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Shoalhaven Starches, Independent Odour Audit (2021-2022)

Addressee(s):	**Shoalhaven Starches Pty Ltd**
Report Reference:	**22.1126.FR1V1**
Date:	**20 October 2022**
Status:	**Final**

Quality Control

Study	Status	Prepared by:	Checked by:	Authorised by:
INTRODUCTION	Final	GCG	MD	GCG
ODOUR AUDIT REQUIREMENTS	Final	GCG	MD	GCG
ODOUR AUDIT EVIDENCE	Final	GCG	MD	GCG
ODOUR AUDIT FINDINGS	Final	GCG	MD	GCG
SUMMARY	Final	GCG	MD	GCG

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
22	1126	Final	R1	V1
Based upon the above, the specific reference for this version of the report is:				**22.1126.FR1V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.

G. Graham **20 October 2022**

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Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol.

For example, 20 odour units cubic metres per second would be presented as 20 $OU \cdot m^3 \cdot s^{-1}$ and not 20 $OU \cdot m^3/s$.

1. INTRODUCTION

Shoalhaven Starches Pty Ltd (on behalf of the Manildra Group) has engaged Gary Graham, Director of Northstar Air Quality Pty Ltd (Northstar) to perform the independent odour audit (2021-2022) of the Shoalhaven Starches Facility (the facility) which operates at Bolong Road, Bomaderry, NSW.

As stipulated in the NSW Government (May 2020) *Independent Audit – Post Approval Requirements* (DPIE, 2020) I, Gary Graham, confirm that I am independent of Shoalhaven Starches as determined under Section 3.1.1 of the above guidance.

I have completed an Independent Audit Declaration Form, and this is attached in **Appendix A** of this report.

The requirement for an Independent Odour Audit is prescribed within Schedule 3 of the consolidated conditions of Project Approval 06_0228. For clarity, the consolidated conditions are reproduced in their entity in **Table 13** (**Section 4**), with a reference to the sections of the report that provide evidence and commentary on the compliance (or otherwise) with each condition related to odour.

1.1. Auditing Period

This odour audit covers the period from Q1 2021/22 to Q4 2021/22, aligned to the EPL reporting period. With reference to the NSW Environment Protection Authority (EPA) website[1], it is noted that anniversary date for EPL 883 is stated as 30 April. Correspondingly, this report covers the period from 1 May 2021 to 30 April 2022.

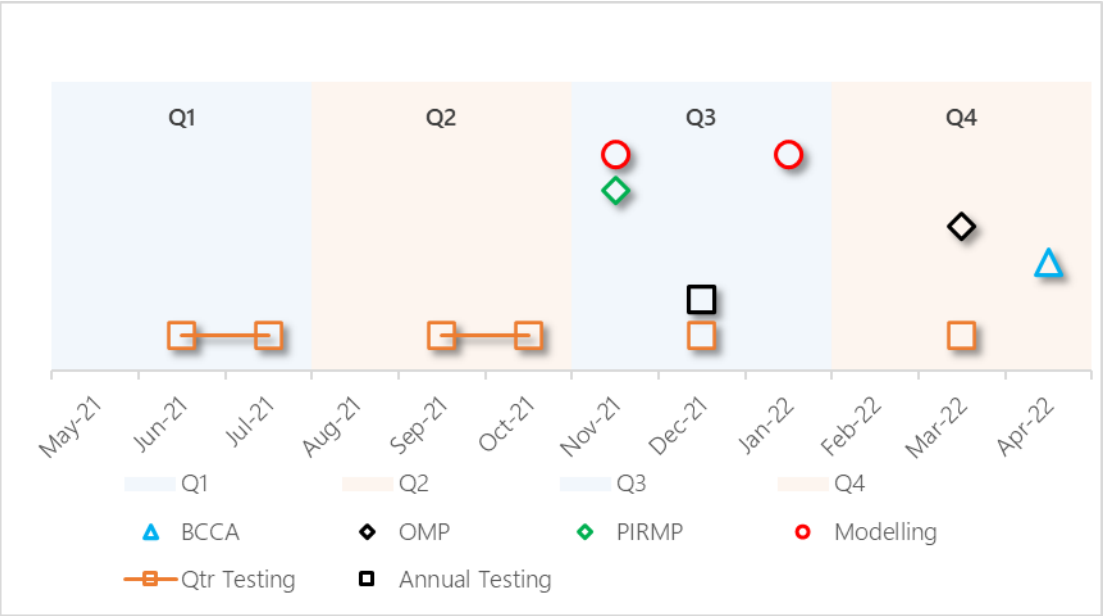
The quarters of the reporting year covered by this audit are therefore:

- Quarter 1 (Q1): May 2021 to July 2021;
- Quarter 2 (Q2): August 2021 to October 2021;
- Quarter 3 (Q3): November 2021 to January 2022; and
- Quarter 4 (Q4): February 2022 to April 2022.

The various reports relating to plant performance and odour emissions (including the quarterly and annual odour emissions test, biofilter capacity and condition assessments, management plans and modelling assessments) are discussed in the relevant sections of this audit report, and for ease of understanding how these data sources relate to the audit period, a summary has been provided in **Figure 1**.

[1] http://www.epa.nsw.gov.au/prpoeoapp/

Figure 1 Data sources audited in this audit period



Notes: BCCA – Biofilter Capacity and Condition report, Qtr Testing – Quarterly odour source monitoring, OMP – Odour Management Plan, Annual testing – Annual odour source monitoring, PIRMP – Pollution Incident and Response Management Plan, Modelling – Odour modelling

1.2. Consultation

As required under Condition 5, consultation with the relevant regulatory bodies (EPA and NSW Department of Planning and Environment [DPE]) was performed as part of this odour audit.

1.2.1. Environment Protection Authority (EPA)

The EPA was contacted by email on 13 October 2022 and a telephone conversation was held on 19 October 2022. Confirmation of that discussion was received from Amanda Fletcher on 19 October 2022, which is reproduced below:

> *"Thanks for your time today. As discussed, the EPA has the following comments.*
>
> - *The purpose of the odour PRP on the licence is for Shoalhaven Starches to provide an update on the odour controls at the premises and provide a baseline which will assist with assessing future modifications. The PRP comes from EPA's assessment of Modification 21, where EPA identified several deficiencies in the AQIA. It was decided, in consultation with Shoalhaven Starches, that some of EPA's comments would be addressed outside of the planning process as the PRP.*

- *The EPA has received three odour complaints from surrounding neighbours regarding odour from the WWTP. These odour complaints related to offensive odour detected by the various complainants on 25 July, 2 August and 5 August 2022. Following discussion with Shoalhaven Starches, the EPA understands that the odour source was excess biogas that was being produced at the WWTP due to the fluctuation in quality of the effluent. The EPA further understands that Shoalhaven Starches are looking into ways to address the excessive biogas production."*

On 27 July 2022, (i.e. outside of the odour audit period), NSW EPA issued Notice 1619775 to vary EPL 883 to include Condition U2: Odour Pollution Reduction Study (Stage 1), the "PRP" discussed above by EPA. The performance of the PRP will be addressed in the 2022-23 independent odour audit. Reference should also be made to the performance of an independent field ambient odour assessment as discussed in **Section 1.4**, and reported separately in Northstar report 22.1126.FR2V1.

The odour complaint dates provided by NSW EPA will also be captured in the 2022-23 independent audit period.

1.2.2. Department of Planning and Environment (DPE)

DPE was contacted by email on 13 October 2022 and provided a response on 19 October 2022, including the following comment:

> *"The Department has no new issues to raise regarding the odour audit for the Shoalhaven Starches facility.*
>
> *However, the Department notes past issues with the site regarding elevated odour emissions levels and the continued development and upgrades of the site which the Department recommends scrutinising further in the Odour Audit."*

The odour performance of the site is determined by the results of the quarterly and annual odour emissions testing, which are discussed in **Section 3.6**. The variability of the odour emissions results is presented in **Section 3.6.4**.

1.3. Site Inspection

A site inspection was performed on 1 August 2022. The site inspection was facilitated by John Studdert (Manildra) and attended by Gary Graham and Nick Phillips-Glyde (Northstar). The purpose of Nick Phillips-Glyde participation in the site visit was to gain familiarity with the different characteristics of odour emissions from the various processes performed across the site, and facilitate off-site odour observations as part of a field ambient odour assessment (FAOA) (see **Section 1.4**).

1.4. Field Ambient Odour Assessment

On 27 July 2022, (i.e. outside of the odour audit period), NSW EPA issued Notice 1619775 to vary EPL 883 to include Condition U2: Odour Pollution Reduction Study (Stage 1).

Condition U2.2 required the following:

> *"The licensee must engage a suitably qualified independent person to undertake a minimum of (3) field odour surveys, at least one week apart. These must at a minimum:*
>
> *a) Characterise the frequency, intensity, duration, offensiveness, location and extent of any off-site odours.*
>
> *b) Be undertaken during hours when poor dispersion and/or peak odour emissions are expected.*
>
> *Findings and conclusions from the odour survey must be presented in the context of the activities being undertaken at the time the odour survey was conducted."*

Simultaneously with the performance of this annual odour audit, Northstar was commissioned to perform a series of four (4) independent field ambient odour surveys. This has been performed independently and in accordance with the requirements specified in EPL 883 Condition U2.2. This stand-alone component has been reported under separate cover to this audit report (ref: 22.1126.FR2V1) (Northstar, 2022).

