Stephenson

Environmental Management Australia

FORMALDEHYDE DESTRUCTION PROOF OF PERFORMANCE TESTS

CONTI 2 HEAT PLANT

BORG PANELS PTY LIMITED

OBERON, NSW

PROJECT NO.: 5707/S24371B/16

DATE OF SURVEY: 1 SEPTEMBER 2016

DATE OF FINAL ISSUE: 24 OCTOBER 2016

Stephenson

Environmental Management Australia

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PW STEPHENSON

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TABLE OF CONTENTS

1 INTRODUCTION 1
2 PRODUCTION CONDITIONS 2
3 RESULTS AND DISCUSSION 3
3.1 INTRODUCTION 3
3.2 FORMALDEHYDE (HCHO) 3
3.3 CARBON DIOXIDE 4
3.4 CARBON MONOXIDE 4
3.5 OXYGEN (O_2) 4
3.6 OXIDES OF NITROGEN (NO_x) 4
4 CONCLUSIONS 6
5 TEST METHODS 7
5.1 EXHAUST GAS VELOCITY 7
5.2 EXHAUST GAS TEMPERATURE 7
5.3 FORMALDEHYDE 7
5.4 CONTINUOUS GASEOUS ANALYSIS 7
5.5 ACCURACY 8
APPENDIX A – EMISSION TEST RESULTS I
APPENDIX B – CONTINUOUS LOGS I
APPENDIX C – NATA ENDORSED EMISSION TEST REPORT I
APPENDIX D – INSTRUMENT CALIBRATION DETAILS I
APPENDIX E – SAMPLE LOCATIONS I
APPENDIX F – PRODUCTION INFORMATION I

TABLE OF TABLES

TABLE 1-1 SCOPE OF WORK 1
TABLE 3-1 SUMMARY OF AVERAGE EMISSION CONCENTRATION RESULTS 5
TABLE 5-1 ESTIMATION OF MEASUREMENT UNCERTAINTY 8

TABLE OF TABLES – APPENDICES

TABLE A-1 EMISSION TEST RESULTS, FLOW – INLET 1 (PAPER TREATER) II
TABLE A-2 EMISSION TEST RESULTS, FLOW – INLET 2 (WET SCRUBBER) III
TABLE A-3 EMISSION TEST RESULTS, FLOW – OUTLET (CONTI-2 HEAT PLANT) IV

TABLE OF FIGURES – APPENDICES

FIGURE B-1 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 INLET LOCATION 1, SEPTEMBER 1, 2016 II
FIGURE B-2 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 INLET LOCATION 2, SEPTEMBER 1, 2016... III
FIGURE B-3 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 OUTLET LOCATION, SEPTEMBER 1, 2016.. IV

FIGURE E-1 INLET LOCATION 1 – PAPER TREATER DUCT II
FIGURE E-2 INLET LOCATION 2 – WET SCRUBBER DUCT II
FIGURE E-3 OUTLET LOCATION – CONTI-2 HEAT PLANT OUTLET III
FIGURE E-4 CONTI-2 HEAT PLANT OUTLET BYPASS DAMPER CONTROLS (DAMPER SHUT) III

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Borg Panels Pty Ltd to conduct a Proof of Performance (PoP) emission trial on their Conti 2 Heat Plant at Oberon, New South Wales (NSW). This trial was undertaken on 1st September, 2016 in response to the request of the NSW EPA, reference EF13/3921; DOC16/282523-01 of the 2 August 2016.

The objective of the PoP trial was to determine the Formaldehyde (HCHO) removal efficiency from the gas stream being thermally treated in the Conti 2 Heat Plant.

Formaledyde gas samples were taken at two Heat Plant inlet locations, namely the Inlet 1 (Paper Treater) and Inlet 2 (Scrubber) and at the Conti 2 Heat Plant outlet location. The scope of work is presented in Table 1-1.

TABLE 1-1 SCOPE OF WORK

Parameter	Conti 2 Heat Plant			Test Method
	Inlet Location 1 Paper Treater	Inlet Location 2 Wet Scrubber	Outlet Duct to Dryers	
Velocity and flow	✓	✓	✓	TM-2
CO_2	Continuous analyser	Continuous analyser	Continuous analyser	TM 24
CO	Continuous analyser	Continuous analyser	Continuous analyser	TM 32
HCHO	Duplicate samples	Duplicate samples	Duplicate samples	TM-34
NO_x	Continuous analyser	Continuous analyser	Continuous analyser	TM 11
O_2	Continuous analyser	Continuous analyser	Continuous analyser	TM-25

Key:

CO_2	=	Carbon Dioxide
CO	=	Carbon Monoxide
HCHO	=	Formaldehyde
NO_x	=	Oxides of Nitrogen
O_2	=	Oxygen
TM	=	NSW approved test method

2 PRODUCTION CONDITIONS

Borg Panels personnel considered the facility was operating under typical conditions on the day of testing. Refer to Appendix F for detailed production records.

Combustion chamber in Heat Plant was operating in range of 920C to 950C with a residence time greater than 0.7 seconds during the PoP emission test works.

All other relevant production records are held by Borg Panels and are available upon request.

3 RESULTS AND DISCUSSION

3.1 INTRODUCTION

SEMA completed all the sampling and analysis for flow, temperature, moisture, CO, CO_2 and NO_x. SEMA is NATA accredited (No.15043) for this work. All sampling and analysis was conducted in accordance with the Office of Environment and Heritage (OEH) Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales. Refer to SEMA's NATA endorsed Emission Test Report in Appendix C which includes the laboratory Certificates of Analysis. The formaldehyde samples were analysed by the NATA accredited (No. 3726) TestSafe Australia laboratory, Report No.2016-2756.

The results of the stack emission tests are presented in Sections 3.2 to 3.6 and detailed in Appendix A. Appendix B presents a graphical logged record of CO, CO_2 and NO_x continuous emission analysis.

Appendix D details the most recent calibration of each instrument used to take measurements. Appendix E presents photographic reference and information on emission sampling point locations.

3.2 FORMALDEHYDE (HCHO)

Inlet 1: The emission concentrations of HCHO from the Inlet Location 1 (Paper Treater) for the two sampling runs were 26.6 milligrams per cubic metre (mg/m^3) and 26.3 mg/m^3 respectively. The average HCHO emission concentration was 26.5 mg/m^3. The HCHO mass emission rate from the Inlet Location 1 for the two sampling runs was 0.17 grams per second (g/s) and 0.16 g/s respectively.

