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Emissions Testing for Downer EDI from the Asphalt Plant Release Point at the Archerfield facility

This document is an initial release

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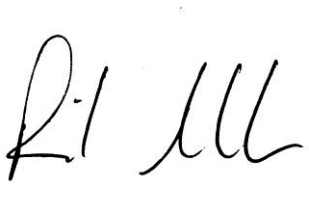
NATA
WORLD RECOGNISED ACCREDITATION

Accreditation Number:
15438

Quality checked by



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1 EXECUTIVE SUMMARY

The following tables provide a summary of results for emission monitoring conducted by Pacific Environment Monitoring for Downer Infrastructure on the 30th October 2013 at their Archerfield Asphalt facility. For further details, refer to supporting document and tables in the results section below

Table 1: Results Summary: Main Stack

Compound	Unit of measure	Result	License Limit	Oxygen Reference	Compliant Yes/No	Number of Samples
Particulates	mg/Nm^3	4.1	50	N/A	Y	1
Velocity [1]	m/s	18	16.3	N/A	Y	2
PM10 [2]	mg/Nm^3	< 4.1	25	N/A	Y	1
CO	mg/Nm^3	409	150	N/A	N	1
H2S	mg/Nm^3	< 0.61	5	N/A	Y	1
NOx	mg/Nm^3	49	50	N/A	Y	1
VOCs	mg/Nm^3	47	50	N/A	Y	1
Odour	OU	1516	1600	N/A	Y	1
PAH (BaP) [3]	µg/Nm^3	0.36	1	N/A	Y	1
Total Metals [4]	µg/Nm^3	50	100	N/A	Y	1

Notes:

1. Reported result is as measured at the sample location.
2. Assuming all particulate matter is PM_{10}.
3. Using total of 16 priority PAH pollutants and the Malcom & Dobson Benzo-a-pyrene (BaP) equivalent – upper bound.
4. Sum of antimony, arsenic, cadmium, lead, mercury & vanadium. Upper bound (sum of all detection limits).
5. Shaded cells are above permit condition limits.

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2 INTRODUCTION

Pacific Environment was commissioned by Downer Infrastructure to monitor emissions from their Archerfield Asphalt Plant. Sampling was conducted by Pacific Environment on the 30th October, 2013.

Pacific Environment was responsible for the collection and analysis of all samples. The collected samples remained sealed and preserved according to method specifications. Upon return to the laboratory the samples were prepared and analyzed by the listed methodologies in table 3.

3 TEST METHODS & TECHNICAL COMMENTS

Unless otherwise stated, the following test methods meet the requirements of Queensland EHP. All sampling and analysis was conducted by Pacific Environment unless otherwise stated. The results presented in this report are related to one or more reference calibrations held by Pacific Environment.

3.1 Sampling Locations

The reference method sampling locations are described in the table and figures to follow.

Table 2: Main Stack sampling location summary

Stack Parameter	Unit
Dimensions (m)	1.1
Port size (inches)	4"
Port Thread Type	Flange
Number of traverses	2
Number of points per traverse	8
Total number of traverse points	16
AS4323.1 Compliance	Compliant, Non-ideal,

3.2 Test Methods

Table 3: Test Methods

Emission Test	Method	Unit of Measure	Analytical Laboratory
Traverse point selection	AS4323.1	-	1
Temperature	USEPA Method 2	°C	1
Velocity	USEPA Method 2	m/s	1
Volumetric flowrate	USEPA Method 2	m^3/min	1
Moisture content	USEPA Method 4	%	1
Carbon dioxide	USEPA Method 3A	%	1
Oxygen	USEPA Method 3A	%	1
Particulate matter (PM)	AS 4323.2	mg/Nm^3	1
Particulate matter < 10 microns (PM_{10})	AS 4323.2	mg/Nm^3	1
Carbon monoxide (CO)	USEPA Method 10	mg/Nm^3	1
Nitrogen oxides (NOx)	USEPA Method 7E	mg/Nm^3	1
Total heavy metals	USEPA Method 29	µg/Nm^3	2
Total Volatile organic compounds	USEPA Method 25A	µg/Nm^3	1
Hydrogen sulphide (H_2S)	USEPA Method 15	µg/Nm^3	1
Polycyclic aromatic hydrocarbons (PAH)	CARB 429	µg/Nm^3	3
Odour	AS4323.2	OU	1

