26 October 2020

John Studdert
Manildra Group
PO Box 123
Nowra NSW 2541

Our ref: 12534209-95352-9
Your ref:

Dear John

Manildra Modification 19 Air Quality Assessment
Letter to address condition 9G of the Development Consent 06_0228

1 Introduction

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to undertake a comparison of sampled and Modification 16 (MOD16) modelled nitrogen oxide (NO_x) emission rates from gluten and starch dryers located at the Shoalhaven Starches factory at Bolong Road in Bomaderry to satisfy condition 9G of Manildra Development Consent 06_0228.

Condition 9G of Manildra Development Consent 06_0228 states:

> *9G. Within 6 months of commencing operation of MOD 16, the Applicant must monitor and report on air emissions from all gluten and starch dryers on the site. The Applicant must:*
>
> *a) monitor emission discharge concentrations for oxides of nitrogen (NOx);*
>
> *b) provide a report of the monitoring results to the EPA and the Planning Secretary;*
>
> *c) compare the emission concentrations and rates from monitoring with the predictions in the Air Quality Impact Assessment prepared by GHD for MOD 16;*
>
> *d) where emission concentrations and rates from monitoring are higher than the predictions, advise if the monitoring results significantly change the outcomes of the Air Quality Impact Assessment prepared for MOD 16.*

Monitoring of NO_x emissions from all gluten and starch dryers was undertaken by Stephenson Environmental Management Australia and is presented in Emissions Test Report No 7093B (2020) provided as Attachment 1.

This letter compared the sampled NO_x emission rates to those modelled in the Air Quality Impact Assessment prepared for MOD 16 (GHD, 2019) titled “Shoalhaven Starches Pty Ltd Proposed modification application to MP 06_0228 Shoalhaven Starches Expansion Project, Proposed new speciality processing facility, new gluten dryer and other associated works at 22, 24 and 171 Bolong Rd, Bomaderry, NSW, Air Quality Assessment (19/02/2019)”.

2 Emissions comparison

2.1 Sampled NO_x emission rates

NO_x emissions from all gluten and starch dryers presented in Emissions Test Report No 7093B (Stephenson Environmental Management Australia, 2020) are summarised in Table 2-1. Resultant NO_x emissions were calculated using the measured volumetric flow rate and NO_x stack concentration.

Sampling was undertaken for starch dryers (SD) 1, 3, 4 and 5 and gluten dryers (GD) 1, 2, 3, 4, 5, 6 and 7.

Table 2-1 Sampling NO_x emission rates

Parameter	SD 1	SD 3	SD 4	SD 5	GD 1	GD 2	GD 3	GD 4	GD 5	GD 6	GD 7
Volumetric flow (m^3/s)	11	19	18	49	15	12	36	30	15	33	31
NO_x stack concentration (mg/m^3, avg)	ns[1]	2	2	2	8	2	12	2	5	3	2
Calculated NO_x emission rate (g/s)	-	0.038	0.036	0.098	0.12	0.024	0.43	0.060	0.075	0.099	0.062

2.2 MOD16 modelled NO_x emission rates

NO_x emissions modelled for the MOD16 air quality assessment (GHD, 2019) were based on the following assumptions:

- The dryers are generally operated using heat generated from the boilers and are therefore not a source of combustion emissions. Occasionally, based on heat load fluctuations, natural gas may be used to heat the dryers. In these instances, the dryers would become a source of combustion emissions.
- The majority of natural gas used in the dryers is consumed by gluten dryers 6 and 7 and starch dryer 5
- Dryer emission rates were based on emissions factors for residential furnaces have been sourced from US EPA AP-42 Compilation of Air Emissions Factors Section 1.4 Natural Gas Combustion
- Modelling conservatively assumed dryers would be heated using the coal fired boilers (as they would most of the time) and 500,000 GJ natural gas consumption occurring at the same time. The dryers

[1] 'ns' indicates not sampled – auxiliary gas burner not fitted to this dryer

would use additional gas when the coal boilers are not running at capacity. This is highly conservative as emissions have been effectively doubled up.

The MOD16 modelled NOx emission rates are provided in Table 2-2.

Table 2-2 MOD16 modelled NO_x emission rates

Source	SD 1	SD 3	SD 4	SD 5	GD 1	GD 2	GD 3	GD 4	GD 5	GD 6	GD 7
Model ID	S01	S18	S19	SD5	S02	204	S03	S05	SDR5	GD6	GD7
Modelled NO_x emission rate (g/s)	-	-	-	0.38	-	-	-	-	-	0.70	0.53

Note '-' indicates NO_x emissions were not modelled from the source

2.3 Comparison

A comparison of sampled and MOD16 modelled NO_x emission rates is provided in Table 2-3. The cumulative starch and gluten dryer NO_x emission rate (sum of NO_x emission rates from all gluten and starch dryers) calculated from sampling results was 1.04 g/s. The cumulative starch and gluten dryer NO_x MOD16 modelled emission rate was 1.61 g/s.

Table 2-3 NO_x emission rate comparison

Parameter	SD 1	SD 3	SD 4	SD 5	GD 1	GD 2	GD 3	GD 4	GD 5	GD 6	GD 7	Sum
Sampling NO_x emission rate (g/s)	-	0.038	0.036	0.098	0.12	0.024	0.43	0.060	0.075	0.099	0.062	1.04
Modelled NO_x emission rate (g/s)	-	-	-	0.38	-	-	-	-	-	0.70	0.53	1.61

The MOD16 modelled NO_x emissions rate is approximately 155% (1.61/1.04) of the sampled NO_x emission rate. Therefore the Air Quality Impact Assessment prepared for MOD 16 is considered to conservatively overestimate potential NO_2 concentrations. As the MOD16 Air Quality Impact Assessment predicted compliance with the NO_2 assessment criteria, no further mitigation or analysis is considered necessary.

3 Conclusions

Based on the sampled NO_x emissions, it was concluded that the MOD16 modelled NO_x emissions rate is approximately 155% of the sampled NO_x emission rate. Therefore the Air Quality Impact Assessment prepared for MOD 16 is considered to conservatively overestimate potential NO_2 concentrations. As the MOD16 Air Quality Impact Assessment predicted compliance with the NO_2 assessment criteria, no further mitigation or analysis is considered necessary.

Sincerely
GHD

Evan Smith
Senior Engineer
+61 2 92397695

Attachment 1 – Emissions test report No 7093B – Starch and gluten dryer NOx sampling report (Stephenson Environmental Management Australia, 2020)

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. 7093B

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:	7093B/20
	Test Date(s):	20 February, 14 May, 4 and 30 June, 30 September and 8 October, 2020
	Production Conditions:	Each dryer tested under normal conditions for the specific dryer
	Analysis Requested:	Nitrogen Oxides (NO_x), Moisture, Oxygen (O_2), Temperature, Flow and Velocity
	Sample Locations:	Starch dryers (SD) 1, 3, 4 and 5 Gluten dryers (GD) 1, 2, 3, 4, 5, 6 and 7
	Sample ID Nos.:	Not Applicable

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

Identification	Each data set recorded the sampling location (or Identification) sampling date and time.

Test	**Test Method Number for Sampling and Analysis**	**NATA Laboratory Analysis By: NATA Accreditation No. & Report No.**
Dry Gas Density	USEPA M3	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Flow	USEPA M2	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Moisture	USEPA M4	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Molecular Weight of Stack Gases	USEPA M3	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Oxides of Nitrogen	USEPA M7E	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Oxygen	USEPA M3A	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Sampling Location	AS4323.1	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Stack Pressure	USEPA M2	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Stack Temperature	USEPA M2	SEMA, Accreditation No.15043 Emission Test Report No. 7093B
Velocity	USEPA M2	SEMA, Accreditation No.15043 Emission Test Report No. 7093B

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

Issue Date
16 October 2020

P W Stephenson
Managing Director

SUMMARY OF AVERAGE STARCH AND GLUTEN DRYER EMISSION RESULTS - 2020

Parameter	Unit of measure	SD 1	SD 3	SD 4	SD 5	GD 1	GD 2	GD 3	GD 4	GD 5	GD 6	GD 7
		14.05.20 1345:1515	30.09.20 1108:1208	30.06.20 1251:1351	20.02.20 1329:1352	14.05.20 1357:1457	04.06.20 1611:1711	14.05.20 1513:1613	04.06.20 1437:1537	30.09.20 1219:1319	08.10.20 1120:1220	30.09.20 1400:1500
Temperature	^oC	38	39	39	68	71	64	74	72	77	74	62
Pressure	kPa	102.7	101.7	102.3	102.7	102.5	93.2	102.5	102.2	101.7	100.7	102.7
Velocity	m/s	6	23	22	14	14	17	11	21	10	20	19
Volumetric flow	m^3/s	11	19	18	49	15	12	36	30	15	33	31
Moisture	%	1.6	5.8	3.2	6.3	7.3	5.9	6.3	6.4	6.8	7.0	6.5
Molecular weight dry stack gas	g/g mole	28.9	28.9	28.9	28.9	28.9	28.9	28.9	28.9	28.9	28.9	28.9
Gas density	kg/m^3	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Nitrogen oxides @ stack O_2 (avg)	mg/m^3	ns	2	2	2	8	2	12	2	5	3	2
Oxygen	%	20.9	20.9	20.9	20.8	20.9	20.9	20.9	20.6	20.9	20.9	20.9
*Dryer auxiliary gas burner setting	% or m^3/hr gas usage	--	5-10 m^3/hr (minim)	5-10 m^3/hr (minim)	266 m^3/hr	8%	20%	7%	15%	10 m^3/hr	19%	4%

Key:

^oC	=	degrees Celsius
kPa	=	kilo Pascal
m/s	=	metres per second
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
%	=	percentage
g/g mole	=	grams per gram mole
kg/m^3	=	kilograms per cubic metre
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa)
m^3/hr	=	cubic metres per hour
O_2	=	oxygen
avg	=	average
minim	=	minimum
ns	=	not sampled - auxiliary gas burner not fitted to this dryer
*	=	as advised by Shoalhaven Starches personnel
--	=	Shoalhaven Starches advised that gas was not supplied to this burner

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, USEPA 4	25%
Nitrogen Oxides	USEPA 7E	15%
Oxygen	USEPA 3A	1% actual
Velocity	AS4323.1, 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.