Inlet 2: The emission concentrations of HCHO from the Inlet Location 2 (Wet Scrubber) for the two sampling runs were 3.41 mg/m^3 and 4.15 mg/m^3 respectively with an average HCHO emission concentration of 3.8 mg/m^3. The HCHO mass emission rate from the Inlet Location 2 for the two sampling runs was 0.0021 g/s and 0.0024 g/s respectively.

Outlet: The emission concentration of HCHO from the Outlet (Conti 2 Heat Plant) for the two sampling runs conducted was less than 0.0081 mg/m^3. The HCHO mass emission rate from the Outlet for the two sampling runs was less than 0.0003 g/s and less than 0.0003 g/s respectively.

Thermal Destruction Efficiency: The formaldehyde thermal destruction efficiency for both Run 1 and Run 2 was greater than 99.8%.

Refer to Table 3-1 and Appendix A for detailed results.

3.3 CARBON DIOXIDE

During the test period the Inlet Location 1 (Paper Treater) CO_2 emission monitoring concentrations averaged 0.7%, the Inlet Location 2 (Wet Scrubber) CO_2 emission monitoring concentrations averaged zero percent and the Outlet (Conti 2 Heat Plant) CO_2 emission monitoring concentrations averaged 4.2%. Refer Table 3.1 and Appendix B.

3.4 CARBON MONOXIDE

During the test period the Inlet Location 1 (Paper Treater) CO emission monitoring concentrations averaged 30 mg/m^3, the Inlet Location 2 (Wet Scrubber) CO emission monitoring concentrations averaged 4 mg/m^3 and the Outlet (Conti 2 Heat Plant) CO emission monitoring concentrations averaged 75 mg/m^3. Refer Table 3.1 and Appendix B.

3.5 OXYGEN (O_2)

During the test period the Inlet Location 1 (Paper Treater Exhaust) O_2 emission monitoring concentrations averaged 19.8%, the Inlet Location 2 (Scrubber Exhaust) O_2 emission monitoring concentrations averaged 20.9% and the Outlet (Conti 2 Heat Plant) O_2 emission monitoring concentrations averaged 16.0%. Refer Appendix B for details.

3.6 OXIDES OF NITROGEN (NO_x)

During the test period the Inlet Location 1 (Paper Treater) NO_x emission monitoring concentrations averaged 10 mg/m^3, the Inlet Location 2 (Wet Scrubber) NO_x emission monitoring concentrations averaged less than 2 mg/m^3 and the Outlet (Conti 2 Heat Plant) NO_x emission monitoring concentrations averaged 195 mg/m^3. Refer Table 3.1 and Appendix B.

TABLE 3-1 SUMMARY OF AVERAGE EMISSION CONCENTRATION RESULTS

Parameter	Unit of measure	Inlet Location 1 Paper Treater exhaust		Inlet Location 2 Scrubber exhaust		Outlet Conti 2 Heat Plant	
		Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Exhaust gas temperature	^oC	62	68	23.9	28.7	260	280
Normal stack gas flow rate	m^3/min	381	360	36	34	2,545	2,498
Moisture content	%	1.4	2.3	2.4	2.5	4.8	4.8
CO_2	%	0.7		0.0		4.2	
CO	mg/m^3	30		4		75	
NO_x	mg/m^3	10		< 2		195	
O_2	%	19.8		21.0		16.0	
HCHO concentration	mg/m^3	26.6	26.3	3.4	4.2	<0.0081	<0.0081
HCHO mass emission rate	g/s	0.17	0.16	0.0021	0.0024	<0.0003	< 0.0003

Key:

<	=	less than the limit of detection for the analytical method
%	=	percentage
^oC	=	degrees Celsius
m^3/min	=	cubic metres per minute @ 0^oC and 1 atmosphere
mg/m^3	=	milligrams per cubic metre @ 0^oC and 1 atmosphere
g/s	=	grams per second mass emission rate
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kpa)
CO	=	Carbon monoxide
CO_2	=	Carbon dioxide
NOx	=	Oxides of nitrogen
O_2	=	Oxygen
HCHO	=	expressed as formaldehyde on 1-hour average period

4 CONCLUSIONS

From the data presented and test work conducted during typical production cycles, the following conclusions can be drawn:

- The average Inlet 1 (Paper Treater) Formaldehyde emission concentration was 26.5 mg/m^3 and the average Formaldehyde mass emission rate was 0.164 g/s.
- The average Inlet 2 (Wet Scrubber) Formaldehyde emission concentration was 3.8 mg/m^3 and the average Formaldehyde mass emission rate was 0.0022 g/s.
- The average Outlet (Conti-2 Heat Plant) Formaldehyde emission concentration was less than 0.0081 mg/m^3 and the average mass Formaldehyde emission rate was less than 0.0003 g/s.
- The average Formaldehyde destruction efficiency was 99.8%.

5 TEST METHODS

5.1 EXHAUST GAS VELOCITY

(OEH NSW TM-2)

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and inclined manometer.

5.2 EXHAUST GAS TEMPERATURE

(OEH NSW TM-2)

The exhaust gas temperature was measured using a Digital thermometer (0-1200^{o}C) connected to a chromel/alumel (K-type) thermocouple probe.

5.3 FORMALDEHYDE

(OEH NSW TM-34, Workcover, WCA Method 179)

A stack gas sample was drawn into a 37 mm cassette loaded with two glass fibre filters in series impregnated with 2,4-Dinitrophenylhydrazine @ 0.5 litre per minute. This pair of filters is labelled front section and back section but form a total combined sample for aldehyde analysis. Each pair of filter samples was analysed by High Performance Liquid Chromatography (HPLC) by the NATA accredited laboratories of TestSafe Australia.

5.4 CONTINUOUS GASEOUS ANALYSIS

(OEH NSW TM-25)

Sampling and analysis of exhaust gas were performed using a Stephenson Environmental Management Australia's mobile combustion and environmental monitoring laboratory. Emission gases were distributed to the analysers via a manifold. The following components of the laboratory were relevant to this work:

Gas Transfer	Technical Heaters, PTFE sample lines, Temperature Controllers
Carbon Dioxide, Carbon Monoxide, Oxygen and Oxides of Nitrogen	Testo 350XL
Calibration	BOC Special Gas Mixtures relevant for each analyser. Instrument calibrations were performed at the start and finish of sampling on each stack.
QA/QC	Calibration (Zero/Span) checks

Sample line integrity calibration check

5.5 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 5-1) uncertainties for various stack testing methods.

