Appendix A.16.1

Ambient Air Assessment Report

A.16.1 Ambient Air Assessment Report

Ambient Air Quality Assessment

ARUP

Galway City Environs

Contents

1. Summary

Ambient air monitoring was carried out on behalf of ARUP Consulting Engineers at 5 separate locations in Galway City to assess concentrations of the following:

Particulate fractions:	1 location.
Oxides of Nitrogen:	4 locations.
Nitrogen Dioxide:	4 locations and one at the EPA monitoring station in Eyre Square.
Ammonia:	4 locations.

An AQ Mesh particulate monitor was installed in Ard An Locha, Bushy Park on the 28th of October 2023. The analyser measured $PM_{2.5}$ and PM_{10} and data was logged on a continuous basis over the monitoring period. There was a gap in data between 07th and 27th November due to the instrument being removed from the set location by the house owner while works had been carried out.

Diffusive tube samplers, used for analysing Oxides of Nitrogen, Ammonia and Nitrogen Dioxide were installed in 4 different locations on a rolling monthly basis. A fifth set of tubes were also installed at the EPA analyser in Eyre Square to determine tube bias during the tests. Tubes were left in situ in their specified locations for approximately four weeks and were then sent to the lab for analysis via UV spectrophotometry. The following locations were monitored:

- Residential Dwelling in Ard An Loche, Bushy Park;
- St. James National School, Bushy Park;
- Castlegar National School, Castlegar;
- Blackrock Clinic, Galway;
- Eyre Square, Galway (Control site beside the EPA Ambient Monitoring Station).

This report summarises the results obtained for particulate fractions by AXIS Environmental Services Ltd. from the period beginning on the 28th of October 2023 to 16th of January 2024.

This report also includes results from the diffusive tube samplers for the period from the 28th of October 2023 to 16th of January 2024.

The main activities in the area which contribute to the production of particulate matter, Oxides of Nitrogen, Ammonia, and Nitrogen Dioxide, could be attributed to the following items which summarise the surrounding area:

- Traffic.
- The combustion of fossil fuels in the housing estates.
- Combustion of fossil fuels in the local businesses, schools, etc.
- Ammonia from local agricultural activities.

Purpose:

The objectives of this assessment were to:

- Assess the local concentrations of particulate matter fractions in ambient air.
- Assess the local concentrations of Oxides of Nitrogen and Nitrogen Dioxide in ambient air.
- Assess the local concentrations of Ammonia in ambient air.
- Compare the measured concentrations with the current limit values as outlined in European legislation.

In order to protect our health, vegetation and ecosystems, EU directives set down air quality standards in Ireland and the other member states for a wide variety of pollutants. These rules include how we should monitor, assess and manage ambient air quality.

The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive. The Ambient Air Quality and Cleaner Air for Europe CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

Summary of Findings:

PM_{10}:

There were no exceedances of the daily limit for the PM_{10} particulate fraction noted during the monitoring period.

$PM_{2.5}$:

There is no limit for $PM_{2.5}$ for a daily average. The annual average limit for this parameter is 20 ug/m^3. All results monitoring period were determined below this limit.

Ammonia:

There are no limits for Ammonia in the CAFE Directive. Ammonia was determined to comply with the limit's outlined for Critical Level in the TII Publication PE-ENV-01107.

Oxides of Nitrogen (NOx):

All locations analysed for oxides of nitrogen during the reporting period were below air quality standards in the CAFE Directive.

Nitrogen Dioxide (NO_2):

All locations analysed for oxides of nitrogen during the reporting period were below air quality standards in the CAFE Directive.

2. Introduction

Ambient air monitoring was carried out on behalf of ARUP Consulting Engineers at 5 separate locations in Galway City to assess concentrations of Particulate fractions, Oxides of Nitrogen, Nitrogen Dioxide and Ammonia.

An AQ Mesh particulate monitor was installed in Ard An Locha, Bushy Park on the 28th of October 2023. The analyser measured $PM_{2.5}$ and PM_{10} and data was logged on a continuous basis over the monitoring period. There was a gap in data between 07-27th November 2023 due to the instrument being removed from the set location by the house owner while works had been carried out.

Diffusive tube samplers, used for analysing Oxides of Nitrogen, Ammonia and Nitrogen Dioxide were installed in 4 different locations on a rolling monthly basis. A set of tubes were also installed at the EPA analyser in Eyre Square to determine tube bias during the tests. Tubes were left in situ in their specified locations for approximately four weeks and were then sent to the lab for analysis via UV spectrophotometry.

