbon Reduction Strategy for Trinidad and Tobago (2013) recognizes that the transportation sector accounts for 7% of national CO₂ emissions and focuses on reducing emissions from this sector, primarily through the establishment of mass transit and alternative fuels.

The Government of the Republic of Trinidad and Tobago (GoRTT) has committed to reducing air pollution and emissions from the transportation sector. Some air pollution management responses and strategies are:

- In 2004, the sale and use of leaded gasoline was discontinued in the country; which eliminated the emission of an estimated 105 tonnes per year of lead into the atmosphere.
• In 2016, GORTT implemented a subsidy on the purchase price for Maxi Taxis fuelled by Compressed Natural Gas (CNG). CNG is a cleaner fuel since it contains no sulfur, particulate matter, heavy metal or toxic additives.

• In its Nationally Determined Contribution (NDC) under the Paris Agreement, Trinidad and Tobago committed unconditionally to reduce its public transportation emissions by 30% (1,700,000 tonnes of CO$_{2e}$) compared to 2013 baseline by December 31, 2030. This is expected to be met and surpassed by public transportation conversion to CNG. To date PTSC has converted 10% of its fleet to CNG.

• The GoRTT reduced the level of subsidy on gasoline and diesel in 2015, 2016 and 2018, which is expected to have the indirect effect of encouraging motorists to drive less and therefore reduce vehicle emissions.

Continued reduction of air emissions from motor vehicles will be achieved by:

• Amendment of specific regulations under the Motor Vehicle and Road Traffic Act regarding air emissions from motor vehicles.

• Continued management of the level of subsidy on gasoline and diesel.

• Continue the subsidy on CNG Maxi Taxis and consider application of a subsidy to other types of vehicles. Also, install more CNG Stations across the country to make it more convenient to operate such vehicles.

• Provide incentives to encourage car-pooling.

• Provide incentives to move away from fossil fuel to CNG and electric vehicles.

• Provision of more efficient Public Transport systems to reduce the use of private vehicles.

• Introduction of monitoring of smoke emitted from all diesel engine vehicles and buses, using an approved and calibrated smoke meter, as part of the annual inspection for these vehicles.

• Ensuring diesel quality sold on the local market is of a high quality.
Conclusion

Ambient air quality monitoring conducted by the EMA for 2018 demonstrated that the air quality for Trinidad and Tobago is acceptable with no exceedances for Carbon Monoxide, Ozone, Nitrogen Dioxide and Sulfur Dioxide with the APR’s Standards. However, trends relating to the increase of air pollutants during peak traffic times are seen. As such, action should be taken to control vehicular emissions, as the number of vehicles on the nation’s road ways continue to increase at an unsustainable rate. Black Carbon, a major pollutant from vehicle emissions, should be monitored and incorporated in future air quality monitoring stations.

Exceedances of PM$_{10}$ with the APR’s standard were recorded on six (6) days. Five of those exceedances occurred in the month of June 2018. These exceedances were directly related to Saharan dust occurrence. Saharan dust occurrence is expected to increase in intensity with climate change. As such, transboundary air pollution is a major concern for Trinidad and Tobago. On June 8 2018, the daily Air Quality Index (AQI), based on particulate matter, was greater than 100. This value is considered unhealthy for people with respiratory or heart disease, the elderly and children. The EMA’s AQI, which will be launch in January 2019, will provide alerts to members of the public, so they can take precautionary measures to protect their health.