LEVINGTON ENVIRONMENTAL
Environmental testing & consultancy
3 Harvesters Way
Martlesham Heath
Ipswich
IP5 3UR

☎ 07932 645818
PeterDarnell@levington.com

Ancient House Printing Group
Whittle Rd
Ipswich
IP2 0HA

FAO: Mr E Mayhew

Test Report: LE390008 **Project No.** 390

Title: Emission Monitoring

Introduction
Monitoring of emissions was carried out at the above site on 26th and 27th July 2012, in accordance with the Pollution Prevention & Control Act 1999 and Pollution Prevention & Control (England & Wales) Regulations 2000, Permit Ref Number 6.4/LK/9/07.

1. Process description
The process comprises two similar Komori System 38S heat set web offset printing presses. In each case, emissions from the Megtec Dual Dry TNV9.1 driers are vented through an integrated recuperative thermal oxidiser to remove VOC's (volatile organic compounds) from the emissions. These exhaust through a short stack, fitted with an ejector cowl, directly above the oven. The afterburner is set to run at a chamber temperature of 774°c on press 1 and 760°c on press 2.

The emissions were tested for the following parameters specified in the Permit, against the following concentration limits:

Emission	Test	Limit
Web press	Total particulate matter	100 mg/m3
	Carbon monoxide	100 mg/m3
	Oxides of nitrogen	100 mg/m3 as NO2
	VOC	50mg C/m3

All concentrations are 30 minute means, expressed at reference conditions of 273K and 101.3kPa without correction for water vapour or oxygen content, i.e. as mg/Nm3.

2. Sampling details
Emission sampling was carried out using the following industry standard techniques. The Testing Protocols are appended.

Press 1
Sampling for particulates was carried out between 10:00 and 11:00hrs on 27th July 2012, when the press was running continuously for the test period.

Sampling for VOC and CO/NO was carried out between 08:30 and 13:30hrs, when the press was running continuously throughout the test period, printing a light ink coverage at a rate of 40,000 impressions per hour.

Press 2
Sampling for particulates was carried out between 09:00 and 10:00hrs on 26th July 2012, when the press was running continuously for the test period.

Sampling for VOC and CO/NO was carried out between 09:50 and 14:50hrs, when the press was running for approximately 80% of the test period, printing a heavy ink coverage at a rate of 25,080 impressions per hour.

2.1 Volatile Organic Compounds (VOCs)
Monitoring for VOCs was carried out using a Kane Quintox 9106 flue gas analyser. The equipment was connected to the 2" sample point in the exhaust stack, approximately 10m above ground level. Samples gases were drawn through a sintered sampling probe to remove particulate matter and a water knock-out pot prior before entering the instrument.

The instrument was calibrated on site using 2080ppm propane (C3H8) calibration gas, and the instrument reads in ppm HnCn (as propane). Measurements were taken continuously and recorded by the datalogger every 15 minutes. Results were then converted to mg/m3 of carbon (excluding particulate matter) at reference conditions of 273K and 101.3kPa without correction for water vapour, i.e. mgC/Nm3.

On each press, the samples were taken from one of the 2 x 2" test points in the stack at platform level, directly on top of each oven.

2.1.1 Extractive Sample
Monitoring for VOCs was also carried out using BS EN 13649:2002; Determination of the mass concentration of individual gaseous organic compounds. Activated carbon and solvent desorption method. This technique was used as a back-up in case of instrumental problems, and is reported for information only.

The test equipment was connected to the 2" sample point in the exhaust stack. Samples gases were drawn through a glass fibre filter to remove particulate matter and an activated carbon sample adsorption tube at a rate of 100ml/min. for 5 hours. The sample tube was analysed in a UKAS laboratory for total hydrocarbons by solvent desorption and GCMS analysis, with the results expressed as mg/m3 of carbon. This was then converted to reference conditions of 273K and 101.3kPa without correction for water vapour, i.e. mgC/Nm3.