TABLE 5-1 ESTIMATION OF MEASUREMENT UNCERTAINTY

Pollutant	Methods	Uncertainty
Carbon Monoxide	TM-32, USEPA 10	15%
Carbon Dioxide	TM-24, USEPA 3A	1% actual
Formaldehyde	TM-34, WCA Method 179	7%
Moisture	AS4323.2, TM-22, USEPA 4	25%
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen	TM-25, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2	5%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

* = range of uncertainties given

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m^{3-} which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of $\pm$ 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

APPENDIX A – EMISSION TEST RESULTS

Glossary:

%	=	percent
^{o}C	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
N/A	=	Not Applicable
Abbreviations of Parameters		
O_2	=	Oxygen
CO	=	Carbon Monoxide
CO_2	=	Carbon Dioxide
NO_x	=	Oxides of Nitrogen
TM	=	NSW OEH Approved Test Method
Abbreviations of Personnel		
PWS	=	Peter Stephenson
AN	=	Ali Naghizadeh
JW	=	Jay Weber

TABLE A-1 EMISSION TEST RESULTS, FLOW – INLET 1 (PAPER TREATER)

Emission Test Results	**Flow**	**Flow**
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Inlet 1 – Paper Treater	Inlet 1 – Paper Treater
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Inlet 1 – Paper Treater	Inlet 1 – Paper Treater
Stack Temperature (^oC)	62.0	68.0
Stack Cross-Sectional area (m^2)	0.866	0.866
Average Stack Gas Velocity (m/s)	10.4	10.1
Actual Gas Flow Volume (am^3/min)	540	524
Total Normal Gas Flow Volume (m^3/min)	381	360
Total Normal Gas Flow Volume (m^3/sec)	6.36	6.00
Total Stack Pressure (kPa)	89.13	89.06
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	1.4	2.3
Molecular Weight Dry Stack Gas (g/g-mole)	28.904	28.904
Dry Gas Density (kg/m^3)	1.29	1.29
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

TABLE A-2 EMISSION TEST RESULTS, FLOW – INLET 2 (WET SCRUBBER)

Emission Test Results	**Flow**	**Flow**
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Inlet 2 – Scrubber	Inlet 2 – Scrubber
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Inlet 2 – Scrubber	Inlet 2 – Scrubber
Stack Temperature (^oC)	23.9	28.7
Stack Cross-Sectional area (m^2)	0.312	0.312
Average Stack Gas Velocity (m/s)	2.4	2.4
Actual Gas Flow Volume (am^3/min)	46	44
Total Normal Gas Flow Volume (m^3/min)	36	34
Total Normal Gas Flow Volume (m^3/sec)	0.60	0.57
Total Stack Pressure (kPa)	89.14	89.05
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	2.4	2.5
Molecular Weight Dry Stack Gas (g/g-mole)	28.841	28.841
Dry Gas Density (kg/m^3)	1.29	1.29
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

TABLE A-3 EMISSION TEST RESULTS, FLOW – OUTLET (CONTI-2 HEAT PLANT)

Emission Test Results	**Flow**	**Flow**
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Exhaust	Exhaust
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Exhaust	Exhaust
Stack Temperature (^oC)	260	280
Stack Cross-Sectional area (m^2)	4.619	4.619
Average Stack Gas Velocity (m/s)	21	22
Actual Gas Flow Volume (am^3/min)	5,922	6,035
Total Normal Gas Flow Volume (m^3/min)	2,545	2,498
Total Normal Gas Flow Volume (m^3/sec)	42	42
Total Stack Pressure (kPa)	89.3	89.3
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	4.8	4.8
Molecular Weight Dry Stack Gas (g/g-mole)	29.307	29.307
Dry Gas Density (kg/m^3)	1.31	1.31
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

APPENDIX B – CONTINUOUS LOGS

REPRESENTATIVE SECTION OF CHARTS - CONCENTRATIONS OF NO_x, CO, CO_2 & O_2

FIGURE B-1 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 INLET LOCATION 1, SEPTEMBER 1, 2016