2. ODOUR AUDIT REQUIREMENTS

2.1. Audit Procedure

The procedure followed during the audit was derived from NSW Department of Planning and Environment (2020) Independent Audit – Post Approval Requirements (PAR) (DPIE, 2020). The requirements for an audit are prescribed in Appendix B of the PAR:

> *"The Audit Table must set out the following information for each requirement to be complied with (compliance requirement):*
>
> 1. *condition of consent number;*
> 2. *the exact wording of the compliance requirement;*
> 3. *a blank column to record the evidence used to assess and determine whether each requirement has been complied with;*
> 4. *a blank column for commentary on findings and recommendations;*
> 5. *a blank column for recording the status of compliance, and*
> 6. *a unique identification non compliance number."*

The methodology adopted in this audit has followed this guidance. An additional column 'recommendations / actions' has been included to discuss remedial actions and/or recommendations where necessary, as required under Section 4.2.4 of the guidance.

For each **non-compliance,** a unique identification number (UIN) has been assigned as required under the PAR (DPIE, 2020). As this odour audit is against the conditions presented in Schedule 3 of the Consolidated Conditions of Project Approval (MOD 19), each UIN has been labelled as **21/22-NC-n** where *n* is the Condition Number derived from MOD 21 and replicated in the first column of **Table 13**. Reference to UINs in previous odour audit reports will adopt the same nomenclature as previously reported (as sequential numbers rather than condition numbers) to avoid any confusion.

2.2. Audit Compliance Status Descriptors

As presented in NSW Government (DPIE, 2020) *Independent Audit – Post Approval Requirements*, the criteria outlined in **Table 1** have been adopted for the independent odour audit:

Table 1 Odour audit compliance criteria

Status	Description
Compliant	The auditor has collected sufficient verifiable evidence to demonstrate that all elements of the requirement have been complied with within the scope of the audit.
Non-compliant	The auditor has determined that one or more specific elements of the conditions or requirements have not been complied with within the scope of the audit.
Not triggered	A requirement has an activation or timing trigger that has not been met during the temporal scope of the audit being undertaken (may be a retrospective or future requirement), therefore an assessment of compliance is not relevant.

The following is also noted:

> *"The terms partial compliance, partial non-compliance, not verified or administrative non-compliance or other similar terms must not be used.*
>
> *As part of the Audit evaluation, the auditor may make observations, including identifying any opportunities for improvement in relation to any compliance requirement or any other aspect of the project. Any observations or notes are in addition to the compliance status descriptor assigned to each compliance requirement, limited to the descriptors listed in Table 2* (as reproduced in **Table 1**).

2.3. Audit Recommendations

Where recommendations are noted, these are expressed in **Section 3** and are not replicated in **Section 4** which relates to the compliance with the Consolidated Conditions of Project Approval only. These are designated identifiers as **21/22-REC-x** (where x is a sequential letter designator) and do not carry the Condition reference to avoid compliance issues. Recommendations are provided for any observed opportunity for improved odour performance and are not solely related to compliance with the Consolidated Conditions of Project Approval.

2.4. Consolidated Odour Conditions and Summary of Compliance

Section 4 and **Table 13** below presents a list of odour conditions, as prescribed in Schedule 3 of the Consolidated Conditions of Project Approval.

These conditions have been repeated *verbatim* and are accompanied with a summary of the sections of this report that provide additional evidence and commentary, and a summary of compliance (or otherwise) with that specific condition.

3. ODOUR AUDIT EVIDENCE

3.1. Review of Management Plans

As required to comply with Condition 5d of PA 06_0228, the odour management plan has been reviewed, including:

- Shoalhaven Starches (2019) Shoalhaven Starches Ethanol Upgrade Odour Management Plan (ref: EN-P-247 1.0.F. Aug 2019) (TOU, Aug 2019)
- Shoalhaven Starches (2022) Shoalhaven Starches Ethanol Upgrade Odour Management Plan (ref: EN-P-247 1.0.G. Mar 2022) (TOU, Mar 2022)
- Shoalhaven Starches (2022) Shoalhaven Starches Ethanol Upgrade Odour Management Plan (ref: EN-P-247 1.0.H. July 2022) (TOU, July 2022); and
- Shoalhaven Starches (2020) Pollution Incident Response Management Plan (ref: EN-P-248 1.0.L. Nov 2021).

3.1.1. Odour Management Plan

The versions of the Odour Management Plan (OMP) in force during the audit period were revisions 1.0.F (Aug 2019) which was reviewed and replaced by version 1.0.G during March 2022, at the end of this audit period. Version 1.0.H has also been provided but this will relate to the 2022/23 audit period.

Subsequent to the last odour audit it is noted that there have been no updates to the OMP between versions 1.0.F and 1.0.G.

At the request of NSW EPA during the 2020/21 audit, the odour complaint procedure presented in the OMP has been reviewed, to facilitate a review of how the reported complaints have been recorded and responded to.

The procedure for responding to odour complaints is presented in section 4.3.1 of the OMP (ref: EN-P-247 1.0.F, 30-Aug-2019):

1. *The Environmental Complaints Handling procedure must reflect the requirements of Licence No. 883 set out in sections M5 of the licence.*
2. *The Environmental Manager and Site Manager have ownership of the system and have authority and responsibility to ensure that necessary corrective actions are taken.*
3. *Environmental complaints can be received through any of the following avenues:*
   a. *Environment Protection Authority (EPA)*
   b. *24 hour a day complaints hotline*
   c. *Ringing main office*
4. *The following procedure is followed when a complaint is received:*
   a. *All environmental complaints must be directed immediately to the Environmental Manager.*

b. *If the Manager is not available, then directed to Farm Manager and then if not available to the Site Manager.*
c. *The following details are recorded (where given by the complainant) in the Environmental Complaints Database*
    i. *Name of complainant and contact details (if they want to be identified). Details are required to enable Shoalhaven Starches to report back to the person once the complaint is investigated.*
    ii. *Nature of complaint – noise, dust/smoke, odour, spill, incident etc*
    iii. *Duration of the problem (dates and times)*
d. *The Environmental Manager then investigates the complaint and if applicable initiates corrective action. This information is recorded in the Environmental Complaints Database.*
e. *Once the investigation is complete, the details are give to the Quality Assurance department and the details entered into the Environmental Complaints section in the Fastrack Document Control system.*
f. *A copy of the complaint is forwarded to the Site Manager and relevant Plant Manager as required.*

5. *Details of complaints received direct from the EPA are sent to the Environmental Manager for investigation and dealt with as per the above procedure.*
6. *If the complaint is the same as one received directly by the company, then the EPA reference Number is added to the existing complaint (hence so doubling up does not occur).*
7. *Environmental Complaints are reviewed on an annual basis as part of the company's Annual Environmental Report. This annual review includes comparison with previous years.*

3.1.2. Pollution Incident Response Management Plan (Updated 2021)

The version of the PIRMP relevant to the audit period is revision 1.0.L (Nov 2021) which supersedes version 1.0.K which was audited during the previous independent odour audit.

The document revision record on p2/33 of the PIRMP outlines the changes as:

> *"updates to section 1 and section 10 contact. Addition of Appendix A site stormwater management plan"*

The following observations are noted:

Table 1 should be updated with reference to the relevant sections of the stated Regulation (currently "*Protection of the Environment Operations (General) Regulation 2009, Chapter 7, Part 3A*" which is (a) superseded by the 2021 Regulation (relevant to the audit period) and (b) incorrectly referenced, as the text in the PIRMP is taken from the requirements of 8, Part 4, Section 131(a)-(p) of the 2021 Regulation.

Irrespective, the PIRMP should be updated to reference the relevant requirements of the updated version of the Regulation in due course.

The updates have been reviewed and are not considered to be significant in terms of the Odour Audit.

3.2. Odour Complaints

Odour complaints may be reported through two principal routes: (i) directly as a telephone call to Shoalhaven Starches (via the 24-hr/day hotline or directly to the Environmental Manager); or (ii) indirectly through the EPA.

Table 2 below presents a summary of the odour complaints received over the reporting period with some information relating to the complainant and/or location removed. Details of the complaints recorded from direct calls and response and follow-up are presented in **Appendix F**.

Table 2 Odour complaints

Date / Time	Route	Complaint	Description	Action	Complaint Status
11/10/21	EPA	Odour (064)	Odour complaint was received via EPA on 11 October 2021 from a resident in Bomaderry, Melinda, complaining of "cheese whey smell" detected on the evening of 6 October which persisted for the next two days.	The likely cause of odour was not coming from the Shoalhaven Starches premises but from local farmers applying fertiliser (chook manure) on their land.	Closed

Details of the complaints recorded from direct calls and response and follow-up are presented in **Appendix F**. These have been reviewed with regard to the complaint procedure discussed in **Section 3.1.1**, and no discrepancies have been identified.

3.3. Review of Production Data

As required, a review of the facility's production data at the times of the odour monitoring (refer **Section 3.6**) has been performed.

The production data correspond to the periods of emission testing, as reported in:

- Manildra Ethanol Production Volumes 2021-22 (measurements taken between 7 June 2021 and 22 March 2022).

Copies of the monitoring reports are presented in **Appendix D** of this report. The production volumes relevant to the odour monitoring events are presented in **Table 3**.

