EMISSIONS MONITORING SURVEY
(Ink Manufacture - Main Vent - Annual Compliance 2011)

Prepared for:

Linx Printing
Burrell Road
St Ives
Huntingdon
Cambridgeshire
PE27 3LA

Guidance Note	**: PG6/44**
Job Number	**: P1185**
Report Number	**: R001**
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Survey Dates:	**: 13th September 2011**

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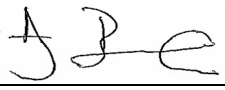
		Signature:	
Date:	07/10/11	***Date:***	07/10/11

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mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2499

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TABLE OF CONTENTS

PART 1 - EXECUTIVE SUMMARY

1 Monitoring Objectives

Environmental Compliance Ltd (ECL) was commissioned by **Linx Printing** to undertake an emission monitoring survey at their **Site in St Ives, Cambs.** This report presents the findings of the study.

The monitoring at this installation was carried out in accordance with our quotation reference **PC/P1185/Q001**, for compliance check monitoring of emissions to air. The substances requested for monitoring at each emissions point are listed below:

Substances to be monitored	Emission Point Identification
	Ink Manufacture – Main Vent
Particulates	• U
Total Organic Carbon (TOC)	• U

• Denotes the substances to be monitored.

U **Denotes UKAS accreditation is held for monitoring that substance, but does not mean that it has been claimed which will depend on whether the testing could be completed in accordance with the Standard Reference Method.**

Special Requirements: *"Test VOC for full 8 hours of production"*

1.1 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Uncertainty %	Units	Reference Conditions 273 K, 101.3 kPa	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method	Tick if non-conforming test (see Sections 2 & 5)	Operating Status
Ink Manufacture – Main Vent	Particulates $	20	0.14	100	mg/m^3	& Wet Gas	13/09/11	09:05 – 11:05	BS EN 13284-1	UKAS / MCERTS	✓	Normal
	Particulates $	20	0.15	100	mg/m^3	& Wet Gas	13/09/11	11:15 – 13:15	BS EN 13284-1	UKAS / MCERTS	✓	Normal
	TOCs as Carbon	150	10.19	17	mg/m^3	& Wet Gas	13/09/11	07:45 – 08:15	BS EN 13526	UKAS / MCERTS		No Production*.
	TOCs as Carbon	150	142.88	12	mg/m^3	& Wet Gas	13/09/11	08:30 – 16:30	BS EN 13526	UKAS / MCERTS		Normal

Notes

*** The "No Production" VOC sample was to determine the baseline level before the production started at 08:30**.

Emission Limit Value	The emission limit value is that stated in the permit and will be expressed as a concentration or a mass emission.
Periodic Monitoring Result	The result given is expressed in the same terms and units as the emission limit value.
Uncertainty	The uncertainty associated with the quoted result is at the 95% confidence interval. The Uncertainty results **DO NOT** take into account the effect of the sample location limitations.
Reference Conditions	All results are expressed at 273 K and 101.3kPa. The oxygen and moisture corrections are stated.
Monitoring Method Reference	The method stated is in accordance with the Environment Agency Technical Guidance Note M2, or other method approved by the Environment Agency.
Accreditation for use of Method	**The details indicate the accreditation for the use of the complete monitoring method, e.g. MCERTs, UKAS. If use of the method is not accredited " NA" is stated.**
Operating Status	The details indicate the feedstock and the loading rate of the plant during monitoring.
$	Chemical Analysis on sample reagents was performed by an External Laboratory as detailed in Section 4
NU	UKAS Accreditation Held but UKAS Accreditation cannot be claimed for the test as sampling did not comply with the Standard Reference Method (SRM), see section 2 & 5
NA	**Method is NOT UKAS Accredited.**

1.2 Operating Information

Emission Point Reference	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results					
							Parameter	Date	Time	CEMS Results	Periodic Monitoring Results	Units
Main Vent	Batch	Various	n/a	n/a	None	Normal	…	…	…	NA	…	…

Notes:

At 09:15, the isolating plate in the extraction above the solvent vessel (MEK) was found to be open a fraction, when it should have been fully closed. It was then closed immediately.

Process Type	State whether the process is a continuous or batch process.
Process Duration	If a batch process, state the duration, frequency and details of the portion of the batch sampled. If continuous state "NA"
Fuel	If applicable, state the fuel type If not applicable state "NA"
Feedstock	State the feedstock type
Abatement	State the type and whether operational during monitoring. If not applicable state "NA"
Load	State the normal load, throughput or rating of the plant
CEMS Data	Enter this data for each CEM installed if it is has been provided by operator otherwise state “NP” (NOT PROVIDED)

2 Monitoring Deviations

The objective of the survey was to measure the concentrations of pollutants from the processes / locations as detailed in Section 1. This survey meets the requirements of the site's **Applicable Process Guidance Note: PG6/44** where UKAS and MCERTS accreditation has and could be claimed for the testing in the monitoring results table.

There were no substance deviations from the original and agreed emissions monitoring schedule.

The particulate tests were carried out using the alternative sampling system allowed by BSEN 13284 & MID, no impingers were used and no moisture test was carried out. As the stack gases are essentially dry and the results are reported at wet gas conditions, UKAS / MCERTS accreditation can still been claimed for these tests.

Non-conforming tests are as follows.

Not all the sample points could be used for particulate sampling, due to Health & Safety restrictions, see section 5.

Homogeneity tests have not been completed and are not required for pollutants at this sampling location.

