

Appendix A7.3 Laboratory Analysis Certificates Trace Gases

LABORATORY ANALYSIS REPORT

DETERMINATION OF SULPHUR DIOXIDE IN DIFFUSION TUBES BY ION CHROMATOGRAPHY

REPORT NUMBER K06134R

BOOKING IN REFERENCE No K06134

DESPATCH NOTE No 31653

CUSTOMER TMS Environmental Attn: Graham Adams

53 Broomhill Drive
Tallaght
Dublin 24
Ireland

DATE SAMPLES RECEIVED 30/09/2016

	Sample	Date	Date	Exposure	µg S	µg S -	SO ₂	SO ₂
Location	Number	Exposed	Finished	Hours	Total	Blank	µg/m ³ *	ppb*
N5D4	762837	08/09/2016	22/09/2016	333.00	<0.03	<0.02	<2.06	<0.77
N6D2	762838	08/09/2016	22/09/2016	332.83	<0.03	<0.02	<2.06	<0.77
N8D8	762839	08/09/2016	22/09/2016	332.83	<0.03	<0.02	<2.06	<0.77
N3D3	762840	08/09/2016	22/09/2016	332.83	<0.03	<0.02	<2.06	<0.77
N2D7	762841	08/09/2016	22/09/2016	332.83	<0.03	<0.02	<2.06	<0.77
N4D5	762842	08/09/2016	22/09/2016	332.67	<0.03	<0.02	<2.06	<0.77
N7D6	762843	08/09/2016	22/09/2016	332.58	<0.03	<0.02	<2.06	<0.77
N1D1	762844	08/09/2016	22/09/2016	332.58	<0.03	<0.02	<2.06	<0.77
Blank	762845				0.01			
Laboratory Blank					0.01			

Comment: Results are blank subtracted

Results reported as <0.03µg S are below the reporting limit.

Overall M.U. ±6.9%

Reporting Limit 0.03µg S

Analysed on Dionex ICS1100 ICU11

Analyst Name Katya Paldamova

Date of Analysis 07/10/2016

Date of Report 11/10/2016

Analysis has been carried out in accordance with in-house method GLM1

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LABORATORY ANALYSIS REPORT

DETERMINATION OF SULPHUR DIOXIDE IN DIFFUSION TUBES BY ION CHROMATOGRAPHY

REPORT NUMBER K06539R
BOOKING IN REFERENCE No K06539
DESPATCH NOTE No 31674
CUSTOMER TMS Environmental Attn: Graham Adams
53 Broomhill Drive
Tallaght
Dublin 24
Ireland
DATE SAMPLES RECEIVED 17/10/2016

	Sample	Date	Date	Exposure	µg S	µg S -	SO ₂	SO ₂
Location	Number	Exposed	Finished	Hours	Total	Blank	µg/m ³ *	ppb*
N5D4	772233	22/09/2016	07/10/2016	359.58	<0.03	<0.02	<2.30	<0.86
N6D2	772234	22/09/2016	07/10/2016	359.50	<0.03	<0.02	<2.30	<0.86
N8D8	772235	22/09/2016	07/10/2016	359.50	0.04	0.03	3.30	1.24
N3D3	772236	22/09/2016	07/10/2016	359.33	<0.03	<0.02	<2.30	<0.86
N2D7	772237	22/09/2016	07/10/2016	358.68	<0.03	<0.02	<2.31	<0.87
N4D5	772238	22/09/2016	07/10/2016	359.52	<0.03	<0.02	<2.30	<0.86
N7D6	772239	22/09/2016	07/10/2016	359.20	<0.03	<0.02	<2.31	<0.86
N1D1	772240	22/09/2016	07/10/2016	359.03	<0.03	<0.02	<2.31	<0.86

Laboratory Blank

0.01

Comment: Results are blank subtracted

Results reported as <0.03µg S are below the reporting limit.

