13 October 2017

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Our ref: 2126310-11444
Your ref:

Dear John

Shoalhaven Starches Mod 13 Air Quality Assessment
Updated Cumulative Air Quality Assessment

1 Introduction

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to conduct a cumulative air quality impact assessment for the proposed modification 13 (MOD 13) at the Shoalhaven Starches manufacturing facility located on Bolong Road, Bomaderry, New South Wales (NSW).

MOD 13 includes modification of Boilers No. 2 and 4 and the installation of an additional baghouse on Boiler 6 for the proposed optimisation of energy use and steam production.

EPA requested that Manildra perform a cumulative assessment of air pollutants in accordance with the EPA Approved Methods 2016.

This letter outlines the assessment methodology and the predicted cumulative odour impacts of MOD 13 and other approved modifications at the site.

This letter should be read in conjunction with Air Quality Assessment Proposed Modifications to Boilers No. 2, 4 and 6 Shoalhaven Starches Bolong Road, Bomaderry NSW (Stephenson Environmental Management Australia, July 2017) and Shoalhaven Starches Ethanol Upgrade Air quality Assessment (GHD, 2008).

2 Assessment overview

GHD conducted a cumulative air quality assessment of the site in 2008 which included assessment of TSP, PM_{10}, NOx, SOx, CO, Heavy Metals (Type I & II), VOC, and PAH. Various modifications have been conducted since then, however since the original assessment predicted pollutants to be significantly below the criteria, no cumulative assessments have been undertaken for some time. EPA has requested that a cumulative assessment be conducted including all existing and proposed sources up until and including MOD 13. The EPA also advised to include the following:

- $PM_{2.5}$ (if PM_{10} levels are significant)
- Hydrogen Fluoride (HF)
- Take into account background TSP levels (nearest monitoring station is Albion Park)

- Provide some commentary around what the available best practice emissions controls are.

3 Background air quality

The OEH runs a state wide air quality monitoring network, with the nearest monitoring site to Shoalhaven Starches being Albion Park South. Albion Park South commenced operation in 2006 meaning that daily background particulate levels ($PM_{2.5}$ and PM_{10}) cannot be directly compared to the GHD Calpuff model of the site which uses meteorology from 2004.

Background levels of pollutants used in the assessment are provided in Table 1, with the exception of $PM_{2.5}$ and PM_{10}, which is based on 2004 data from Wollongong. This is because the nearest monitoring station that operated in 2004 with both $PM_{2.5}$ and PM_{10} data is the Wollongong site, approximately 20 km to the north of Albion Park. Wollongong generally experiences elevated particulate levels compared to Albion Park South due to the greater presence of emissions from urban and industrial sources (refer to Table 2).

Highest measured levels of particulate for the year 2004 at Wollongong are shown in the contemporaneous assessment in Section 5.

A reasonable representation of ambient $PM_{2.5}$ and PM_{10} (24-hour) concentration levels is the 70th percentile for use in plotting general cumulative impacts. The 70th percentile at Albion Park South in 2016 was 18.3 $\mu g/m^3$ for PM_{10} and 8.0 $\mu g/m^3$ for $PM_{2.5}$.

Table 1 Background Air Quality Data – Albion Park South (2016)

Pollutant	Averaging Period	Concentration (100 percentile)	Units
Nitrogen dioxide (NO_2)	1 hour	80.8	$\mu g/m^3$
	Annual	7.1	
Sulphur dioxide (SO_2)	1 hour	57.6	$\mu g/m^3$
	24 hour	1.6	
	Annual	15.7	
Carbon monoxide (CO) [1]	1 hour	1.0	mg/m^3
	8 hour	0.6	
PM_{10}	24 hours	43.2	$\mu g/m^3$
	Annual	14.9	
$PM_{2.5}$	24 hours	30.7	$\mu g/m^3$
	Annual	7.2	

[1] CO was sourced from the Wollongong monitoring station as this was not available at Albion Park South

The contemporaneous particulate assessment was undertaken using data from Wollongong in 2004. A review of particulate levels at Wollongong and Albion Park is provided in Table 2. Average particulate levels at Wollongong have reduced from 2004 to 2016. Levels at Albion Park South in 2016 are lower than the levels at Wollongong over the same period.

Table 2 Review of particulate monitoring at Albion Park South and Wollongong

Site and Year	Albion Park 2016	Wollongong 2016	Wollongong 2004
Average PM_{10}	14.9	17.3	25.5
70^{th} percentile PM_{10}	18.3	20.7	28.8
90^{th} percentile PM_{10}	25.6	29.7	37.8
Average $PM_{2.5}$	7.2	7.4	9.7
70^{th} percentile $PM_{2.5}$	8.0	8.3	12.2
90^{th} percentile $PM_{2.5}$	11.2	11.6	16.4

Shoalhaven Starches engaged Stephenson Environmental Management Australia to conduct targeted background ambient air quality monitoring at 26 Coomea Street, Bomaderry over four seasons. (AMBIENT AIR QUALITY MONITORING –SUMMARY REPORT 2015-2016, Stephenson Environmental Management Australia, April 2016). The maximum measured levels of pollutants measured over the monitoring periods with a 24 hour averaging period were:

- SO_2 – 10.2 $\mu g/m^3$
- NO_2 – 54.5 $\mu g/m^3$
- PM_{10} – 28.1 $\mu g/m^3$

The results show all pollutants are significantly lower than the levels recorded at Albion Park South, and would include any emissions from the Shoalhaven Starches site. The maximum levels all readily comply with the relevant criteria. Using the background data from Albion Park South in this assessment allows for additional conservatism.

4 Emissions inventory

Air emissions associated with the operation of the Shoalhaven Starches facility and proposed ethanol upgrade may include:

- Odour;
- Particulate matter; and
- Products of combustion.

Odour for MOD13 has been addressed in GHD's assessment "Shoalhaven Starches Mod 13 Air Quality Assessment Cumulative odour assessment".

- Emission rates used in the assessment are presented below in Table 3.

All modelling assumptions are the same as the 2008 Air Quality Assessment (GHD, 2006) with the exception of the following sources:

- Boiler 2, 4 and 5/6 have been based on monitoring data and scaled where appropriate
- Ring dryer 5 emissions based off measured in stack emissions and a flow rate of 853 m^3/min
- Gluten dryer 7 based on data provided in the SEMA report "Stack Emission Survey – TSP emissions Gluten Dryers 6 and 7" (June 2014)
- Packing plant based on emission rates in the SEMA report "Air Quality Impact Assessment Proposed Modifications to Approved Packing Plant (December 2015)
- New flour mill B based on emission rates in the SEMA report "Air Quality Impact Assessment Proposed Flour Mill B (October 2016)

Levels of Sulphur Dioxide (SO_2) at the site have decreased over time, due to the use of coal with a lower sulphur content. A figure showing the average SO_2 emissions at the site from 2011 to 2017 is shown in Attachment A.