2.1 Purpose of the Report

The objectives of this assessment were to:

- Assess the local concentrations of particulate matter fractions in ambient air.
- Assess the local concentrations of Oxides of Nitrogen and Nitrogen Dioxide in ambient air.
- Assess the local concentrations of Ammonia in ambient air.
- Compare the measured concentrations with the current limit values as outlined in European legislation.

3. Summary of Methods Used

Table 3-1: Methods

Parameter	Method
Particulate Fractions	AQ Mesh Particulate analyser
Ammonia	SP11 ion chromatography, Passam ag, Schellenstrasse 44, 8708 Männedorf, Switzerland, accredited laboratory for air analysis by diffusive samplers according to ISO/IEC 17025
Oxides of Nitrogen / Nitrogen Dioxide	SP10 ion chromatography, Passam ag, Schellenstrasse 44, 8708 Männedorf, Switzerland, accredited laboratory for air analysis by diffusive samplers according to ISO/IEC 17025

Table 3-2: Equipment

Item	ID Number	Calibration Status
Particulate Fractions	2451005	The equipment was installed calibrated and holds valid calibration certificates for the period of monitoring
Oxides of Nitrogen / Nitrogen Dioxide	Diffusion Tubes	No calibration required
Ammonia	Diffusion Tubes	No calibration required

4. Summary of CAFE Limit Values

The following limit values have been obtained from the CAFE Directive which is the current legislation covering ambient air quality in Ireland.

Table 4-1: 2008/50/EC Limits

Individual Components	Hourly Limit (µg/m^3)	Daily Limit (µg/m^3)	Annual Limit (µg/m^3)
PM_{10}	-	50 [1, 3]	40 [1,2]
$PM_{2.5}$	-	-	20 [1,2]
Oxides of Nitrogen (NO_x)	-	-	30 [4]
Nitrogen Dioxide (NO_2)	200 [1,5]	-	40 [1,2]
Ammonia	No limit	No limit	No limit

Note 1: For the protection of Human Health.
Note 2: Annual mean.
Note 3: Not to be exceeded more than 35 times in a calendar year.
Note 4: For the protection of ecosystems.
Note 5: Not to be exceeded more than 18 times in a calendar year.

5. Locations Tested

Figure 5-1: Test Locations

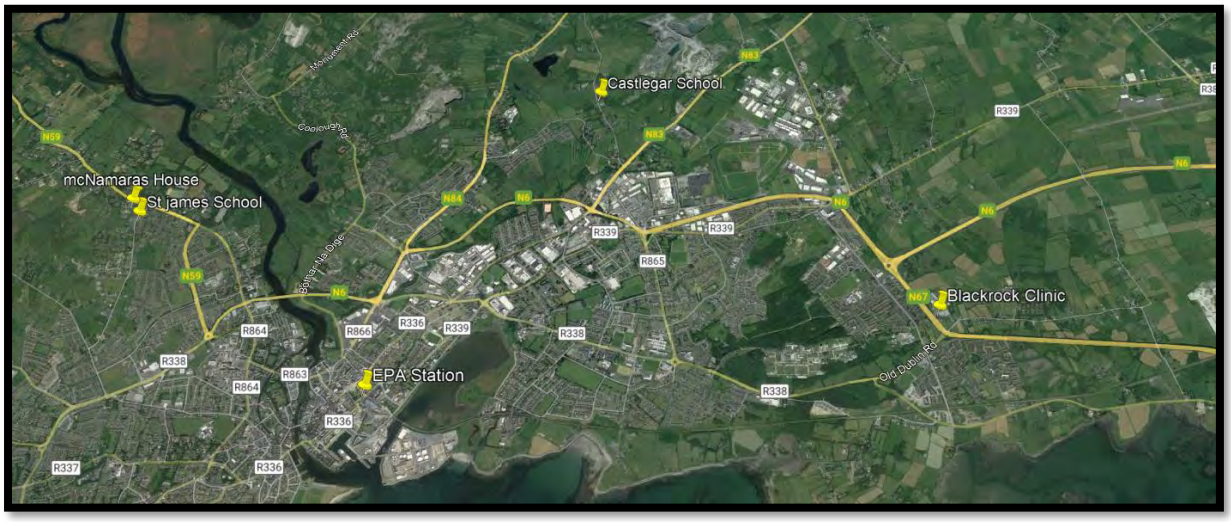

Figure 5-2: Location Pictures

St James National Schol Directly across from the school southern boundary on a lap post 	McNamara's Residence Back of the residence 
Castlegar National School On the traffic lights at school boundary. 	EPA Attached to the air station. 
Blackrock Clinic Entrance road before after carpark on a lamp post. 	Blank

