

Appendix A.16.1

**Galway City Ambient Air
Quality February - May 2017**

A.16.1



Air | Noise | Water | Soil | Environmental Consultancy
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Galway City Ambient Air Quality
February - May 2017

Report Reference Number:	4410-17-01
Version:	Draft 1
Date of Issue:	19-05-2017
Report Compiled by:	Gregory Dempsey
Report Reviewed by:	Mark McGarry





Report Title	Galway City Ambient Air Quality
Company address	AXIS environmental services., Unit 5, Caherdavin Business Centre, Caherdavin, Park, Ennis Road, Limerick V94 NT63.
Testing Report Commissioned by	ARUP Consulting Engineers
Facility Name	Limerick Office
Contact Person	Sinead Whyte
Licence Number	Not applicable
Licence Holder	Not applicable
Report Reference Number	4410-17-01_01
Dates of the Monitoring Campaign	06 th February to 03 rd May 2017
Job Reference Number	4410-17-01
Report Written By	Mr. Gregory Dempsey
Report Approved by	Mr. Mark McGarry
Testing Team	Mr. Mark McGarry
Report Date	19-05-2017
Report Type	Test Report Assessment Monitoring
Version	D1
Signature of Approver	 Environmental Manager

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Report Date:	19-05-2017	Site Contact(s):	Sinead Whyte
Report Issued By:	Mark Mc Garry	Version No:	D1
Signed:		Client:	ARUP Consulting Engineers
Version Register:			
Version D1:	First Draft for Comment		
Version 1:	Will be Original Report Final Draft		

1. Monitoring Objectives

The aim of the monitoring campaign was to assess ambient concentrations of Particulate Matter PM_{10} and Nitrogen Dioxide in pre-agreed locations around Galway City. PM_{10} describes inhalable particles, with diameters that are generally 10 micrometres and smaller. Continuous monitoring was carried out for dust over a three-month period, between the 06th February and the 02nd May 2017.

There were 4 locations monitored during the survey:

- Location 1 McNamara's Residential Dwelling ITM X,Y 527683.73, 727199.53



- Location 2 Bushypark School ITM X,Y 527795.93, 727138.94



- Location 3 St. Cholmcille School

ITM X,Y 532064.87, 728377.69

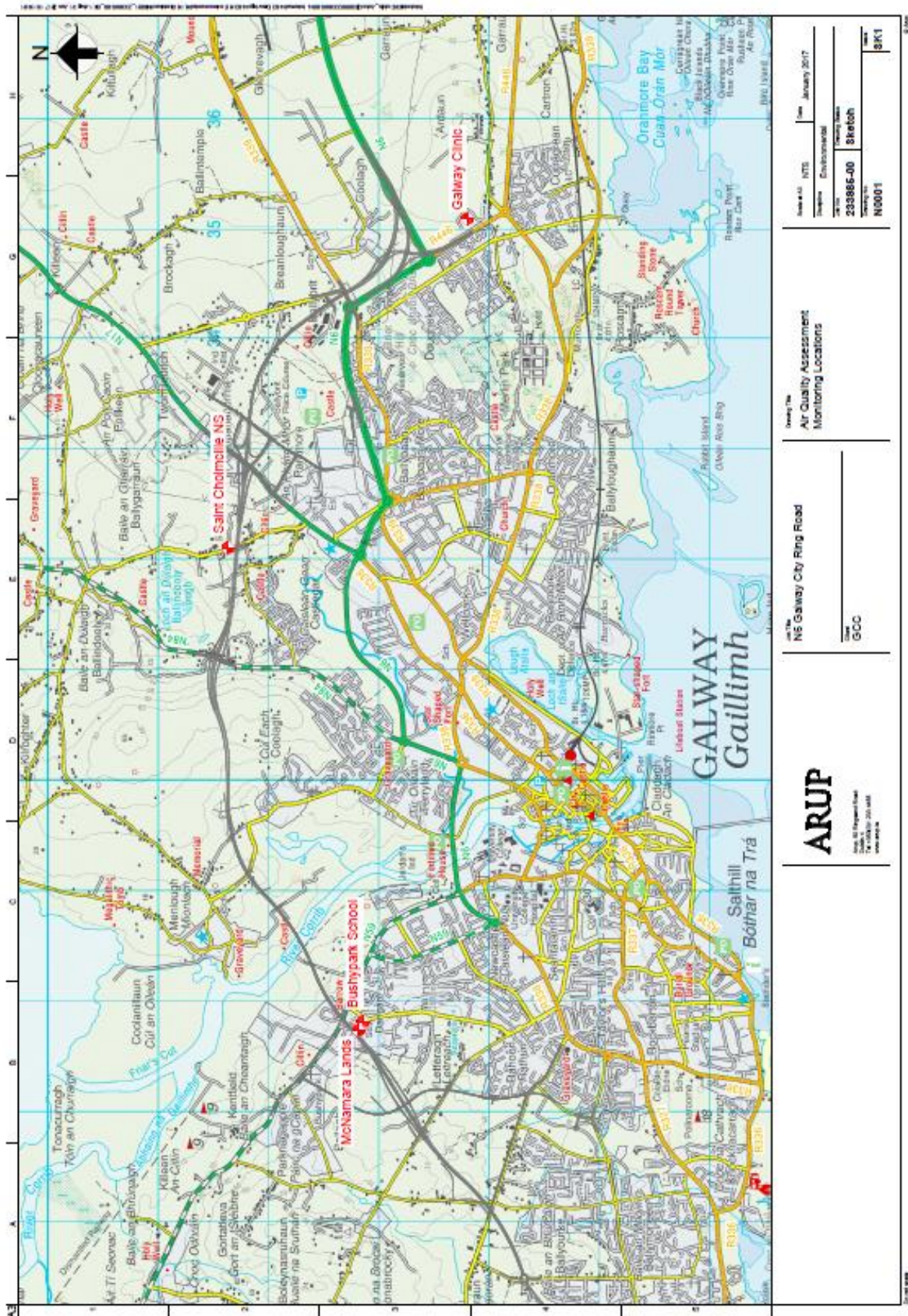


- Location 4 Galway Clinic

ITM X,Y 534953.12, 726245.50



2. Map of Locations



3. Target Parameters

Particulate Matter – PM ₁₀
Nitrogen Dioxide – NO ₂

4. Ambient Limit Values

Ground Level Concentrations	µg.m ⁻³	Notes
24 hour PM ₁₀	50	Not to be exceeded on more than 35 occasions in a calendar year
NO ₂	40	Annual mean in a calendar year

5. Overall Results

Table 1: February Dust Monitoring Results

Location 1 – McNamara's Dwelling	Dust Concentrations – 24 Hour Averages				
February 2017	Units	Total Dust	PM ₁₀	PM _{2.5}	PM ₁₀ Limit
06/02/2017	µg.m ⁻³	13.05	10.27	5.29	40
07/02/2017	µg.m ⁻³	6.19	5.72	3.27	
08/02/2017	µg.m ⁻³	11.18	10.43	6.51	
09/02/2017	µg.m ⁻³	7.82	7.34	5.25	
10/02/2017	µg.m ⁻³	6.22	5.32	3.33	
11/02/2017	µg.m ⁻³	2.54	2.19	1.48	
12/02/2017	µg.m ⁻³	6.04	5.72	4.5	
13/02/2017	µg.m ⁻³	15.87	15.43	13.78	
14/02/2017	µg.m ⁻³	9.27	8.49	6.15	
15/02/2017	µg.m ⁻³	16.18	15.51	9.68	
16/02/2017	µg.m ⁻³	16.78	15.97	8.06	
17/02/2017	µg.m ⁻³	4.49	4.03	2.64	
18/02/2017	µg.m ⁻³	10.73	10.03	4.91	
19/02/2017	µg.m ⁻³	1.99	1.7	1.03	
20/02/2017	µg.m ⁻³	2.96	2.54	1.43	
21/02/2017	µg.m ⁻³	16.67	15.97	9.4	
22/02/2017	µg.m ⁻³	7.27	6.94	4.2	
23/02/2017	µg.m ⁻³	8.91	8.59	6.39	
24/02/2017	µg.m ⁻³	11.35	10.77	6.07	
25/02/2017	µg.m ⁻³	10.76	10.3	6.91	
26/02/2017	µg.m ⁻³	11.72	11.29	7.13	
27/02/2017	µg.m ⁻³	4.6	4.3	2.31	
28/02/2017	µg.m ⁻³	9.44	9.09	6.38	