Table 3 Emission Inventory – Particulate Matter

Discharge Point	Emission Control	TSP g/s	PM_{10} g/s
Boiler No. 1	Gas-fired	0.07	0.07
Boiler No. 2	Cyclone and fabric filter	0.14	0.07
Boiler No. 3	Gas-fired	0.04	0.04
Boiler No. 4	Cyclone and fabric filter	0.25	0.13
Boiler No. 5/6	Cyclone & Fabric filter	1.03	0.53
Gluten dryer No. 1	Fabric filter	0.015	0.0003
Gluten dryer No. 2	Fabric filter	0.015	0.001
Gluten dryer No. 3	Fabric filter	0.02	0.02
Gluten dryer No. 4	Fabric filter	0.02	0.02
Starch dryer No. 1	Wet-scrubber	0.59	0.18
Starch dryer No. 3	Wet-scrubber	0.04	0.013
Starch dryer No. 4	Wet-scrubber	1.2	0.31
Starch dryer No. 5	Cyclone	0.39	0.12
Spray dryer	Fabric filter	0.48	0.14
Flour Mill	Fabric filter	0.03	0.009

Discharge Point	Emission Control	TSP g/s	PM_{10} g/s
DDG Pellet Plant	Fabric Filter	0.25	0.25
Packing Plant (proposed)	Fabric Filter	0.016	0.016
Flour Mill B (proposed)	Fabric Filter	0.0054	0.0054
Gluten dryer No. 6	Fabric filter	0.02	0.02
Gluten grinder	Fabric filter	0.02	0.02
Boiler No. 7	Gas-fired	0.07	0.07
Co-generator turbine No. 1 (proposed)	Gas-fired	0.1	0.1
Co-generator turbine No. 2 (proposed)	Gas-fired	0.1	0.1

All modelling assumptions for combustion sources are the same as the 2008 Air Quality Assessment (GHD, 2006) with the exception of the following:

- Manildra undertakes quarterly air quality sampling of the existing coal fired boiler (No. 5/6). A review of the sampling results for the last year shows that quarter 3 (sampling undertaken on 1 December 2016) has the highest overall emissions for most pollutants. A summary of this report is shown in Attachment B. Emissions were sourced from the Stephenson report "Compliance stack emission survey – Quarter No 3 2016-2017 Emission Survey – Boilers 5 & 6" (December 2016). Emissions from this boiler have been scaled to approximate emissions from Boiler 2 and Boiler 4 when they are converted to run on coal.
- Stack parameters for Boilers No. 2 and No. 4 were taken from SEMA report "Air quality impact assessment Proposed Modifications to boilers 2, 4 and 6" (June 2017).

Pollutants from combustion in the site boilers and turbines are presented in Table 4. Reference SEMA reports used to calculate concentrations of metals are provided in Attachment C.

Table 4 Emission Inventory - Products of Combustion

Discharge Point[1]	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4	Boiler No. 5/6	Boiler No. 7	Turbine No. 1 & 2
Status	Existing	Existing	Existing	Existing	Existing	Existing	Proposed
Fuel type	Natural gas	Coal	Natural gas	Coal	Coal	Natural gas	Natural gas
Stack height (m)	25	39	20	39	54	25	30

Discharge Point[1]	Boiler No. 1	Boiler No. 2	Boiler No. 3	Boiler No. 4	Boiler No. 5/6	Boiler No. 7	Turbine No. 1 & 2
Exhaust temp. (°K)	180	138	180	138	150	180	160
Stack diameter (m)	0.9	0.63	0.9	1.16	2.05	1.0	0.5
Exhaust velocity (m/s)	25	19.9	25	5.8	16.8	25	25
Oxygen (%)	ND	ND	ND	ND	9.2	ND	ND
Moisture (%)	ND	ND	ND	ND	6.6	ND	ND
Exhaust Flow rate (Nm^3/s)	ND	4.5	ND	8.4	33.8	ND	ND
Emission rates (g/s)							
Carbon monoxide	0.82	0.59	0.42	1.09	4.39	0.82	0.3
Oxides of nitrogen	2.7	2.11	1.4	3.92	15.83	2.7	2.0
Sulphur dioxide	3.8E-05	2.54	2.0E-05	4.71	19.04	3.8E-05	0.012
Heavy metals (type 1)	2.0E-05	1.33E-04	1.0E-05	2.47E-04	9.99E-04	1.5E-05	ND
Heavy metals (type 2)	5.9E-05	2.22E-04	3.1E-05	4.12E-04	1.66E-03	5.9E-05	ND
Total VOC	5.3E-02	5.40E-03	2.8E-02	1.00E-02	4.05E-02	5.3E-02	4.2E-02
PAH	6.2E-06	3.67E-06	3.2E-06	6.82E-06	2.75E-05	6.2E-06	4.4E-05
HF	ND	2.91E-02	ND	5.40E-02	2.18E-01	ND	ND

ND: No Data.

5 Predicted impacts

5.1 Particulates

The air quality impacts of PM_{10} and TSP emissions from Shoalhaven Starches operation have been assessed using atmospheric dispersion modelling.

The impact of dust emissions principally relates to the potential effect on human health of inhalation of particles in the air column, and it is the finer fraction that have the greater potential to cause respiratory health effects. EPA have advised to assess $PM_{2.5}$, if PM_{10} impacts are significant. The $PM_{2.5}$ emissions from many sources on site are not known, however guidance is available for estimates of $PM_{2.5}$ from boilers in the NPI. NPI emission factors for coal boilers with a baghouse states that $PM_{2.5}$ emissions are half of PM_{10} emissions and the ratio of $PM_{2.5}$ to PM_{10} in gas fired boilers is the same.

The worst case predicted incremental PM_{10} level is at R1 with a level of 9.2 µg/m^3. A contemporaneous assessment has been undertaken for the year 2004 in accordance with the Approved Methods. Predicted 24 hour $PM_{2.5}$ and PM_{10} values from the site in 2004 have been added to the 24 hour measured values at Wollongong for every day in the year. The top predicted, measured and total concentrations at the most impacted receptor (R1) are presented in Table 5 and Table 6 below. Results of the assessment show full compliance with the $PM_{2.5}$ and PM_{10} 24 hour criteria.

Table 5 Summary of highest measured and predicted PM_{10} levels (R1)

Date	PM_{10} background	Date	PM_{10} increment	Date	PM_{10} Total
08/03/2004	49.0	22/03/2004	9.2	26/03/2004	49.3
27/11/2004	48.4	10/03/2004	8.3	27/11/2004	49.0
21/02/2004	47.0	19/10/2004	5.5	08/03/2004	49.0
26/03/2004	46.1	23/09/2004	5.2	21/02/2004	47.8
08/12/2004	43.7	17/08/2004	5.0	09/02/2004	44.7
10/01/2004	43.4	18/01/2004	4.9	08/12/2004	43.9
09/02/2004	43.1	17/01/2004	4.6	10/01/2004	43.4
06/02/2004	41.2	01/03/2004	4.4	06/02/2004	42.9
07/12/2004	40.8	16/10/2004	4.4	22/01/2004	42.3
20/02/2004	40.4	14/01/2004	4.3	07/12/2004	41.6

Table 6 Summary of highest measured and predicted $PM_{2.5}$ levels (R1)

Date	$PM_{2.5}$ background	Date	$PM_{2.5}$ increment	Date	$PM_{2.5}$ Total
10/01/2004	22.6	22/03/2004	4.6	21/02/2004	22.7
21/02/2004	22.3	10/03/2004	4.2	10/01/2004	22.6
26/03/2004	19.9	19/10/2004	2.7	26/03/2004	21.5
06/02/2004	19.0	23/09/2004	2.6	06/02/2004	19.9
09/02/2004	18.3	17/08/2004	2.5	09/02/2004	19.1
11/02/2004	17.9	18/01/2004	2.4	11/02/2004	18.5
09/03/2004	17.6	17/01/2004	2.3	27/11/2004	17.8
08/03/2004	17.5	01/03/2004	2.2	13/03/2004	17.7
27/11/2004	17.5	16/10/2004	2.2	09/03/2004	17.6
13/03/2004	17.0	14/01/2004	2.2	08/03/2004	17.5

A summary of the maximum predicted levels at each receptor site is presented in Table 7.