6. Summary of Results

Table 6-1: Nitrogen Dioxide (NO_2) Monitoring Results

NO_2 Concentrations Round 1 28th October to 25th November 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NO_2 Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	671.0	8.5	6.9	40 µg/m³
St James National School Tube 2	671.0	8.6	7.0	
St James National School Tube 3	671.0	8.9	7.2	
Castlegar National School Tube 1	670.7	11.0	8.9	
Castlegar National School Tube 2	670.7	11.4	9.2	
Castlegar National School Tube 3	670.7	11.1	9.0	
Blackrock Clinic Galway Tube 1	669.1	17.4	14.1	
Blackrock Clinic Galway Tube 2	669.1	17.3	14.0	
Blackrock Clinic Galway Tube 3	669.1	17.7	14.3	
Private Residence Bushy Park Tube 1	-	-	-	
Private Residence Bushy Park Tube 2	-	-	-	
Private Residence Bushy Park Tube 3	-	-	-	

Note: There are no results for the private residence as the diffusion tubes were removed from their location by the resident for house repairs and could not be located on arrival for collection.

Table 6-2: Nitrogen Dioxide (NO_2) Monitoring Results

NO_2 Concentrations Round 2 25th November 2023 to 19th December 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NO_2 Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	572.0	8.2	6.6	40 µg/m³
St James National School Tube 2	572.0	7.7	6.2	
St James National School Tube 3	572.0	7.4	6.0	
Castlegar National School Tube 1	570.8	8.9	7.2	
Castlegar National School Tube 2	570.8	9.2	7.5	
Castlegar National School Tube 3	570.8	10.5	8.5	
Blackrock Clinic Galway Tube 1	571.3	13.4	10.9	
Blackrock Clinic Galway Tube 2	571.3	12.2	9.9	
Blackrock Clinic Galway Tube 3	571.3	10.2	8.3	
Private Residence Bushy Park Tube 1	572.0	5.2	4.2	
Private Residence Bushy Park Tube 2	572.0	4.4	3.6	
Private Residence Bushy Park Tube 3	572.0	5.2	4.2	

Table 6-3: Nitrogen Dioxide (NO_2) Monitoring Results

NO_2 Concentrations Round 3 19th December 2023 – 16th January 2024				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NO_2 Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	678.0	4.9	4.0	40 µg/m³
St James National School Tube 2	678.0	5.0	4.1	
St James National School Tube 3	678.0	5.2	4.2	
Castlegar National School Tube 1	677.8	6.4	5.2	
Castlegar National School Tube 2	677.8	6.6	5.3	
Castlegar National School Tube 3	677.8	6.7	5.4	
Blackrock Clinic Galway Tube 1	677.8	9.3	7.5	
Blackrock Clinic Galway Tube 2	677.8	11.3	9.2	
Blackrock Clinic Galway Tube 3	677.8	12.1	9.8	
Private Residence Bushy Park Tube 1	677.8	3.3	2.7	
Private Residence Bushy Park Tube 2	677.8	3.4	2.8	
Private Residence Bushy Park Tube 3	677.8	3.2	2.6	

Table 6-4: Nitrogen Dioxide (NOx) Monitoring Results

NOx Concentrations Round 1 28th October to 25th November 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NO_x Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	671.0	11.4	-	30 µg/m³
St James National School Tube 2	671.0	13.4	-	
St James National School Tube 3	671.0	12.8	-	
Castlegar National School Tube 1	670.7	16.2	-	
Castlegar National School Tube 2	670.7	15.3	-	
Castlegar National School Tube 3	670.7	16.9	-	
Blackrock Clinic Galway Tube 1	669.1	23.9	-	
Blackrock Clinic Galway Tube 2	669.1	22.5	-	
Blackrock Clinic Galway Tube 3	669.1	22.5	-	
Private Residence Bushy Park Tube 1	-	-	-	
Private Residence Bushy Park Tube 2	-	-	-	
Private Residence Bushy Park Tube 3	-	-	-	

Note 1: There are no results for the private residence as the diffusion tubes were removed from their location by the resident for house repairs and could not be located on arrival for collection.
Note 2: The EPA analyser was not set to record for NOx during the period therefore no EPA data was available to adjust for Bias.