Overall M.U. ±6.9%

Analysed on Dionex ICS1100 ICU11

Reporting Limit

0.03µg S

Analyst Name

Katya Paldamova

Date of Analysis

26/10/2016

Date of Report

28/10/2016

Analysis has been carried out in accordance with in-house method GLM1

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER K06114R

BOOKING IN REFERENCE K06114

DESPATCH NOTE 31653

CUSTOMER TMS Environmental Attn: Graham Adams
53 Broomhill Drive
Tallaght
Dublin 24
Ireland

DATE SAMPLES RECEIVED 30/09/2016

Location	Sample Number	Exposure Data		Time (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	TOTAL
		Date On	Date Off				$\mu\text{g NO}_2$
N5D4	762825	08/09/2016	22/09/2016	333.00	10.26	5.35	0.25
N6D2	762826	08/09/2016	22/09/2016	332.83	9.45	4.93	0.23
N8D8	762827	08/09/2016	22/09/2016	332.83	9.80	5.12	0.24
N3D3	762828	08/09/2016	22/09/2016	332.83	10.20	5.32	0.25
N2D7	762829	08/09/2016	22/09/2016	332.83	11.53	6.02	0.28
N4D5	762830	08/09/2016	22/09/2016	332.67	10.39	5.42	0.25
N7D6	762831	08/09/2016	22/09/2016	332.58	26.95	14.07	0.65
N1D1	762832	08/09/2016	22/09/2016	332.58	9.66	5.04	0.23
Blank	762833	08/09/2016	22/09/2016	333.00	0.13	0.07	0.00
Laboratory Blank				333.00	0.12	0.06	0.003

Comment: Results are not blank subtracted

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

Overall M.U. 5.2% +/-

Limit of Detection 0.010 μgNO_2

Tube Preparation : 20% TEA / Water

Analysed on UV05 Camspec M550

Analyst Name Charlotte Grove

Date of Analysis 06/10/2016

Date of Report 06/10/2016

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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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER K06538R
BOOKING IN REFERENCE K06538
DESPATCH NOTE 31674
CUSTOMER TMS Environmental Attn: Graham Adams
53 Broomhill Drive
Tallaght
Dublin 24

Ireland

DATE SAMPLES RECEIVED 17/10/2016

Location	Sample Number	Exposure Data		Time (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	TOTAL $\mu\text{g NO}_2$
		Date On	Date Off				
N6D2	772224	22/09/2016	07/10/2016	359.45	9.22	4.81	0.24
N8D8	772225	22/09/2016	07/10/2016	359.50	<0.65	<0.34	<0.02
N3D3	772226	22/09/2016	07/10/2016	359.33	<0.65	<0.34	<0.02
N4D5	772228	22/09/2016	07/10/2016	359.52	12.40	6.47	0.32
N7D6	772229	22/09/2016	07/10/2016	359.20	27.10	14.14	0.71
N1D1	772230	22/09/2016	07/10/2016	359.03	8.34	4.35	0.22
Laboratory Blank				359.52	0.27	0.14	0.007

Comment: Results are not blank subtracted

Tubes 772227 and 772223 could not be analysed as they did not contain any grids.

Results reported as <0.02 is below the reporting limit.

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

Overall M.U. 7.8% +/-

Tube Preparation : 20% TEA / Water

Analysed on UV 04 Camspec M550

Limit of Detection 0.017 μgNO_2

Analyst Name Ben Whitmarsh

Date of Analysis 26/10/2016

Date of Report 27/10/2016

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

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LABORATORY ANALYSIS REPORT

REPORT NUMBER K06130R
CUSTOMER TMS ENVIRONMENTAL
53 Broomhill Drive
Tallaght
Dublin 24
Ireland
GRADKO LAB REFERENCE 02K1711-02K1719
DESPATCH NOTE No. 31653
JOB REFERENCE D-16-8769
DATE SAMPLES RECEIVED 30.09.2016
BOOKING IN REF. X6460