2.2 Carbon Monoxide and Oxides of Nitrogen
Monitoring for carbon monoxide and oxides of nitrogen, along with carbon dioxide, oxygen and temperature, was carried out using a Testo 350XL flue gas analyser and datalogger. Measurements were taken every 10 minutes. The instrument was calibrated by the supplier using reference gases of known and gave a read out directly in ppm carbon monoxide, nitric oxide & nitrogen dioxide, and % carbon dioxide. Results were subsequently converted from ppm to mg/m3 and expressed at reference conditions of 273K and 101.3kPa, i.e. mg/Nm3, without correction for water vapour or oxygen.

On each press, the samples were taken from one of the 2 x 2" test points in the stack at platform level, directly on top of each oven.

2.3 Total Particulate Matter
The sampling and analysis procedure is based on the main procedural requirements of British Standard BS ISO9096:2003. On each press, the samples were taken from one of the 2 x 2" test points in the stack at platform level, directly on top of each oven.

Stack gas velocities were measured at the test points using an Airflow Developments PVM100 Pitot probe and meter.

3. Results
The individual results are shown in full and graphically in the Appendix to this report.

3.1 Press 1

3.1.1 Summary of gaseous emission results

Press 1	VOC	CO	NO2	Temp
		mg/Nm3		C
Mean	**8.1**	**113**	**32**	**361**
Max	19.6	212	66	371
Min	0.0	7	6	333
EPA Limit	**100**	**100**	**100**	
July, 2011	3.5	9	27	340
April, 2010	3.3	81	71	358
June, 2009	2.6	17	61	359

3.1.2 Stack gas flow measurements

Press	Stack dia mm	Area m2	Temp C	Vel. m/s	Flow m3/hr	Nm3/hr
1	445	0.16	363	14.7	9232	3533

3.1.3 Total Particulate matter

Location	Sample	TPM mg/Nm3
Stack	P1	0.6
EPA Limit		**50**

3.2 Press 2

3.2.1 Summary of gaseous emission results

Press 2	VOC	CO mg/Nm3	NO2	Temp C
Mean	**9.7**	**32**	**55**	**344**
Max	24.7	57	72	373
Min	0.0	7	8	238
EPA Limit	**100**	**100**	**100**	
July, 2011	5.5	79	18	359
August, 2010	3.3	81	71	358
Apr, 2010	1.7	42	32	334
Dec, 2009	3.6	65	71	343

3.2.2 Stack gas flow measurements

Press	Stack dia mm	Area m2	Temp C	Vel. m/s	Flow m3/hr	Nm3/hr
2	445	0.16	363	14.3	7985	3427

3.2.3 Total Particulate matter

Location	Sample	TPM mg/Nm3
Stack	P2	0.4
EPA Limit		**50**

3.3 VOC extractive samples

Sample	Press	Time on	Time off	VOC		
Point				ug	mgC/Nm3	g/hr
Press 1	P1	09:30	14:30	23	0.8	2.71
Press 2	P2	08:30	13:30	16	0.5	1.83
	EPA Limit				**30**	

4. Discussion

The mean results for the gaseous emissions; VOCs, CO and NOx were all below the emission limits on both presses. During each test, the presses were running for approximately 80 to 100% of the 5-hour test period, which is considered normal operations for this equipment.

The results for the particulate emissions on both presses were negligible, and therefore well below the emission limit.

The installations are both performing well, and when running emissions were below the prescribed limits.

5. Recommendations

The VOC abatement equipment is operating correctly and no remedial action is required.

Emissions should be checked annually to comply with the authorisation.

Signed:....P J Darnell.....