PART 2 – SUPPORTING INFORMATION

3 SAMPLING STAFF DETAILS

Site Sampling Team

Names of Site Team	Dates on Site	MCERTS No.	LEVEL	Technical Endorsements
Andy Barnes	13/09/11	MM 03 235	2	TE1, TE2, TE3, TE4

Report Reviewer

Name	MCERTS No.	LEVEL	Technical Endorsements
Andy Barnes	MM 03 235	2	TE1, TE2, TE3, TE4

Technical Endorsement Key:-

TE1 – **Isokinetic** Particulates, Temperature & Velocity Profiles, Oxygen.
TE2 – **Isokinetic** Extractive Pollutants:- Metals, Dioxin & Furans, PAHs, PCBs, HCL, HF.
TE3 – **Non-Isokinetic** Extractive Pollutants:- Speciated VOCs, HF, HCL, Cyanide.
TE4 – **Continuous Analysers** (Combustion Gases):- VOCs, CO, NOx, SO2.

4 SAMPLING PROTOCOLS / METHODOLOGIES

TOCs as Carbon

Testing was carried out using a Signal 3030PM FID and heated gas transport system with reference to the manufacturer's operation handbook, **BS EN BS EN 13526** and in-house technical procedure **ECL/TPD/032**. The analyser was calibrated pre and post the sample period using span gas and nitrogen / zero scrubbed air. Data was corrected by molecular weight to VOCs as total carbon.

Data was recorded as minute averages over each test period. The minute averaged data is presented in the Figures Section and the minute averaged data is detailed in the Tables Section**.**

Particulates

Testing was carried out using a Manual Stack Sampling system in accordance with **BS EN 13284-1 & MID** and In-house technical procedure **ECL/TPD/027a**.

Isokinetic particulate sampling is achieved when the velocity of gas entering the sampling nozzle is exactly equal to the velocity of the approaching gas stream within the stack.

A measured volume of sample gas is withdrawn from the stack isokinetically through a sampling nozzle and through a pre-weighed filter positioned in an unheated housing inserted into the stack.

Particulate matter is collected on the filter. Following testing the front half of the filter housing and the sample nozzle are rinsed to remove any particulate matter which, may have impacted on the surfaces during testing.

The filters and rinses are subsequently analysed to determine the amount of particulate matter captured.

Scientific Analysis Laboratories Ltd (SAL) who are situated in Manchester carried out the analysis of the samples. **SAL** are UKAS accredited for all analysis conducted. In addition to the survey samples, a field blank is submitted as part of the technical procedure.

Pressure, Temperature and Velocity

Testing was carried out using a sampling system in accordance with **BS EN 13284-1 & MID** and In-house technical procedure **ECL/TPD/022.**

Temperature was recorded using a thermocouple and digital temperature reader.

Velocity and pressure was recorded using an “L” type pitot and digital manometer, data being recorded in Pascals.

5 SAMPLE POINT DESCRIPTION

The sample location that was monitored is detailed below:-

Ink Manufacture – Main Vent

The sampling plane is in long straight vertical section of the emissions stack.

The diameter at the sample plane is 0.5m.

The flow characteristics meet the ***requirements*** of the standard.

2 x 2" ports are available and are located as per the requirements of BS EN 13284.

The equipment is set up at ground level, with probes raised to the sample plane (<5m) via temporary access.

Samples for Particulates are non-conforming tests, due to the fact that not all the designated sample points on the sample plane could be used. Whilst it was possible to safely reach both ports for the purposes of the pitot traverse, there was no safe way to support the probe in Port B for particulate sampling. This non-conformity does not alter the accreditation status of the tests.

The Uncertainty of the reported concentrations for these pollutant results DOES NOT take into account the effect of these non-conformities or sample location limitations.

EQUIPMENT IDs
(Pre site checklist from SSP)

PRE SITE EQUIPMENT CHECKLIST/ EQUIPMENT USED

(Completed before departure to site and when on site in full)

Equipment	Equip. Type	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:	ID No:
MST console/pump	E001								
MST Nozzle set									
MST "S" Type Pitot									
MST Probe									
MST Hot Box									
MST Impinger Arm									
Barometer		352							
Site Balance									
Site Check weights									
Horiba	E002								
Heated Probe									
Chiller									
Sonimix									
Heated Line									
FID	E003	211							
Heated Line		212	213						
Testo	E004								
FTIR	E005								
Heated Probe									
Heated Line									
Stackmite	E006	367							
"L" Type Pitot		488							
Digital Manometer		506							
Stack Thermocouple		464							
Thermocouple Reader		431							
Nozzle Set		802							
Workhorse Pumps	E007								
Low Flow Pumps									

Quantity of Ice Required / Used for Survey	ZERO	Bags (2kg bags)

FIGURES

Figure 1

Continuous TOC Emissions Data - Linx Printing - Main Stack.
Reference conditions 273K, 101.3kPa & Wet Gas.

Pre-Shift Baseline Data recorded between 07:45 & 08:15 on 13th September 2011.