Graph 1: February Monitoring Summary

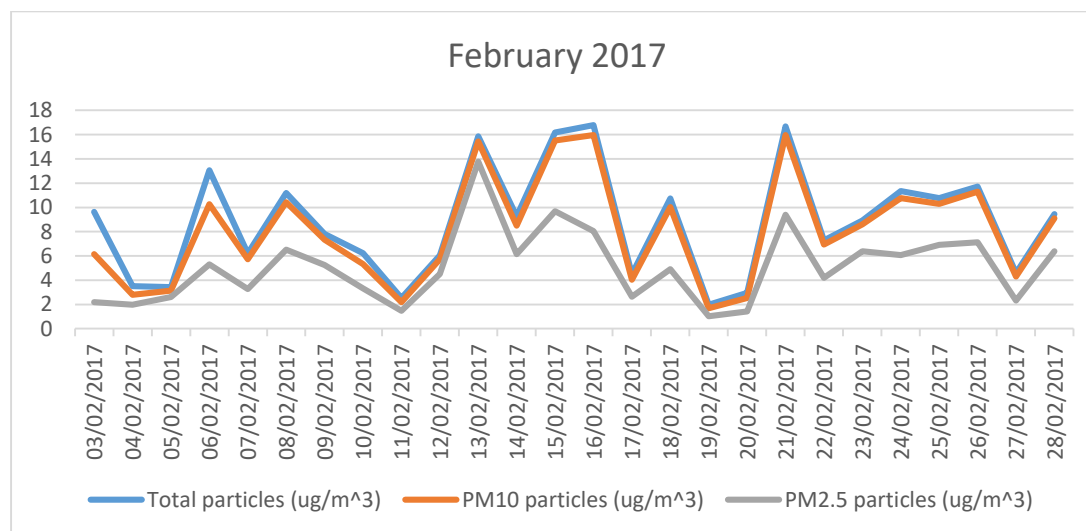


Table 2: March Dust Monitoring Results

Location 1 – McNamara's Dwelling	Dust Concentrations – 24 Hour Averages				
March 2017	Units	Total Dust	PM ₁₀	PM _{2.5}	PM ₁₀ Limit
01/03/2017	µg.m ⁻³	11.15	10.5	6.35	50
02/03/2017	µg.m ⁻³	8.53	7.93	4.81	
03/03/2017	µg.m ⁻³	2.26	2.01	1.23	
04/03/2017	µg.m ⁻³	2.52	2.33	1.36	
05/03/2017	µg.m ⁻³	6.58	6.23	3.84	
06/03/2017	µg.m ⁻³	8.89	8.32	4.42	
07/03/2017	µg.m ⁻³	8.05	7.36	3.79	
08/03/2017	µg.m ⁻³	18.47	17.55	8.74	
09/03/2017	µg.m ⁻³	16.66	15.62	9.12	
10/03/2017	µg.m ⁻³	5.42	4.76	3.03	
11/03/2017	µg.m ⁻³	11.58	10.88	6.77	
12/03/2017	µg.m ⁻³	13.58	12.95	7.74	
13/03/2017	µg.m ⁻³	42.82	41.26	23.37	
14/03/2017	µg.m ⁻³	26.99	25.73	14.21	
15/03/2017	µg.m ⁻³	14.82	13.99	6.52	
16/03/2017	µg.m ⁻³	10.89	10.41	6.52	
17/03/2017	µg.m ⁻³	11.33	10.94	7.67	
18/03/2017	µg.m ⁻³	19.17	18.1	9.86	
19/03/2017	µg.m ⁻³	13.64	13.05	7.94	
20/03/2017	µg.m ⁻³	10.59	10.23	7.12	
21/03/2017	µg.m ⁻³	3.99	3.71	2.26	
22/03/2017	µg.m ⁻³	3.55	3.25	2.13	
23/03/2017	µg.m ⁻³	5.37	4.93	3.65	
24/03/2017	µg.m ⁻³	11.97	10.87	7.64	
25/03/2017	µg.m ⁻³	8.16	6.9	4.34	
26/03/2017	µg.m ⁻³	6.01	5.05	3.34	
27/03/2017	µg.m ⁻³	8.23	7.06	4.57	
28/03/2017	µg.m ⁻³	9.26	8.39	6.5	
29/03/2017	µg.m ⁻³	8.86	8.42	6.42	
30/03/2017	µg.m ⁻³	9.12	8.52	6.04	
31/03/2017	µg.m ⁻³	10.25	9.33	5.31	