Table 6-5: Nitrogen Dioxide (NO_x) Monitoring Results

NOx Concentrations Round 2 25th November 2023 to 19th December 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NOx Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	572.0	12.2	-	30 µg/m³
St James National School Tube 2	572.0	12.5	-	
St James National School Tube 3	572.0	12.0	-	
Castlegar National School Tube 1	570.8	15.4	-	
Castlegar National School Tube 2	570.8	13.8	-	
Castlegar National School Tube 3	570.8	15.7	-	
Blackrock Clinic Galway Tube 1	571.3	18.2	-	
Blackrock Clinic Galway Tube 2	571.3	18.6	-	
Blackrock Clinic Galway Tube 3	571.3	18.5	-	
Private Residence Bushy Park Tube 1	572.0	6.7	-	
Private Residence Bushy Park Tube 2	572.0	3.6	-	
Private Residence Bushy Park Tube 3	572.0	6.5	-	

Note: The EPA analyser was not set to record for NOx during the period therefore no EPA data was available to adjust for Bias.

Table 6-6: Nitrogen Dioxide (NO_x) Monitoring Results

NO_x Concentrations Round 3 19th December 2023 – 16th January 2024				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**NO_x Annual Limit**
		µg/m³	**µg/m³**	
St James National School Tube 1	678.0	7.4	-	30 µg/m³
St James National School Tube 2	678.0	6.8	-	
St James National School Tube 3	678.0	7.6	-	
Castlegar National School Tube 1	677.8	10.2	-	
Castlegar National School Tube 2	677.8	8.9	-	
Castlegar National School Tube 3	677.8	9.2	-	
Blackrock Clinic Galway Tube 1	677.8	25.1	-	
Blackrock Clinic Galway Tube 2	677.8	24.3	-	
Blackrock Clinic Galway Tube 3	677.8	24.1	-	
Private Residence Bushy Park Tube 1	677.8	5.1	-	
Private Residence Bushy Park Tube 2	677.8	3.9	-	
Private Residence Bushy Park Tube 3	677.8	4.8	-	

Note: The EPA analyser was not set to record for NOx during the period therefore no EPA data was available to adjust for Bias.

Table 6-7: Ammonia Monitoring Results

Ammonia Concentrations Round 1 28th October to 25th November 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**Ammonia Critical Levels TII Publication PE-ENV-01107**
		µg/m³	**µg/m³**	
St James National School Tube 1	671.0	0.4	N/a	2 Critical Levels Quoted for sensitive designated habitat. Critical Level 1.0 µg/m³ Critical Level 3.0 µg/m³
St James National School Tube 2	671.0	< 0.3	N/a	
St James National School Tube 3	671.0	0.3	N/a	
Castlegar National School Tube 1	670.7	0.4	N/a	
Castlegar National School Tube 2	670.7	0.5	N/a	
Castlegar National School Tube 3	670.7	0.3	N/a	
Blackrock Clinic Galway Tube 1	669.1	0.6	N/a	
Blackrock Clinic Galway Tube 2	669.1	0.5	N/a	
Blackrock Clinic Galway Tube 3	669.1	0.6	N/a	
Private Residence Bushy Park Tube 1	-	-	N/a	
Private Residence Bushy Park Tube 2	-	-	N/a	
Private Residence Bushy Park Tube 3	-	-	N/a	

Note: There are no results for the private residence as the diffusion tubes were removed from their location by the resident for house repairs and could not be located on arrival for collection.

Table 6-8: Ammonia Monitoring Results

Ammonia Concentrations Round 2 25th November 2023 to 19th December 2023				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**Ammonia Critical Levels TII Publication PE-ENV-01107**
		µg/m³	**µg/m³**	
St James National School Tube 1	572.0	< 0.3	N/a	2 Critical Levels Quoted for sensitive designated habitat. Critical Level 1.0 µg/m³ Critical Level 3.0 µg/m³
St James National School Tube 2	572.0	< 0.3	N/a	
St James National School Tube 3	572.0	< 0.3	N/a	
Castlegar National School Tube 1	572.0	< 0.3	N/a	
Castlegar National School Tube 2	572.0	< 0.3	N/a	
Castlegar National School Tube 3	572.0	< 0.3	N/a	
Blackrock Clinic Galway Tube 1	570.8	0.5	N/a	
Blackrock Clinic Galway Tube 2	570.8	0.8	N/a	
Blackrock Clinic Galway Tube 3	570.8	0.7	N/a	
Private Residence Bushy Park Tube 1	571.3	0.6	N/a	
Private Residence Bushy Park Tube 2	571.3	0.7	N/a	
Private Residence Bushy Park Tube 3	571.3	0.7	N/a	