Table 4: Laboratory Scope

Analysis Note	Company	Accreditation ID	Report Number
1	Pacific Environment	NATA: 15438	08238
2	Envirolab Services	NATA: 2901	100402
3	AsureQuality	IANZ / ILAC MRA: 131	143742

Table 5: NATA Analysis Scope

Company	Accreditation ID	Scope of accreditation (laboratory analysis)
Pacific Env.	NATA: 15438	Particulate Matter – balance weighing – Yes VOCs – Yes
Envirolab Services	NATA: 2901	Heavy Metals – Yes
AsureQuality	IANZ: 131	PAHs - Yes

Table 6: Sampling Notes

Note	Comment
Sample location	Sample location is compliant, but non-ideal as per AS 4323.1. It is less than 6, but greater than 2 diameters downstream from a disturbance.
PAHs	A singular PAH sample was collected and analyzed for this project.
PM_{10}	Due to process time restrictions, sample port access and the expected low concentration of total particulate matter, an individual PM_{10} sample was not collected. The measured total particulate matter showed a very low result, approaching the limit of detection for a standard particulate test, therefore when establishing compliance to a standard, assuming 100% of the collected particulate matter is PM_{10} demonstrates a 'worst case' scenario.
Metals	The reported total heavy metals result includes the sum of all listed metals in the Archerfield environmental permit, including those below the limit of detection. Only Cadmium (0.6 µg/Nm^3) and Lead (31 µg/Nm^3) were found in the sample above the limit of detection.

3.3 Test Equipment

The sampling equipment was transported to site in Pacific Environment's mobile lab; the lab was set up at the base of the main stack and acted as a temporary site office and lab whilst on site. Sampling consoles, analysers, calibration gases and sample recovery equipment were set up inside the van with umbilical's connecting these sampling consoles to the probes and impingers at the platform level of the stack. This area also provides a clean area in which to carry out the sample recovery and an air-conditioned environment for the analysers to operate in.

Figure 1: On-site sampling

All equipment used during the course of the testing meets all relevant performance standards as required by all jurisdictions. The isokinetic equipment used for this project was from Apex Instruments. Combustion gases were monitored using a Thermo 60i combustion gas analyser.

Figure 2: Full Isokinetic Sampling ensemble (Apex Instruments)

3.4 Technical Notes

3.4.1 Main Stack

3.4.1.1 CARB Method 429

- The supplied Benzo-a-Pyrene (BaP) Potency Equivalency Factors (PEF) in this report are referenced to a WHO published document entitled 'Environmental Health Criteria 202', specifically table AI.9, using 'Malcom & Dobson – 1994' factors. One sample was collected from each source.

3.4.1.2 USEPA Method 3A & 7E

- Calibrations of the analyser sampling for gas densities CO_2, O_2 and CO occurred at the beginning of each day of sampling. Direct analyser calibrations were firstly performed, followed by a system bias check, where calibration gas is sent to the probe of the sampling system to determine any possible bias introduced by the sampling system. For each days calibration check, no adjustments needed to be made to the analyser, i.e. no significant drift had occurred between calibration check events.

3.4.1.3 USEPA Method 25A

- USEPA Method 25A samples for total volatile organic compounds (TVOC) via a flame ionization detector analyzer. Samples were taken on site with flex-foil bags and analyzed later that day at Pacific Environment Monitoring office.
- Emission rate calculations for the TVOC results are calculated using data from a separate velocity traverse conducted at the time of the TVOC sample.
- The FID instrument measures ppm-propane Total VOC on a wet basis at 0°C, therefore results are converted to dry using moisture values from corresponding isokinetic runs.

3.4.2 Operational Data

Table 7: Operation details

Item	Detail
Production rate	170 tph
Product made/materials	DG 14
Mixing vessels operating	Rotary drying drum
Mixing temperatures	Drum: 210 °C Bag-filter: 120 °C

4 QUALITY ASSURANCE & QUALITY CONTROL (QA/QC)

Pacific Environment operates within a quality system based upon the requirements of ISO17025. Our quality system defines specific procedures and methodologies to ensure any project undertaken by Pacific Environment is conducted with the highest level of quality given the specific confines of each project.