Table 3 Odour monitoring and production rates

Quarter	Date of Quarterly Odour Sampling	Daily Ethanol Production (L)	Annual Production Rate Equivalent ($ML{\cdot}yr^{-1}$)
1	7/06/2021	598 033	218
	8/06/2021	570 000	208
	20/07/2021	460 843	168
	22/07/2021	667 919	244
2	30/09/2021	647 441	236
	5/10/2021	790 590	289
	6/10/2021	793 894	290
	20/10/2021	716 298	261
3	9/12/2021	879 273	321
	14/12/2021	606 441	221
	15/12/2021	824 058	301
	20/12/2021	803 514	293
	21/12/2021	567 245	207
4	17/03/2022	613 366	224
	21/03/2022	803 923	293
	22/03/2022	793 234	290
Minimum		460 843	168
Maximum		879 273	321
Mean		696 005	254
Range (Max/Min)		1.91	1.91

For comparison purposes only, the production rates reported in the 2020-21 independent odour audit report were in the range of 396 159 $L{\cdot}day^{-1}$ (145 $ML{\cdot}y^{-1}$) to 707 683 $Lday^{-1}$ (258 $ML{\cdot}y^{-1}$) with a mean of 581 683 $L{\cdot}day^{-1}$ 212 $ML{\cdot}y^{-1}$). The production rates during the 2021-22 audit period were higher than those in the previous year by a factor of around 20 % determined through a comparison of the calculated mean values.

3.4. Independent Environmental Audit

Whilst some developments documented in the independent environmental audit report (Malo Sustainability Consulting (2019) *Independent Environmental Audit*) have a direct implication on the management of odour from the facility, most of the content in the audit report is outside of the scope of the Independent Odour Audit, and no comment is offered. A search of the document did not identify any incomplete recommendations relating to odour control.

3.5. Biofilter Capacity and Condition Assessments

A copy of the DDG Biofilter Capacity and Condition Assessment Reports performed by The Odour Unit over the audit period are presented in **Appendix C**, namely:

- DDG Biofilter Capacity and Condition Assessment #25 – 6 April 2022

The report presented in **Appendix C** has not been replicated in the main body of this audit report but presented below is a summary of the key observations and measurements.

The design airflow of the installed biofilter system is stated as 15 000 $m^3 \cdot hr^{-1}$. The combined inlet flow (main duct + dryer 4 duct) is reported as 21 090 $m^3 \cdot hr^{-1}$ which is 141 % of the design airflow.

The operating conditions of the biofilters are summarised in **Table 4**, and the odour measurements are summarised in **Table 5**.

Table 4 Biofilter capacity and condition report (#25) – operating parameters

Date	Position	Airflow ($m^3 \cdot hr^{-1}$)	RH (%)	Observation	Air Temp (°C)	Surface Temp (°C)	UB Pressure (Pa)
6-Apr-22 (#25)	Main duct	18,210	100%	NR	46.0	NR	220
	DDG bf#2	8,500	100%	saturated	44.6	NR	190
	Dryer 4 duct	2,880	100%	NR	33.0	NR	350
	DDG bf#1	9,600	100%	saturated	44.4	40.6	70

Notes: bf – biofilter
NR – not reported

Table 5 Biofilter capacity and condition reports – odour measurements

Date	BCCA (#)	Inlet (OU)	DDG bf#1 (OU)		DDG bf#2 (OU)		Flow weighted (OU)	Efficiency (%)
			South cell	North cell	South cell	North cell		
6 Apr-22	25	8 930	5 790	6 890	1 330	4 470	8 930	56

Notes: BCCA – biofilter capacity and condition assessment

With reference to **Table 5**, a flow weighted average odour concentration of 8 930 OU was measured which exceeds the *de facto* standard of 500 OU.

Recommendation: 21/22-REC-A

Whilst it is acknowledged that the biofilters are achieving a reasonable degree of odour control (56 % efficacy), the flow-weighted average odour concentration is not achieving the d*e-facto* 500 OU standard. This matter remains an unresolved issue and it is recommended that it is resolved at the earliest opportunity.

3.6. Odour Monitoring Results

The results of the monitoring programs performed over the monitoring period are presented in **Table 6**, **Table 7** and **Table 8**. Copies of the monitoring reports are presented in **Appendix D** of this report.

These data are taken from the following reports:

- Ektimo (2021) R011036 Odour Emission Testing Report Quarter 1 2020-2021 (measurements taken during June and July 2021) (Ektimo, Sep 2021)
- Ektimo (2021) R011744 Odour Emission Testing Report Quarter 2 2020-2021 (measurements taken during September and October 2021) (Ektimo, Jan 2022)
- Ektimo (2021) R12022 Odour Emission Testing Report Quarter 3 2020-2021 (measurements taken during December 2021) (Ektimo, Feb 2022)
- Ektimo (2022) R012511 Odour Emission Testing Report Quarter 4 2020-2021 (measurements taken during March 2022) (Ektimo, Apr 2022)

3.6.1. Process Conditions during the Monitoring

The Ektimo monitoring reports do not present any information regarding plant conditions during the monitoring campaigns. From the monitoring data summary (see Section 3.6.3), it is noted that the following EPL discharge points were not tested:

- EPA ID 42 Boiler 4, during quarter 3; and
- EPA ID 46b DDG Pellet Stack, during quarter 4; and
- EPA ID 20 Effluent Storage Dam 2 and 4, during quarter 3 (including the annual testing requirements.

It is noted that EPA ID 20 Effluent Storage Dam 2 was not tested during the 2021/22 monitoring period, with the previous SEMA odour monitoring report stating that it was "unsafe for sampling".

Recommendation: 21/22-REC-B

It is recommended that the safety issue(s) preventing EPA 20 from being tested are resolved to ensure that EPA 20 is available to be tested during the 2022-2023 period. It is understood that the safety issue is the stability of the dam banks due to the low water levels and the dam is used when all other dams are full.

3.6.2. Summary of Measurements – Annual Testing

Table 6 presents a summary of the annual odour tests over the reporting period, conducted on the effluent storage dams (EPA ID nos 19-24) and the sulphur oxidation pond (EPA ID 25).

Table 6 Summary of annual odour monitoring results

EPA Ref	Location	Frequency	Q3 and Annual (OU)
19	Effluent Storage Dam 1	Annual	37
20	Effluent Storage Dam 2	Annual	nd
21	Effluent Storage Dam 3	Annual	34
22	Effluent Storage Dam 4	Annual	nd
23	Effluent Storage Dam 5	Annual	57
24	Effluent Storage Dam 6	Annual	49
25	Sulphur Oxidation Pond	Annual	41

Note: nd no data. (Ektimo, Feb 2022)

3.6.3. Summary of Measurements – Quarterly Testing

Table 7 presents a summary of the quarterly monitoring results measured over the reporting period. The table has been presented by source (EPA source ref) and by testing quarter (Q1 to Q4, with the corresponding dates). The data is presented as odour concentrations (OU) and as mass odour emission rates (MOER) ($OU \cdot Nm^3 \cdot s^{-1}$).

Note: It is noted that the MOER stated in the quarterly monitoring reports are presented at standard temperature and pressure (STP) as stated in Appendix A of the test reports.

It is noted that biofilter odour concentration measurements taken during the Q1, Q2 and Q3 tests exceed the *de facto* emission standard of 500 OU. These data are highlighted in **Table 7**.

Where the quarterly testing reports indicate no data ('nd'), these are similarly highlighted in **Table 7** for clarity.

Table 7 Summary of quarterly odour monitoring results

EPA Ref	Location	Frequency	Q1		Q2		Q3		Q4	
			OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}
8	No 1 Gluten Dryer	Quarterly	970	nd[(b)]	130	nd[(b)]	680	nd[(b)]	480	nd[(b)]
9	No 2 Gluten / Starch Dryer	Quarterly	680	10 200	450	6 750	310	4 030	340	5 100
10	No 3 Gluten Dryer	Quarterly	530	32 330	310	11 780	440	34 760	310	13 330
11	No 4 Gluten Dryer	Quarterly	750	21 750	440	11 000	340	10 200	480	15 360
12	No 1 Starch Dryer	Quarterly	190	3 610	87	1 740	340	6 460	520	10 920
13	No 3 Starch Dryer	Quarterly	89	1 602	79	1 422	180	3 240	88	1 496
14	No 4 Starch Dryer	Quarterly	230	4 370	62	1 054	260	5 200	74	1 332
16	CO_2 Scrubber Outlet	Quarterly	20 000	38 000	51 000	96 900	15 000	22 500	7 200	7 920
--	CO_2 Scrubber Inlet	Quarterly	14 000	22 400	65 000	123 500	25 000	37 500	66 000	66 000
35	Combined Stack Boilers No5&6	Quarterly	480	14 880	400	13 200	810	23 490	610	17 690
39	Inlet Pipe Biofilters A&B	Quarterly	4 900	15 680	5 400	18 360	11 000	38 500	5 200	16 120
39A	Inlet Pipe Biofilters A&B (DDG#4)	Quarterly	60 000	43 200	10 000	4 800	33 000	21 780	nd[(a)]	nd[(a)]
40	Outlet of Biofilter A (east)	Quarterly	7 100	nd[(b)]	10 000	nd[(b)]	8 000	nd[(b)]	1 200	nd[(b)]
	Outlet of Biofilter A (west)	Quarterly	8 100	nd[(b)]	7 500	nd[(b)]	7 400	nd[(b)]	2 500	nd[(b)]
41	Outlet of Biofilter B (east)	Quarterly	6 200	nd[(b)]	9 600	nd[(b)]	7 300	nd[(b)]	4 500	nd[(b)]
	Outlet of Biofilter B (west)	Quarterly	8 700	nd[(b)]	9 400	nd[(b)]	8 100	nd[(b)]	4 500	nd[(b)]
42	Boiler 4	Quarterly	1 900	22 800	400	4 800	nd[(a)]	nd[(a)]	940	12 220
44	Fermenters	Quarterly	11 000	13 200	11 000	1 430	9 600	2 400	2 300	391
45	Boiler No2 Outlet	Quarterly	440	2 156	520	2 600	1 000	8 000	940	4 136
46	DDG Pellet Plant Stack	Quarterly	1 300	31 200	2 000	34 000	740	17 760	nd[(a)]	nd[(a)]
47	No 5 Starch Dryer	Quarterly	1 400	14 000	1 600	92 800	310	18 290	160	7 520

Note: (a) nd = no data.

(b) No data relating to odour volumetric flow rate provided in the relevant reports.

3.6.4. Variability of Measurements

It is noted that EPA letter DOC16574291-21 dated 27 July 2017 confirms satisfaction that the matter of emission variability has been resolved, but for ongoing review and transparency, the variability of the measured odour emission rates (MOER) during this reporting period has been reviewed.

In terms of assessing the odour emission variability, the MOER (as $OU \cdot Nm^3 \cdot s^{-1}$) is the critical metric and is the product of the measured odour concentration (OU) and the measured volumetric discharge rate ($Nm^3 \cdot s^{-1}$). The variability in the MOER across the audit period is presented in **Table 8**.

Table 8 Observed variability in the measured odour emission rate (by quarter)

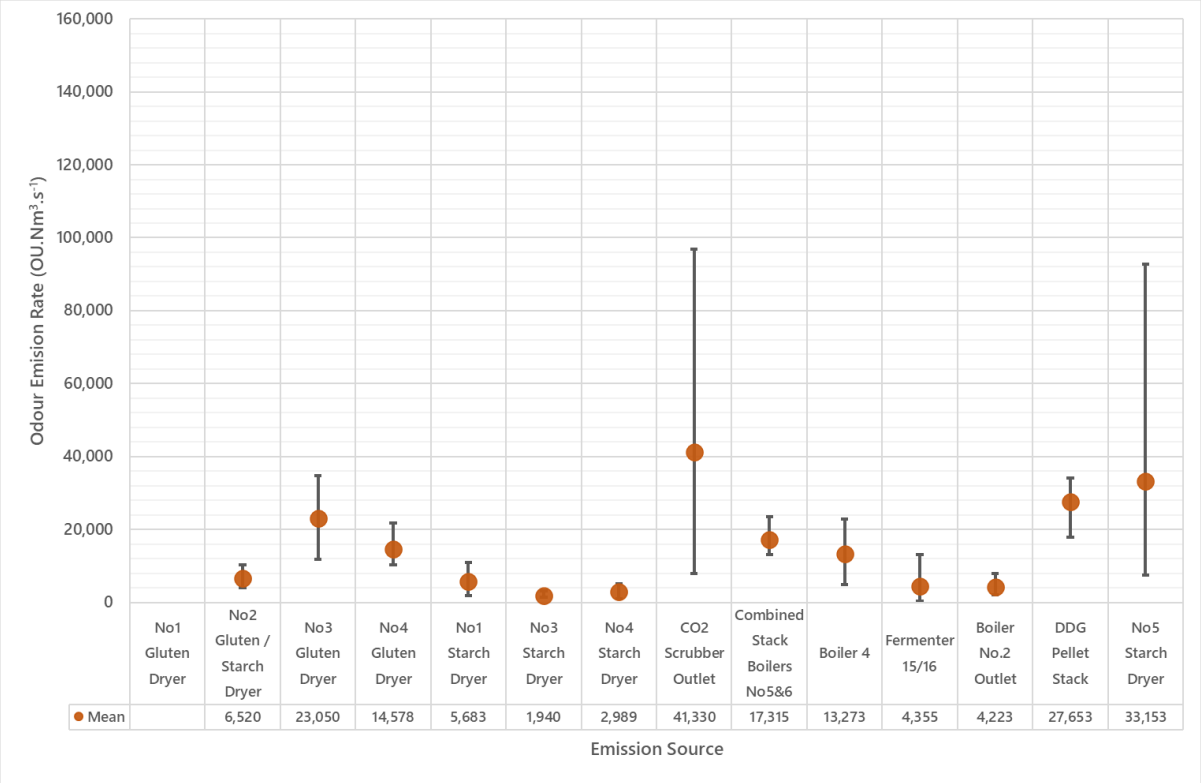
EPA Ref	Location	MOER ($OU \cdot Nm^3 \cdot s^{-1}$)					
		Count	Min.	Max.	Mean	±STDev	Max/ Min
8	No 1 Gluten Dryer	0	nd	nd	nd	nd	nd
9	No 2 Gluten / Starch Dryer	4	4 030	10 200	6 520	2 696	2.5
10	No 3 Gluten Dryer	4	11 780	34 760	23 050	12 176	3.0
11	No 4 Gluten Dryer	4	10 200	21 750	14 578	5 292	2.1
12	No 1 Starch Dryer	4	1 740	10 920	5 683	3 995	6.3
13	No 3 Starch Dryer	4	1 422	3 240	1 940	870	2.3
14	No 4 Starch Dryer	4	1 054	5 200	2 989	2 104	4.9
16	CO_2 Scrubber Outlet	4	7 920	96 900	41 330	39 030	12.2
35	Combined Stack Boilers No5&6	4	13 200	23 490	17 315	4 514	1.8
39	Inlet Pipe to Biofilters A&B	4	15 680	38 500	22 165	10 953	2.5
39A	Inlet Pipe to Biofilters A&B (DDG4)	3	4 800	43 200	23 260	19 243	9.0
42	Boiler 4	3	4 800	22 800	13 273	9 046	4.8
44	Fermenter 15/16	4	391	13 200	4 355	5 953	33.8
45	Boiler No2 Outlet	4	2 156	8 000	4 223	2 657	3.7
46	DDG Pellet Stack	3	17 760	34 000	27 653	8 682	1.9
47	No 5 Starch Dryer	4	7 520	92 800	33 153	40 011	12.3

The variation in odour emission rates, as range (represented by the observed minimum and maximum) and the arithmetic mean is illustrated in **Figure 2**.

Recommendation: 21/22-REC-C

With regard to flow measurements at EPA ID 8 the odour monitoring reports state: "*Sampling was undertaken at the exit of the stack as it was the only accessible area for the samples to be taken. No temperature or flow rate readings could be taken due to access issues.*" It is recommended that the access restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed. It is understood that new sampling ports have been installed (Sep 2022) that would be in compliance during the following odour audit period.

Figure 2 Variation in measured emission rates (range and mean)S



It is noted that for a number of emission points there is a noted significant variation in the rate of odour emissions (presented as $OU{\cdot}Nm^3{\cdot}s^{-1}$), notably:

- EPA ID 16 (CO_2 Scrubber Outlet) × 12.2
- EPA ID 44 Fermenter 15/16 × 33.8
- ID 47 No 5 Starch Drier of × 12.3

As noted in the previous independent odour audit reports, the atypical odour emission profile highlights an inherent potential variability in the emission rate subject to process operations. It is further noted that the odour measurement uncertainty, as performed in accordance with AS4323.3 and AS4323.4 is (generally) within the range of $\mathbf{0.7}OU < OU < \mathbf{1.4}OU$. The Ektimo test reports present upper and lower uncertainty limits for odour measurements which confirms this uncertainty (at the 95th percentile confidence limits).

The data comparing the mean measured odour concentration as compared to the previous three odour audit periods is presented in **Table 9** below:

Table 9 Observed variability in the measured odour emission rate (by audit year)

EPA Ref	Source	MOER ($OU{\cdot}Nm^3{\cdot}s^{-1}$)			
		2021-22	2020-21	2019-20	2018-19
8	No1 Gluten Dryer	nd	7 979	6 375	7 152
9	No2 Gluten / Starch Dryer	6 520	6 287	6 225	4 915
10	No3 Gluten Dryer	23 050	23 780	15 675	19 411

EPA Ref	Source	MOER (OU·Nm^3·s^{-1})			
		2021-22	2020-21	2019-20	2018-19
11	No4 Gluten Dryer	14 578	12 923	11 600	14 355
12	No1 Starch Dryer	5 683	4 353	3 130	6 068
13	No3 Starch Dryer	1 940	5 181	9 513	5 376
14	No4 Starch Dryer	2 989	3 549	6 285	3 824
16	CO_2 Scrubber Outlet	41 330	14 470	19 950	18 171
35	Combined Stack Boilers No5&6	17 315	55 982	52 750	43 831
39	Inlet Pipe to Biofilters A&B	22 165	46 149	56 900	31 757
39A	Inlet Pipe to Biofilters A&B DDG#4	23 260	15 307	8 500	nd
42	Boiler 4	13 273	19 796	23 633	18 926
44	Fermenter 15/16[(A)]	4 355	2 168	3 412	1 303
45	Boiler No.2 Outlet	4 223	6 068	7 167	nd
46	DDG Pellet Plant Stack	27 653	66 514	40 167	46 073
47	No5 Starch Dryer	33 153	17 676	21 621	nd
	aggregate (OU·Nm^3·s^{-1})	241,487	308 181	292 902	221 160
	mean ethanol production rate (ML·yr^{-1})	254	212	182	223
	odour emission intensity (OU·ML^{-1})	951	1 452	1 607	993

Note: (A) As compared to Fermenter 11 in 2017-18

The mean ethanol production rates (as ML·year^{-1}) have been refenced from **Section 3.3**. It is noted that the production rates relate to the mean daily production rates averaged across all days during the Q1-Q4 testing periods, expressed as an annualised production volume only, and is not the total measured ethanol production rate. The aggregated MOER has been divided by the annual ethanol production rates to derive a "odour emission intensity" to provide a benchmark of emissions against the production rates. As may be observed, the more recent data for 2020-21 and 2021-22 shows a decrease in the pro-rata odour emission intensity. It is noted that not all MOER are scalable by ethanol production rates, and this metric should be viewed acknowledging that uncertainty.

The MOER is the product of the measured odour concentration (OU) and the volumetric discharge rate (Nm^3·s^{-1}) expressed as OU·Nm^3·s^{-1}. **Table 10** below presents a breakdown of the two component factors to the MOER, to add some light on whether the odour concentration and/or the volumetric discharge rate is overly influencing the variability in the MOER. All max/min ratios of <5 are highlighted.

Table 10 Observed variability in the measured odour concentration and volumetric discharge rate

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate (Nm^3·s^{-1})			
		Max	Mean	Min	Max/ Min	Max	Mean	Min	Max/ Min
8	No1 Gluten Dryer	970	565	130	7.5	nd	nd	nd	nd
9	No2 Gluten / Starch Dryer	680	445	310	2.2	15.00	14.50	13.00	1.2

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate ($Nm^3 \cdot s^{-1}$)			
		Max	Mean	Min	Max/ Min	Max	Mean	Min	Max/ Min
10	No3 Gluten Dryer	530	398	310	1.7	79.00	55.25	38.00	2.1
11	No4 Gluten Dryer	750	503	340	2.2	32.00	29.00	25.00	1.3
12	No1 Starch Dryer	520	284	87	6.0	21.00	19.75	19.00	1.1
13	No3 Starch Dryer	180	109	79	2.3	18.00	17.67	17.00	1.1
14	No4 Starch Dryer	260	157	62	4.2	20.00	18.50	17.00	1.2
16	CO2 Scrubber Outlet	51 000	23 300	7 200	7.1	1.90	1.60	1.10	1.7
35	Combined Stack Boilers No5&6	810	575	400	2.0	33.00	30.50	29.00	1.1
39	Inlet Pipe to Biofilters A&B	11 000	6 625	4 900	2.2	3.50	3.30	3.10	1.1
39A	Inlet Pipe to Biofilters A&B DDG #4	60 000	34 333	10 000	6.0	0.72	0.62	0.48	1.5
42	Boiler 4	1 900	1 080	400	4.8	13.00	12.33	12.00	1.1
44	Fermenter 15/16	11 000	8 475	2 300	4.8	1.20	0.44	0.13	9.2
45	Boiler No.2 Outlet	1 000	725	440	2.3	4.40	3.45	2.50	1.8
46	DDG Pellet Stack	2 000	1 347	740	2.7	24.00	20.50	17.00	1.4
47	No5 Starch Dryer	1 600	868	160	10.0	59.00	43.50	10.00	5.9

Further to the variability in the MOER from EPA 16 (CO_2 Scrubber Outlet) by a factor of × 12.2 (see **Table 8**), **Table 10** shows that the measured odour concentration is variable (a factor of ×7.1) and the measured volumetric discharge rate, with a factor of ×1.7 is relatively consistent.

For EPA ID 44 Fermenter 15/16, the measured odour emission concentration and volumetric flow rates vary by factors of × 4.8 and × 9.2 respectively, and similarly for EPA ID 47 by × 10.02 × 5.9.

3.7. Odour Modelling

During the audit period, two modelling assessments have been performed as relates to MOD 21 (modification to packing plant and other works), described as MOD21 Q2 and MOD21 Q3, and the second for MOD23 (gas-fired co-generation), which are reported in:

- GHD (Nov 2021) Shoalhaven Starches Modification 21 – Proposed Modification to Packing Plant and other works, Air Quality Assessment (GHD, Nov 2021); and
- GHD (Nov 2021) Shoalhaven Starches Modification 23 – Gas-fired Co-Generation, Air Quality Assessment (GHD, Jan 2022)

Those two modelling reports have been presented in **Appendix E** of this independent odour audit report.

The assumptions and changes to the previous odour modelling for MOD 21 are presented in section 7.2.2 of (GHD, Nov 2021) and are reproduced below:

- *Peak odour emission rates were sourced from the odour monitoring conducted by SEMA in the previous four quarters for EPA ID sources. The sources were scaled to an ethanol production rate of 300 ML per year production. The quarter with the maximum measured total OER was selected for use in the assessment and is consistent with guidance in the Approved Methods and the recommendation from EPA (16 February 2017) that peak emissions should be assessed. The peak period was found to be quarter 2, 2020 (August 2020).*
- *The exit velocities and temperatures for EPA ID sources were adjusted to the modelled quarter. These measurements include the mitigation modifications made to No. 3 and No. 4 gluten dryer exhausts as part of the Mod 11 and 12 air quality assessment recommendations.*
- *No. 1 and No. 2 gluten dryers were proposed to be modified to starch dryers as part of 16 assessment. Therefore, the emission rates assigned to these dryers remains unchanged from the Mod 16 assessment as the dryers have not been modified yet.*
- *Mod 16 assessed the addition of a new gluten dryer (GD8). The emission rates assumed in Mod 16 remain unchanged as the dryer has not been constructed yet.*
- *Mod 17 assessed the addition of a new product dryer (No. 9) (PD9), which is planned to be installed within the speciality products building. The product dryer will comprise about 20% of the size and production capacity of the approved (but not yet constructed) Gluten Dryer 8. It is envisaged that Product Dryer 9 will be used on an interim basis to process gluten allowing for an incremental increase in processing of gluten until the approved product dryer building is constructed and gluten dryer 8 is operational.*
- *Once gluten dryer 8 is operational, it is envisaged that product dryer 9 will revert to processing starch. PD9 will not result in any increase in production above the current approval limit for flour processing under Mod 16 of 25,400 tonnes per week.*
- *For the purposes of odour modelling, as part of Mod 17, PD9 was modelled as processing gluten with odour emission rates conservatively modelled as per gluten dryer 1 (which is of a similar size). The stack from the dryer will rise above and through the roof of the speciality product building at a height of 35.6 m. The diameter of the stack is proposed to be 0.85 m. The flow rates were calculated based on 20% of the proposed gluten dryer 8.*

- *As part of the Mod 19 proposal, a new distillation plant (with columns and associated processing equipment) is proposed to be installed immediately to the west of the existing Ethanol Distillery Plant. One additional emission source associated with this change is the new Distillation plant Column Washing Vent (CWV2), which is a duplication of the existing source (CWV). The stack height of the new source as provided by Manildra, is 55 metres tall. Stack diameter, exit velocity and temperature were sourced from the sampling report for the similar existing source (Odour Research Laboratories Australia (2020) Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01).*
- *Cooling tower odours are not included in the Mod 19 emissions inventory based on improvements at the site and subsequently being removed as a EPL odour sampling point*
- *As part of the current proposal (Mod 21), the following changes were made:*
  - *Increased indirect cooking facility odour emissions by 50%.*
  - *Odour concentrations from the upgraded biofilters A and B were estimated based on sampling from quarter 4 of 2017-2018. A biofilter outlet odour concentration of 669.3 OU was adopted. This was the highest measured biofilter outlet value (highest quarterly value for the average of biofilters A and B outlets) in the year before odorous air from DDG4 was diverted to the biofilter.*
- *Odour emission rates were assumed to be unchanged for the other emission sources.*

It is noted that the discharge temperatures reported in Table C.1 and Table C.2, Appendix C (GHD, Nov 2021) for EPA ID 42 (Boiler 4) and EPA ID 45 (Boiler 2) are presented as 30 K and 28 K respectively (in both tables). The monitoring reports appended to (GHD, Nov 2021) indicate measured gas temperatures of 164.6 °C and 216-214 °C respectively.

Subsequent correspondence from GHD to Manildra states:

> *The discharge temperatures for boiler 2 and 4 in TableC.1 and C.2 of MOD21 AQIA are a typographical error (exit velocity rounded to 1 d.p. presented instead of discharge temperature). The values modelled and those that should be presented in appendix C tables are:*
>
> - *Boiler 2 = 489.0 K (216°C)*
> - *Boiler 4 = 437.6 K (164.6°C)*

MOD23 Modelling – Emissions Assumptions

The assumptions and changes to the previous odour modelling for MOD 23 are presented in section 7.2.2 of (GHD, Nov 2021) and are reproduced below:

- *As part of the Mod 21 proposal, the following changes were added:*

- *installation of additional biofilter capacity to improve odour performance and increase biofilter ability to treat a higher volume of odorous air. Therefore odour concentrations from biofilter sampling undertaken prior to the diversion of odorous air from DDG4 have been used in this assessment.*
- *odour emissions from the indirect cooking facility were increased by 50%.*
- *Boiler 5/6 emissions were modelled with an exit velocity of 10 metres per second.*

- *As part of the current proposal (Mod 23), the following changes were made:*
  - *All boilers would be converted to gas fired. Odour emissions from boiler no 5 & 6 (gas fired) was estimated based on quarterly odour sampling data scaled based on proposed flowrate. Odour emission rates were assumed to be unchanged for the other emission sources.*

It is noted that the emissions inventory presented in Appendix C of (GHD, Jan 2022) does not include emission rates for EPA ID 42 (Boiler 4) and EPA ID 45 (Boiler 2). Section 8.1.1 of the modelling report (GHD, Jan 2022) states:

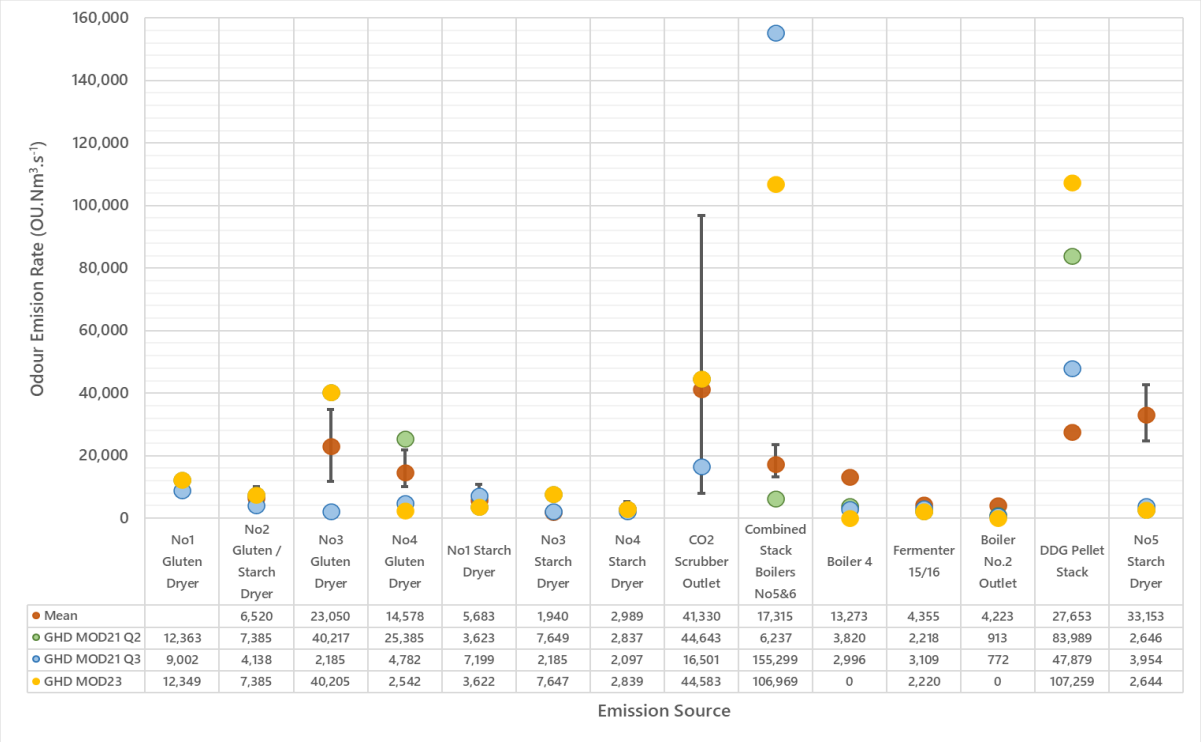
> *The existing gas boilers (boilers 1, 3, 7 and proposed gas boiler 8) will continue to be maintained and the existing coal and mixed coal and woodchip fired boilers (boilers 2, 4, 5, 6) will be converted from coal to biogas / natural gas fired.*
>
> *For typical operational conditions, boilers 1, 2, 3, 4, 7 and 8 would be on standby, while only boilers 5 and 6 are proposed to be used.*
>
> *Boilers allocated to standby duty (i.e. Boilers 1, 2, 3, 4, 7 and 8) would not be operational (no fuel usage and no emissions) and would only be brought online during statutory maintenance periods while a gas turbine or boiler 5 and 6 is offline for inspection and maintenance or in emergency situations.*

The odour emissions inventories for MOD21 Q2, MOD21 Q3 and MOD23 presents assumptions for a range of sources not covered by this odour audit. However, a simple comparison of the aggregated odour emission rates measured and modelled for sources (EPA ID, 8, 9, 10, 11, 12, 13, 14, 16, 35, 39, 39A, 40(E/W), 41(E/W), 42, 44, 45, 26, 47) shows the following (noting that these emission rates have been corrected to 273 K).

- Measured: 196 061 $OU \cdot Nm^{-3} \cdot s^{-1}$
- Modelled (MOD21 Q2): 248 956 $OU \cdot Nm^{-3} \cdot s^{-1}$ (127 % of measured)
- Modelled (MOD21 Q2): 273 282 $OU \cdot Nm^{-3} \cdot s^{-1}$ (139 % of measured)
- Modelled (MOD23) 345 292 $OU \cdot Nm^{-3} \cdot s^{-1}$ (176 % of measured)

The distribution of the measured and modelled odour emission rates is presented in **Figure 3**.

Figure 3 Comparison of measured and modelled odour emission rates



Mod21 Modelling - Odour Modelling Results

The odour modelling results presented in (GHD, Nov 2021) are presented in table 7.2 on page 48 of that report. These data have been extracted are reproduced below in **Table 11**.

Table 11 Summary of odour modelling results (MOD 21) (99th percentile 1-second OU)

Receptor	Range (m)	Nearest odour source	Dir.	Odour criterion	Odour impact, OU, 99th percentile, nose-response time					
					MOD 13	MOD 16	MOD 17	MOD 19	MOD 21 Q2	MOD 21 Q3
R1 Bomaderry	150	Packing plant	W	6	3.3	3.5	4	4	5	4
R2 North Nowra	1 300	Factory	SW	3	2.5	2.6	3	3	4	3
R3 Nowra	700	Factory	S	5	4	4.6	5	5	6	5
R4 Terara	1 300	Factory	SE	5	3.7	3.7	4	4	5	4
C1	45	Factory	N	n/a	n/a	10.3	12	12	16	14
C2	20	Factory	N	n/a	n/a	5.8	8	10	10	9
C3	30	Factory	N	n/a	n/a	5.3	7	9	9	8
C4	75	Factory	NW	n/a	n/a	4.4	6	7	8	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7	8	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10	10	9
C7	55	Factory	NW	n/a	n/a	4.8	7	8	10	9

Note: Predicted exceedances of the relevant criterion are highlighted

It may be noted that for MOD21 the modelling predicts exceedances with stated odour impact assessment criteria for the Q2 emission estimation at receptors R2 and R3 The isopleth plots for the predicted odour footprints is replicated in **Figure 4** (figure 7.2 (GHD, 2021)).

Mod23 Modelling - Odour Modelling Results

The odour modelling results presented in (GHD, Jan 2022) are presented in table 7.2 on page 32 of that report. These data have been extracted are reproduced below in **Table 11**.

Table 12 Summary of odour modelling results (MOD 23) (99th percentile 1-second OU)

Rec	Range (m)	To nearest odour source	Dir.	OAC	Odour impact, OU, 99th percentile, nose-response time						
					MOD 13	MOD 16	MOD 17	MOD 19	MOD 21 Q2	MOD 21 Q3	MOD 23
R1	150	Packing plant	W	6	3.3	3.5	4	4	5	4	5
R2	1 300	Factory	SW	3	2.5	2.6	3	3	4	3	3
R3	700	Factory	S	5	4	4.6	5	5	6	5	5
R4	1 300	Factory	SE	5	3.7	3.7	4	4	5	4	5
C1	45	Factory	N	n/a	n/a	10.3	12	12	~~16~~ 14	~~14~~ 12	12
C2	20	Factory	N	n/a	n/a	5.8	8	10	10	9	8
C3	30	Factory	N	n/a	n/a	5.3	7	9	9	8	8
C4	75	Factory	NW	n/a	n/a	4.4	6	7	8	7	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7	8	7	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10	10	9	9
C7	55	Factory	NW	n/a	n/a	4.8	7	8	~~10~~ 9	~~9~~ 8	8

Note: Predicted exceedances of the relevant criterion are highlighted

It may be noted that for MOD23 the modelling predicts no exceedances with stated odour impact assessment criteria. The isopleth plot for the predicted odour footprints is replicated in **Figure 4** (figure 7.2 (GHD, 2021)).

It is noted that the reported odour concentrations at receptors C1 and C7 within (GHD, Jan 2022) are different to those presented in (GHD, Nov 2021) (see **Table 11**). The identified discrepancies are indicated with strike through data, replaced by the MOD 23 reported values.

Recommendation: 21/22-REC-D

It is recommended that the difference between reported predicted concentration values as reported in (GHD, Nov 2021) and (GHD, Jan 2022) is clarified so that there is consistency between the modelling reports.

Figure 4 Ground level odour predictions (MOD 21) (GHD, Nov 2021)

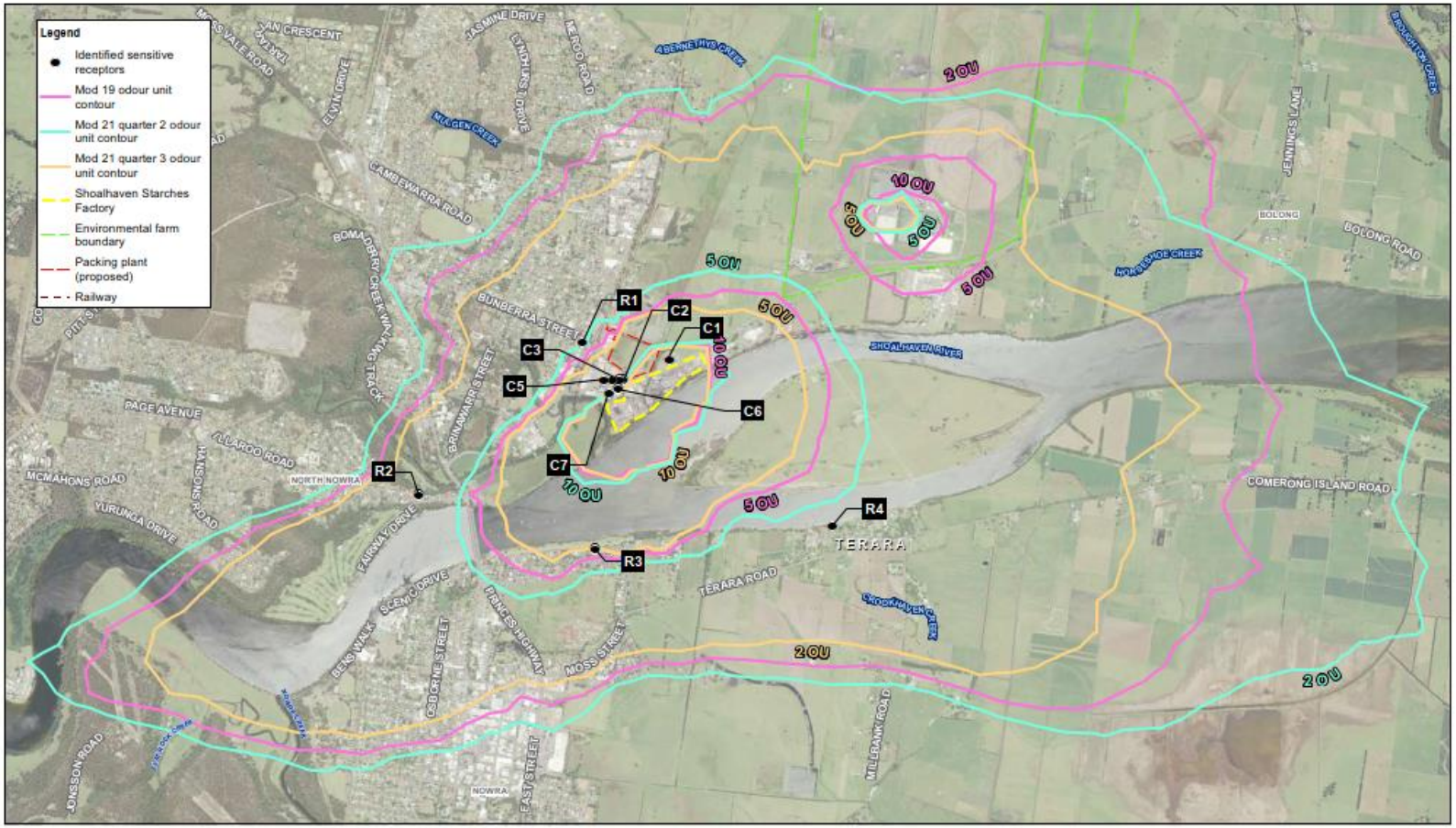
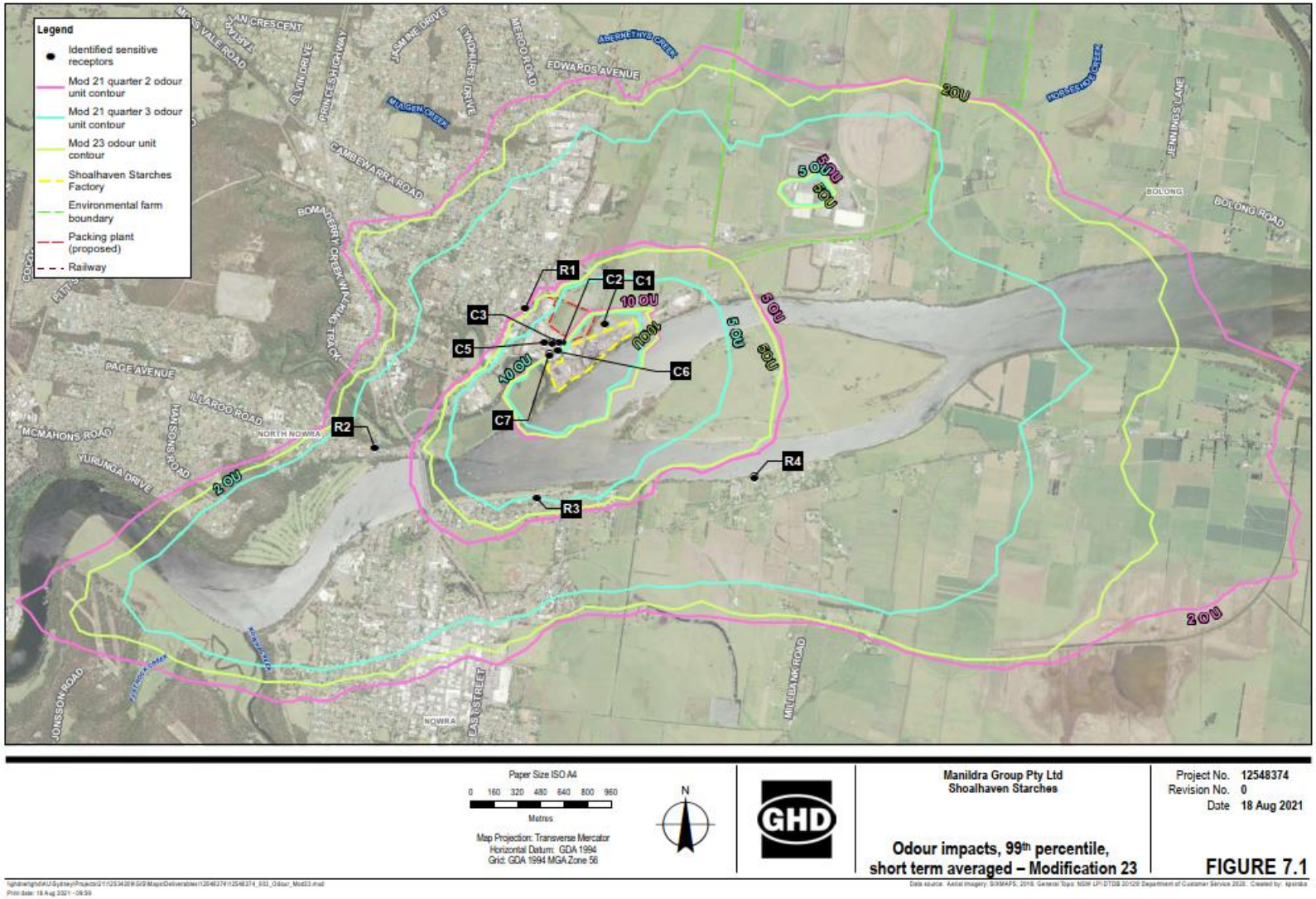

Legend
Identified sensitive receptors
Mod 19 odour unit contour
Mod 21 quarter 2 odour unit contour
Mod 21 quarter 3 odour unit contour
Shoalhaven Starches Factory
Environmental farm boundary
Packing plant (proposed)
Railway
R1
R2
R3
R4
C1
C2
C3
C5
C6
C7
2 OU
5 OU
10 OU
BUNBERRA STREET
SHOALHAVEN RIVER
TERARA
TERARA ROAD
COMERONG ISLAND ROAD
BOLONG ROAD
JENNINGS LANE
LAMBEWARRA ROAD
PAGE AVENUE
MCMAHONS ROAD
YURUNGA DRIVE
NORTH NOWRA
NOWRA
MOSS STREET
EAST STREET
MILL BANK ROAD
JONSSON ROAD
JASMINE DRIVE
BENNETTHYS CREEK
MILGEN CREEK
BOMADERRY CREEK WALKING TRACK
BRUNDAWARR STREET
HANSENS ROAD
ILLAROO ROAD
FAIRWAY DRIVE
SCENIC DRIVE
BEINGWALK
CROOKHAVEN CREEK
HORSEMOE CREEK
BROUGHTON CREEK
Paper Size ISO A4
0 170 340 510 680 850 1,020
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56
N
GHD
Manildra Group Pty Ltd
Shoalhaven Starches
Odour impacts, 99th percentile, short term averaged – Modification 21
Project No. 12548374
Revision No. 0
Date 30 Jun 2021
FIGURE 7.2

Figure 5 Ground level odour predictions (MOD 23) (GHD, Jan 2022)



4. ODOUR AUDIT FINDINGS

The compiled audit table of the above information is presented in **Table 13**.

Table 13 Consolidated odour conditions and summary of compliance (MOD 16, Schedule 3)

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
Offensive Odour				
1	The Applicant shall not cause or permit the emission of offensive odours from the site, as defined under Section 129 of the POEO Act.	**Section 3.2** provides a summary of the odour complaints, and these are replicated (with redaction) in **Appendix F**.	The number of odour complaints received in this period is one (1), which has been investigated and are closed.	Compliant
Implementation of Mandatory Odour Controls				
2	Prior to increasing ethanol production rates on site above 126 million litres a year or within 12 months of this approval, whichever is sooner, the Applicant shall implement all the mandatory odour controls listed in Appendix 3 and described in detail in the Odour Management Plan (see condition 4 below), to the satisfaction of the Secretary.	Controls implemented as evidenced in previous IOA.	None.	Compliant
3	The Applicant shall implement additional mandatory odour controls as may be directed by the Secretary, arising from the Department's assessment of any:	Controls implemented as evidenced in previous IOA.	None.	Not triggered
	a) Independent Odour Audit (see condition 5 below);	None.	None.	--

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	b) Independent Environmental Audit (see condition 4 of schedule 4); or	None.	None.	--
	c) any monitoring results, incidents or complaints related to the project.	None.	None.	--
3A	Prior to commissioning the duct work that directs additional emissions from the evaporator plant area and load-out chute to the bio-filter (as identified in the amended modification proposal) the Applicant must demonstrate to the satisfaction of the Secretary and the EPA that the bio-filter can accommodate the additional load while maintaining acceptable treatment performance.	Controls implemented as evidenced in previous IOA.	Completed.	Compliant
3B	Should the Applicant opt to install a DDG pelletising plant as identified in the additional odour controls in Appendix 3 the plant must comply with all regulatory requirements including air and odour emissions standards that are in force at the time of installation. Compliance must be demonstrated to the satisfaction of the Secretary and EPA before installation work begins.	Controls implemented as evidenced in previous IOA.	Completed.	Compliant
3C	Deleted	None.	None	--