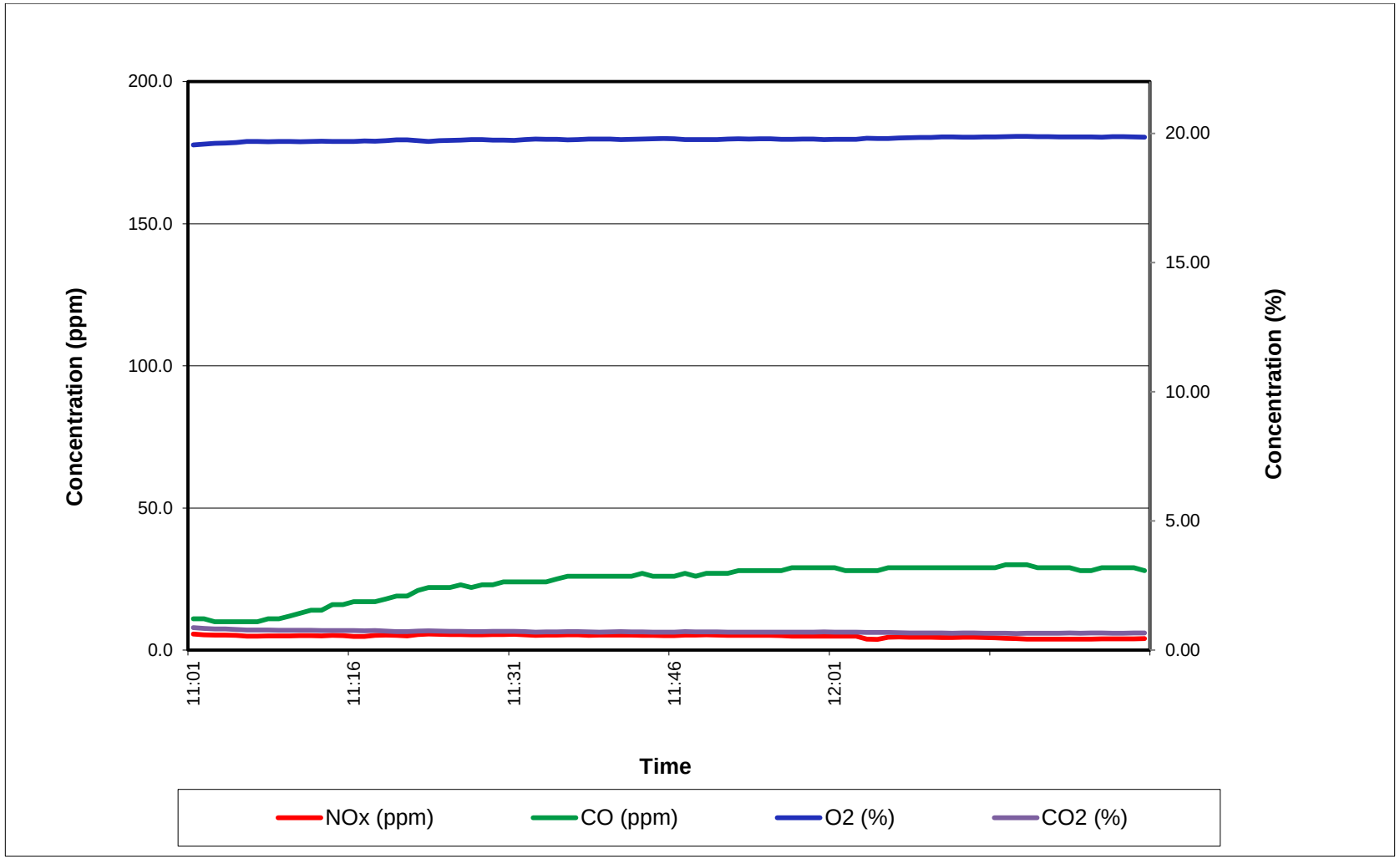


FIGURE B-2 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 INLET LOCATION 2, SEPTEMBER 1, 2016

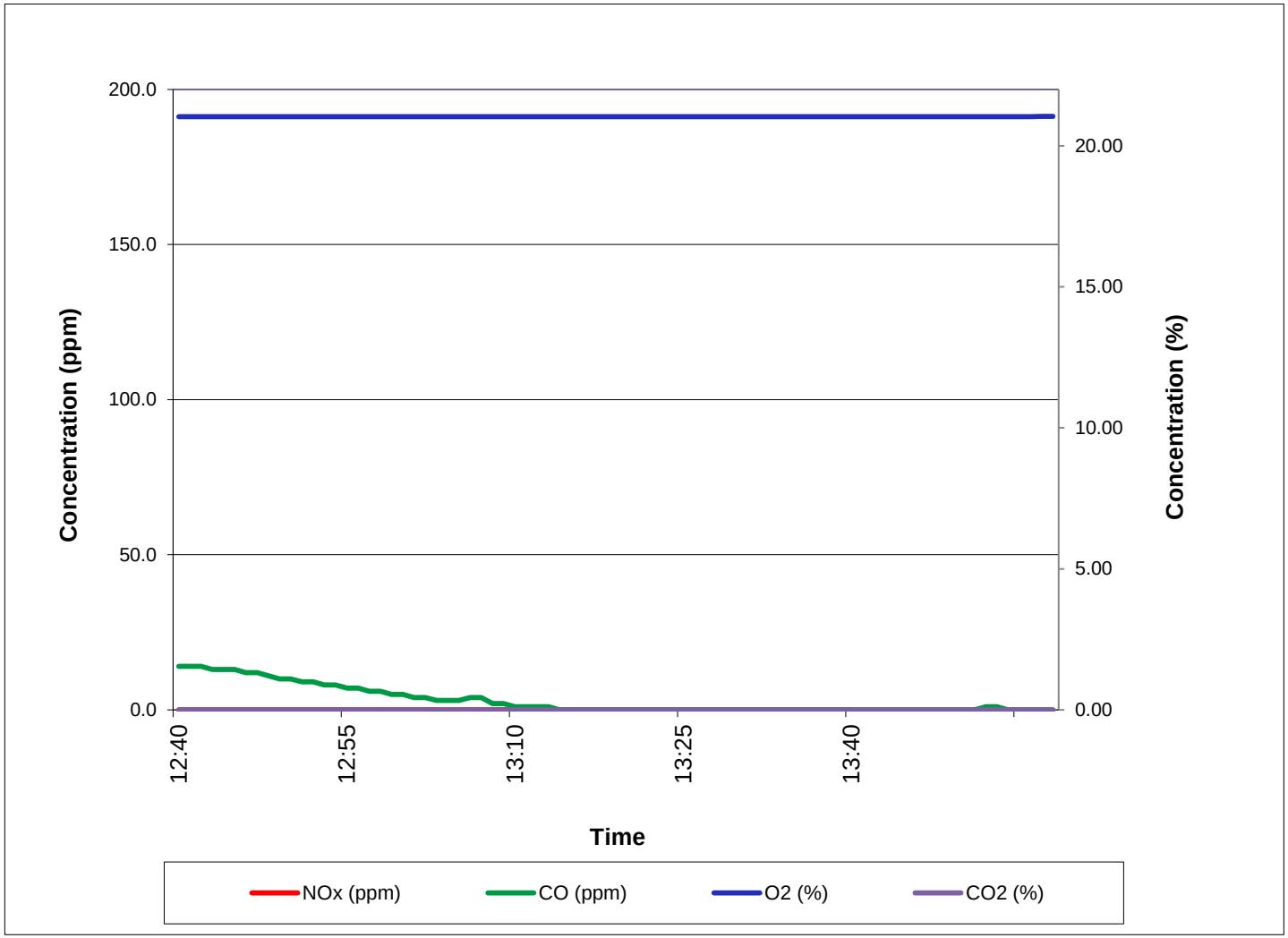
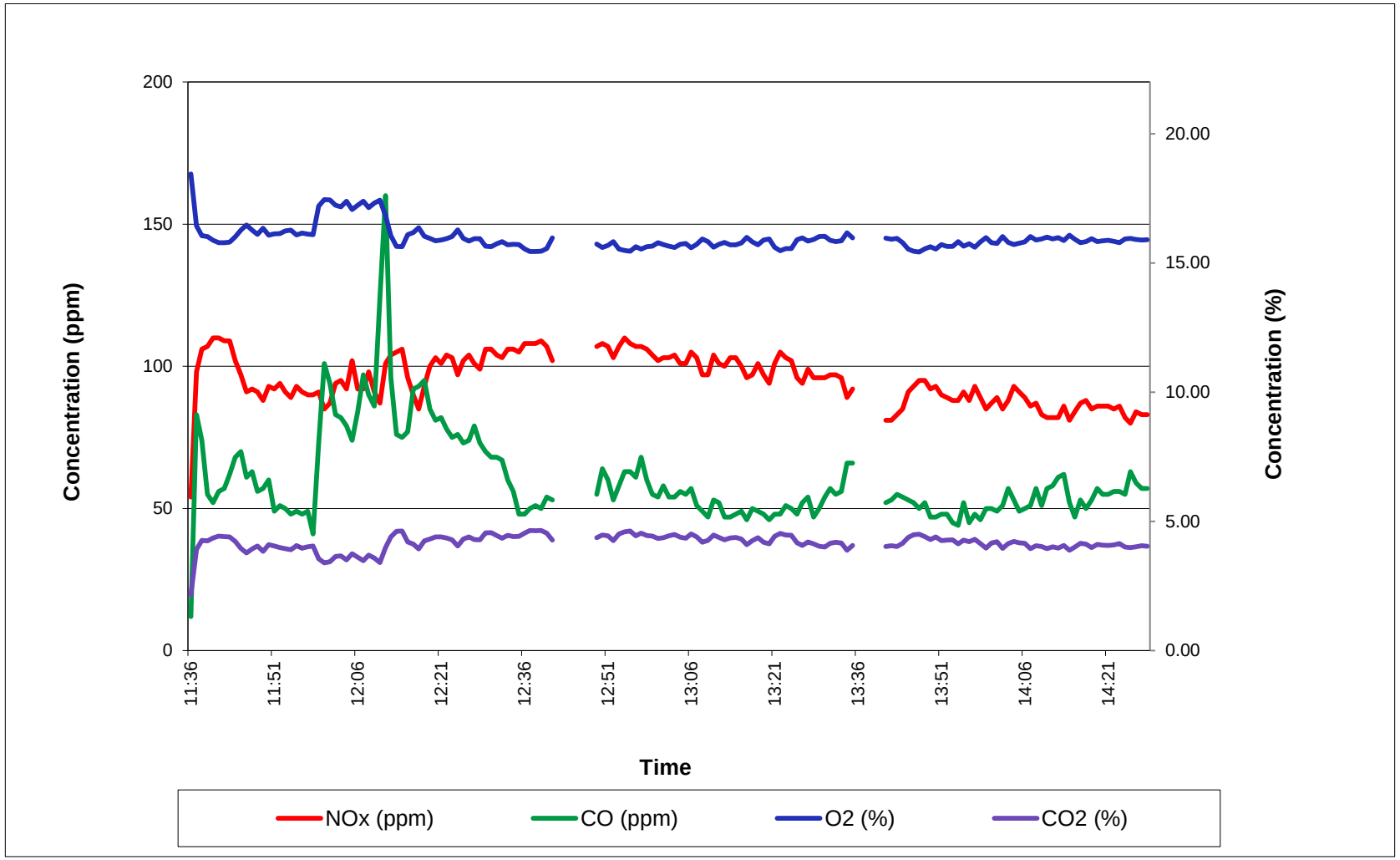