P.J.Darnell MRSC

Date: 13th Aug 2012

Flue Gas Emission Testing									Express Instruments kit			
Site	Ancient House Press											
Date	27 July 2012								**Conversion Factors**		**Factor @273k**	
Equip.	Kane May Quintox								mgCO/m3	=COppm x	1.17	
Test	Komori press 1								mgCO2/m3	=%CO2x10000 x	1.83	
Point	Stack A1								mgNO/m3	=NOppm x	1.25	
									mgNO2/m3	=NOppm x	1.91	
									mg/m3NOx	=NOxppm x	2.05	as NO2
									mgC/m3	=VOC propane x	1.47	

	Measured data from Quintox								**Calculated results at std conditions**			
Time	**Temp** °C	**O2** %	**CO** ppm	**CO2** %	**NO** ppm	**NO2** ppm	**NOx** ppm	**VOC** ppm	**CO** mg/Nm3	**NOx** mgNO2/Nm3	**VOC** mgC/Nm3	**Press**
08:30	358.2	17.7	151	1.7	13	3	16	3.4	176	33	5.0	running
08:45	371.1	17.5	146	1.7	17	8	25	3.5	170	51	5.1	running
09:00	360.9	17.9	151	1.6	12	2	14	12.3	176	29	18.1	running
09:15	363.3	17.5	156	1.0	11	0	11	2.0	182	23	2.9	running
09:30	361.0	18.4	27	1.0	12	1	13	2.0	31	27	2.9	running
09:45	363.8	18.5	27	1.6	32	0	32	0.3	31	66	0.4	running
10:00	360.9	18.0	154	0.9	12	0	12	2.9	179	25	4.3	running
10:15	364.1	18.4	28	1.7	27	0	27	3.6	33	55	5.3	running
10:30	366.9	16.5	33	1.6	27	0	27	5.1	38	55	9.0	running
10:45	367.5	16.3	129	1.6	11	0	11	7.1	150	23	10.4	running
11:00	361.6	17.9	182	1.6	3	0	3	0.0	212	6	0.0	running
11:15	359.9	18.1	19	1.7	9	0	9	2.2	22	18	3.2	running
11:30	363.3	18.0	107	1.6	10	0	10	5.6	125	21	8.8	running
11:45	360.8	18.1	159	1.6	10	0	10	8.3	185	21	12.2	running
12:00	364.7	17.9	105	1.8	12	0	12	8.2	122	25	12.1	running
12:15	363.6	18.1	33	1.6	30	0	30	3.3	38	62	4.9	running
12:30	363.9	18.0	93	1.6	12	0	12	8.5	108	25	12.5	running
12:45	361.6	18.0	142	1.6	12	0	12	9.1	165	25	13.4	running
13:00	359.9	17.8	67	1.1	27	0	27	8.9	78	55	13.1	running
13:15	332.9	17.9	8	1.1	5	0	5	13.3	7	10	19.6	running
13:30	357.2	18.0	119	1.8	7	0	7	4.8	139	14	7.1	running
Mean	**361.3**	**18.0**	**96.9**	**1.5**	**14.8**	**0.7**	**15.5**	**5.5**	**112.6**	**31.7**	**8.1**	
Max	371.1	18.5	182.0	1.8	32.0	8.0	32.0	13.3	212.0	66.6	19.6	
Min	332.9	17.5	8.0	0.9	3.0	0.0	3.0	0.0	7.0	6.2	0.0	