Table 7 Maximum Predicted Ground Level PM10 and TSP Concentrations

Pollutant	Averaging Period	Criteria $\mu g/m^3$	Predicted Incremental Ground Level Concentration ($\mu g/m^3$)			
			Bomaderry (R1)	North Nowra (R2)	Nowra (R3)	Terara (R4)
PM_{10}	24-hour	50	9.2	5.6	7.6	6.3
PM_{10}	annual	25	0.9	0.5	0.7	1.1
TSP	annual	90	2.0	1.0	1.4	2.2

Plots of the predicted 24 hour maximum PM_{10} levels are provided in Figure 1 (incremental impact) and in Figure 2 (cumulative impact with 70th percentile PM_{10} levels at Albion Park South 2016 for comparative purposes).

Plots of the predicted 24 hour maximum $PM_{2.5}$ levels are provided in Figure 3 (incremental impact) and in Figure 4 (cumulative impact with 70th percentile $PM_{2.5}$ levels at Albion Park South 2016 for comparative purposes).

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- PM10 24HR concentration contour (µg/m3)

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-26310
Revision	A
Date	24 Aug 2017

Maximum Predicted Incremental Ground Level PM10 Concentrations (24 hour Average)

Figure 1

G:\21\26310\GIS\Maps\Deliverables\21_26310_Z002_Grids.mxd (SMA record: 6)

Data source: LPI, topographic base data, 2012. Created by:apmiller

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- PM10 24HR concentration contour (µg/m3)

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-26310
Revision	A
Date	24 Aug 2017

Maximum Predicted Cumulative Ground Level PM10 Concentrations (24 hour Average)

Figure 2

G:\21\26310\GIS\Maps\Deliverables\21_26310_Z002_Grids.mxd (SMA record: 7)

Data source: LPI, topographic base data, 2012. Created by:apmiller

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Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- PM2.5 24HR concentration contour (µg/m3)

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-26310
Revision	A
Date	13 Oct 2017

Maximum Predicted Incremental Ground Level PM2.5 Concentrations (24 hour Average)

Figure 3

G:\21\26310\GIS\Maps\Deliverables\21_26310_Z003_Grids.mxd (SMA record: 8)

Data source: NSW LPI, topographic base data, 2012. Created by:apmiller

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- PM2.5 24HR concentration contour (µg/m3)

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Shoalhaven Starches

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Maximum Predicted Cumulative Ground Level PM2.5 Concentrations (24 hour Average)

Figure 4

G:\21\26310\GIS\Maps\Deliverables\21_26310_Z003_Grids.mxd (SMA record: 9)

Data source: NSW LPI, topographic base data, 2012. Created by:apmiller

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

5.2 Products of combustion

The primary pollutants in coal and gas fired boiler emissions are oxides of nitrogen (NO_x), formed by the high temperatures in the combustors, sulphur dioxide (SO_2), formed from the sulphur content of the fuel, VOCs, polycyclic aromatic hydrocarbons (PAH), carbon monoxide (CO) and hydrogen fluoride (HF) all formed by incomplete combustion of the fuel.

NO_2, SO_2, and CO have all been assessed against their 'worst case' 1 hour criteria from the Approved Methods as these were found to be closest to the criteria in the 2008 assessment. Predicted levels all readily comply with the criteria .

Contour plots of cumulative NO_2 and SO_2 predictions are shown in Figure 5 and Figure 6.

Table 8 Maximum Predicted Ground Level Sulphur Dioxide Concentrations

Receptor	Averaging Period	Incremental Impact (μg/m³)	Background Concentration (μg/m³)	Total Impact (μg/m³)	Criteria (μg/m³)
Bomaderry (R1)	1 hour	102	57.6	159	570
North Nowra (R2)	1 hour	66	57.6	124	570
Nowra (R3)	1 hour	70	57.6	128	570
Terara (R4)	1 hour	62	57.6	120	570

Table 9 Maximum predicted Ground Level Nitrogen Dioxide Concentrations

Receptor	Averaging Period	Incremental Impact (μg/m³)	Background Concentration (μg/m³)	Total Impact (μg/m³)	Criteria (μg/m³)
Bomaderry (R1)	1 hour	127	80.8	208	246
North Nowra (R2)	1 hour	94	80.8	175	246
Nowra (R3)	1 hour	127	80.8	207	246
Terara (R4)	1 hour	91	80.8	172	246

Table 10 Maximum Predicted Ground Level Carbon Monoxide Concentrations

Receptor	Averaging Period	Incremental Impact (mg/m^3)	Background Concentration (mg/m^3)	Total Impact (mg/m^3)	Criteria (mg/m^3)
Bomaderry (R1)	1 hour	0.04	1	1.04	30
North Nowra (R2)	1 hour	0.03	1	1.03	30
Nowra (R3)	1 hour	0.04	1	1.04	30
Terara (R4)	1 hour	0.03	1	1.03	30

Table 11 Maximum Predicted Ground Level Hydrogen Fluoride Concentrations

Receptor	Averaging Period	Incremental Impact ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	Criteria ($\mu g/m^3$)
Bomaderry (R1)	24 hours	0.30	-	0.30	1.5
North Nowra (R2)	24 hours	0.23	-	0.23	1.5
Nowra (R3)	24 hours	0.18	-	0.18	1.5
Terara (R4)	24 hours	0.13	-	0.13	1.5

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- NO2 1HR concentration contour (µg/m3)

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Shoalhaven Starches

Job Number	21-26310
Revision	A
Date	13 Oct 2017

Maximum Predicted Cumulative Ground Level NO2 Concentrations (1 hour Average)

Figure 5

G:\21\26310\GIS\Maps\Deliverables\21_26310_Z003_Grids.mxd (SMA record: 10)

Data source: NSW LPI, topographic base data, 2012. Created by:apmiller

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Legend

- Packing plant (proposed)
- Shoalhaven Starches Factory
- Environmental farm boundary
- Identified sensitive receptors
- SO2 1HR concentration contour (µg/m3)

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-26310
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Date	13 Oct 2017

Maximum Predicted Cumulative Ground Level SO2 Concentrations (1 hour Average)

Figure 6

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Data source: NSW LPI, topographic base data, 2012. Created by:apmiller

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

6 VOCS

The maximum predicted (99.9 percentile, 1-hour average) ground level aggregate VOC concentration, at and beyond the factory site boundary, was 0.001 mg/m^3, which is lower than the respective EPA principal toxic air pollutant criteria for all the VOC compounds.

The maximum predicted (99.9 percentile, 1-hour average) ground level total VOC, at the most exposed sensitive receptor (R3), was 0.00025 mg/m^3, which is lower than the respective EPA principal toxic air pollutant criteria for all the VOC compounds.

7 PAH

The maximum predicted (99.9 percentile, 1-hour average) ground level total PAH concentration, at and beyond the factory site boundary, was 4.2 x 10^{-7} mg/m^3, which is lower than the EPA PAH criterion of 0.0004 mg/m^3.

The maximum predicted (99.9 percentile, 1-hour average) ground level total PAH, at the most exposed sensitive receptor (R3), was 2.25 x 10^{-7} mg/m^3, which is 0.05% of the criterion – that is more than 1000-fold below the criterion at the most exposed receptor.

8 Metals

The maximum predicted (99.9 percentile, 1-hour average) ground level heavy metal type 1 concentration, at the most exposed sensitive receptor (R1), was 0.0000038 mg/m^3 which is lower than the respective air quality criteria for all constituents (the lowest is cadmium at 0.000018 mg/m^3). The EPA criteria also require consideration of the maximum predicted ground level concentration at and beyond the site boundary of the factory. The maximum predicted level of type 1 metals at the site boundary is 0.0000073 mg/m^3 which is also below the worst case criteria. This is shown in Table 12.