QUANTITATIVE ANALYSIS OF BTEX IDENTIFICATION AND ESTIMATION (SEMI-QUANTITATIVE ANALYSIS) OF TOP 10 VOC ON TENAX DIFFUSION TUBES BY GC/MS

Analysis has been carried out in accordance with in-house method GLM 13

Index to UKAS Accreditation Status

U	Analysis is UKAS accredited under our Fixed Scope
F	Analysis is UKAS accredited under our Flexible Scope
N	Analysis is not UKAS accredited

Tube Number GRA 11778
Exposure Time(mins) 19980
Sample ID N5D4
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	6.76	0.33	1.02
Toluene	U	16.13	0.66	2.44
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	6.70	0.23	0.95
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Nonanal**	N	43.37	1.09	6.16
Benzaldehyde**	F	22.27	0.56	2.36
Acetic Acid	F	12.51	0.31	0.75
Benzoic acid	N	12.40	0.31	1.51
Acetophenone**	F	10.60	0.27	1.27
Isopropyl Myristate	N	10.36	0.26	2.80
Octanal**	N	9.90	0.25	1.27
Phenol	F	9.53	0.24	0.90
Cyclotetradecane	N	8.70	0.22	1.71
Decanal**	N	6.94	0.17	1.08

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LABORATORY ANALYSIS REPORT

Tube Number GRA 10059
Exposure Time(mins) 19970
Sample ID N6D2
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	5.80	0.28	0.88
Toluene	U	5.91	0.24	0.89
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	5.00	0.17	0.71
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzaldehyde**	F	13.92	0.35	1.48
Acetophenone**	F	7.15	0.18	0.86
Nonanal**	N	5.59	0.14	0.80
1-Hexanol, 2-ethyl-	F	<5.00	<0.13	<0.65
Phenol	F	<5.00	<0.13	<0.47
Acetic acid	F	<5.00	<0.13	<0.30
Cyclotetradecane	N	<5.00	<0.13	<0.98
Octanal**	N	<5.00	<0.13	<0.64
Benzene, 1,2,4-trimethyl-	F	<5.00	<0.13	<0.60
Hexanal**	N	<5.00	<0.13	<0.50

Tube Number GRA 11948
Exposure Time(mins) 19970
Sample ID N8D8
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	6.65	0.32	1.01
Toluene	U	27.78	1.14	4.20
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	8.92	0.30	1.27
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Isopropyl Myristate	N	178.67	4.47	48.31
Nonanal**	N	44.01	1.10	6.26
Phenol	F	18.98	0.48	1.79
Benzaldehyde**	F	15.39	0.39	1.63
Diethyl phthalate	F	12.17	0.30	2.71
Acetic Acid	F	12.08	0.30	0.73
2-Ethyl-1-hexanol	F	11.43	0.29	1.49
Dodecane	F	11.20	0.28	1.91
Octanal**	N	7.72	0.19	0.99
2-Propenoic acid, 2-ethylhexyl ester	N	7.27	0.18	1.34

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LABORATORY ANALYSIS REPORT

Tube Number GRA 11958
Exposure Time(mins) 19970
Sample ID N3D3

Tube was received damaged and could not be analysed.

Tube Number GRA 10521
Exposure Time(mins) 19970
Sample ID N2D7
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.25	<0.79
Toluene	U	12.97	0.53	1.96
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	6.65	0.22	0.95
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene, 1,2,4-trimethyl-	F	<5.00	<0.13	<0.60
1-Hexanol, 2-ethyl-	F	<5.00	<0.13	<0.65
Acetophenone**	F	<5.00	<0.13	<0.53
Benzaldehyde**	F	<5.00	<0.13	<0.53
Benzonitrile	N	<5.00	<0.13	<0.52
Butane, 2-methyl-	N	<5.00	<0.13	<0.36
Octanal**	N	<5.00	<0.13	<0.64
Dodecane	F	<5.00	<0.13	<0.85
Heptanal**	N	<5.00	<0.13	<0.57
Hexanal**	N	<5.00	<0.13	<0.50