The overall objective of our QA/QC procedures is to representatively sample and accurately analyse components in the gas streams and therefore report valid measurements of emission concentrations.

To ensure representativeness of field work, our quality procedures target:

1. Correct sampling locations
2. Sample time
3. Frequency of samples and
4. Method selection & adherence

To ensure representativeness of lab work, our quality procedures target:

1. Sample preservation
2. Chain of custody (COC)
3. Sample preparation and
4. Analytical techniques

Pacific Environment maintains strict quality assurance throughout all its sampling programs, covering on-site 'field work' and the analytical phase of our projects. Our QA program covers the calibration of all sampling and analytical apparatus, where applicable, and the use of spikes, replicate sample and reference standards.

The test methodologies used for this project are outlined in section 3 of this document. Field test data has been recorded and calculated using direct entry into Microsoft Excel spreadsheets following the procedures of the appropriate test methods. Determination of emission concentrations has been performed using the same Microsoft Excel spreadsheets. Additional information can be supplied upon request.

QA/QC checks for this project used validation techniques and criteria appropriate to the type of data and the purpose of the measurement to approve the test report. Records of all data collected will be maintained by PE-M. Complete chain of custody (COC) procedures has been followed to document the entire custodial history of each sample. The COC forms also served as a laboratory sheet detailing sample ID and analysis requirements.

Table 8: Sampling data QA/QC checklist

Sampling Data QA/QC Checklist	Comment
Use of appropriate test methods	Yes
'Normal' operation of the process being tested	Yes – as instructed by Downer Staff
Use of properly operating and calibrated test equipment	Yes
Use of high purity reagents	Yes
Performance of leak checks post sample (at least)	Yes

Table 9: Laboratory Data QA/QC checklist

Laboratory Data QA/QC Checklist	Comment
Use of appropriate analytical methods	Yes
Use of properly operating and calibrated analytical equipment	Yes
Precision and accuracy comparable to that achieved in similar projects	Yes
Accurate reporting	Yes

5 DEFINITIONS

The following terms and abbreviations may be used in this report:

Table 10: Definitions

Symbol	Definition
<	The analytes tested for was not detected; the value stated is the reportable limit of detection
NT	Not tested
Am^3	Gas volume in cubic meters at measured conditions
AS	Australian Standard
BH	Back half of sample train (filter holder and impingers) (referred to during sample recovery)
^oC	Degrees Celsius
dscm	dry standard cubic meters
FH	Front half of sample train (probe and filter holder) (referred to during sample recovery)
g	Grams
kg	Kilograms
m	Meters
m^3	actual gas volume in cubic meters as measured
mb	Millibars
mg	Milligrams (10^{-3} grams)
min	Minute
ml	Milliliters
mmH_2O	Millimeters of water
Mole	SI unit that measures the amount of substance
N/A	Not applicable
ng	Nanograms (10^{-9} grams)
Nm^3	Gas volume in dry cubic meters at standard temperature and pressure (0°C and 101.3 kPa)
PM	Particulate matter
ppm-c	Parts per million referenced to carbon
ppm-p	Parts per million referenced to propane
s	Second
Sm^3	Gas volume in dry cubic meters at standard temperature and pressure (0°C and 101.3 kPa) and corrected to a standardised value (e.g. 7% O_2)
STP	Standard temperature and pressure (0°C and 101.3 kPa)
TVOC	Total volatile organic compounds
µg	microgram (10^{-6} grams)
USEPA	United States Environmental Protection Authority
*	Indicates compounds that are not covered under the respective analytical labs' accreditation scope

5.1 Document Control

Table 11: Document Control

Report ID	Date	Comment	Author	QA	Recipient
08238 R_0	3rd December 2013	Initial release	TB	DA	Simon Moroney