The maximum predicted (99.9 percentile, 1-hour average) ground level heavy metal type 2 concentration, at the most exposed receptor (R1), was 0.0000068 mg/m^3, which is lower than the respective air quality criteria for all constituents, except for beryllium at 0.000004 mg/m^3. The maximum predicted (99.9 percentile, 1-hour average) ground level beryllium concentration at the most exposed sensitive receptor (R1) was 0.000000068 mg/m^3, which complies with the criterion.

The maximum predicted type 2 metals level at the site boundary is 0.000013 mg/m^3 which is also below the worst case criteria except for beryllium. The maximum predicted (99.9 percentile, 1-hour average) ground level beryllium concentration at the site boundary is 0.0000013 mg/m^3, which complies with the criterion. This is shown in Table 12.

Table 12 Maximum Predicted Ground Level Metals Concentrations

Pollutant	Receptor	Averaging Period	Predicted Impact (mg/m^3)	Criteria (mg/m^3)
Total type 1 metals	Bomaderry (R1)	1 hour	0.0000038	Cadmium 0.000018

Pollutant	Receptor	Averaging Period	Predicted Impact (mg/m^3)	Criteria (mg/m^3)
Total type 1 metals	Site boundary	1 hour	0.0000073	Cadmium 0.000018
Total type 2 metals	Bomaderry (R1)	1 hour	0.0000068	Beryllium 0.000004
Total type 2 metals	Site boundary	1 hour	0.000013	Beryllium 0.000004
Beryllium	Bomaderry (R1)	1 hour	0.000000068	Beryllium 0.000004
Beryllium	Site boundary	1 hour	0.0000013	Beryllium 0.000004

9 Best practice controls

Based on this air quality assessment, compliance is predicted for all pollutants at sensitive receptors and the site boundary where relevant. GHD finds the current controls in place - cyclone and fabric filters on Boilers 2, 4 and 5/6 to be best practice and no additional controls are currently recommended.

In the future, Shoalhaven Starches should include $PM_{2.5}$ sampling on all sources of combustion emissions during commissioning and ongoing air quality sampling.

10 Conclusion

GHD has undertaken a cumulative air quality assessment of site wide emissions. Results of the assessment show compliance with the air quality goals at all nearby receptors and at the site boundary. Shoalhaven should continue to monitor air emissions in accordance with their licence requirements.

Sincerely
GHD Pty Ltd

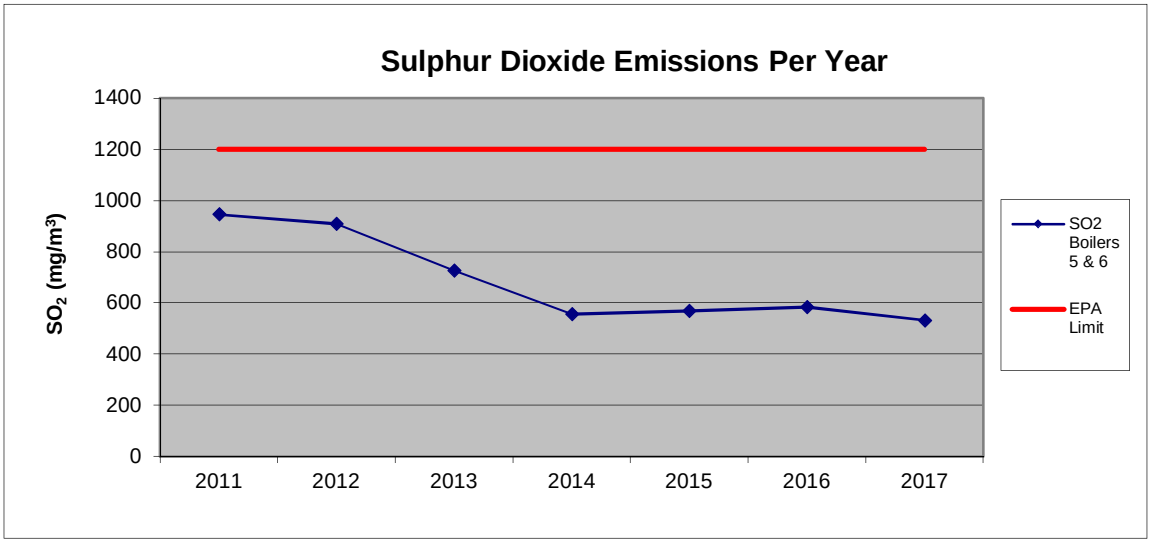
Evan Smith
Senior Environmental Engineer - Air and Noise Assessments
+61 2 9239 7695

Attachment A - Graph of SO_2 emissions at the site

Attachment B – Summary of Boiler 5 and 6 Quarterly Monitoring

Attachment C – SEMA metals sampling reports

Attachment A - Graph of SO_2 emissions at the site



Attachment B – Summary of Boiler 5 and 6 Quarterly Monitoring

Boiler 5 & 6 Quarterly Monitoring (Point 35)

Date	TSP Boilers 5 & 6 mg/m^3	EPL 100 Percentile Limit mg/m^3	NO2 Boilers 5 & 6 mg/m^3	EPL 100 Percentile Limit mg/m^3	SO2 Boilers 5 & 6 mg/m^3	EPL 100 Percentile Limit mg/m^3	VOC Boilers 5 & 6 mg/m^3	EPL 100 Percentile Limit mg/m^3
21/07/2017	15.7	50	397	500	536	1200	4.1	40
26/04/2017	7.1	50	449	500	510	1200	4.2	40
1/12/2016	**30.7**	50	**469**	500	**564**	1200	**1.2**	40
4/08/2016	20.5	50	478	500	517	1200	4.387	40
25/05/2016	8.3	50	460	500	**605**	1200	4.19	40
3/02/2016	40.9	50	456	500	583	1200	5.09	40
25/11/2015	13.9	50	413	500	576	1200	4.8	40
13/08/2015	18.4	50	447	500	567	1200	4.9	40
12/09/2014	30	50	469	500	592	1200	4.3	40
14/11/2014	17.3	50	387	500	565	1200	4.57	40
3/02/2015	**48.9**	50	**479**	500	555	1200	4.95	40
14/05/2015	13.5	50	368	500	566	1200	0.095	40
13/06/2014	19.2	50	415	500	575	1200	**5.3**	40
21/02/2014	46.2	50	415	500	533	1200	5.04	40
12/11/2013	13.4	50	378	500	561	1200	4.26	40
4/09/2013	16.0	50	310	500	540	1200		40
4/07/2013	17.0	50	320	500	580	1200		40
min	7.1	min	310.0	min	510.0	min	0.1	
max	48.9	max	479.0	max	605.0	max	5.3	
avg	22.2	avg	418.2	avg	560.3	avg	4.1	

Annual Averages

	TSP	Percentile	NO2	Percentile	SO2	Percentile	VOC	Percentile
2011	21.0	50	377	500	946	1200		40
2012	9.0	50	353	500	908	1200		40
2013	24.0	50	382	500	726	1200		40
2014	23.1	50	364	500	556	1200	4.65	40
2015	27.4	50	426	500	570	1200	3.48	40
2016	20.375	50	444	500	583	1200	4.745	40
2017	18.5	50	448	500	532	1200	3.472	40

Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
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EMISSION TEST REPORT NO. 5733B

COMPLIANCE STACK EMISSION SURVEY – QUARTER NO. 3, 2016-2017

EMISSION POINT EPL ID 35 - (SERVING BOILERS NO. 5 & 6)

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: **5733B/S24248/16**

DATE OF SURVEY: **1 DECEMBER 2016**

DATE OF ISSUE: **21 DECEMBER 2016 (ACTUAL FLOW 180817)**

1 EMISSION TEST REPORT NO. 5733B

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	5733/S24248/16
Test Date:	1 December 2016
Production Conditions:	Normal boiler operating conditions during emission testing.
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, Carbon Monoxide, Carbon Dioxide, Oxygen, Nitrogen Oxides, Particulate Matter less than 10 microns, Stack Pressure, Sulfur Dioxide, Total Solid Particulate Matter and Volatile Organic Compounds
Sample Locations:	EPL No.883; EPL ID No. 35 – Combined Stack Boilers No. 5 & 6
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 Dioxide	NSW TM-24, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Carbon Monoxide	NSW TM-32, USEPA M10	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Oxygen	NSW TM-25, USEPA M3A,	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2016

Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Sulfur Dioxide	NSW TM-4, USEPA M6C	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report No. 2016
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No 2016-4018

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) Schedule 4 and 5 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

21 December 2016 (actual volumetric flow added to Table 1.1 at request of GHD – 18/08/2017)

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 5733B

Parameter	Unit	Location EPL ID 35 (Boilers 5 & 6) Date Tested: 1 December 2016 Average Result	EPL(No.883) 100 Percentile Emission Concentration Limit (mg/m^3)
Temperature	^oC	150	N/A
Pressure	kPa	100.1	N/A
Velocity	m/s	16.8	N/A
Actual Volumetric Flow	Am^3/s	52.7	N/A
Volumetric Flow	m^3/s	31.5	N/A
Moisture	%	6.6	N/A
Molecular Weight Dry Stack Gas	g/g mole	29.9	N/A
Dry Gas Density	kg/m^3	1.34	N/A
Carbon Dioxide (CO_2)	%	9.8	N/A
Carbon Monoxide (1 hour block average) (at 7% O_2)	mg/m^3	130	N/A
Sulfur Dioxide (1 hour block average) (at 7% O_2)	mg/m^3	564	1,200
Nitrogen Oxides (1 hour block average) (at 7% O_2)	mg/m^3	469	500
Oxygen	%	9.2	> 5%
Particulate Matter less than 10 microns (at 7% O_2)	mg/m^3	15.9	N/A
Total Solid Particulates (at 7% O_2)	mg/m^3	30.7	50
Volatile Organic Compounds (as n-propane equivalent) (at 7% O_2)	mg/m^3	1.2	40
Volatile Organic Compounds (uncorrected for n-propane) (at 7% O_2)	mg/m^3	2.5	N/A

Key:

^oC	=	degrees Celsius
<	=	less than
>	=	greater than
%	=	percentage
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
Am^3/s	=	dry cubic metre per second @ in-stack conditions
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
m/s	=	metres per second
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)
N/A	=	Not referenced in EPL

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA 7E	15%
Oxygen and Carbon Dioxide	NSW TM-24, TM-25, USEPA 3A	1% actual
Carbon Monoxide	TM-32, USEPA 10	15%
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2,	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2,	50%
Particulate matter less than 10 microns	NSW OM-5, USEPA M201A	50%
Sulfur Dioxide	NSW TM-4, USEPA M6C	15%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA M18	25%

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*

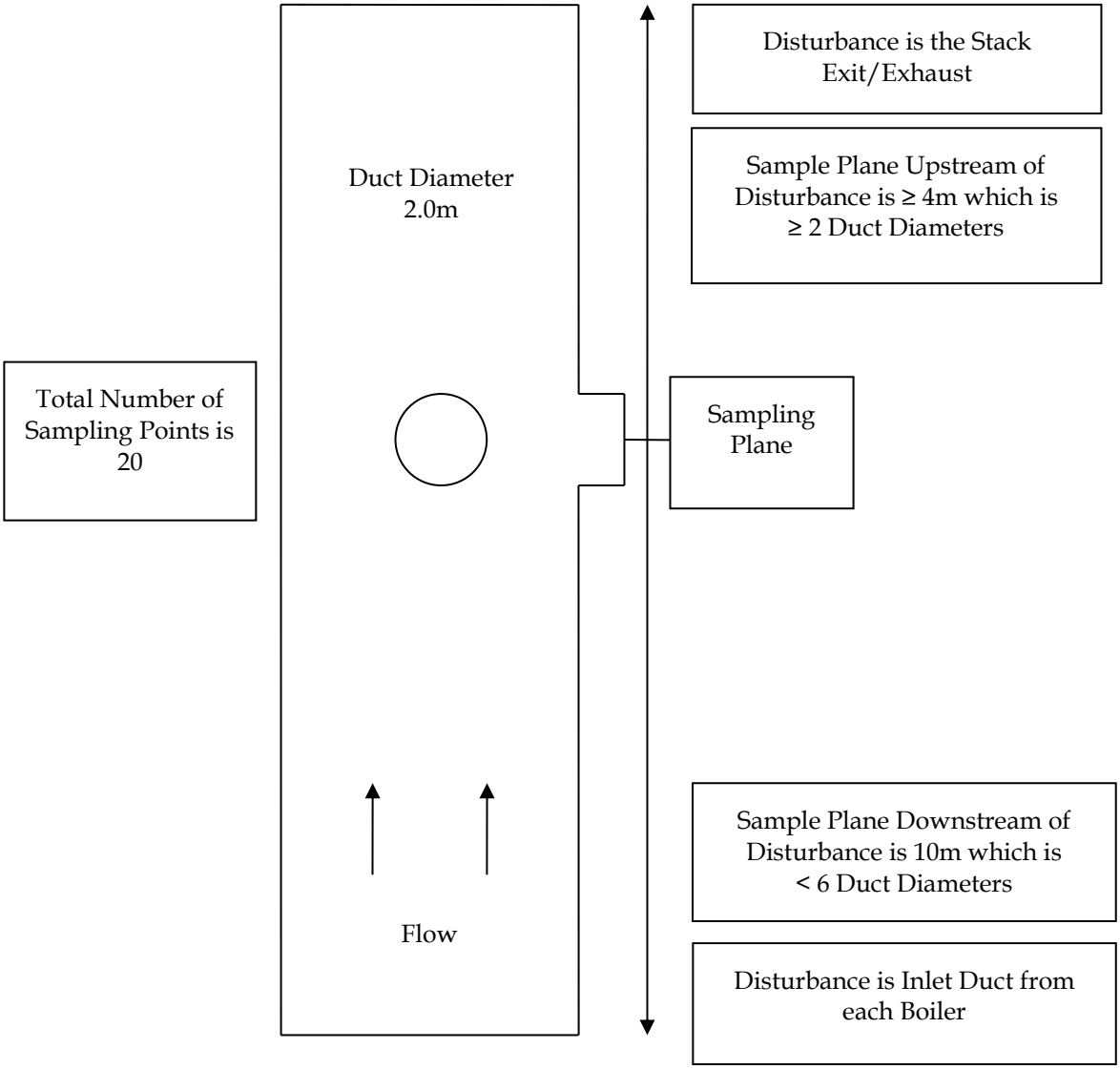
Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/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 ± 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.

1.3 CONTINUOUS LOGGED RECORD OF SO_2 AND NO_x – 1 DECEMBER 2016

FIGURE 1-1 CONTINUOUS LOGGED TREND OF SO_2 AND NO_x IN MG/M³ @ 7%O_2

1.4 SAMPLING LOCATION – BOILER NOS. 5 & 6



In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the sampling plane was non-ideal.

The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

1.5 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
647	Stopwatch	25-Jul-16	25-Jan-17
904	Gas Meter	06-Jun-16	06-Jun-17
859	Digital Temperature Reader	30-Jun-16	30-Dec-16
720	Thermocouple	29-Aug-16	01-Mar-17
427	Nozzle TSP Swagelok 2	10-Mar-16	10-Mar-17
885	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
937	Nozzle PM_{10} Head	06-Jan-16	06-Jan-17
924	Nozzle USEPA Metals Set Glass	06-Jan-16	06-Jan-17
835	Personal Sampler	22-Mar-16	22-Mar-17
936	Buck Calibrator 1cc/min - 6L/min	30-Aug-16	28-Feb-17
708	Gas Meter	21-Mar-16	21-Mar-17
792	Gas Meter	28-Jul-16	28-Jul-17
539	USEPA Meter Box (gas meter)	08-Mar-16	08-Mar-17
946	combustion analyzer	19-Aug-16	19-Feb-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	ALSM1604	25-Oct-18
383 ppm	Sulphur Dioxide In Nitrogen	ALSD 3948	25-Oct-18
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Ali Naghizadeh
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2016-4018

SAMPLE ORIGIN: Project No. 5733

DATE OF INVESTIGATION: 01/12/2016 **DATE RECEIVED:** 5/12/16

ANALYSIS REQUIRED: Volatile Organic Compounds 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.

Increment and total pagination can be seen on the following pages.

G O'Donnell

Greg O'Donnell

Date: 7/12/16

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Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Ali Naghizadeh

Sample ID : 725949 **Sample : 2016-4018-1**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	ND	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND	45	Styrene	100-42-5	ND	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	4	8
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	ND	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
	Total VOCs (LOD =50µg/compound/section)		ND	ND		Worksheet check		yes	yes

2016-4018.xlsx Page 2 of 3

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Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SW08051 1215

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Ali Naghizadeh

Stephenson Environmental Management Australia

ND = Not Detected
VOCs = Volatile Organic Compounds
All compounds numbered 1-73 are included of this analysis in the scope of NATA accreditation. Any additional compounds attonated with * are not covered by NATA accreditation.

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry
Method Number : WCA.207
Detection Limit : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section and aromatic hydrocarbon at 1µg/section.
Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS_2. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

Total Volatile Organic Compounds (TVOC) test result in µg/section is calculated by comparison to the average mass detector response of the 73 quantified compounds. The response of a mass detector is dependent on the fragmentation of the molecule. Therefore, the TVOC test result should be interpreted as a semi-quantitative guide to the amount of VOCs present. If the TVOC test result is less than the addition of the total amount of the 73 quantified compounds then the TVOC result is of little value other than for comparative purposes. If the TVOC test result is greater than the addition of all the compounds quantified then this can indicate that there are additional compounds present other than the 73 quantified compounds reported.

PGME : Propylene Glycol Monomethyl Ether
PGMEA : Propylene Glycol Monomethyl Ether Acetate
DGMEA : Diethylene Glycol Monoethyl Ether Acetate

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.

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. The laboratory has participated for many years in several national and international inter-laboratory comparison programs listed below:-
- Workplace Air, Ambient Air, and Stack Emissions Proficiency Testing Scheme conducted by LGC, UK;
- G-EQUAS - Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- PTA- Proficiency Testing Australia;

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ilac-MRA NATA

Accreditation No. 3726

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SW08051 1215

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Tel: (02) 9737 9991

E-Mail: info@stephensonenv.com.au

Particle Test Report No. 2016

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	5733/S24248/16
	Analysis Requested:	TM-15, OM-5
	Chain of Custody Number	S24539
	Date Analysis Completed:	9 December 2016
	No. of Samples Tested:	2
	Sample Locations:	EPL ID No. 35 (Boiler 5 & 6)
	Sample ID Nos.:	725969, 725970
	Filter ID Nos.:	14620, 14619

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

Identification — The filters 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	*Analysis Test Method*
TSP	AS4323.2:2001 (NSW TM-15)
PM_{10}	AS4323.2:2001 (NSW OM-5)

Deviations from Test Methods: Nil

Issue Date
16 December 2016

Jay Weber
Testing Supervisor

Gravimetric Results – Test Report No. 2016

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Boiler 5 & 6	725969	14620	01/12/2016	9/12/2016	0.02672
Boiler 5 & 6	725970	14619	01/12/2016	9/12/2016	0.01458

Key:
g = grams

Attachment C – SEMA metals sampling 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

EMISSION TEST REPORT NO. 5733/M

STACK EMISSION SURVEY – QUARTER NO. 3, 2016-2017

EMISSION POINT 35 SERVING BOILERS NO. 5 & 6

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: **5733/M/S24248/16**

DATE OF SURVEY: **1 DECEMBER 2016**

DATE OF ISSUE: **21 DECEMBER 2016**

NATA
WORLD RECOGNISED ACCREDITATION

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. 5733/M

HEXAVALENT CHROMIUM, HYDROGEN CHLORIDE AND METALS

The sampling and analysis was commissioned by:

Client	Organisation:	Shoalhaven Starches Pty Ltd
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	5733/M/S24248/16
	Test Date:	1 December 2016
	Production Conditions:	Normal boiler operating conditions during testing of parameters
	Analysis Requested:	Metals, Hexavalent Chromium, Hydrogen Chloride, Dry Gas Density, Flow, Moisture, Molecular Weight of Stack Gases, Temperature, Oxygen, Stack Pressure
	Sample Locations:	EPL No. 833 EPL ID No. 35 – Combined Stack Boilers 5 & 6
	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.

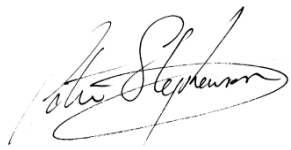
Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Hexavalent Chromium	NSW OM-4, Carb 425	SGS Environmental Services Accreditation No. 2562 Report No. SE159924
Hydrogen Chloride	NSW TM-7 & 8, USEPA M26 & 26A	SGS Environmental Services Accreditation No. 2562 Report No. SE159924
Metals	NSW TM-12, 13 & 14, USEPA M29	Envirolab Services Accreditation No. 2901 Report No. 158595 R02
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M
Oxygen	NSW TM-25, USEPA M3A,	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M

Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5733/M

Deviations from Test Methods	A field blank for metals analysis, which is required under USEPA M29, was not analysed. This was requested by the client for commercial reasons.
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) Schedule 4 and 5 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
21 December 2016



Peter Stephenson
Managing Director

1.1 SUMMARY OF THE AVERAGE EMISSION RESULTS – TEST REPORT NO. 5733/M

Parameter	Unit	Location – Boiler 5 & 6 (EPA ID 35)
		1 December 2016
		Average Result
Temperature	^oC	150
Pressure	kPa	100.1
Velocity	m/s	16.8
Volumetric Flow	m^3/s	31.5
Moisture	%	6.6
Molecular Weight Dry Stack Gas	g/g mole	29.9
Dry Gas Density	kg/m^3	1.34
Oxygen	%	9.2
Hydrogen Chloride (Average)	mg/m^3	6.71
Hexavalent Chromium (Cr^{+6})	mg/m^3	<0.0010
Metals - Type I & II Substances in Aggregate	mg/m^3	0.058
Antimony (Sb) Type I	mg/m^3	< 0.0039
Arsenic (As) Type I	mg/m^3	< 0.0039
Beryllium (Be) Type II	mg/m^3	0.0005
Cadmium (Cd) Type I	mg/m^3	0.0001
Chromium (Cr) Type II	mg/m^3	0.0029
Cobalt (Co) Type II	mg/m^3	0.0010
Lead (Pb) Type I	mg/m^3	0.0214
Manganese (Mn) Type II	mg/m^3	0.0052
Mercury (Hg) Type I	mg/m^3	0.0003
Nickel (Ni) Type II	mg/m^3	0.0057
Selenium (Se) Type II	mg/m^3	0.0194
Tin (Sn) Type II	mg/m^3	< 0.0097
Vanadium (V) Type II	mg/m^3	< 0.0049

Key:

^oC	=	degrees Celsius
<	=	less than
%	=	percentage
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
m/s	=	metres per second
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa)

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-M22, USEPA M4	25%
Hydrogen Chloride	NSW TM-7 & 8, USEPA M26 & M26A,	25%
Hexavalent Chromium (Cr^{+6})	NSW OM-4, Carb 425	200% ##
Metals - Type I & II Substances in Aggregate	NSW TM-12,13 & 14, USEPA M29	100%*(50-200%)**
Oxygen	NSW TM-24, USEPA M3A	1% actual
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%

Key:

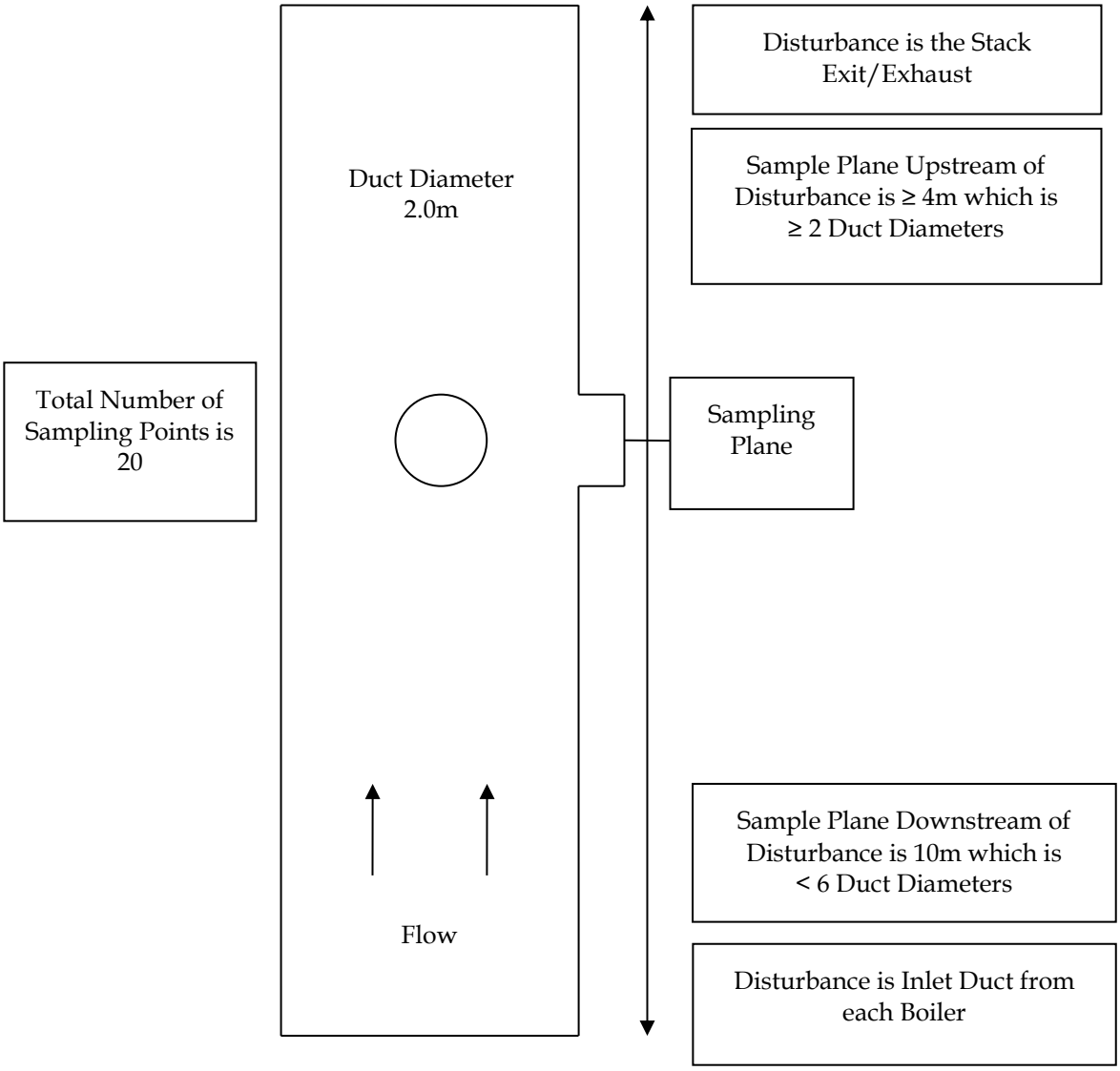
Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

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/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.

1.2 SAMPLING LOCATION – EPL ID 35: COMBINED STACK - BOILER NOS. 5 & 6



In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the sampling plane was non-ideal.

The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

1.3 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
647	Stopwatch	25-Jul-16	25-Jan-17
904	Gas Meter	06-Jun-16	06-Jun-17
859	Digital Temperature Reader	30-Jun-16	30-Dec-16
720	Thermocouple	29-Aug-16	01-Mar-17
427	Nozzle TSP Swagelok 2	10-Mar-16	10-Mar-17
885	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
937	Nozzle PM10 Head	06-Jan-16	06-Jan-17
924	Nozzle USEPA Metals Set Glass	06-Jan-16	06-Jan-17
835	Personal Sampler	22-Mar-16	22-Mar-17
936	Buck Calibrator 1cc/min - 6L/min	30-Aug-16	28-Feb-17
708	Gas Meter	21-Mar-16	21-Mar-17
792	Gas Meter	28-Jul-16	28-Jul-17
539	USEPA Meter Box (gas meter)	08-Mar-16	08-Mar-17
946	combustion analyzer	19-Aug-16	19-Feb-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	ALSM1604	25-Oct-18
383 ppm	Sulphur Dioxide In Nitrogen	ALSD 3948	25-Oct-18
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

ENVIROLAB GROUP
ENVIROLAB SERVICES
mpl

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 158595

Client:
Stephenson & Associates
PO Box 6398
Silverwater
NSW 1811

Attention: Jay Weber

Sample log in details:

Your Reference:	5733
No. of samples:	One m29 sample train
Date samples received / completed instructions received	06/12/2016 / 06/12/2016

Report R02 supercedes R00 as Project No. corrected to 5733 and date of receipt corrected.

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	20/12/16 / 20/12/16
Date of Preliminary Report:	Not issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing **Tests not covered by NATA are denoted with *.**

Results Approved By:

David Springer
General Manager

Envirolab Reference: 158595
Revision No: R 02

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Client Reference: 5733

Metals in Emissions USEPA m29 Our Reference: Your Reference Type of sample	UNITS ---------- - ----------	158595-2 725945-2 Acetone Rinse	158595-3 725945-3 Front half rinse - 0.1N HNO3	158595-4 725945-4 Back half - 5% HNO3 / 10% H2O2	158595-5 725945-5A 4th impinger rinse - 0.1N HNO3	158595-6 725945-5B 4% KMnO4 / 10% H2SO4
Date prepared	-	08/12/2016	08/12/2016	08/12/2016	08/12/2016	08/12/2016
Date analysed	-	08/12/2016	08/12/2016	08/12/2016	08/12/2016	08/12/2016
Volume	mL	[NA]	85	332	41	265
Particle Matter	mg	31	[NA]	[NA]	[NA]	[NA]

Metals in Emissions USEPA m29 Our Reference: Your Reference Type of sample	UNITS ---------- - ----------	158595-8 725945-run1-Analytical Fraction 1A m29 Impinger	158595-9 725945-run1-Analytical Fraction 2A m29 Impinger	158595-10 725945-run1-Analytical Fraction 1B m29 Impinger	158595-11 725945-run1-Analytical Fraction 2B m29 Impinger	158595-12 725945-run1-Analytical Fraction 3A m29 Impinger
Date prepared	-	08/12/2016	08/12/2016	08/12/2016	08/12/2016	08/12/2016
Date analysed	-	08/12/2016	08/12/2016	08/12/2016	08/12/2016	08/12/2016
Antimony	µg	<4	<4	[NA]	[NA]	[NA]
Arsenic	µg	<4	<4	[NA]	[NA]	[NA]
Barium	µg	78	<3	[NA]	[NA]	[NA]
Beryllium	µg	0.5	<0.3	[NA]	[NA]	[NA]
Cadmium	µg	0.1	<0.1	[NA]	[NA]	[NA]
Chromium	µg	2	1	[NA]	[NA]	[NA]
Cobalt	µg	1	<0.3	[NA]	[NA]	[NA]
Copper	µg	4	5	[NA]	[NA]	[NA]
Lead	µg	21	1	[NA]	[NA]	[NA]
Manganese	µg	4.3	1	[NA]	[NA]	[NA]
Mercury	µg	[NA]	[NA]	0.07	0.2	<0.05
Nickel	µg	5.9	<0.3	[NA]	[NA]	[NA]
Phosphorus	µg	220	<150	[NA]	[NA]	[NA]
Selenium	µg	<4	20	[NA]	[NA]	[NA]
Silver	µg	<3	<3	[NA]	[NA]	[NA]
Thallium	µg	<10	<10	[NA]	[NA]	[NA]
Tin	µg	<10	<10	[NA]	[NA]	[NA]
Vanadium	µg	<5	<5	[NA]	[NA]	[NA]
Zinc	µg	210	<6	[NA]	[NA]	[NA]
Magnesium	µg	<100	<100	[NA]	[NA]	[NA]

Envirolab Reference: 158595
Revision No: R 02

Page 2 of 7

Client Reference: 5733

Metals in Emissions USEPA m29			
Our Reference:	UNITS	158595-13	158595-14
Your Reference	----------	725945-run1-Analytical Fraction 3B	725945-run1-Analytical Fraction 3C
Type of sample	----------	m29 Impinger	m29 Impinger
Date prepared	-	08/12/2016	08/12/2016
Date analysed	-	08/12/2016	08/12/2016
Mercury	µg	0.08	<0.05

Envirolab Reference: 158595
Revision No: R 02

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Client Reference: 5733

Method ID	Methodology Summary
Metals-029	Sample is evaporated to dryness at ambient temperature and pressure, dessicated and weighed back as per USEPAm29.
Metals-010	Determination of Metals in impingers and filters by ICP-OES/MS and Cold Vapour AAS using USEPA29 and in house methods METALS-010, 020, 021 and METALS-022.

Client Reference: 5733

QUALITY CONTROL Metals in Emissions USEPAm29	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			08/12/2016	[NT]	[NT]	LCS-1	08/12/2016
Date analysed	-			08/12/2016	[NT]	[NT]	LCS-1	08/12/2016
Particle Matter	mg	0.2	Metals-029	<0.2	[NT]	[NT]	[NR]	[NR]
Antimony	µg	4	Metals-010	<4	[NT]	[NT]	LCS-1	102%
Arsenic	µg	4	Metals-010	<4	[NT]	[NT]	LCS-1	97%
Barium	µg	3	Metals-010	<3	[NT]	[NT]	LCS-1	92%
Beryllium	µg	0.3	Metals-010	<0.3	[NT]	[NT]	LCS-1	84%
Cadmium	µg	0.1	Metals-010	<0.1	[NT]	[NT]	LCS-1	101%
Chromium	µg	0.3	Metals-010	<0.3	[NT]	[NT]	LCS-1	95%
Cobalt	µg	0.3	Metals-010	<0.3	[NT]	[NT]	LCS-1	95%
Copper	µg	3	Metals-010	<3	[NT]	[NT]	LCS-1	97%
Lead	µg	1	Metals-010	<1	[NT]	[NT]	LCS-1	101%
Manganese	µg	0.3	Metals-010	<0.3	[NT]	[NT]	LCS-1	95%
Mercury	µg	0.05	Metals-010	<0.05	[NT]	[NT]	LCS-1	100%
Nickel	µg	0.3	Metals-010	<0.3	[NT]	[NT]	LCS-1	96%
Phosphorus	µg	150	Metals-010	<150	[NT]	[NT]	LCS-1	103%
Selenium	µg	4	Metals-010	<4	[NT]	[NT]	LCS-1	95%
Silver	µg	3	Metals-010	<3	[NT]	[NT]	LCS-1	102%
Thallium	µg	15	Metals-010	<10	[NT]	[NT]	LCS-1	99%
Tin	µg	10	Metals-010	<10	[NT]	[NT]	LCS-1	105%
Vanadium	µg	5	Metals-010	<5	[NT]	[NT]	LCS-1	96%
Zinc	µg	6	Metals-010	<6	[NT]	[NT]	LCS-1	105%
Magnesium	µg	150	Metals-010	<100	[NT]	[NT]	LCS-1	102%

Envirolab Reference: 158595
Revision No: R 02

Page 5 of 7

Client Reference: 5733

Report Comments:

Please note that Magnesium, Tin and Vanadium are not accredited to USEPA m29 but are accredited under in house methods.
Please note that container 5C was not provided and therefore had no contribution to analytical fraction 3C.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Client Reference: 5733

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Envirolab Reference: 158595
Revision No: R 02

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Ali Naghizadeh	Manager	Huong Crawford
Client	Peter Stephenson & Associates Pty Ltd	Laboratory	SGS Alexandria Environmental
Address	Po Box 6398 Silverwater NEWINGTON NSW 1811	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	02 9737 9991	Telephone	+61 2 8594 0400
Facsimile	02 9737 9993	Facsimile	+61 2 8594 0499
Email	ali@stephensonenv.com.au	Email	au.environmental.sydney@sgs.com
Project	**5733 - Doc No S24529**	SGS Reference	**SE159924 R0**
Order Number	**4668**	Date Received	05 Dec 2016
Samples	3	Date Reported	19 Dec 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong Liang
Metals/Inorganics Team Leader

SGS

ANALYTICAL REPORT

SE159924 R0

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	SE159924.001 Impinger Solution 01 Dec 2016 725946	SE159924.002 Impinger Solution 01 Dec 2016 725947	SE159924.003 Impinger Solution 01 Dec 2016 725948
Hydrogen Halides and Halogen Emissions (USEPA Method 26A) Method: AN540 Tested: 19/12/2016						
Volume*	mL	1		-	340	335
Hydrogen Chloride as HCl	mg	0.08		-	6.9	7.0
Hexavalent Chromium analysis in Impinger/Filter Extract by Discrete Analyser Method: CEPA-ARB Method 425 Tested: 12/12/2016						
Hexavalent Chromium, Cr6+*	mg	0.001		<0.001	-	-

SGS

QC SUMMARY

SE159924 R0

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Hydrogen Halides and Halogen Emissions (USEPA Method 26A) **Method: ME-(AU)-[ENV]AN540**

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Hydrogen Chloride as HCl	LB115791	mg	0.08	<0.08	NA

SGS

METHOD SUMMARY

SE159924 R0

METHOD	METHODOLOGY SUMMARY
AN540	A gas sample is extracted isokinetically from a stack. Hydrogen halides are solubilised in acidic solutions, forming chloride (Cl-), bromide (Br-) and fluoride (F-) ions. Halogens are passed through an alkaline solution where they are hydrolysed to form a proton (H+), a halide ion and a hypohalous acid molecule (HClO and HBrO). Sodium thiosulfate is added to the alkaline solution to assure reaction with hypohalous acid to form a second halide ion such that 2 halide ions are formed for each molecule of halogen gas.
CEPA-ARB Method 425	The received impinger solution and filter from the sampling process are combined and extracted by shaking for a minimum of 30 minutes followed by analysis of a portion of the extract for Chromium by ICP OES and Hexavalent Chromium by Discrete Analyser.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/ Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

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