Graph 2: March Monitoring Summary

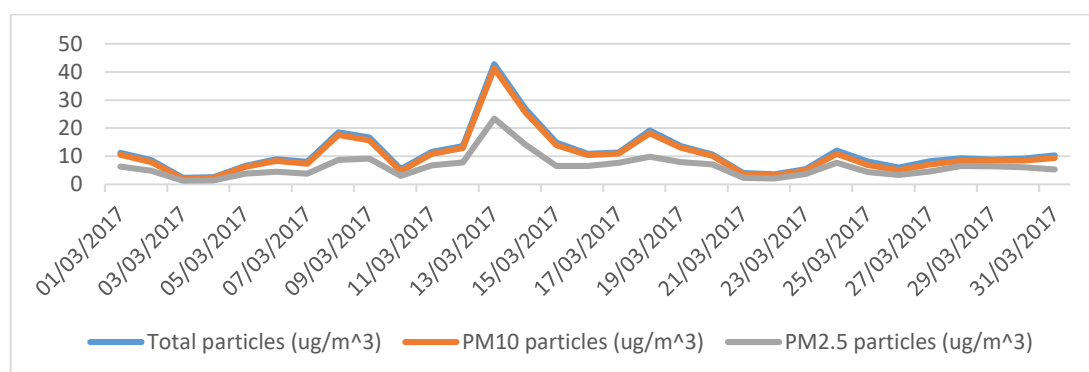


Table 3: April Dust Monitoring Results

Location 1 – McNamara's Dwelling	Dust Concentrations – 24 Hour Averages				
April 2017	Units	Total Dust	PM ₁₀	PM _{2.5}	PM ₁₀ Limit
01/04/2017	µg.m ⁻³	8.44	7.43	3.39	50
02/04/2017	µg.m ⁻³	40.38	33.49	10.18	
03/04/2017	µg.m ⁻³	22.44	20.9	10.41	
04/04/2017	µg.m ⁻³	10.99	10.31	6.96	
05/04/2017	µg.m ⁻³	7.9	7.07	4.35	
06/04/2017	µg.m ⁻³	8.06	7.44	5.19	
07/04/2017	µg.m ⁻³	7.23	6.27	4	
08/04/2017	µg.m ⁻³	7.79	6.82	4.31	
09/04/2017	µg.m ⁻³	11.41	10.59	7	
10/04/2017	µg.m ⁻³	6.99	6.25	3.61	
11/04/2017	µg.m ⁻³	7.55	6.97	4.14	
12/04/2017	µg.m ⁻³	6.87	6.34	4.03	
13/04/2017	µg.m ⁻³	4.91	4.19	2.22	
14/04/2017	µg.m ⁻³	4.53	3.8	1.96	
15/04/2017	µg.m ⁻³	3.79	3.47	2.16	
16/04/2017	µg.m ⁻³	8.13	7.23	4.01	
17/04/2017	µg.m ⁻³	3.24	2.89	1.51	
18/04/2017	µg.m ⁻³	4.78	3.25	1.5	
19/04/2017	µg.m ⁻³	19.96	13.93	4.31	
20/04/2017	µg.m ⁻³	15.28	10.75	3.18	
21/04/2017	µg.m ⁻³	33.63	26.39	7.16	
22/04/2017	µg.m ⁻³	24.67	19.49	7.77	
23/04/2017	µg.m ⁻³	13.03	10.7	4.9	
24/04/2017	µg.m ⁻³	14.65	10.17	3.07	
25/04/2017	µg.m ⁻³	15.18	12.01	4.42	
26/04/2017	µg.m ⁻³	15.82	11.02	3.59	
27/04/2017	µg.m ⁻³	11.79	8.32	2.39	
28/04/2017	µg.m ⁻³	11.57	9.03	2.78	
29/04/2017	µg.m ⁻³	6.17	5.12	2.78	
30/04/2017	µg.m ⁻³	5.3	4.61	3.22	
01/05/2017	µg.m ⁻³	7.06	5.42	2.18	