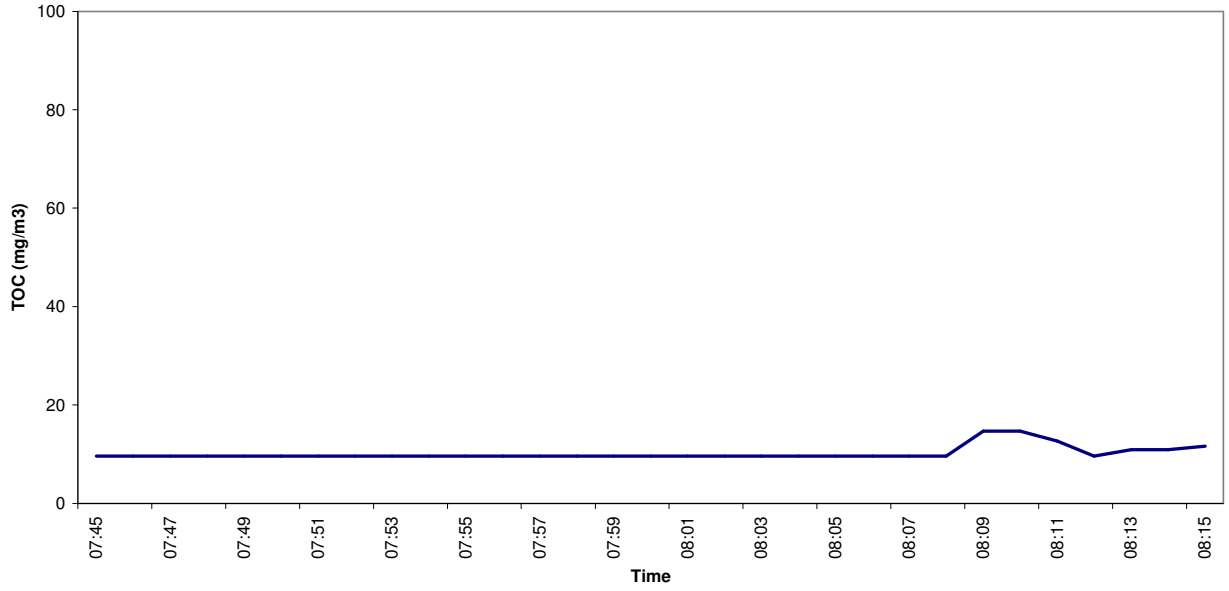
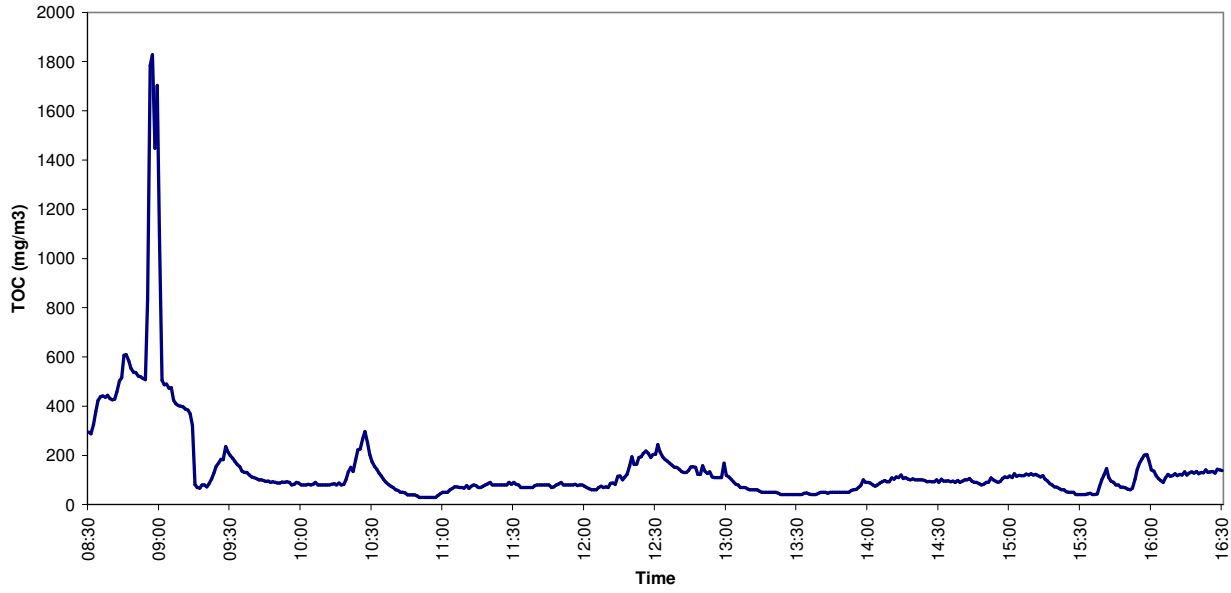


Figure 2

Continuous TOC Emissions Data - Linx Printing - Main Stack.
Reference conditions 273K, 101.3kPa & Wet Gas.

Data recorded between 08:30 & 16:30 on 13th September 2011.



TABLES

Table 1

Data Recorded from Ink Filling – Main Vent (No Production)
Sample Period: 07:45 – 08:15 on the 13th September 2011

Volumetric Flowrate (Reference Conditions) = 0.87 **m^3/sec ***

	Average	Emission Rate
	mg/m^3	**Kg/hr**
TOCs (as carbon)	**10.19**	**0.032**

Data expressed at (273K, 101.3 kPa & Wet Gas)

Table 2

Data Recorded from Ink Filling – Main Vent (Normal Production)
Sample Period: 08:30 – 16:30 on the 13th September 2011

Volumetric Flowrate (Reference Conditions) = 0.87 **m^3/sec ***

	Average	Emission Rate
	mg/m^3	**Kg/hr**
TOCs (as carbon)	**142.88**	**0.45**

Data expressed at (273K, 101.3 kPa & Wet Gas)

Table 3 – Particulates

Data Recorded from Ink Manufacture - Main Vent

Emission Parameter	Units	TPM 1	Blank
Stack Diameter	metres	0.50	…
			…
Area of Sample Plane	m^2	0.196	…
Moisture Content	%	0.12	…
Oxygen Content	%	20.90	…
Stack Temperature	°C	18	…
Gas Velocity (at Stack Conditions)	m/sec	4.71	…
Gas Velocity (Reference Conditions)	m/sec*	4.39	…
Volumetric Flowrate (Stack Conditions)	m^3/sec	0.93	…
Volumetric Flowrate (Reference Conditions)	m^3/sec*	0.86	…
Sample Date	…	13/09/2011	…
Sample Period	…	09:05 - 11:05	…
Sample Volume (at Stack)	m^3	1.83	…
Sample Volume (reference Conditions)	m^3*	1.71	1.71
Isokinetic Sampling Rate	%	104.1	…
Sample Reference (ECL ID)	ECL/11/	4810 & 4811	4814 & 4815
Mass of Particulate Matter Collected	mg	0.24	0.16
Concentration of Particulate Matter	mg/m^3*	**0.14**	0.09
Emission Rate of Particulate Matter	g/hr	0.44	…
Expanded Uncertainty (% Relative)	%	146	…
Emission Limit Value (ELV)	mg/m^3*	20	…
Blank Concentration as Percentage of ELV	%	…	<1.00%

*Reference Conditions (273K, 101.3kPa, Wet Gas)

Table 4 – Particulates

Data Recorded from Ink Manufacture - Main Vent

Emission Parameter	Units	TPM 2	Blank
Stack Diameter	metres	0.50	…
			…
Area of Sample Plane	m^2	0.196	…
Moisture Content	%	0.10	…
Oxygen Content	%	20.90	…
Stack Temperature	°C	18	…
Gas Velocity (at Stack Conditions)	m/sec	4.71	…
Gas Velocity (Reference Conditions)	m/sec*	4.39	…
Volumetric Flowrate (Stack Conditions)	m^3/sec	0.93	…
Volumetric Flowrate (Reference Conditions)	m^3/sec*	0.86	…
Sample Date	…	13/09/2011	…
Sample Period	…	11:15 - 13:15	…
Sample Volume (at Stack)	m^3	1.80	…
Sample Volume (reference Conditions)	m^3*	1.68	1.68
Isokinetic Sampling Rate	%	102.5	…
Sample Reference (ECL ID)	ECL/11/	4812 & 4813	4814 & 4815
Mass of Particulate Matter Collected	mg	0.25	0.16
Concentration of Particulate Matter	mg/m^3*	**0.15**	0.10
Emission Rate of Particulate Matter	g/hr	0.46	…
Expanded Uncertainty (% Relative)	%	142	…
Emission Limit Value (ELV)	mg/m^3*	20	…
Blank Concentration as Percentage of ELV	%	…	<1.00%

*Reference Conditions (273K, 101.3kPa, Wet Gas)

VELOCITY TRAVERSE PROFILE

Environmental Compliance Limited	Traverse Data Proforma	Date of Measurement	13/09/2011

Company	Linx Printing	Stack Diameter (mm)	500	Pitot tube coefficient	1.00
Site	St Ives	Port Length (mm)		Pitot ID	488
Location	Ink Manufacture	Duct Length (mm) A		Stack Thermocouple ID	464
Stack	Main Vent	Duct width (mm) B		Stack Thermocouple Reader ID	431
Job No	P1185	Barometric Pressure. (mb)	1007	Manometer ID	506
Operators	AB	Static Pressure. (mm H_20) (= Pa/9.81)	1	Barometer ID	352

	Distance to Point (mm)	Port	Temp. (°C)	(ΔP) (Pa)	Swirl Test °From Reference	Port	Temp. (°C)	(ΔP) (Pa)	Swirl Test °From Reference
	50	A1	18.0	5.0	10	B1	18.0	25.0	6
	75	A2	18.0	9.0	10	B2	18.0	25.0	6
	125	A3	18.0	10.0	10	B3	18.0	24.0	7
	175	A4	18.0	10.0	7	B4	18.0	20.0	7
	225	A5	18.0	11.0	8	B5	18.0	12.0	8
	275	A6	18.0	12.0	8	B6	18.0	12.0	8
	325	A7	18.0	18.0	7	B7	18.0	10.0	10
	375	A8	18.0	20.0	6	B8	18.0	9.0	10
	425	A9	18.0	20.0	6	B9	18.0	7.0	10
	450	A10	18.0	20.0	6	B10	18.0	5.0	12
Total			180				180		
Max			18	20.0			18	25.0	
Min			18	5.0			18	5.0	
Average			18.0	13.5			18.00	14.90	

Average temp (K)	291

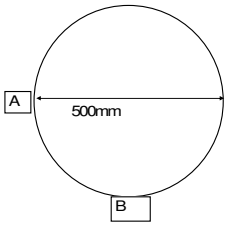
Suitability of Sampling Position	Actual Stack Conditons
Permitted highest:lowest flow pressure ratio =9:1	5:1
Average deviation of flow from axis <15°	OK
X-sectional area for stacks= πr^2	0.20 m^2
X-sectional area for ducts = L x B	0.000 m^2
Suitabilty of Position for Sampling	OK

Stack Moisture	0.1	%
Measured Oxygen	20.9	%
Measured Carbon Dioxide		%
Dry Gas Molecular Weight	28.836	g/g mole

Gas Velocity (as Measured)	4.73	m/sec
Gas Velocity (Reference Conditions)	4.41	m/sec*
Volumetric Flowrate (as Measured)	0.9294	m^3/sec
Volumetric Flowrate (Reference Conditions)	0.8669	m^3/sec*

*Reference Conditions: 273K, 101.3kPa, Wet Gas

Diagram/ Description of Cross Section of Stack/Duct



Access is via temporary platform

Plane is <5m above ground

All kit stays on ground, plenty of space.

Only probes raised via temporary access and tied to stack brace

Deviations from procedure/ non - conformities

Can measure pitot on both ports, but cannot sample from port B (as no way to safely suspend probe)

Compliance With Positional Requirements?

Height of sample ports from Platform	1 m
Number of sample ports	2
Width of platform (port back to handrail)	1 m

Nearest downstream disturbance	Exit	4m
Nearest upstream disturbance	Bend	2m
Disturbances are classed as bends, fans or diameter variations		

FIELD CALIBRATION AND SAMPLING DATA

Environmental Compliance Limited	PARTICULATE DATA SAMPLING PROFORMA	Date of Measurement	13/09/2011	

ECL/TPD/	27a	Time taken to change Ports	0	Start Time	09:05	End Time	11:05	Duration (mins)	120

Client	Linx Printing	Stack Profile	Circular	Pitot ID	488	Stack Thermocouple ID	464	Impingers	n/a
Site	St Ives	Stack Area (m^2)	0.20	Manometer ID	506	Stack Temp Reader ID	431	SOL/	n/a
Location	Ink Manufacture	Barometric Pressure (mb)	1007	Barometer ID	352	Meter Thermocouple ID	367c	Start Weight (g)	0.00
Stack ID	Main Vent	Stat Pres. (mmH^20) (Pa/9.81)	1	DGM Yd	1.0359	Meter Temp Reader ID	431	End Weight (g)	1.60
Test No.	TPM 1	Pitot coefficient	1	Nozzle ID	802	Dry Gas Meter ID	367a	Total weight (g)	1.60
Job No	P1185	Balance ID	n/a	Nozzle Size (mm)	8.11	Timer ID	367d		
ECL Site Staff	AB	Console ID	367	Filter ID	18	Rotameter ID	367b		

	Sample	Leak 1	Leak 2	Leak 3	Leak 4
Start Volume	968200.0				
Final Volume	970035.0				
Total Volume	1835.0	0.0	0.0	0.0	0.0

Total	Volume (litres) @STP Dry	
	Expected Sample Volume	1638.56
	Actual Sample Volume	1705.10
1835.0	Isokinetic Percentage	104.06

Impingers are not used for UKAS/MCERTS sampling of particulate to ECL TPD 27a as method is for dry stacks only (& wet gas reporting). In these cases moisture is entered into calculations as 0.1%.

Leak Check	First	Second	Third	Final
Leak Rate l/min	0.2			0.2
Set Rate (l/min)	20			20
Time Of Leak Check	09:00			11:07
Leak % of set rate	1.0			1.0

Maximum allowed leak rate is 2% of the set rate				
	Measured O_2	20.90	Moisture	0.12
	Measured CO_2 %		Ref O_2	20.9
	Measured CO ppm		Dry Gas Molecular Weight	28.84

Acetone SOL/	1473
DI Rinse SOL/	1482

Traverse Point	A3	A3	A3	A3	A3	A3	A3	a3	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	
ΔP (Pa)	10	10	10	10	10	10	10	10	10.0
Velocity at Stack (m/s)	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	12.5	12.5	12.6	12.6	12.6	12.7	12.8	12.8	12.6
Meter (Tm)	16	17	18	19	20	21	23	24	19.8
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

Original Flowrate Settings	
Tm	40
Ts	18
% moisture	0.1

Traverse Point	A5	A5	A5	A5	A5	A5	A5	A5	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80	
ΔP (Pa)	11	11	11	11	11	11	11	11	11.0
Velocity at Stack (m/s)	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.28	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	13.5	13.6	13.7	13.7	13.8	13.8	13.9	13.9	13.7
Meter (Tm)	26	28	29	30	31	32	33	34	30.4
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

Traverse Point	A8	A8	A8	A8	A8	A8	A8	A8	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	80 - 85	85 - 90	90 - 95	95 - 100	100 - 105	105 - 110	110 - 115	115 - 120	
ΔP (Pa)	20	20	20	20	20	20	20	20	20.0
Velocity at Stack (m/s)	5.77	5.77	5.77	5.77	5.77	5.77	5.77	5.77	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	18.8	18.9	19.0	19.0	19.0	19.1	19.2	19.2	19.0
Meter (Tm)	35	37	38	38	39	40	41	41	38.6
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

Environmental Compliance Limited	PARTICULATE DATA SAMPLING PROFORMA	Date of Measurement	13/09/2011	

ECL/TPD/	27a	Time taken to change Ports	0	Start Time	11:15	End Time	13:15	Duration (mins)	120

Client	Linx Printing	Stack Profile	Circular	Pitot ID	488	Stack Thermocouple ID	464	Impingers	n/a
Site	St Ives	Stack Area (m^2)	0.20	Manometer ID	506	Stack Temp Reader ID	431	SOL/	n/a
Location	Ink Manufacture	Barometric Pressure (mb)	1007	Barometer ID	352	Meter Thermocouple ID	367c	Start Weight (g)	0.00
Stack ID	Main Vent	Stat Pres. (mmH^20) (Pa/9.81)	1	DGM Yd	1.0359	Meter Temp Reader ID	431	End Weight (g)	1.35
Test No.	TPM 2	Pitot coefficient	1	Nozzle ID	802	Dry Gas Meter ID	367a	Total weight (g)	1.35
Job No	P1185	Balance ID	n/a	Nozzle Size (mm)	8.11	Timer ID	367d		
ECL Site Staff	AB	Console ID	367	Filter ID	19	Rotameter ID	367b		

Impingers are not used for UKAS/MCERTS sampling of particulate to ECL TPD 27a as method is for dry stacks only (& wet gas reporting). In these cases moisture is entered into calculations as 0.1%.

	Sample	Leak 1	Leak 2	Leak 3	Leak 4
Start Volume	970055.0				
Final Volume	971930.0				
Total Volume	1875.0	0.0	0.0	0.0	0.0

Total	Volume (litres) @STP Dry	
	Expected Sample Volume	1634.30
	Actual Sample Volume	1674.92
1875.0	Isokinetic Percentage	102.49

Leak Check	First	Second	Third	Final
Leak Rate l/min	0.2			0.2
Set Rate (l/min)	20			20
Time Of Leak Check	11:10			13:20
Leak % of set rate	1.0			1.0

Maximum allowed leak rate is 2% of the set rate

Measured O_2	20.90	Moisture	0.10
Measured CO_2 %		Ref O_2	20.9
Measured CO ppm		Dry Gas Molecular Weight	28.84

Acetone SOL/	1473
DI Rinse SOL/	1482

Traverse Point	A3	A3	A3	A3	A3	A3	A3	a3	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	
ΔP (Pa)	10	10	10	10	10	10	10	10	10.0
Velocity at Stack (m/s)	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	13.3	13.4	13.5	13.5	13.5	13.5	13.5	13.6	13.5
Meter (Tm)	36	38	39	39	40	40	40	41	39.1
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

Original Flowrate Settings	
Tm	40
Ts	18
% moisture	0.1

Traverse Point	A5	A5	A5	A5	A5	A5	A5	A5	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80	
ΔP (Pa)	11	11	11	11	11	11	11	11	11.0
Velocity at Stack (m/s)	4.28	4.28	4.28	4.28	4.28	4.28	4.28	4.28	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	14.2	14.2	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Meter (Tm)	41	41	42	42	42	43	43	43	42.1
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

Traverse Point	A8	A8	A8	A8	A8	A8	A8	A8	Total
Time Interval (mins)	5	5	5	5	5	5	5	5	
Time/Point (mins)	80 - 85	85 - 90	90 - 95	95 - 100	100 - 105	105 - 110	110 - 115	115 - 120	
ΔP (Pa)	20	20	20	20	20	20	20	20	20.0
Velocity at Stack (m/s)	5.77	5.77	5.77	5.77	5.77	5.77	5.77	5.77	
Sample Rate (l/min) 101.3 mbar, Tm, Dry Gas	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4
Meter (Tm)	43	44	44	44	44	44	44	45	44.0
Stack Temp (Ts)	18	18	18	18	18	18	18	18	18.0

FID CALIBRATION DATA

		TOC		
		ppm		
Analyser Range		1000		
Repeatability at Zero		10		
Span Gas Concentration Applied		200.6		
Zero Gas Concentration Applied		0		
Direct Cal	Zero	0.20		
	Span	200.39		
	Zero	0.22		
Difference (Zero)		0.0234375		
<2×Repeatability @ Zero?		YES		
Pre Test	Zero	0.30		
	Span	200.71		
Difference (Zero)		0.076388889		
<5% (2% for O_2) Relative to Direct Span		YES		If Red CONTACT QM
Difference (Span)		0.315625		
<5% (2% for O_2) Relative to Direct Span		YES		If Red CONTACT QM
Post Test	Zero	0.00		
	Span	200.00		
Difference (Zero)		0.295		
<2% of Analyser Range		YES		If Red apply Drift
Difference (Span)		0.706		
<2% of Analyser Range		YES		If Red apply Drift
Drift <5% of Analyser Range?		YES		If Red CONTACT QM
Note* TOC is logged in mA NOT ppm - Zero Offset is likely				

LABORATORY ANALYSIS RESULTS

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Combrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

Report Number: 250920-1

Date of Report: 03-Oct-2011

Customer: Environmental Compliance Ltd
Building 26
Bay 6
First Avenue
Pensnett Trading Estate
Kingswinford
DY6 7TB

Customer Contact: Mr Andy Barnes

Customer Job Reference: P1185
Customer Purchase Order: P9051
Date Job Received at SAL: 19-Sep-2011
Date Analysis Started: 20-Sep-2011
Date Analysis Completed: 03-Oct-2011

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

UKAS TESTING
1549

Report checked
and authorised by :
Ms Jennifer Hughes
Customer Service Manager
(Air Division)

Issued by :
Ms Jennifer Hughes
Customer Service Manager
(Air Division)

Validity unknown
Digitally signed by Jenny Hughes
Date: 2011.10.03 17:15:16 BST
Reason: Issue
Location: SAL

SCIENTIFIC ANALYSIS LABORATORIES

SAL Acetone Wash Reweigh Tracking Form

Job Number: 250920 Balance Id: 1850 Oven Id:

Sample Number	Volume (ml)	Pre-Weight (g)	Post-Weight (g) 1 Minute	Post-Weight (g) 2 Minute	Post-Weight (g) 3 Minute	Post-Weight (g) 0 Minute	Residue (g)	Residue (after Blank Correction) (g)	Residue (after Blank Correction) (mg)	Comments	Oven - Time/Date In	Oven - Time/date Out
002		31.3276	31.3278	31.3278	31.3277	31.3277	0.0001	0.0001	0.08			
004		31.7948	31.7946	31.7946	31.7946	31.7946	-0.0002	-0.0002	-0.22			
006		31.6664	31.6664	31.6664	31.6664	31.6664	0.0000	0.0000	0.00			
Blank data								Mean				
Blank1		97.8469				97.8469	0.0000					
Blank2		104.5439				104.5439	0.0000	0.0000	0.00			
Blank3		111.3306				111.3306	0.0000					

Operator: LISA Date: 03/10/11

Checked by: Date:

SCIENTIFIC ANALYSIS LABORATORIES

SAL Filter Reweigh Tracking Form

Job Number: 250920 Balance Id: 1850 Filter Type : G37/precon

Sample Number	Filter Id	Filter Loading	Pre-Weight (g)	Post-Weight (g) 1 Minute	Post-Weight (g) 2 Minute	Post-Weight (g) 3 Minute	Post-Weight (g) 0 Minute	Residue (g)	Residue (after Blank Correction) (g)	Residue (after Blank Correction) (mg)	Comments
001	018	x	0.05793	0.05813	0.05807	0.05807	0.05807	0.00014	0.00017	0.17	
003	019	x x	0.05817	0.05838	0.05834	0.05832	0.05832	0.00015	0.00018	0.18	
005	020	x	0.05796	0.05803	0.05803	0.05802	0.05802	0.00006	0.00009	0.09	
									Mean (g)	Mean (mg)	
Blank1	062		0.05803				0.05803	0.00000			
Blank2	063		0.05819				0.05815	-0.00004			
Blank3	064		0.05806				0.05809	0.00003			
Blank4	065		0.05741				0.05737	-0.00004			
Blank5	066		0.05829				0.05825	-0.00004	-0.00003	-0.03	
Blank6	067		0.05743				0.05733	-0.00010			

Operator dc Date 03/10/11

Checked b Date

Controlled Document SAL Stack filter reweigh tracking form 1-20 Version 1.0 Released by: paulh on 2nd Sept 2010
Page 1 of 1

SAL Reference: 250920
Customer Reference: P1185

Wash(Acetone) Analysed as Wash(Acetone)
Miscellaneous

				SAL Reference	**250920 002**	**250920 004**	**250920 006**
				Customer Sample Reference	ECL/11/4811	ECL/11/4813	ECL/11/4815
				Test Sample	**AR**	**AR**	**AR**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Particulates (Total)	Grav	0.1	mg	U	<0.1	<0.1	<0.1

SAL Reference: 250920
Customer Reference: P1185

Filter Quartz 37mm Analysed as Filter Quartz 37mm
Miscellaneous

				SAL Reference	**250920 001**	**250920 003**	**250920 005**
				Customer Sample Reference	ECL/11/4810	ECL/11/4812	ECL/11/4814
				Test Sample	**AR**	**AR**	**AR**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Particulates (Total)	Grav (5 Dec)	0.05	mg	U	**0.14**	**0.15**	**0.06**

Index to symbols used in 250920-1

Value	Description
AR	As Received
U	Analysis is UKAS accredited

UNCERTAINTY CALCULATIONS

Site: Linx Printing, St Ives
Location: Ink Manufacture , Stack ID: Main Vent

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	RPS Method Uncert (%) K=2 Filter mg	Solution mg	Standard Uncertainty Filter mg	Solution mg	Combined Uncertainty mg
			TPM 1					
Particulates	0.14	0.10	0.24	0.14	0.27	0.0700	0.14	0.15

	TPM 1			Standard Uncertainty @ 95%	
Sampled Volume (V_m)	1.84	m^3	uV_m	0.001	m^3
Meter Correction Factor (Yd)	1.04	...	...	...	...
Meter Temperature (T_m)	302.73	k	uT_m	1.5	k
Static Pressure of Stack P_{static}	1.00	mmH_2O	uP_{static}	0.25	mmH_2O
Absolute Stack Pressure ρ_s	755.31	mmHg	up_s	0.8	mmHg
Barometric Pressure ρ_b	755.50	mmHg	up_b	3.8	mmHg
Average Differential Pressure (ΔH)	1.39	mmH_2O	$u\Delta H$	0.25	mmH_2O
Oxygen content ($O_{2,m}$)	20.90	%by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.00	%by volume
Moisture Content (H_2O)	0.12	%by volume	uH_2O	0.09	%by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying th contributing factor e.g. i =uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = \quad 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured static pressure uncertainty component (uPstatic) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = \quad 0.930$$

	Maximum	Minimum	Sensitivity	ufstp
$u\Delta H$	0.49	0.49	0.0000476	0.0000119
up_b	0.49	0.49	0.000647	0.00243
uT_m	0.49	0.49	0.000849	0.00127
H_2O	0.49	0.49	0.00489	0.000437

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = \quad 0.16$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = \quad 1.7062$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uf_s	2.01	1.41	1.84	0.30
Effect of uV_m	1.71	1.71	0.93	0.000930

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = \quad 0.55$$

Uncertainty of correction factor to reference oxygen due to measured oxygen uncertainty component (uf_{O2}) & Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2%max) in the sample system (uL)

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = \quad 1.00$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
uf_{o_2}	...	...	...	...

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}} = \quad \text{mg/Nm}^3 \quad 0.00162$$

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM), oxygen correction uncertainty component (uf_{Oxy}) and STP volume uncertainty component (uVstp)

$$Conc = \frac{M_{\text{Recovered}}}{V_m \times f_s \times f_{O_2}} = \quad 0.14$$

	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	u mg/Nm³
uM	0.23	0.0515	0.59	0.0891
uO_2	...	...	...	...
uV_{stp}	0.21	0.11	0.0921	0.0509

Combined Uncertainty

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uf_{Oxy})^2 + (uV_{stp})^2}$$

Combined Uncertainty mg/Nm³	Expanded Uncertainty mg/Nm³	Measured Concentration mg/Nm³	Percent of Measured Concentration
0.10	0.21	0.14	145.9%

Site: Linx Printing, St Ives
Location: Ink Manufacture , Stack ID: Main Vent

$$u_{mass} = \sqrt{\sum (u_{filter})^2 + (u_{solution})^2}$$

Determinand	Filter mg	Solution mg	Recovered Mass mg	RPS Method Uncert (%) K=2 Filter mg	Solution mg	Standard Uncertainty Filter mg	Solution mg	Combined Uncertainty mg
			TPM 2					
Particulates	0.15	0.10	0.25	0.14	0.27	0.0700	0.14	0.15

	TPM 2				
			Standard Uncertainty @ 95%		
Sampled Volume (V_m)	1.88	m^3	uV_m	0.001	m^3
Meter Correction Factor (Yd)	1.04	...	...	...	...
Meter Temperature (T_m)	314.90	k	uT_m	1.5	k
Static Pressure of Stack P_{static}	1.00	mmH_2O	uP_{static}	0.25	mmH_2O
Absolute Stack Pressure ρ_s	755.31	mmHg	up_s	0.8	mmHg
Barometric Pressure ρ_b	755.50	mmHg	up_b	3.8	mmHg
Average Differential Pressure (ΔH)	1.39	mmH_2O	$u\Delta H$	0.25	mmH_2O
Oxygen content ($O_{2,m}$)	20.90	%by volume	$uO_{2,m} = \sigma/\sqrt{n}$	0.00	%by volume
Moisture Content (H_2O)	0.0998	%by volume	uH_2O	0.09	%by volume

Note: In the following calculations, the sensitivity coefficient (C) is estimated using: $C_i = \frac{\partial f}{\partial x_i}$

For each factor, uncertainty is then calculated by $C_i u_i$ where C is the sensitivity coefficient, u is the standard uncertainty and i is the index identifying th contributing factor e.g. i =uV_m, uT_m etc.

Where results are required at wet conditions, the following correction factor is used to convert the data from the dry gas meter:

$$f_{s,wet} = \frac{100}{(100 - H_2O)} = 1.00$$

Uncertainty in correction factor to STP due to measured barometric pressure uncertainty component (upb), measured static pressure uncertainty component (uPstatic) & measured temperature of dry gas

$$f_s = \frac{273}{760} \times \frac{P_b + \frac{\Delta H}{13.6}}{T_m} \times Y_d = 0.894$$

	Maximum	Minimum	Sensitivity	ufstp
$u\Delta H$	0.48	0.48	0.0000466	0.0000116
up_b	0.48	0.48	0.000634	0.00238
uT_m	0.48	0.48	0.000814	0.00122
H_2O	0.48	0.48	0.00479	0.000435

$$\frac{uf_s}{f_s} = \sqrt{\left(\frac{\sqrt{(u\Delta H)^2 + (uP_s)^2}}{(P_m/101.3)}\right)^2 + \left(\frac{uT_m}{(T_m/273.15)}\right)^2 + \left(\frac{uH_2O}{100/(100 - H_2O)}\right)^2} = 0.15$$

Uncertainty in volume @ STP due to volume correction factor uncertainty component (uVstd) & volume uncertainty component (uVm)

$$V_{std} = V_{measured} \times f_s = 1.6758$$

	Maximum m^3	Minimum m^3	Sensitivity	Standard Uncertainty (m^3)
Effect of uf_s	1.97	1.39	1.88	0.29
Effect of uV_m	1.68	1.67	0.89	0.000894

$$\frac{uV_{std}}{V_{std}} = \sqrt{\left(\frac{uV_{std}}{f_s}\right)^2 + \left(\frac{uV_m}{V_m}\right)^2} = 0.54$$

Uncertainty of correction factor to reference oxygen due to measured oxygen uncertainty component (uf_{O2}) & Uncertainty in final measurement @ reference conditions due to uncertainty component arrising from leak and/or loss (assumed 2%max) in the sample system (uL)

$$f_{o_2} = \frac{20.9\% - O_{2,ref}}{20.9\% - O_{2,measured}} = 1.00$$

	Maximum	Minimum	Sensitivity	Standard Uncertainty
uf_{o_2}	...	...	...	...

$$uL = \frac{Conc \times \frac{2}{100}}{\sqrt{3}} = \text{mg/Nm}^3\ 0.00172$$

Uncertainty in final measurement @ reference conditions due to mass uncertainty component (uM), oxygen correction uncertainty component (uf_{Oxy}) and STP volume uncertainty component (uVstp)

$$Conc = \frac{M_{\text{Recovered}}}{V_m \times f_s \times f_{O_2}} = 0.15$$

	Maximum mg/Nm³	Minimum mg/Nm³	Sensitivity	u mg/Nm³
uM	0.24	0.0584	0.60	0.0907
uO_2	...	...	...	...
uV_{stp}	0.22	0.11	0.0995	0.0540

Combined Uncertainty

$$u_{combined} = \sqrt{\sum (u_M)^2 + (u_L)^2 + (uf_{Oxy})^2 + (uV_{stp})^2}$$

Combined Uncertainty mg/Nm³	Expanded Uncertainty mg/Nm³	Measured Concentration mg/Nm³	Percent of Measured Concentration
0.11	0.21	0.15	141.6%