Tube Number GRA 10569
Exposure Time(mins) 20145
Sample ID N4D5
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	6.67	0.32	1.00
Toluene	U	43.63	1.78	6.53
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	8.27	0.28	1.17
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Acetic acid	F	16.21	0.40	0.97
Benzaldehyde**	F	14.89	0.37	1.57
Nonanal**	N	8.03	0.20	1.13

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Tetrachloroethylene	F	7.44	0.18	1.21
Acetophenone**	F	7.23	0.18	0.86
Butane, 2-methyl-	N	7.10	0.18	0.51
Pentane, 3-methyl-	F	6.46	0.16	0.55
Phenol	F	5.75	0.14	0.54
Benzoic acid	N	<5.00	<0.12	<0.61
Hexane	F	<5.00	<0.12	<0.43

Tube Number GRA 10326
Exposure Time(mins) 19955
Sample ID N7D6
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.25	<0.79
Toluene	U	10.40	0.43	1.57
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	5.15	0.17	0.73
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzaldehyde	F	11.89	0.30	1.26
Nonanal**	N	9.83	0.25	1.40
Cyclotetradecane	N	7.85	0.20	1.54
Acetic Acid	F	7.21	0.18	0.43
Acetophenone**	F	5.87	0.15	0.71
Pentanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl ester	N	5.25	0.13	1.51
Phenol	F	<5.00	<0.13	<0.47
Benzene, 1,2,4-trimethyl-	F	<5.00	<0.13	<0.60
Cyclohexane, isocyanato-	N	<5.00	<0.13	<0.63
Decanal**	N	<5.00	<0.13	<0.78

Tube Number GRA 10048
Exposure Time(mins) 19955
Sample ID N1D1
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	7.29	0.35	1.11
Toluene	U	21.05	0.86	3.18
Ethylbenzene	U	27.52	0.93	3.92
m/p-Xylene	U	28.66	0.96	4.09
o-Xylene	U	11.24	0.38	1.60

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Top 10 VOC		ng on tube	ppb in air*	µgm ⁻³ *
Nonanal**	N	25.60	0.64	3.64
Benzaldehyde**	F	14.20	0.36	1.51
Dodecane	F	8.52	0.21	1.45
Benzene, 1,2,4-trimethyl-	F	8.08	0.20	0.97
Octanal**	N	7.80	0.20	1.00
Heptane, 2,2,4,6,6-pentamethyl-	N	6.84	0.17	1.17
Benzene, 1,2,3,5-tetramethyl-	F	6.56	0.16	0.88
1-Hexanol, 2-ethyl-	F	6.50	0.16	0.85
Tridecane	F	5.24	0.13	0.97
Acetic Acid	F	5.13	0.13	0.31

Tube Number GRA 07462
Exposure Time(mins) 19950
Sample ID Blank

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.25	<0.79
Toluene	U	<5.00	<0.21	<0.76
Ethylbenzene	U	<5.00	<0.17	<0.71
m/p-Xylene	U	<5.00	<0.17	<0.71
o-Xylene	U	<5.00	<0.17	<0.71

Top 10 VOC		ng on tube	ppb in air*	µgm ⁻³ *
Cyclotetradecane	N	8.35	0.21	1.64
Octadecanal	N	8.31	0.21	2.23
Diethyl phthalate	F	6.57	0.16	1.46
Benzene, 1,3,5-trifluoro-	N	<5.00	<0.13	<0.66
2-Ethyl-1-hexanol	F	<5.00	<0.13	<0.65
Acetic Acid	F	<5.00	<0.13	<0.30
Hexanal**	N	<5.00	<0.13	<0.50
Nonanal**	N	<5.00	<0.13	<0.71
Benzaldehyde**	F	<5.00	<0.13	<0.53
Heptanal**	N	<5.00	<0.13	<0.57

Results are not Blank corrected.