Graph 3: April Monitoring Summary

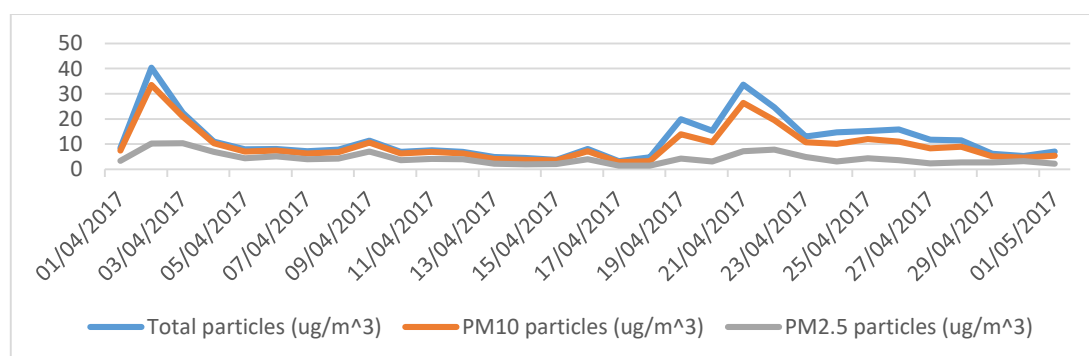


Table 4: Nitrogen Dioxide (NO₂) Monitoring Results

NO ₂ Concentrations – Monthly Averages					
06 th February to 06 th March 2017	Hours	µg/m ³	ppb	Uncertainty	NO ₂ Annual Limit
Location 1: McNamara's Dwelling	670	8.20	4.28	7.8%	40 µg/m ³
Location 2: Bushypark School	699	9.09	4.74	7.8%	
Location 3: St. Cholmcille School	699	11.06	5.77	7.8%	
Location 4: Galway Clinic Hospital	670	20.45	10.67	7.8%	
06 th March to 03 rd April 2017	Hours	µg/m ³	ppb	Uncertainty	
Location 1: McNamara's Dwelling	673	5.58	2.91	7.8%	
Location 2: Bushypark School	674	6.29	3.28	7.8%	
Location 3: St. Cholmcille School	674	9.29	4.85	7.8%	
Location 4: Galway Clinic Hospital	674	8.66	4.52	7.8%	
03 rd April to 02 nd May 2017	Hours	µg/m ³	ppb	Uncertainty	
Location 1: McNamara's Dwelling	742	8.75	4.57	7.8%	
Location 2: Bushypark School	743	4.22	4.22	7.8%	
Location 3: St. Cholmcille School	743	7.02	7.02	7.8%	
Location 4: Galway Clinic Hospital	742	10.82	10.82	7.8%	

6. Sample Location Details

Location	1
Description	Back garden of McNamaras Residential dwelling
Adjacent Roads	N59, Local access roads
Adjacent Industries	None within 500m
Co-ordinates	527683.73, 727199.53
Elevation above GL	1.5m
Dates	06 th February to 02 nd May 2017
Location	2
Description	Railing of the Bushypark National School – beside school car park
Adjacent Roads	N59, Local access roads
Adjacent Industries	None within 500m
Co-ordinates	527795.93, 727138.94
Elevation above GL	1.5m
Dates	06 th February to 02 nd May 2017
Location	3
Description	St Cholmcille National School – attached to adjoining shed
Adjacent Roads	Local access roads
Adjacent Industries	None within 500m
Co-ordinates	532064.87, 728377.69
Elevation above GL	1.5m
Dates	06 th February to 02 nd May 2017
Location	4
Description	Grounds of the Galway Clinic Hospital adjacent to the R446
Adjacent Roads	R446, N6
Adjacent Industries	Largely residential and agricultural lands surrounding
Co-ordinates	534953.12, 726245.50
Elevation above GL	1.5m
Dates	06 th February to 02 nd May 2017