Table 6-9: Ammonia Monitoring Results

Ammonia Concentrations Round 3 19th December 2023 – 16th January 2024				
Location	**Exposure Time**	**Result**	**Adjusted for Bias**	**Ammonia Critical Levels TII Publication PE-ENV-01107**
		µg/m³	**µg/m³**	
St James National School Tube 1	572.0	< 0.3	N/a	2 Critical Levels Quoted for sensitive designated habitat. Critical Level 1.0 µg/m³ Critical Level 3.0 µg/m³
St James National School Tube 2	572.0	< 0.3	N/a	
St James National School Tube 3	572.0	< 0.3	N/a	
Castlegar National School Tube 1	572.0	0.5	N/a	
Castlegar National School Tube 2	572.0	0.8	N/a	
Castlegar National School Tube 3	572.0	0.7	N/a	
Blackrock Clinic Galway Tube 1	570.8	0.6	N/a	
Blackrock Clinic Galway Tube 2	570.8	0.7	N/a	
Blackrock Clinic Galway Tube 3	570.8	0.7	N/a	
Private Residence Bushy Park Tube 1	571.3	< 0.3	N/a	
Private Residence Bushy Park Tube 2	571.3	< 0.3	N/a	
Private Residence Bushy Park Tube 3	571.3	< 0.3	N/a	

Table 6-10: PM_{10} / $PM_{2.5}$ Monitoring Results

Date	$PM_{2.5}$	PM_{10}	Humidity	Temperature
	µg/m³	µg/m³	%RH	Degrees C
28/10/2023	5.53	9.75	75.79	13.63
29/10/2023	3.65	6.18	82.11	10.32
30/10/2023	6.16	8.38	83.96	10.36
31/10/2023	5.03	7.3	85.02	10.89
01/11/2023	3.88	8.23	83.29	10.55
02/11/2023	2	5.98	83.59	9.91
03/11/2023	11.32	14.98	76.19	11.51
04/11/2023	3.52	6.6	74.12	13
06/11/2023	1.91	5.8	75.36	10.19
07/11/2023	2.06	5.58	75.48	10.42

Note: There is missing data as the meter was disconnected and removed from its sample location by the resident for repair works to the house.