FIGURE B-3 CONTINUOUS LOG RECORD - NO_x, CO, CO_2 & O_2 OUTLET LOCATION, SEPTEMBER 1, 2016



APPENDIX C – NATA ENDORSED EMISSION TEST REPORT

Stephenson
Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

52A Hampstead Road
Auburn NSW 2144 Australia
Tel: (02) 9737 9991
E-Mail: info@stephensonenv.com.au

Emissions Test Report No. 5707

The sampling and analysis was commissioned by:

Client	Organisation:	Borg Manufacturing
	Contact:	Victor Bendevski
	Address:	Lowes Mount Road, Oberon NSW 2787
	Telephone:	02 4340 8271
	Email:	bendevskiv@borgs.com.au
	Project Number:	5707/S24371B/16
	Test Date:	1 September 2016
	Production Conditions:	Normal operating conditions during testing
	Analysis Requested:	Flow, temperature, moisture, Carbon Monoxide, Carbon Dioxide, Nitrogen Oxides, Oxygen and Formaldehyde.
	Sample Locations:	Paper Treater, Wet Scrubber and Conti-2 Heat Plant
	Sample ID Nos.:	See Attachment A

NATA accredited laboratory number 15043.
Accredited for Compliance with ISO/IEC 17025.

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.	
Test	***Test Method Number for Sampling and Analysis***	***NATA Laboratory Analysis By: NATA Accreditation No. & Report No.***
Carbon Monoxide	NSW TM-32	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Carbon Dioxide	NSW TM-24	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Dry Gas Density	NSW TM-23	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Aldehydes/Formaldehyde	NSW TM-34 / WorkCover Method 179	Test Safe Australia, Accreditation No. 3726 Reports No.2016 -2756
Oxides of Nitrogen	NSW TM-11	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Deviations from Test Methods	Nil	
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.	

Reference Conditions NSW - As per

(1) Environment Protection Licence conditions, or

(2) Part 3 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date
14 September 2016

P W Stephenson

SUMMARY OF THE AVERAGE EMISSION RESULTS – TEST REPORT NO. 5707

Parameter	Unit of measure	Inlet Location 1 Paper Treater exhaust		Inlet Location 2 Scrubber exhaust		Outlet Conti 2 Heat Plant	
		Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Exhaust gas temperature	°C	62	68	23.9	28.7	260	280
Normal stack gas flow rate	m^3/min	381	360	36	34	2545	2498
Moisture content	%	1.4	2.3	2.4	2.5	4.8	4.8
Oxygen	%	19.8		21.0		16.0	
Nitrogen Oxides	mg/m^3	10		< 2		195	
Carbon Monoxide	mg/m^3	30		4		75	
Carbon Dioxide	%	0.7		0.0		4.2	
Formaldehyde concentration	mg/m^3	26.6	26.3	3.4	4.15	<0.0081	<0.0081
Formaldehyde mass emission rate	g/s	0.17	0.16	0.0021	0.0024	<0.0003	< 0.0003

Key:

<	=	less than the limit of detection for the analytical method
%	=	percentage
°C	=	degrees Celsius
m^3/min	=	cubic metres per minute @ 0°C and 1 atmosphere
mg/m^3	=	milligrams per cubic metre @ 0°C and 1 atmosphere
g/s	=	grams per second mass emission rate
mg/m^3	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kpa)