7. Monitoring, Equipment & Analytical Methods

Parameter	Standard	Technical Procedure	Analytical Technique	Equipment / Media	Equipment ID Used on Site
Particulate Matter	Turnkey Osiris	2102	Proprietary nephelometer. A pump continuously draws an air sample through the nephelometer, which analyses the individual particles as they pass through a laser beam.	Osiris 1	AXIS OSIRIS 1
Nitrogen Dioxide (NO ₂)	Diffusion Tubes by UV Spectrophotometry	2104	UV Spectrophotometry in a UKAS accredited laboratory.	Diffusion Tubes 20% TEA / Water	Diffusion tubes

Appendix I: Monitoring Personnel & Equipment

Team Leader	Name	Mark McGarry
	System approval	AXIS Team Leader Approved

Appendix II: Calibration Certificates

Calibrated	05-01-2017	Re Cal Due	05-01-2018
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Dust Monitor Service/Calibration Certificate

Instrument Details	Calibration No: 11191
Customer: AXIS ENVIRONMENTAL SERVICES	
Instrument: Osiris	Serial Number: TNO2536
Date of Last Service: 19/05/15	Software Version: O4.28
	Date Supplied New: N/A

Calibration Factors prior to Servicing			
Measured Flow Rate:	1100 cc/min	Total pump usage:	739 hours
TSP: 1.0	PM10: 1.0	PM2.5: 1.0	PM1.0: 1.0
Inhalable: /	Thoracic: /	Respirable: /	PM2.0: /

Fault Report:
Routine Service & Re-calibration.

Work Carried Out:
Full Service & Re-calibration.
Charge battery <input checked="" type="checkbox"/> . Change reference filter <input checked="" type="checkbox"/> .
Photometer Scale 1850 Laser current 36 mA Flow rate 600 cc/min Stray light 0 mV
Wind inputs OK <input checked="" type="checkbox"/> External inputs OK <input checked="" type="checkbox"/> Inlet Heater OK <input checked="" type="checkbox"/> Alarm output OK <input checked="" type="checkbox"/>
Clean-Air filter OK <input checked="" type="checkbox"/> Backup-Filter OK <input checked="" type="checkbox"/> PC-Link OK <input checked="" type="checkbox"/> Telemetry OK <input checked="" type="checkbox"/>

Parts Required:
Pump, Battery, Charger, Piping.

Instrument Calibration against Reference Instrument				
reading is with new calibration factor applied				
Fraction	Zero	Reading	Reference	New Cal. Factor
TSP	0.0 $\mu\text{g}/\text{m}^3$	292.7 $\mu\text{g}/\text{m}^3$	294.0 $\mu\text{g}/\text{m}^3$	1
PM10	0.0 $\mu\text{g}/\text{m}^3$	291.3 $\mu\text{g}/\text{m}^3$	291.5 $\mu\text{g}/\text{m}^3$	1
PM2.5	0.00 $\mu\text{g}/\text{m}^3$	279.69 $\mu\text{g}/\text{m}^3$	267.34 $\mu\text{g}/\text{m}^3$	1
PM1.0	0.00 $\mu\text{g}/\text{m}^3$	88.72 $\mu\text{g}/\text{m}^3$	74.70 $\mu\text{g}/\text{m}^3$	1
Reference Instrument: TNO2163		Date Reference Calibrated: 10/06/16		

Signed: Macalla Nelson	Date: 05/01/2017	Temperature: 25.1 °C
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Calibration Due: 05/01/2018

Appendix III: Certificate of Analysis

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER L01938R
BOOKING IN REFERENCE L01938
DESPATCH NOTE 34676
CUSTOMER Axis Environmental Services Attn: Mark McGarry
Unit 5
Caherdavin Business Centre
Ennis Road
Limerick
V94 NT63
Ireland
DATE SAMPLES RECEIVED 10/03/2017