Identification and estimation results for ng on tube are calculated by reference to toluene and toluene-d8 Internal standard.

Overall MU 13.6% for quantitative analysis of BTEX compounds.

**Compounds may be an artifact due to reaction of ozone with the Tenax sorbent.

Acetic Acid may be an artifact due to the breakdown of Tenax sorbent.

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Uptake Rates:

Benzene 1.03 ng.ppm⁻¹.min⁻¹.

Toluene 1.22 ng.ppm⁻¹.min⁻¹.

Ethylbenzene 1.49 ng.ppm⁻¹.min⁻¹.

m/p Xylene 1.49 ng.ppm⁻¹.min⁻¹.

o-Xylene 1.49 ng.ppm⁻¹.min⁻¹.

All other compounds: 2.00 ng.ppm⁻¹.min⁻¹.

Results reported as <5ng on tube are below the reporting limit.

Reporting Limits:

Benzene 5.2ng

Toluene 5ng

Ethylbenzene 5ng

m/p-Xylene 5ng

o-Xylene 5ng

Reporting limit for non BTEX compounds are derived from the non-specific standard Toluene.

Date of Analysis 13.10.2016

Analysts Name

Mariella Angelova

Date of Report

14.10.2016

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LABORATORY ANALYSIS REPORT

REPORT NUMBER K06442R
CUSTOMER TMS ENVIRONMENTAL
53 Broomhill Drive
Tallaght
Dublin 24
Ireland
GRADKO LAB REFERENCE 02K1814-02K1821
DESPATCH NOTE No. 31674
JOB REFERENCE D-16-8769
DATE SAMPLES RECEIVED 17.10.2016
BOOKING IN REF. X6513

**QUANTITATIVE ANALYSIS OF BTEX
IDENTIFICATION AND ESTIMATION (SEMI-QUANTITATIVE ANALYSIS) OF TOP 10 VOC
ON TENAX DIFFUSION TUBES BY GC/MS**

Analysis has been carried out in accordance with in-house method GLM 13

Index to UKAS Accreditation Status

U	Analysis is UKAS accredited under our Fixed Scope
F	Analysis is UKAS accredited under our Flexible Scope
N	Analysis is not UKAS accredited

Tube Number	GRA 10419			
Exposure Time(mins)	21575			
Sample ID	N5D4			
	Accreditation			
BTEX	Status	ng on tube	ppb in air*	µgm⁻³*
Benzene	U	6.66	0.30	0.94
Toluene	U	<5.00	<0.19	<0.70
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	5.19	0.16	0.68
o-Xylene	U	<5.00	<0.16	<0.66
Top 10 VOC		ng on tube	ppb in air*	µgm⁻³*
Cyclohexadecane	N	24.96	0.58	5.18
Benzaldehyde**	F	18.58	0.43	1.83
Hexadecanal	N	16.13	0.37	3.59
Acetophenone**	F	8.79	0.20	0.98
Acetic Acid	F	8.37	0.19	0.47
Nonanal**	N	7.36	0.17	0.97
1-Hexanol, 2-ethyl-	F	7.00	0.16	0.84
Phenol	F	6.22	0.14	0.54
Diethyl phthalate	F	<5.00	<0.12	<1.03
Benzonitrile	N	<5.00	<0.12	<0.63

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LABORATORY ANALYSIS REPORT

Tube Number GRA 04414
Exposure Time(mins) 21570
Sample ID N6D2
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.23	<0.73
Toluene	U	5.49	0.21	0.77
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	6.93	0.22	0.91
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzoic acid	N	77.23	1.79	8.74
Acetic Acid	F	40.89	0.95	2.27
Isopropyl Myristate	N	35.27	0.82	8.83
Benzaldehyde**	F	29.51	0.68	2.90
Diethyl phthalate	F	25.19	0.58	5.19
Cyclohexadecane	N	22.00	0.51	4.57
Acetophenone**	F	16.46	0.38	1.83
Nonanal**	N	13.81	0.32	1.82
Phenol	F	12.75	0.30	1.11
Phenylmaleic anhydride	F	12.38	0.29	2.00