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Carbon Dioxide	TM-32, USEPA 10	15%
Carbon Monoxide	TM-24, USEPA 3A	1% actual
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen	TM-24, TM-25, USEPA 3A	1% actual
Formaldehyde	OSHA-64 (WCA Method 179)	7%
Velocity	AS4323.1, TM-2, USEPA 2	5%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96)
(Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m³ which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m³ correlates to 5 mg/m³ with most quoted uncertainties of ± 5.3 mg/m³ @ 6.4 mg/m³. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m³ under lab conditions.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Lab. Reference: 2016-2756

Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

SAMPLE ORIGIN: 5707

DATE OF INVESTIGATION: 01/09/2016 **DATE RECEIVED:** 5/09/16

ANALYSIS REQUIRED: Aldehyde Screen

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Martin Mazereeuw
Manager
Date: 12/09/16

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179

ilac-MRA NATA
Accreditation No. 3726
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Test Safe AUSTRALIA

Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Formaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	**400.2 ± 87.2**	**433.4 ± 94.5**
2016-2756-2	725729	**399.0 ± 87.0**	**423.5 ± 92.3**
2016-2756-3	725730	**102.5 ± 22.3**	ND
2016-2756-4	725731	**124.5 ± 27.1**	**0.29 ± 0.06**
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Acetaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	**0.89 ± 0.19**	**1.78 ± 0.39**
2016-2756-2	725729	**0.64 ± 0.14**	**1.73 ± 0.38**
2016-2756-3	725730	**3.74 ± 0.82**	**0.83 ± 0.18**
2016-2756-4	725731	**3.76 ± 0.82**	**0.63 ± 0.14**
2016-2756-5	725732	ND	**0.51 ± 0.11**
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

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Test Safe AUSTRALIA

Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Chloroacetaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Acrolein (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

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Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Crotonaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Valeraldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

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Analysis of Aldehydes in Air

Client : Jay Weber

SEMA

Date Sampled : 1-Sep-2016

Project No. : 5707

ND = Not Detected

Method : Analysis of Aldehydes in Air by HPLC
Method Number : WCA.179
Detection Limit : 0.25 µg Aldehydes/Sample
Brief Description : The aldehyde concentrations in air are determined by drawing a volume of air through a glass fibre filter which has been impregnated with 2,4-dinitrophenylhydrazine (DNPH) derivatizing agent. The aldehyde-DNPH derivative is then eluted from the tfilter with acetonitrile and analysed by HPLC using 365 nm UV detection.

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Sampling Parameters
The measurement uncertainty relates to the analysis of the analyte on the sampling device and does not take into consideration the sampling parameters such as pump flowrate, time, temperature and pressure.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

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APPENDIX D – INSTRUMENT CALIBRATION DETAILS

TABLE D-1 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
859	Digital Temperature Reader	30-Jun-16	30-Dec-16
921	Thermocouple	30-Jun-16	30-Dec-16
894	Thermocouple	30-Jun-16	30-Dec-16
879	Digital Manometer	26-Feb-16	26-Feb-17
613	Barometer	26-Feb-16	26-Feb-17
726	Pitot	03-Jun-16	03-Jun-2017 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
646	Stopwatch	25-Jul-16	25-Jan-17
946	Testo 350 (cal check each job)	19-Aug-16	19-Feb-17
655	Testo 350 (cal check each job)	19-Aug-16	19-Feb-17
832	Personal Sampler	22-Mar-16	22-Mar-17
12	Personal Sampler	05-Aug-16	06-Aug-17
833	Personal Sampler	22-Mar-16	22-Mar-17
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
245 ppm 245 ppm 250 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALSB 1372	05-Jan-20
393 ppm 399 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen	ALSM 1604	25-Oct-18
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18
383 ppm	Sulphur Dioxide In Nitrogen	ALSD 3948	25-Oct-18

APPENDIX E – SAMPLE LOCATIONS

FIGURE E-1 INLET LOCATION 1 – PAPER TREATER DUCT

FIGURE E-2 INLET LOCATION 2 – WET SCRUBBER DUCT

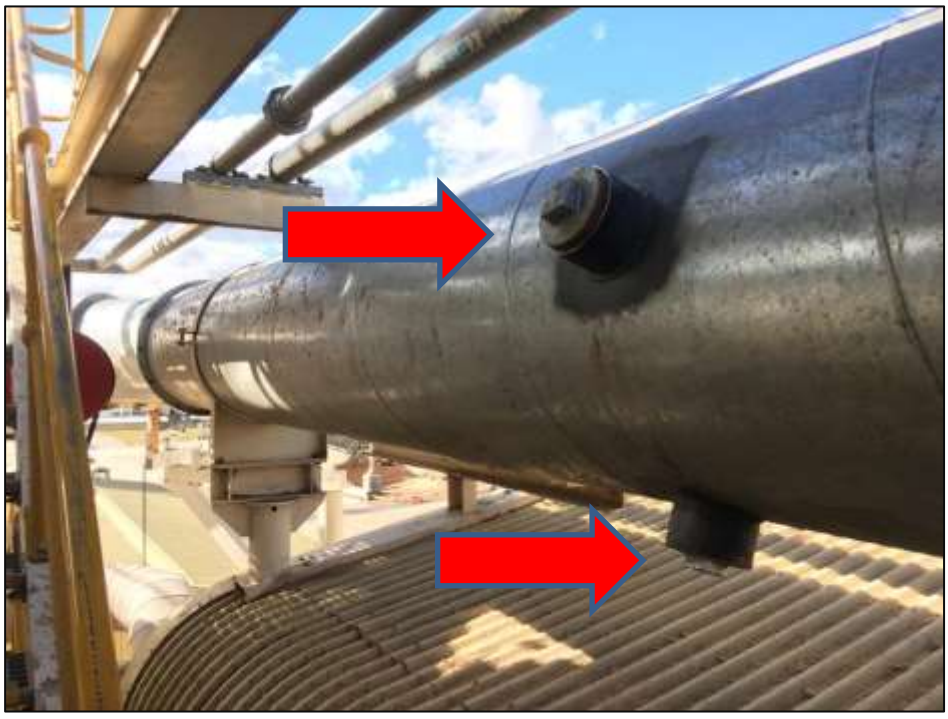

FIGURE E-3 OUTLET LOCATION – CONTI-2 HEAT PLANT OUTLET

FIGURE E-4 CONTI-2 HEAT PLANT OUTLET BYPASS DAMPER CONTROLS (DAMPER SHUT)