6.0 RESULTS

Table 12: Test Information

Source Data				Stack SDS version - 3.03		Stack SDS version - 3.03
Client				Downer EDI		Downer EDI
Site				Archerfield		Archerfield
Sample Point				Kiln Stack		Kiln Stack
Reference Method				USEPA M29 - Metals - ISOKINETIC		CARB 429 - PAH - ISOKINETIC
Test Parameters				PM & HM		PAH
Process conditions				DG14		DG14 @ 170tph
Historical Data & Hardware Information - Manual Sample						
Run Start Date		dd-mm-yy		Wednesday, 30 October 2013		Wednesday, 30 October 2013
Project ID				08238		08238
Run ID				-1		-2
Run Start Time	Ti	hh:mm		9:26:00		7:19:00
Run Stop Time	Tf	hh:mm		11:42:00		8:46:00
Positioning compliance check with AS4323.1				Non-ideal		Non-ideal
Flow & temperature compliance check with AS4323.1				YES		YES
Traverse pt factors; up, down, total & trav pts				1.1, 1, 1.1, 16		1.1, 1, 1.1, 16
Console Serial Number				SN256		SN256
Meter Calibration Factor	(Y)			0.990		0.990
Orifice Coefficient		($DH_@$)		45.35		45.35
Pitot Tube Coefficient	(C_p)			0.84		0.84
Actual Nozzle Diameter	($D_{n,a}$)	mm		5.55		5.55
Stack Test Data						
Initial Meter Volume	($V_{m,i}$)	m^3		6.272		4.622
Final Meter Volume	($V_{m,f}$)	m^3		7.585		5.937
Actual Sampling Time	(Q)	minutes		80		80
Average Meter Temperature	(t_{m})$_{avg}$	°C		28		26
Average Stack Temperature	(t_{s})$_{avg}$	°C		111		110
Barometric Pressure	(P_b)	mb		1014		1014
Stack Static Pressure	(P_{static})	mm H_2O		-16		-16
Absolute Stack Pressure	(P_s)	mb		1012		1012
Sample Volumes						
Actual Meter Volume	(V_m)	m^3		1.300		1.302
Standard Meter Volume	(V_m)$_{std}$	Nm^3		1.181		1.194
Moisture Content Data						
Impingers 1-3 Water Volume Gain	(V_n)	ml		184		194
Impinger 4 Silica Gel Weight Gain	(W_n)	g		10		15
Total Water Volume Collected	(V_{lc})	ml		194		209
Calculated Stack Moisture	($B_{wr(calc)}$)	%		18		19
Stack Gas Density Analysis Data						
Carbon Dioxide Percentage	(%CO_2)	%		4.2		4.2
Oxygen Percentage	(%O_2)	%		15.4		15.6
Carbon Monoxide Percentage	(%CO)	%		0.0		0.0
Nitrogen Percentage	(%N_2)	%		79		79
Dry Gas Molecular Weight	(M_d)	kg/Nm3		1.3		1.3
Dry Gas Molecular Weight	(M_d)	g/g-mole		29		29
Wet Stack Gas Molecular Weight	(M_s)	g/g-mole		27		27
Volumetric Flow Rate Data (at Sample Plane)						
Average Stack Gas Velocity	(v_s)	m/sec		18		19
Stack Diameter	Ds	m		1.1		1.1
Stack Cross-Sectional Area	(A_s)	m^2		0.95		0.95
Upstream distance (from disturbance)	B	m		3.6		3.6
Downstream distance (from disturbance)	A	m		3.0		3.0
Actual Stack Flow Rate	(Q_{sa})	m^3/min		1,040		1,061
Wet Standard Stack Flow Rate	(Q_{sw})	Nm^3/min-wet		739		756
Dry Standard Stack Flow Rate	(Q_{sd})	Nm^3/min-dry		606		613
Percent of Isokinetic Rate	(I)	%		96		96
Particulate Matter (PM) Concentration						
Total Mass of Particulates	(m_n)	g		0.0048		
Stack PM Concentration	(c_s)	mg/Nm^3		4.1		
Stack PM Concentration at 12 % CO2	(c_s)	mg/Nm^3		4.4		
Particulate Emission Rate	(E)	g/min		2.5		