Flue Gas Emission Testing							Express Instruments kit					
Site	Ancient House Press											
Date	26 July 2012						**Conversion Factors**				**Factor**	
Equip.	Kane May Quintox										@273k	
							mgCO/m3		=COppm x		1.17	
Test	Komori press 2						mgCO2/m3		=%CO2x10000 x		1.83	
Point	Stack A2						mgNO/m3		=NOppm x		1.25	
							mgNO2/m3		=NOppm x		1.91	
							mg/m3NOx		=NOxppm x		2.05	as NO2
							mgC/m3		=VOC propane x		1.47	
	Measured data from Testo 350MXL							**FID**	**Calculated results at std conditions**			
Time	**Temp** °C	**O2** %	**CO** ppm	**CO2** %	**NO** ppm	**NO2** ppm	**NOx** ppm	**VOC** ppm	**CO** mg/Nm3	**NOx** mgNO2/Nm3	**VOC** mgC/Nm2	**Press**
09:50	256.0	20.0	29	0.7	3	1	4	3	34	8	11.6	starting
10:05	236.0	20.1	12	1.2	13	1	14	5	14	29	7.4	starting
10:20	241.0	20.1	6	0.7	12	2	14	12.3	7	29	18.1	starting
10:35	282.0	18.6	30	1.5	22	3	25	16.8	35	51	24.7	starting
10:50	362.2	18.4	27	1.7	31	0	31	0	31	64	0.0	running
11:05	363.9	18.5	27	1.6	32	0	32	0.3	31	65	0.4	running
11:20	372.8	17.8	39	1.8	31	0	31	2	45	64	2.4	running
11:35	364.1	18.4	31	1.7	27	0	27	4	36	55	5.3	running
11:50	366.9	18.5	33	1.6	27	0	27	6	38	55	9.0	running
12:05	367.5	18.3	31	1.6	27	0	27	8	36	55	11.2	running
12:20	367.4	18.3	31	1.6	28	0	28	11	36	57	16.0	running
12:35	370.9	18.4	30	1.6	28	0	28	12	35	57	16.9	running
12:50	325.7	19.1	22	1.3	21	0	21	7	26	43	10.3	running
13:05	360.7	18.0	17	1.7	35	0	35	7	20	72	10.3	running
13:20	364.6	18.3	28	1.6	33	0	33	10	33	68	14.7	running
13:35	364.4	18.4	29	1.6	32	0	32	12	34	66	17.6	running
13:50	365.3	18.3	28	1.6	34	0	34	14	33	70	20.6	running
14:05	367.4	18.1	34	1.5	34	0	34	1	40	70	1.5	running
14:20	373.1	18.3	49	1.7	23	0	23	0	57	47	0.0	running
14:35	371.7	18.2	20	1.7	32	0	32	2	23	66	3.4	running
14:50	372.1	18.2	23	1.5	31	0	31	2	27	64	3.2	running
Mean	**343.8**	**18.6**	**27.4**	**1.5**	**26.5**	**0.3**	**26.8**	**6.6**	**32.0**	**55.0**	**9.7**	
Max	373.1	20.1	49.0	1.8	35.0	3.0	35.0	16.8	57.1	71.8	24.7	
Min	236.0	17.8	6.0	0.7	3.0	0.0	4.0	0.0	7.0	8.2	0.0	

Gas flows at stack sample points							
Press	Stack dia mm	Area m2	Temp C	Vel. m/s	Flow m3/hr	Nm3/hr	
1	445	0.16	363	14.7	8232	3533	
2	445	0.16	363	14.3	7985	3427	
TPM							
Location	Sample	TPM mg/Nm3					
Stack	P1	0.5					
EPA Limit		50					
VOC Emissions History							
Date	Press	VOC mg/Nm3	Flow Nm3/hr	VOC kg/8hr			
July, 2012	P1	8.1	3533	0.23			
July, 2011	P1	3.5	2424	0.07			
April, 2010	P1	2.9	3683	0.09			
Jun, 2009	P1	2.6	1952	0.04			
Extractive Sample							
Sample Point	Press	Filter	Time on	Time off	Duration	Rate l/min	Vol litres
Press 1	P1	T4	09:30	14:30	5h	0.10	30.00
Press 2	P2	T3	08:30	13:30	5h	0.10	30.00
Sample Point	Press	Time on	Time off	VOC ug	ngC/Nm3	g/hr	
Press 1	P1	09:30	14:30	23	0.8	2.71	
Press 2	P2	08:30	13:30	16	0.5	1.83	
	EPA Limit				30		

Press 1 stack showing test points

Press 2 stack showing test points

LEVINGTON ENVIRONMENTAL
Environmental testing & consultancy
3 Harvesters Way
Martlesham Heath
Ipswich
IP5 3UR

07932 645818
PeterDarnell@levington.com

Protocol for Particulate Emission Testing

Date: July 2012 **Site**: Ancient House Press Ltd.