APPENDIX F – PRODUCTION INFORMATION

FIGURE F-1 SCREEN SHOT 1- HEAT PLANT

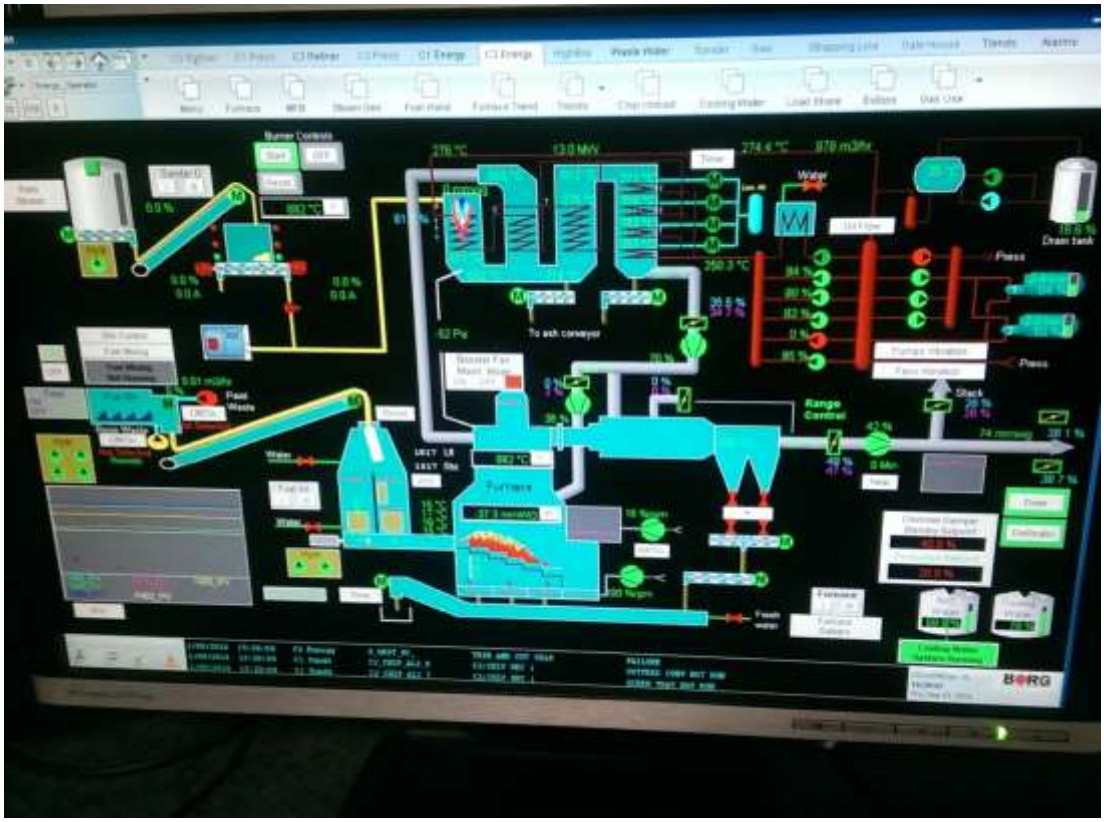

FIGURE F-2 SCREEN SHOT 2 – HEAT PLANT

FIGURE F-3 SCREEN SHOT 3 – HEAT PLANT

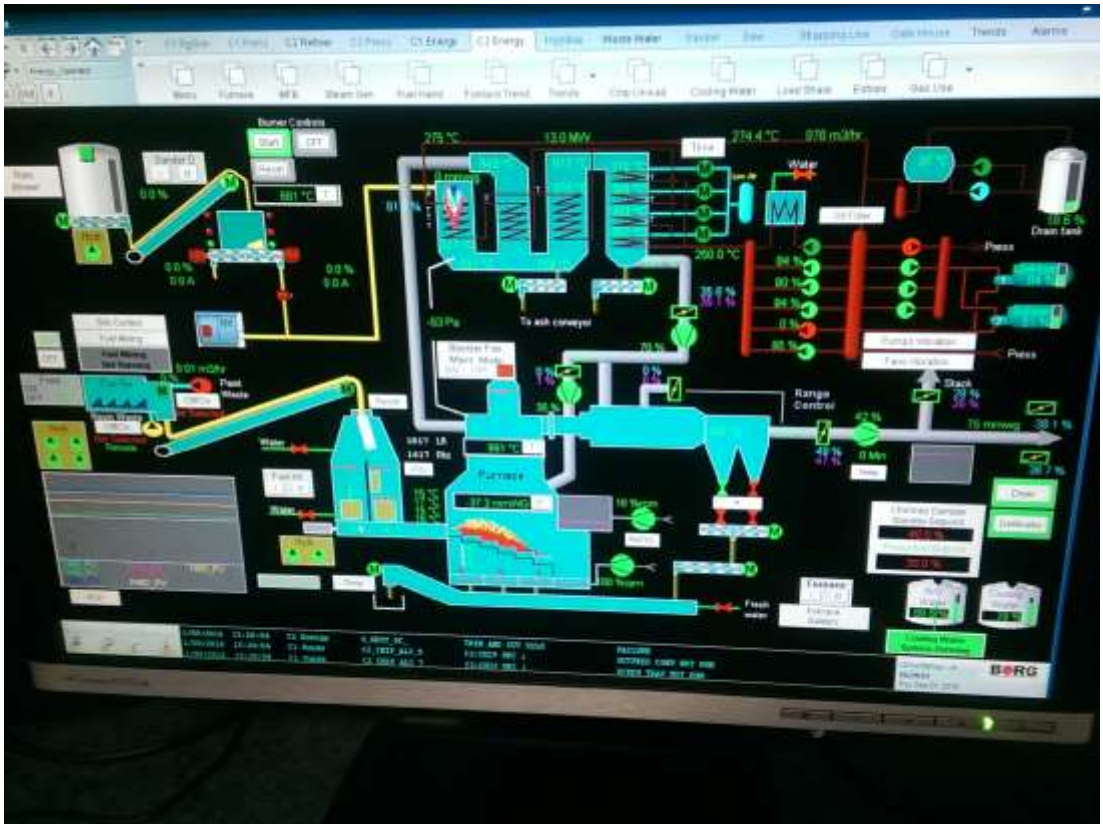

FIGURE F-4 SCREEN SHOT 4 – PAPER TREATER (GRAVURE COATER)