Tube Number GRA 10414
Exposure Time(mins) 21570
Sample ID N8D8
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.23	<0.73
Toluene	U	<5.00	<0.19	<0.70
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	<5.00	<0.16	<0.66
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Cyclohexadecane	N	80.84	1.87	16.79
Hexadecanal	N	54.16	1.26	12.05
2-Ethylhexyl Salicylate	N	37.93	0.88	8.79
Nonanal**	N	22.90	0.53	3.01
Phthalic anhydride	N	19.47	0.45	2.69
Isopropyl Palmitate	N	18.79	0.44	5.19
Benzaldehyde**	F	13.10	0.30	1.29
2-Ethyl-1-hexanol	N	12.29	0.28	1.48
Decanal**	F	11.12	0.26	1.61
Acetic Acid	F	9.71	0.23	0.54

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LABORATORY ANALYSIS REPORT

Tube Number GRA 09842
Exposure Time(mins) 21563
Sample ID N3D3

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	7.67	0.35	1.08
Toluene	U	<5.00	<0.19	<0.70
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	6.17	0.19	0.81
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzaldehyde**	F	19.34	0.45	1.90
Benzoic acid	N	17.76	0.41	2.01
Acetophenone**	F	12.52	0.29	1.39
Acetic acid	F	6.94	0.16	0.39
Phenol	F	5.75	0.13	0.50
Nonanal**	N	5.54	0.13	0.73
Phenylmaleic anhydride	F	5.52	0.13	0.89
2-Ethylhexyl salicylate	N	5.41	0.13	1.26
Diethyl phthalate	F	<5.00	<0.12	<1.03
Isopropyl Myristate	N	<5.00	<0.12	<1.25

Tube Number GRA 10077
Exposure Time(mins) 21521
Sample ID N2D7

Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.23	<0.73
Toluene	U	5.04	0.19	0.71
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	8.93	0.28	1.18
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzoic acid	N	63.38	1.47	7.19
Isopropyl Myristate	N	32.43	0.75	8.14
Cyclohexadecane	N	21.93	0.51	4.56
Benzaldehyde**	F	21.13	0.49	2.08
Acetophenone**	F	15.11	0.35	1.69
Phenylmaleic anhydride	F	9.09	0.21	1.47
Phenol	F	9.03	0.21	0.79
2-Ethylhexyl salicylate	N	8.59	0.20	2.00
Nonanal**	N	8.29	0.19	1.09
Acetic acid	F	7.43	0.17	0.41

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LABORATORY ANALYSIS REPORT

Tube Number GRA 10487
Exposure Time(mins) 21569
Sample ID N4D5
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.23	<0.73
Toluene	U	<5.00	<0.19	<0.70
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	<5.00	<0.16	<0.66
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Cyclohexadecane	N	166.01	3.85	34.48
Benzoic acid	N	82.15	1.90	9.29
Isopropyl Myristate	N	28.08	0.65	7.03
Benzaldehyde**	F	24.45	0.57	2.40
Acetophenone**	F	17.62	0.41	1.96
Nonanal**	N	15.86	0.37	2.09
Acetic Acid	F	13.43	0.31	0.75
Phenylmaleic anhydride	F	12.77	0.30	2.06
Phenol	F	12.73	0.30	1.11
Decanal**	N	9.88	0.23	1.43

Tube Number GRA 09871
Exposure Time(mins) 21552
Sample ID N7D6
Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm ⁻³ *
Benzene	U	<5.20	<0.23	<0.73
Toluene	U	5.10	0.19	0.71
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	5.31	0.17	0.70
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC	Status	ng on tube	ppb in air*	µgm ⁻³ *
Cyclohexadecane	N	57.11	1.32	11.87
Isopropyl Myristate	N	30.87	0.72	7.73
Benzoic acid	N	29.49	0.68	3.34
Benzaldehyde**	F	21.18	0.49	2.08
Nonanal**	N	14.99	0.35	1.98
Acetophenone**	F	13.89	0.32	1.55
Acetic Acid	F	11.80	0.27	0.66
Diethyl phthalate	F	10.23	0.24	2.11
2-Ethyl-1-hexanol	F	7.79	0.18	0.94
Phenol	F	7.07	0.16	0.62

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LABORATORY ANALYSIS REPORT

Tube Number
Exposure Time(mins)
Sample ID

GRA 09925

21538

N1D1

Accreditation

BTEX	Status	ng on tube	ppb in air*	µgm⁻³*
Benzene	U	6.42	0.29	0.90
Toluene	U	<5.00	<0.19	<0.70
Ethylbenzene	U	<5.00	<0.16	<0.66
m/p-Xylene	U	<5.00	<0.16	<0.66
o-Xylene	U	<5.00	<0.16	<0.66

Top 10 VOC

		ng on tube	ppb in air*	µgm⁻³*
Benzaldehyde**	F	15.45	0.36	1.52
Nonanal**	N	13.54	0.31	1.79
Benzoic acid	N	11.72	0.27	1.33
Acetic Acid	F	10.77	0.25	0.60
Acetophenone**	F	7.79	0.18	0.87
Phenol	F	7.17	0.17	0.63
Diethyl phthalate	F	6.03	0.14	1.24
Cyclohexadecane	N	<5.00	<0.12	<1.04
Phenylmaleic anhydride	F	<5.00	<0.12	<0.81
Octanal**	F	<5.00	<0.12	<0.59

Tube Number
Sample ID

GRA 10167

Laboratory Blank

Accreditation

BTEX	Status	ng on tube
Benzene	U	<5.20
Toluene	U	<5.00
Ethylbenzene	U	<5.00
m/p-Xylene	U	<5.00
o-Xylene	U	<5.00

Top 10 VOC

		ng on tube
Isopropyl Myristate	N	12.30
Cyclotetradecane	N	12.30
Cyclohexadecane	N	9.82
Pentadecane	F	8.74
Diethyl Phthalate	F	7.85
2-Ethylhexyl salicylate	N	6.07
Dodecane, 4,6-dimethyl-	N	5.97
Decanal**	N	5.49
Nonanal**	N	<5.00
Benzaldehyde**	F	<5.00

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Report Number **K06442R**

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LABORATORY ANALYSIS REPORT

Results are not Blank corrected.

Identification and estimation results for ng on tube are calculated by reference to toluene and toluene-d8 Internal standard.
Overall MU 13.6% for quantitative analysis of BTEX compounds.

****Compounds may be an artifact due to reaction of ozone with the Tenax sorbent.**

Acetic Acid may be an artifact due to the breakdown of Tenax sorbent.

Uptake Rates:

Benzene 1.03 ng.ppm⁻¹.min⁻¹.

Toluene 1.22 ng.ppm⁻¹.min⁻¹.

Ethylbenzene 1.49 ng.ppm⁻¹.min⁻¹.

m/p Xylene 1.49 ng.ppm⁻¹.min⁻¹.

o-Xylene 1.49 ng.ppm⁻¹.min⁻¹.

All other compounds: 2.00 ng.ppm⁻¹.min⁻¹.

Results reported as <5ng on tube are below the reporting limit.

Reporting Limits:

Benzene 5.2ng

Toluene 5ng

Ethylbenzene 5ng

m/p-Xylene 5ng

o-Xylene 5ng

Reporting limit for non BTEX compounds are derived from the non-specific standard Toluene.

Date of Analysis 31.10.2016

Analysts Name Mariella Angelova Date of Report 01.11.2016

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LABORATORY ANALYSIS REPORT

HYDROGEN SULPHIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER K06117R

BOOKING IN REFERENCE K06117

DESPATCH NOTE 31653

CUSTOMER TMS Environmental Attn: Graham Adams
53 Broomhill Drive
Tallaght
Dublin 24
Ireland

DATE SAMPLES RECEIVED 30/09/2016

JOB NUMBER N/A

Location	Sample Number	Exposure Data			TOTAL		µg H ₂ S -		µg/m ³ *	ppb *
		Date On	Date Off	Time (hr.)	µg H ₂ S	Blank				
N5D4	762813	08/09/2016	22/09/2016	333.00	<0.03	<0.01			<0.05	<0.04
N6D2	762814	08/09/2016	22/09/2016	332.83	0.04	0.02			0.10	0.07
N8D8	762815	08/09/2016	22/09/2016	332.83	<0.03	<0.01			<0.05	<0.04
N3D3	762816	08/09/2016	22/09/2016	332.78	0.06	0.05			0.21	0.15
N2D7	762817	08/09/2016	22/09/2016	332.83	<0.03	<0.01			<0.05	<0.04
N4D5	762818	08/09/2016	22/09/2016	332.70	<0.03	<0.01			<0.05	<0.04
N7D6	762819	08/09/2016	22/09/2016	332.58	<0.03	<0.01			<0.05	<0.04
N1D1	762820	08/09/2016	22/09/2016	332.58	<0.03	<0.01			<0.05	<0.04
Blank	762821				0.02					

Comments:

Tubes have exceeded shelf-life (6 weeks). Results may be compromised.

Results reported as < 0.031 µg H₂S on tube are below the reporting limit.

Overall M.U. ±11.1% Limit of Detection 0.031µg on tube

Analysed on UV08 Camspec M550 Analyst Name Mariusz Witek

Date of Analysis 12/10/2016 Date of Report 13/10/2016

Analysis carried out in accordance with documented in-house Laboratory Method GLM5

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 K06117R

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LABORATORY ANALYSIS REPORT

HYDROGEN SULPHIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER K06541R

BOOKING IN REFERENCE K06541

DESPATCH NOTE 31674

CUSTOMER TMS Environmental Attn: Graham Adams
53 Broomhill Drive
Tallaght
Dublin 24

Ireland

DATE SAMPLES RECEIVED 17/10/2016

JOB NUMBER N/A

Location	Sample Number	Exposure Data			TOTAL µg H ₂ S	µg H ₂ S -		µg/m ³ *	ppb *
		Date On	Date Off	Time (hr.)		Blank			
N5D4	772213	22/09/2016	07/10/2016	359.58	0.03	0.01		0.04	0.03
N6D2	772214	22/09/2016	07/10/2016	359.50	<0.03	<0.01		<0.03	<0.02
N8D8	772215	22/09/2016	07/10/2016	359.50	0.03	0.01		0.05	0.03
N3D3	772216	22/09/2016	07/10/2016	359.33	0.03	0.01		0.03	0.02
N2D7	772217	22/09/2016	07/10/2016	358.68	<0.03	<0.01		<0.03	<0.02
N4D5	772218	22/09/2016	07/10/2016	359.52	<0.03	<0.01		<0.03	<0.02
N7D6	772219	22/09/2016	07/10/2016	359.20	0.05	0.03		0.14	0.10
N1D1	772220	22/09/2016	07/10/2016	359.03	<0.03	<0.01		<0.03	<0.02

Laboratory Blank

0.023

Comments:

Results reported as < 0.031 µg H₂S on tube are below the reporting limit.

Overall M.U. ±11.1%

Limit of Detection 0.031 µg on tube

Analysed on UV08 Camspec M550

Analyst Name Mariusz Witek

Report Checked By B. Fiser

Date of Analysis 02/11/2016

Date of Report 03/11/2016

Analysis carried out in accordance with documented in-house Laboratory Method GLM5

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