Figure 6-1: Particulate Matter Daily Average

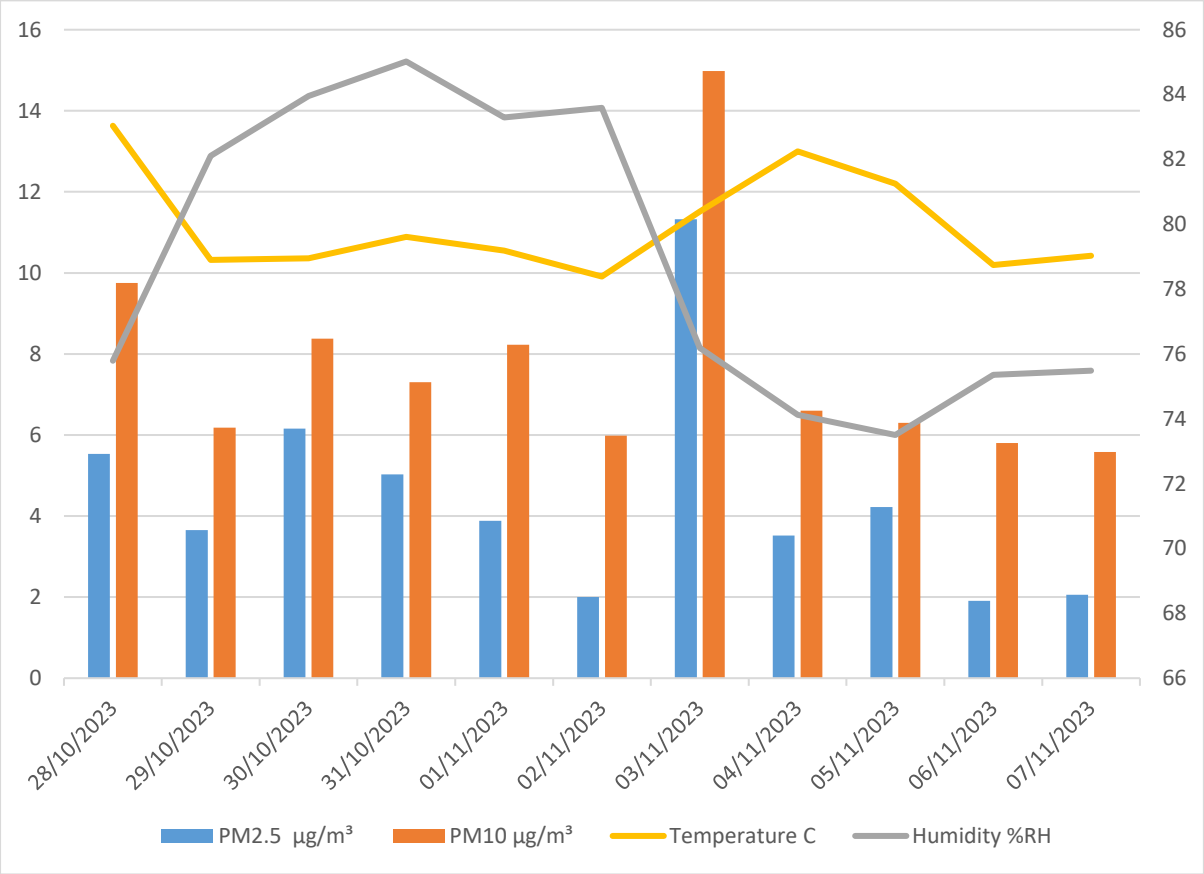

Table 6-11: PM_{10} / $PM_{2.5}$ Monitoring Results

Date	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Humidity %RH	Temperature Degrees C
27/11/2023	2.88	4.33	87.98	10.06
28/11/2023	2.96	4.44	86.3	7.88
29/11/2023	4.47	6	85.61	5.99
30/11/2023	8.1	8.76	87.84	3.61
01/12/2023	4.56	5.56	84.54	1.49
02/12/2023	13.82	13.93	89.13	2.43
03/12/2023	13.4	13.75	89.89	2.67
04/12/2023	9.68	10.83	90.77	1.33
05/12/2023	3.95	4.97	88.42	2.88
06/12/2023	9.73	10.52	88.61	2.4
07/12/2023	4.55	5.85	88.68	7.84
08/12/2023	5.18	8.52	87.9	9.93
09/12/2023	6.85	12.54	88.82	9.74
10/12/2023	5.42	9.46	85.7	9.62
11/12/2023	6.27	11.29	88.37	9.59
12/12/2023	5.23	7.28	90.37	7.91
13/12/2023	3.96	5.63	90.91	8.13
14/12/2023	3.28	5.23	87.86	8.57
15/12/2023	5.92	10.49	86.86	9.25
16/12/2023	4.05	7	88.95	10.37
17/12/2023	3.86	6.3	89.09	11
18/12/2023	4.16	6.93	88.33	12.12
19/12/2023	2.9	4.23	90.78	10.73