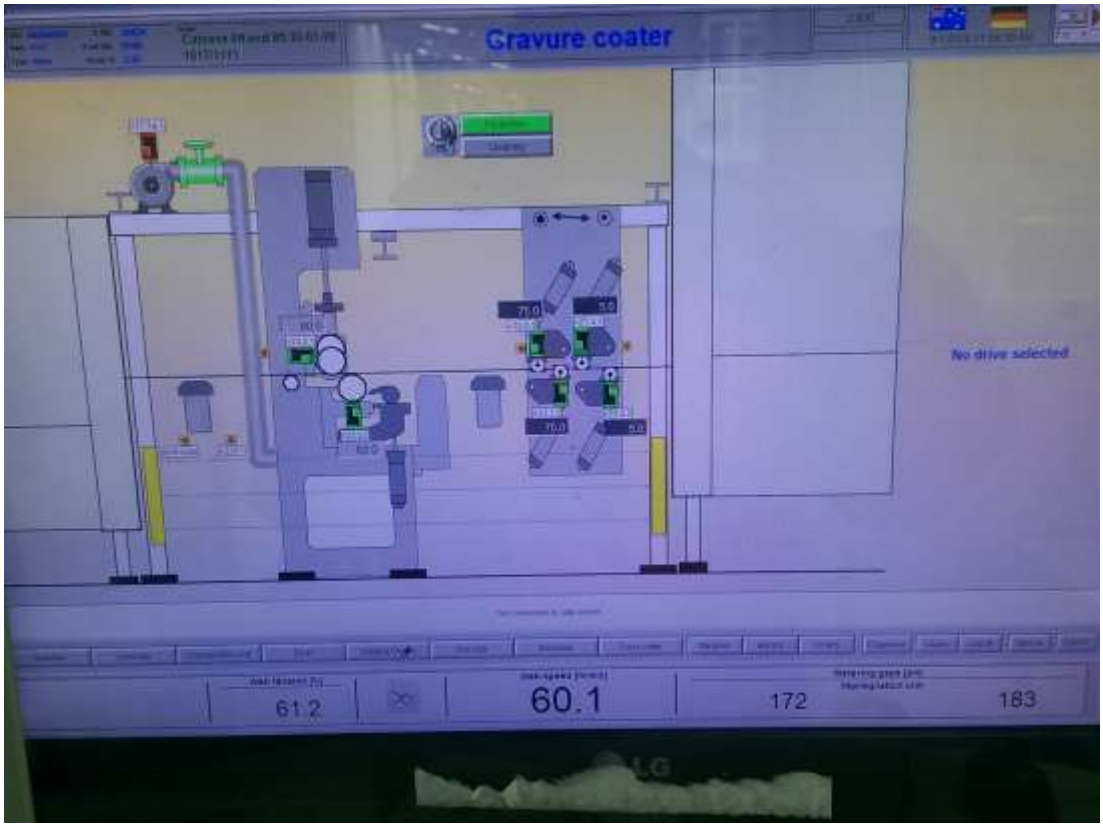

FIGURE F-5 SCREEN SHOT 5 – PAPER TREATER (CROSS CUTTER)

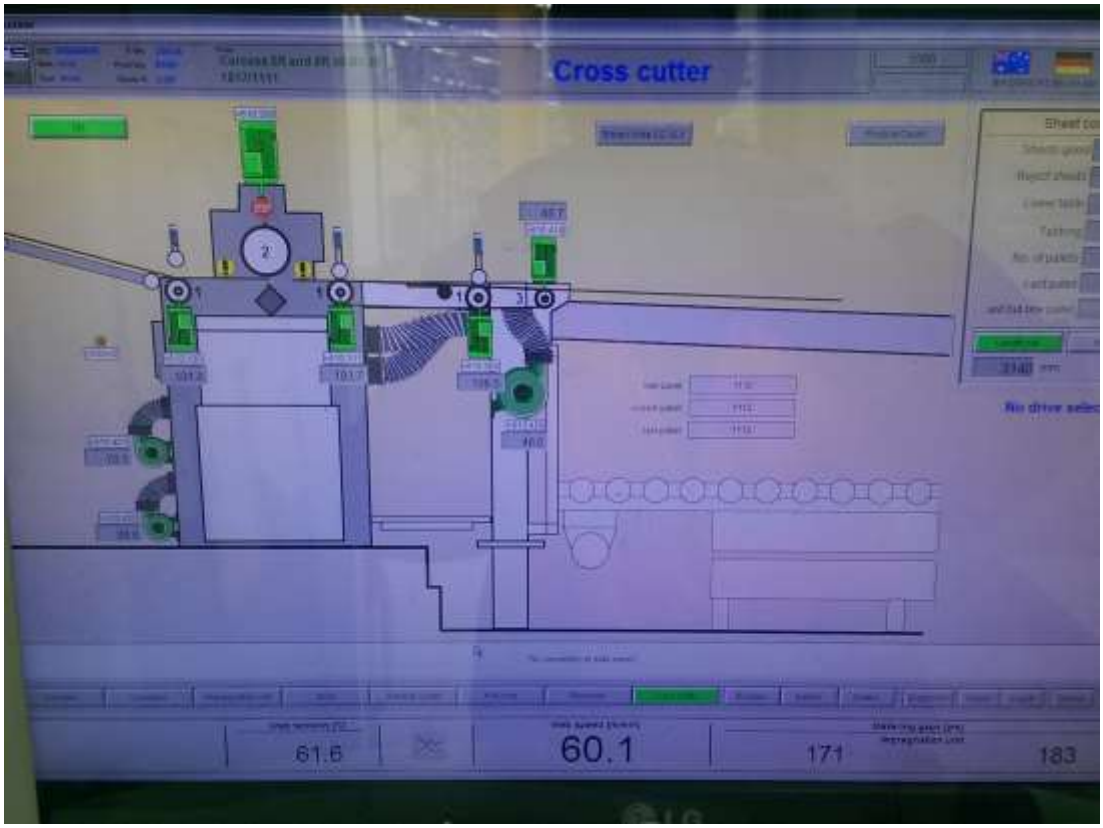

FIGURE F-6 SCREEN SHOT 6 – PAPER TREATER (IMPREGNATION UNIT)