Monitoring of emissions will carried out at the above site in accordance with the Pollution Prevention & Control Act 1999 and Pollution Prevention & Control (England & Wales) Regulations 2000, Permit Ref Number 6.4/RJD/4.

1. Process description

The process comprises a Komori System 38S heat set web offset printing press. Emissions from the Megtec Dual Dry TNV9.1 drier are vented through an integrated recuperative thermal oxidiser to remove VOC's (volatile organic compounds) from the emissions. This is exhausted through a short stack, fitted with an ejector cowl, directly above the oven. The afterburner is set to run at a chamber temperature of 775°c.

Emission from the stack must comply with the following concentration limits:

total particulate matter shall not exceed 50 mg/m3.

2. Test Procedure

Particulate sampling will be in accordance with the main procedural requirements of British Standard BS ISO9096:2003.

Air flows within the stack will be measured at each test point, to establish a velocity profile. Samples will then be taken isokinetically, by taking incremental samples at 2 locations within the stack. Particulates will be collected onto dried pre-weighed glass fibre filters, which will be subsequently dried and re-weighed to determine total dust concentrations. Two 1-hour samples will be taken to ensure representative results are obtained.

3. Sampling

3.1 Sampling and analysis will be carried out following Levington Laboratories method EA/5.

3.2 The sample train consists of a stainless steel probe with an appropriate nozzle, between 3 & 12.7mm dia. fitted with a Whatman 25mm GF/A filter in a two part cassette. This is connected via flexible tubing to a cooled Dreschel bottle as a water condenser, a rotameter, a dry gas meter and finally a suction pump.

3.3 Leak testing is carried out in the lab by pressurising the assembled apparatus with compressed air and using soap solution to test the joints. On site, the nozzle is blocked to check there is no flow due to leaks.

3.4 Typical sampling flow rates are from 5 to15 litres/min, dependent on stack flows, and duplicate samples are taken over two 1 hour periods.

3.5 A four point sampling regime will be employed if the duct area is less than 2.5sqm (0.15d & 0.85d), otherwise an eight point regime will be used.

3.6 Dust from the sample probe is knocked from the probe into the filter after sampling with the pump still running. If necessary it is washed using a acetone.

3.7 The filters are pre-weighed after desiccation and loaded into the cassettes. After exposure they are dried, desiccated and re-weighed on an analytical balance with a resolution of 0.01mg.

3.8 The volume of the condensate collected in the first Dreschel bottle will be combined with the weight gain in the second bottle to calculate the moisture content, if required.

3.9 Results are expressed at reference conditions 273K, 101.3kPa without correction for water vapour content.

4. Site Requirements

4.1 Plant operating conditions are not within our scope of work, but samples are taken under 'normal operating conditions' according to plant management.

4.2 Sampling will only be carried out provided safe access is provided to a working platform with handrails adjacent to the sample points. Protective equipment will be worn as required.

5. Quality Control

5.1 Flow measurement equipment is calibrated by the manufacturer, and checked against laboratory reference sets.

5.2 The analytical balance is calibrated daily and maintained under a service contract.

5.3 A 'travelling blank' filter is weighed alongside the exposed filters.

5.4 During chemical analysis 'check samples' of known analysis are tested alongside samples.

6. Reporting

6.1 Data is logged on site onto form EA/5f, and then transferred onto a PC spreadsheet to enable the calculations to be carried out. A copy of this spreadsheet is appended to the Test Report.

6.2 Samples filter holders are numbered, and the details transferred to the site form. On receipt in the laboratory, all samples are given a unique laboratory reference number and logged into the laboratory 'Analytical Record' system.

6.3 Test reports are produced in a standard format, with a unique reference number. A summary of the test procedure and analytical results are included in the report.