Figure 6-2: Particulate Matter Daily Average

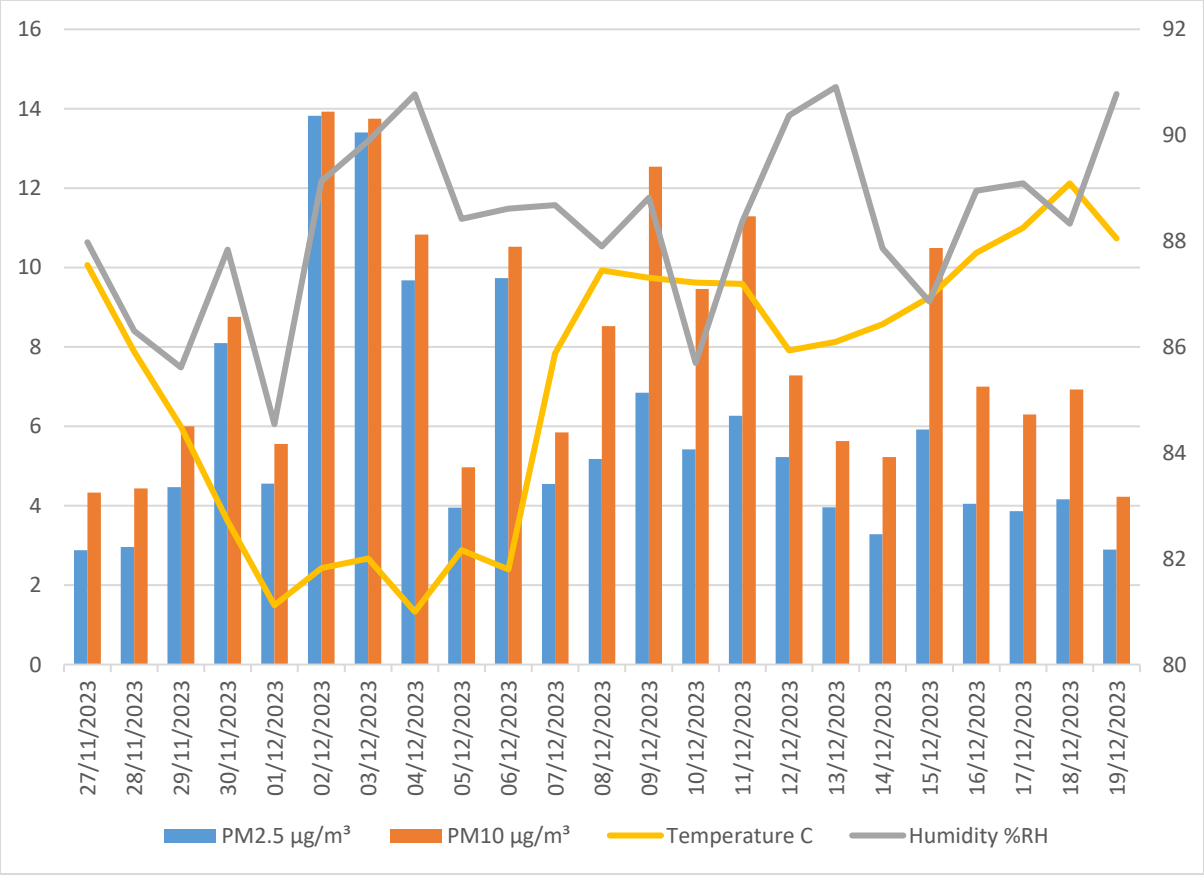

Table 6-12: PM_{10} / $PM_{2.5}$ Monitoring Results

Date	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Humidity %RH	Temperature Degrees C
20/12/2023	3.69	6.43	88.05	7.93
21/12/2023	5.87	10.27	88.62	10.72
22/12/2023	5.48	9.65	88.39	11.18
23/12/2023	5.37	9.11	85.73	10.53
24/12/2023	4.54	7.81	89.2	10.99
25/12/2023	4.81	8.62	89.57	11.31
26/12/2023	4.87	9	86.68	9.49
27/12/2023	5.14	6.67	88.64	5.71
28/12/2023	3.42	5.46	89.11	8.49
29/12/2023	4.57	8.22	86.34	8.38
30/12/2023	3.72	6.13	84.11	6.1
31/12/2023	4.68	7.64	87.83	7.11
01/01/2024	3.52	5.98	88.32	7.2
02/01/2024	6.06	10.34	88.92	6.75
03/01/2024	5.91	11.21	89.58	9.56
04/01/2024	3.19	5.6	90.34	8.06
05/01/2024	3.06	5.17	88.44	6.55
06/01/2024	2.89	4.76	86.05	5.94
07/01/2024	4.88	6.54	85.64	4.97
08/01/2024	14.99	18.28	89.96	0.98
09/01/2024	12.3	13.06	88.47	0.82
10/01/2024	5.53	7.34	84.68	2.04
11/01/2024	5.03	6.33	87.2	1.64
12/01/2024	3.79	4.98	85.49	5.58
13/01/2024	8.67	8.4	84.55	3.76
14/01/2024	8.92	9.14	86.74	4.9
15/01/2024	4.14	5.6	88.27	3.8
16/01/2024	3.3	5.09	86.29	2.67
17/01/2024	2.72	4.34	84.88	3.53
20/12/2023	3.69	6.43	88.05	7.93

Figure 6-3: Particulate Matter Daily Average