Particulate Uncertainty Calculation						
Uncertainty expressed at 95%CI	(U)	%		Non ideal.		Non ideal.
Uncertainty expressed at 95%CI	(U)	mg/Nm^3		Cannot quote		Cannot quote
Instrumental Analyser - Historical Data & Hardware Information						
Analyser serial number, make & model		value		SN034		SN034
Analyser Run Start Time	Ti	hh:mm		9:26:51		8:04:45
Analyser Run Stop Time	Tf	hh:mm		11:14:59		8:45:47
Analyser Total Sampling Time	(Q)	hh:min		1:48		0:41
Instrumental Analyser Raw Data Averages						
Oxides of Nitrogen	(NOx)	ppm		24		
Carbon Monoxide	(CO)	ppm		327		
age Oxides of Nitrogen (USEPA Method 7E - instrumental analyser)						
Nitrogen Oxides (NOx as NO2)	(Conc)	mg/Nm3		49		
Nitrogen Oxides (NOx as NO2)	(Conc)	mg/Nm3		53		
Nitrogen Oxides (NOx as NO2)	(E)	g/min		30		
erage Carbon Monoxide (USEPA Method 10 - instrumental analyser)						
Carbon Monoxide (CO)	(Conc)	mg/Nm^3		409		
Carbon Monoxide at 7 % O2	(Conc)	mg/Nm3		441		
Carbon Monoxide (CO)	(E)	g/min		248		
Heavy Metals (USEPA Method 29)						
Antimony		µg/Nm^3	<	4.8		
Arsenic		µg/Nm^3	<	4.8		
Cadmium		µg/Nm^3		0.59		
Lead		µg/Nm^3		31		
Vanadium		µg/Nm^3	<	6.0		
Mercury		µg/Nm^3	<	2.7		
OTHER ANALYTES						
Odour	(Conc)	ou				1,516
Odour emission rate	(E)	ou/min (wet)				1,147,075
Total VOCs - as propane	(Conc)	mg/Nm3				47
Total VOCs - as propane emission rate	(E)	g/min				29
Hydrogen Sulphide	(Conc)	mg/Nm3			<	0.61
Hydrogen Sulphide emission rate	(E)	g/min			<	0.37
PAHs (CARB 429) ANALYTE						
Naphthalene	(Conc)	µg/Nm^3				279
2-Methylnapthalene	(Conc)	µg/Nm^3				196
Acenaphthylene	(Conc)	µg/Nm^3				23
Acenaphthene	(Conc)	µg/Nm^3				6.7
Fluorene	(Conc)	µg/Nm^3				9.3
Phenanthrene	(Conc)	µg/Nm^3				14
Anthracene	(Conc)	µg/Nm^3				1.8
Fluoranthene	(Conc)	µg/Nm^3				0.56
Pyrene	(Conc)	µg/Nm^3				1.0
Benz[a]anthracene	(Conc)	µg/Nm^3				0.015
Chrysene	(Conc)	µg/Nm^3				0.044
Benzo[b]fluoranthene	(Conc)	µg/Nm^3				0.0058
Benzo[k]fluoranthene	(Conc)	µg/Nm^3				0.0033
Benzo[e]pyrene	(Conc)	µg/Nm^3				0.0050
Benzo[a]pyrene	(Conc)	µg/Nm^3			<	0.0014
Perylene	(Conc)	µg/Nm^3				0.0024
Indeno[123-c,d]pyrene	(Conc)	µg/Nm^3			<	0.0021
Dibenzo (a,h) pyrene	(Conc)	µg/Nm^3			<	0.0020
Benzo[g,h,i]perylene	(Conc)	µg/Nm^3				0.0021
Total Target PAHs - LOWER	(Conc)	µg/Nm^3				531
Toxic CARB Benzo [a] pyrene equivalents - LOWER	(Conc)	µg/Nm^3				0.00
Toxic USEPA Benzo [a] pyrene equivalents - LOWER	(Conc)	µg/Nm^3				0.00
WHO - Malcom & Dobson (1994)	(Conc)	µg/Nm^3				0.35
Total Target PAHs - MEDIUM	(Conc)	µg/Nm^3				531
Toxic CARB Benzo [a] pyrene equivalents - MEDIUM	(Conc)	µg/Nm^3				0.00
Toxic USEPA Benzo [a] pyrene equivalents - MEDIUM	(Conc)	µg/Nm^3				0.00
WHO - Malcom & Dobson (1994)	(Conc)	µg/Nm^3				0.36
Total Target PAHs - UPPER	(Conc)	µg/Nm^3				531
Toxic CARB Benzo [a] pyrene equivalents - UPPER	(Conc)	µg/Nm^3				0.01
Toxic USEPA Benzo [a] pyrene equivalents - UPPER	(Conc)	µg/Nm^3				0.01
WHO - Malcom & Dobson (1994)	(Conc)	µg/Nm^3				0.36