Location	Sample Number	Exposure Data		Time (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	TOTAL $\mu\text{g NO}_2$
		Date On	Date Off				
Mc Namaras	858576	06/02/2017	06/03/2017	669.52	8.20	4.28	0.40
Bushylawn School	858578	06/02/2017	06/03/2017	669.17	9.09	4.74	0.44
St. Cholmckille School	858575	06/02/2017	06/03/2017	669.17	11.06	5.77	0.54
Galway Clinic	858574	06/02/2017	06/03/2017	669.53	20.45	10.67	1.00
Travel Blank	858577			669.53	0.32	0.17	0.02
Laboratory Blank				669.53	0.04	0.02	0.002

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. $\pm 7.8\%$

Limit of Detection 0.017 μgNO_2
Analysed
on UV 04
Camspec
M550

Tube Preparation : 20% TEA / Water

Analyst Name

Eva Habjan

Report Checked By

Duncan
Wilson

Date of Analysis 14/03/2017

Date of Report 14/03/2017

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk (*). Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.
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Report Number L01938R

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REPORT OFFICIALLY CHECKED

Gradko International Ltd
This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER L02765R
BOOKING IN REFERENCE L02765
DESPATCH NOTE 35261
CUSTOMER Axis Environmental Services Attn: Mark McGarry
Unit 5
Caherdavin Business Centre
Ennis Road
Limerick
V94 NT63
Ireland
DATE SAMPLES RECEIVED 12/04/2017

Location	Sample Number	Exposure Data		Time (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	TOTAL $\mu\text{g NO}_2$
		Date On	Date Off				
Hospital Galway Clinic	873347	06/03/2017	03/04/2017	674.00	8.66	4.52	0.42
House m'Namara	873346	06/03/2017	03/04/2017	673.58	5.58	2.91	0.27
School Bushypark	873345	06/03/2017	03/04/2017	673.75	6.29	3.28	0.31
St Cholmchille school	873344	06/03/2017	03/04/2017	673.83	9.29	4.85	0.45
Blank	873343			674.00	0.18	0.09	0.01
Laboratory Blank				674.00	0.15	0.08	0.007

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. $\pm 7.8\%$

Limit of Detection 0.017 μgNO_2
Analysed
on UV 04
Camspec
M550

Tube Preparation : 20% TEA / Water

Analyst Name
Joanna Kowalewska

Report Checked By
Duncan Wilson

Date of Analysis 25/04/2017

Date of Report 25/04/2017

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk (*). Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.
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Report Number L02765R

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Signed.....
L. Gates, Laboratory Manager

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER L03407R
BOOKING IN REFERENCE L03407
DESPATCH NOTE 36216
CUSTOMER Axis Environmental Services Attn: Mark McGarry
Unit 5
Caherdavin Business Centre
Ennis Road
Limerick
V94 NT63
Ireland
DATE SAMPLES RECEIVED 09/05/2017

Location	Sample Number	Exposure Data		Time (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	TOTAL $\mu\text{g NO}_2$
		Date On	Date Off				
Mc House Namara	890158	03/04/2017	04/05/2017	742.67	8.75	4.57	0.47
Bushypark School	890157	03/04/2017	04/05/2017	743.50	4.22	2.20	0.23
St. Colmchille School	890155	03/04/2017	04/05/2017	743.50	7.02	3.67	0.38
Galway Clinic	890159	03/04/2017	04/05/2017	742.50	10.82	5.65	0.58
Blank	890156			743.50	0.21	0.11	0.01
Laboratory Blank				743.50	0.28	0.14	0.015

Comment: Results are not blank subtracted

Tube 890159 was dirty when received. Result may be compromised.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. $\pm 7.8\%$

Limit of Detection $0.017\mu\text{gNO}_2$

Analysed
on UV 04
Camspec
M550

Tube Preparation : 20% TEA / Water

Analyst Name

Eva Habjan

Report Checked By

Duncan
Wilson

Date of Analysis 18/05/2017

Date of Report 18/05/2017

Analysis carried out in accordance with documented in-house Laboratory Method
GLM7

The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk (*). Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.
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Report Number L03407R

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Gradko International Ltd
This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager