

Concentrations in $\mu\text{g}/\text{m}^3$	Sample Location							All Tubes			Triplicate Tubes				
		North East 1	North East 2	North East 3	South East	South West	North West	Min	Max	Average	Mean	Standard Deviation	CV		
Exposed from	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015	15/07/2015				
Exposed to	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015	13/08/2015				
Date samples received	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015	18/08/2015				
NO <sub>2</sub>	14.75	14.61	14.79	18.15	9.19	10.52	9.19	18.15	13.67	14.72	0.09	0.64			
NOx	19.75	22.98	23.39	25.65	14.64	15.65	14.64	25.65	20.34	22.04	1.99	9.05			
NO	5.00	8.37	8.60	7.49	5.45	5.13	5.00	8.60	6.67	7.32	2.02	27.52			



# **APPENDIX O**

**Monitoring Period 13 August to 15 September 2015**

**LABORATORY ANALYSIS REPORT**  
**NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY**

**REPORT NUMBER** X4417R

**BOOKING REFERENCE No** X4417

**DESPATCH NOTE No** SOR25095

**CUSTOMER** Golder Associates UK Ltd

Attenborough House

Browns Lane, Business Park, Stanton-on-the Wolds

Nottinghamshire, NG12 5BL

**DATE SAMPLES RECEIVED** 18/09/2015

NO <sub>2</sub>	Tube Number	NO <sub>x</sub>	Exposure Data		Time (hr.)	NO <sub>2</sub> ppb *	NO <sub>x</sub> ppb *	NO ppb * +	NO <sub>2</sub> µg/m <sup>3</sup> *	NO <sub>x</sub> µg/m <sup>3</sup> *	NO µg/m <sup>3</sup> * +	TOTAL µg NO <sub>2</sub>	TOTAL µg NO <sub>x</sub>
			Date On	Date Off									
585617	Northeast 1	585625	13/08/2015	15/09/2015	793.00	5.93	7.95	2.02	11.36	15.23	3.87	0.66	0.88
585616	Northeast 2	585624	13/08/2015	15/09/2015	793.00	3.73	8.36	4.63	7.15	16.01	8.87	0.41	0.92
585615	Northeast 3	585623	13/08/2015	15/09/2015	793.00	5.09	8.81	3.72	9.75	16.88	7.13	0.56	0.97
585614	Southeast	585622	13/08/2015	15/09/2015	793.25	7.57	8.24	0.67	14.50	15.78	1.28	0.84	0.91
585613	Southwest	585621	13/08/2015	15/09/2015	793.42	5.84	8.94	3.10	11.19	17.13	5.95	0.65	0.99
585612	Northwest	585620	13/08/2015	15/09/2015	793.58	5.86	7.94	2.08	11.23	15.22	3.99	0.65	0.88
Lab Blanks					793.58	0.03	0.26	0.24	0.05	0.50	0.45	0.003	0.029

**Comment: Results are not blank subtracted**

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L. Gates, Laboratory Manager

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## LABORATORY ANALYSIS REPORT

**The exposure times were calculated from start and finish times given on the exposure sheet.**

**\*NO results are derived by subtracting NO2 from NOx.**

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

**Overall M.O.U.**

5.2% +/-

**Limit of Detection** 0.029ug NOx, 0.01ug NO2 on tube

**Tube Preparation: 20%TEA/Water** Analysed on UVS05 Camspec M550

<b>Date of Analysis</b>	24/09/2015	<b>Analyst Name</b>	C. Fraser
	30/09/2015	<b>Date of Report</b>	

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

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## LABORATORY ANALYSIS REPORT

**REPORT NUMBER** J05042R  
**CUSTOMER** Golder Associates UK Ltd  
Attenborough House  
Browns Lane Business Park  
Stanton-on-the-Wolds  
Nottinghamshire NG12 5BL  
**GRADKO LAB REFERENCE** 02J0078-02J0083  
**DESPATCH NOTE No.** 25095  
**DATE SAMPLES RECEIVED** 18.09.2015  
**BOOKING IN REF.** X4419

### 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

**Tube Number** GRA 08756  
**Exposure Time(mins)** 49020  
**Sample ID** Northeast 1

Top 10 VOC	ng on tube	µgm <sup>-3*</sup>	ppb in air*
Cyclohexadecane +	2733	249.78	27.88
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	224.77	23.84	2.29
Diethyl Phthalate +	166.38	15.07	1.70
Hexadecanal +	126.25	12.36	1.29
Nonanal** +	99.33	5.75	1.01
Benzoic acid +	87.24	4.34	0.89
Pentadecane	56.45	4.88	0.58
Cyclotetradecane +	52.63	4.21	0.54
Benzaldehyde**	41.33	1.79	0.42
Heptadecane	40.94	4.01	0.42

**Tube Number** GRA 10187  
**Exposure Time(mins)** 49020  
**Sample ID** Northeast 2

Top 10 VOC	ng on tube	µgm <sup>-3*</sup>	ppb in air*
Cyclohexadecane +	406.08	37.11	4.14
Diethyl Phthalate +	72.35	6.55	0.74
2-Ethylhexyl salicylate +	64.49	6.58	0.66
Nonanal** +	60.66	3.51	0.62
Hexadecanal +	52.94	5.18	0.54
Decanal** +	48.61	3.09	0.50
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	38.41	4.07	0.39

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## LABORATORY ANALYSIS REPORT

Benzoic acid +	25.79	1.28	0.26
Benzaldehyde**	25.25	1.09	0.26
Heptadecane	22.68	2.22	0.23

**Tube Number** GRA 09503  
**Exposure Time(mins)** 49020  
**Sample ID** Northeast 3

Top 10 VOC	ng on tube	µgm <sup>-3</sup> *	ppb in air*
Cyclohexadecane +	1915	174.97	19.53
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	136.14	14.44	1.39
Benzoic acid +	105.35	5.24	1.07
Pentane, 2-methyl-	63.98	2.24	0.65
Hexadecanal +	53.45	5.23	0.55
Pentane, 3-methyl-	51.07	1.79	0.52
Benzaldehyde**	40.00	1.73	0.41
Nonadecane	35.61	3.89	0.36
Hexane	35.44	1.24	0.36
m/p-Xylene	32.54	1.41	0.33

**Tube Number** GRA 10326  
**Exposure Time(mins)** 49030  
**Sample ID** Southeast

Top 10 VOC	ng on tube	µgm <sup>-3</sup> *	ppb in air*
Cyclohexadecane +	16548	1512.1	168.76
Hexadecanal +	182.54	17.87	1.86
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	158.67	16.83	1.62
1-Hexadecene +	109.50	10.01	1.12
Benzoic acid +	104.96	5.22	1.07
Compound A	100.18	0.00	1.02
Pentane, 2-methyl-	78.36	2.75	0.80
1-Hexadecanol +	58.40	5.77	0.60
Pentane, 3-methyl-	57.61	2.02	0.59
Benzaldehyde**	57.10	2.47	0.58

**Tube Number** GRA 08635  
**Exposure Time(mins)** 49040  
**Sample ID** Southwest

Top 10 VOC	ng on tube	µgm <sup>-3</sup> *	ppb in air*
Cyclohexadecane +	14797	1351.8	150.87
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	321.87	34.13	3.28
Hexadecanal +	301.55	29.52	3.07

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## LABORATORY ANALYSIS REPORT

Benzoic acid +	120.96	6.02	1.23
Diethyl Phthalate +	107.33	9.72	1.09
Nonanal +	82.59	4.78	0.84
1-Hexadecene +	67.56	6.17	0.69
Pentane, 2-methyl-	59.79	2.10	0.61
Pentane, 3-methyl-	49.74	1.74	0.51
Naphthalene	43.42	2.27	0.44

**Tube Number** GRA 10398  
**Exposure Time(mins)** 49050  
**Sample ID** Northwest

Top 10 VOC	ng on tube	µgm <sup>-3</sup> *	ppb in air*
Cyclohexadecane +	1144	104.51	11.66
2,5-Cyclohexadiene-1,4-dione, 2,5-diphenyl-	80.25	8.51	0.82
Hexadecanal +	78.29	7.66	0.80
Diethyl Phthalate +	77.94	7.06	0.79
Benzoic acid, 2-ethylhexyl ester +	77.92	7.72	0.79
Nonanal** +	60.20	3.49	0.61
Benzaldehyde**	43.34	1.87	0.44
Naphthalene	38.49	2.01	0.39
Nonadecane	28.10	3.07	0.29
2-Ethylhexyl salicylate +	23.48	2.39	0.24

### Uptake Rates:

All compounds: 2.00 ng.ppm<sup>-1</sup>.min<sup>-1</sup>.

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

\* These compounds are not covered by our UKAS accredited flexible scope.

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

Unable to identify compound A. Library did not contain matches for mass spectrum.

Results greater than 1000ng are outside of our UKAS accredited calibration range.

Date of Analysis 25.09.2015

Analysts Name Mariella Angelova Date of Report 29.09.2015

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Concentrations in $\mu\text{g}/\text{m}^3$	North East 1			North East 2			North East 3			South East			South West			North West			All Tubes			Triplicate Tubes					
	Sample Location	Exposed from	Exposed to	Date samples received	NO <sub>2</sub>	NOx	NO	NO <sub>2</sub>	NOx	NO	NO <sub>2</sub>	NOx	NO	NO <sub>2</sub>	NOx	NO	Min	Max	Average	Mean	Standard Deviation	CV					
	13/08/2015	15/09/2015	18/09/2015	11.36	7.15	16.01	9.75	16.88	7.13	14.50	15.78	1.28	13/08/2015	15/09/2015	18/09/2015	11.19	17.13	5.95	11.23	15.22	3.99	7.15	14.50	10.86	9.42	2.12	22.55
	15/09/2015	18/09/2015		15.23	16.01	8.87	16.88	16.88	7.13	15.78	15.78	1.28	15/09/2015	18/09/2015		17.13	17.13	5.95	15.22	15.22	3.99	15.22	17.13	16.04	16.04	0.83	5.15
	18/09/2015			3.87	8.87		7.13	7.13		1.28			18/09/2015			5.95			3.99	3.99		1.28	8.87	5.18	6.62	2.54	38.32



Concentrations in $\mu\text{g}/\text{m}^3$	Sample Location	North East 1			North East 2			North East 3			South East			South West			North West			All Tubes			Triplicate Tubes		
		13/08/2015	15/09/2015	18/09/2015	13/08/2015	15/09/2015	18/09/2015	13/08/2015	15/09/2015	18/09/2015	13/08/2015	15/09/2015	18/09/2015	13/08/2015	15/09/2015	18/09/2015	13/08/2015	15/09/2015	18/09/2015	Min	Max	Average	Mean	Standard Deviation	CV
Exposed from																									
Exposed to																									
Date samples received																									
NO <sub>2</sub>		11.36		7.15	9.75	14.50	11.19	11.23	7.15	14.50	10.86	9.42	2.12	22.55											
NOx		15.23	16.01	16.88	15.78	17.13	15.22	17.13	15.22	17.13	16.04	16.04	0.83	5.15											
NO		3.87	8.87	7.13	1.28	5.95	3.99	1.28	1.28	8.87	5.18	6.62	2.54	38.32											



# **APPENDIX P**

## **Well Testing Data**

Date	Zone	Emission Point	Total gas/day scf	Total gas/day m3	Gas flow kg	Gas flow tonnes	H2S Concentration	Methane concentration	Emissions				Combustion temperature °C			
									NOx	CO	Total VOC's	Average	Range	Comments		
					kg	tonnes	ppm	ppm	kg	tonnes	kg	tonnes	tonnes	°C	°C	
03/02/2015	Ashover grt (1)		7,510		177	0.18	0.00	0.61	3,971	0.004	0.000	0.088	7,510	332.00	94 - 808	
05/02/2015	Ashover grt (1)	A1 (Flare)	18,900		444	0.44	0.00	0.61	9,995	0.010	0.000	0.222	18,900	313.47	43 - 992	
06/02/2015	Ashover grt (1)		3,630		85	0.09	0.00	0.61	1,920	0.002	0.000	0.043	3,630	347.33	185 - 537	
14/02/2015	Wringfield Flags (2)		222,860		4,796	4.80	0.00	0.76	127,794	0.128	0.000	0.000	222,860	1316.28	108 - 1652	
15/02/2015	Wringfield Flags (2)	A1 (Flare)	232,050		4,993	4.99	0.00	0.76	133,047	0.133	0.000	0.000	232,050	1178.42	706 - 1467	
16/02/2015	Wringfield Flags (2)		176,330		3,795	3.79	0.00	0.76	85,384	0.085	0.000	0.000	176,330	837.26	434 - 1222	
23/02/2015	Penistone Flags (3)		17,260		406	0.41	0.00	0.66	9,128	0.009	0.000	0.000	17,260	911.93	67 - 1648	
24/02/2015	Penistone Flags (3)		422,930		8,383	8.38	0.00	0.66	186,626	0.189	0.000	0.000	422,930	1384.59	285 - 1624	
25/02/2015	Penistone Flags (3)	A1 (Flare)	416,360		8,253	8.25	0.00	0.66	185,996	0.186	0.000	0.000	416,360	1369.32	1186 - 1660	
26/02/2015	Penistone Flags (3)		239,290		4,753	4.75	0.00	0.66	109,946	0.107	0.000	0.000	239,290	1000.79	790 - 1307	
27/02/2015	Penistone Flags (3)		136,770		2,751	2.75	0.00	0.66	61,891	0.062	0.000	0.000	136,770	926.60	866 - 1041	
30/03/2015	Penistone Flags (3A)		0		0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.000	0.000	
31/03/2015	Penistone Flags (3A)	A1 (Flare)	0		0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.000	0.000	
21/03/2015	Penistone Flags (3A)		0		0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.000	0.000	
23/03/2015	Penistone Flags (3A)		0		0	0.00	0.00	0.00	0.000	0.000	0.000	0	0	0.000	0.000	
06/07/2015	Penistone Flags (3A)		6,463	183	128	0.13	0.00	0.66	2,882	0.003	0.000	0.000	6,463	227.58	37 - 655	Intermittent flow periods.
07/07/2015	Penistone Flags (3A)		0		0	0.00	0.00	0.66	0.000	0.000	0.000	0	0	0.000	0.000	No flow
08/07/2015	Penistone Flags (3A)		54,971	1,517	1,090	1.09	0.00	0.66	24,517	0.025	0.000	0.000	54,971	416.86	95 - 865	2 x flow periods, slugging.
09/07/2015	Penistone Flags (3A)		115,830	3,280	2,296	2.30	0.00	0.66	51,660	0.052	0.000	0.000	115,830	832.55	305 - 1013	24hr flow, slugging.
10/07/2015	Penistone Flags (3A)		224,995	6,271	4,460	4.46	0.00	0.66	100,348	0.100	0.000	0.000	224,995	889.54	507 - 980	24hr flow, slugging.
11/07/2015	Penistone Flags (3A)		325,004	9,203	6,442	6.44	0.00	0.66	144,951	0.145	0.000	0.000	325,004	889.55	103 - 593	24hr flow, slugging, shut-down event.
12/07/2015	Penistone Flags (3A)	A1 (Flare)	154,019	4,361	3,053	3.05	0.00	0.66	68,692	0.069	0.000	0.000	154,019	799.69	41 - 989	Intermittent flow, slugging, shut-down events.
13/07/2015	Penistone Flags (3A)		280,164	7,934	5,553	5.55	0.00	0.66	124,953	0.125	0.000	0.000	280,164	848.54	27 - 971	Intermittent flow periods.
14/07/2015	Penistone Flags (3A)		395,344	11,195	7,837	7.84	0.00	0.66	176,323	0.176	0.000	0.000	395,344	921.1	75 - 996	Flow 08:40 to 24:00, intermittent shut-downs.
15/07/2015	Penistone Flags (3A)		495,564	12,900	9,030	9.03	0.00	0.66	203,181	0.203	0.000	0.000	495,564	906.6	734 - 967	24hr flow no interruptions.
16/07/2015	Penistone Flags (3A)		496,569	14,062	9,843	9.84	0.00	0.66	221,469	0.221	0.000	0.000	496,569	876.76	664 - 960	24hr flow no interruptions.
17/07/2015	Penistone Flags (3A)		259,954	7,361	5,153	5.15	0.00	0.66	115,939	0.116	0.000	0.000	259,954	667.79	31 - 951	Flow from 06:00 to c. 19:00hrs

Aug-15 No production  
 Sep-15 No production  
 Oct-15 No production

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