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
3D	Prior to construction of any part of MOD 11 and MOD 12 as described in Schedule 2, Condition 2, the Applicant shall implement odour mitigation controls on the gluten dryers 3 and 4. The controls shall include re-orienting the discharge vents and increasing the velocity of discharges to improve odour dispersion, as described in MOD 11 and MOD 12. The Applicant shall provide evidence to the satisfaction of the Secretary to demonstrate that the odour mitigation controls have been successfully implemented.	The plant modifications, including the re-orientation of the discharge vents have been implemented, although it is noted that neither of the modified discharges are vertical.	A letter from DPI&E (ref: 10/06422-11, dated 24/10/17) provides evidence of DPI&E satisfaction on the installation of the odour controls on gluten dryers 3 and 4.	Compliant
Odour Management Plan				
4	The Applicant shall prepare an Odour Management Plan for the project to the satisfaction of the Secretary. This plan must: a) be prepared in consultation with EPA by a suitably independent, qualified and experienced expert whose appointment has been endorsed by the Secretary, and submitted to the Secretary for approval within 3 months of the date of this approval;	The OMP is discussed in **Section 3.1.1**.	It has been completed by The Odour Unit, who are a suitably qualified and experienced expert in odour management. It is noted that the OMP has received DPI&E review.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	b) describe in detail the measures that would be implemented on site to control the odour impacts of the project, and to ensure that these controls remain effective over time;	The OMP is discussed in **Section 3.1.1**.	Section 2 and 3 of the OMP adequately addresses odour control.	Compliant
	c) identify triggers for remedial action; and	The OMP is discussed in **Section 3.1.1**.	Section 3 of the OMP addresses upset conditions that would prompt remedial actions to assist reduce the resultant potential impacts.	Compliant
	d) include a program for monitoring the odour impacts of the project.	The OMP is discussed in **Section 3.1.1**.	Section 4 of the OMP presents details of the system monitoring program.	Compliant
4A	Prior to increasing ethanol production the Odour Management Plan for the project must be updated to the satisfaction of the Secretary to include the additional Appendix 3 mandatory odour controls specified in the modification approval MOD 1 – Deletion of DDG Pelletiser.	None.	Completed.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
Independent Odour Audit				
5	Within 3 months of the implementation of the mandatory odour controls (see Appendix 3), and annually thereafter unless the Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Odour Audit of the project. This audit must be conducted by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Secretary. During the audit, this expert must:	The Letter of Endorsement from the Director General is provided in **Appendix A**.	The Letter of Endorsement from the Director General is provided in **Appendix A**.	Compliant
	a) consult with the EPA and the Department	**Section 1.2** presents a summary of the consultation with the EPA and DPE.	Consultation performed and recommendations for the odour audit adopted	Compliant
	b) audit the effectiveness of the odour controls on site in regard to protecting receivers against offensive odour;	**Section 3** presents the collated information regarding odour control.	The information provided and reviews includes a wide range of ongoing compliance monitoring data to quantify and evaluate the odour control performance of the plant.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	c) review the Applicant's production data (that are relevant to the odour audit) and complaint records;	**Section 3.3** presents a summary of the production data corresponding to the monitoring program dates. **Section 3.2** presents a summary of the odour complaints for the audit period.	The production data provided by Shoalhaven Starches has been reviewed and is tabulated in **Table 3**. The number of odour complaints received in this period is one (1) (#064) which has been closed out.	Compliant
	d) review the Odour Management Plan for the project;	**Section 3.1.1** provides a summary of any relevant updates to the OMP.	During this audit period, there are no relevant updates relevant to this odour audit.	Compliant
	e) measure all key odour sources on site, and compare the results of these measurements against the predictions in the EA;	Audit of monitoring data presented in **Sections 3** and **3.6**. The comparison against modelling assessment provided in **Section 3.7**	The quarterly and annual emission testing has been completed over the auditing period.	Compliant
	f) determine whether the project is complying with the requirements in this approval; and	Reference should be made to the rest of the document.	Reference should be made to the rest of the document in which specific compliance (or otherwise) is documented.	--
	g) if necessary, recommend and prioritise measures to either improve the odour controls on site and/or the Odour Management Plan, such that receivers would be protected against offensive odour from the site.	**Section 5** provides a summary of this Independent Odour Audit. **Section 5.1** provides a summary of non-compliances and **Section 5.2** provides recommendations.	Recommendations as documented in **Section 5.2**.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	Note: The Secretary may vary the frequency of the audit depending on the performance of the project.	None	None.	--
6	Within 6 weeks of the completion of this audit, the Applicant shall submit a copy of the audit report to both EPA and the Secretary with a response to any recommendations contained in the audit report.	Outside the scope of the Independent Odour Audit.	None	--
Odour verification (MP 06_0228 MOD 2)				
6A	The Applicant shall ensure that any Independent Odour Audit submitted to the Secretary in accordance with Condition 5 of this Schedule includes: a) 3 monthly (quarterly) odour monitoring with samples taken from the carbon dioxide/ethanol recovery scrubber inlet/s and outlet/s; and	The quarterly odour monitoring reports are discussed in **Section 3.6**, and attached as **Appendix D** to this audit report.	The quarterly and annual emission testing has been completed over the auditing period.	Compliant
	b) quarterly odour monitoring with samples taken of single vent stack (direct to atmosphere) emissions from a filling fermenter tank.	The quarterly odour monitoring reports are discussed in **Section 3.6**, and attached as **Appendix D** to this audit report.	The quarterly and annual emission testing has been completed over the auditing period.	Compliant
6B	Deleted	None required	The quarterly and annual emission testing has been completed over the auditing period.	--

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
6C	The Applicant shall conduct quarterly odour monitoring from the DDG exhaust stack and report the results in the independent odour audit required under Condition 5 of Schedule 3.	The quarterly odour monitoring reports are discussed in **Section 3.6**, and attached as **Appendix D** to this audit report.	The quarterly and annual emission testing has been completed over the auditing period.	Compliant
6D	The Applicant shall conduct odour monitoring on the relocated starch dryer described in MOD 7 in accordance with the requirements of the EPL and report the results in the independent odour audit required under Condition 5 of Schedule 3.	The quarterly odour monitoring reports are discussed in **Section 3.6**, and attached as **Appendix D** to this audit report.	MOD7 relates to the No5 Starch Dryer (as captured in the EPL variation dated June 2018).	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
6E	If the results of odour monitoring show any odour impact greater than that predicted by the odour dispersion modelling in the EA and the modification proposals referred to in Condition 2 of Schedule 2, the Applicant shall investigate and implement further odour treatment options as directed by the Secretary or the EPA.	Section 3.7 presents a summary of the modelled odour emission rates as presented in the MOD21 and MOD 23 air quality assessment reports.	The sequential process modifications have been modelled and assessed, up to MOD23, including further odour treatment options, noting MOD21 Q2 showed some predicted exceedances of the odour impact assessment criteria at R2 and R3. A comparison presented in Section 3.7 shows modelled emissions were in the order of 127 % to 176 % of the corresponding measured odour emission rates. It is noted that the MOD21 and MOD23 modelling includes a significant number of additional sources not included within the scope of this audit. Overall, it is considered that the modelling represents the site adequately.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
6F	The Applicant shall conduct odour validation monitoring on the gluten dryers 3 and 4, following implementation of the mitigation controls required by Condition 3D. Results of the odour validation monitoring shall be included in the independent odour audit required under Condition 5 of Schedule 3.	The quarterly odour monitoring reports are discussed in **Section 3.6**, and attached as **Appendix D** to this audit report.	The quarterly and annual emission testing has been completed over the auditing period.	Compliant

5. SUMMARY

Based upon the information reviewed the following recommendations are proposed.

5.1. Identified Non-Compliances

Table 14 below presents the observed non-compliances against the consolidated odour conditions (see **Table 13**).

Table 14 Independent odour audit non-compliances

UIN	Condition and Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
None	None	None	None

5.2. Recommendations

Recommendations from this 2021-22 audit and any remaining unresolved recommendations from the previous audits are summarised in **Table 15**.

Table 15 Independent odour audit recommendations

Reference	Recommendation	Implementation
2021-22 Odour Audit Recommendations		
21/22-REC-A	Whilst it is acknowledged that the biofilters are achieving a reasonable degree of odour control (56 % efficacy), the flow-weighted average odour concentration is not achieving the de-facto 500 OU standard. This matter remains an unresolved issue and it is recommended that it is resolved at the earliest opportunity.	Identified in this report for consideration
21/22-REC-B	It is recommended that the safety issue(s) preventing EPA 20 from being tested are resolved to ensure that EPA 20 is available to be tested during the 2022-2023 period. It is understood that the safety issue is the stability of the dam banks due to the low water levels and the dam is used when all other dams are full.	Identified in this report for consideration
21/22-REC-C	With regard to flow measurements at EPA ID 8 the odour monitoring reports state: "*Sampling was undertaken at the exit of the stack as it was the only accessible area for the samples to be taken. No temperature or flow rate readings could be taken due to access issues.*" It is recommended that the access	Identified in this report for consideration

Reference	Recommendation	Implementation
	restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed. It is understood that new sampling ports have been installed (Sep 2022) that would be in compliance during the following odour audit period.	
21/22-REC-D	It is recommended that the difference between reported predicted concentration values as reported in (GHD, Nov 2021) and (GHD, Jan 2022) is clarified so that there is consistency between the modelling reports.	Identified in this report for consideration
2020-21 Odour Audit Recommendations		
20/21-REC-A	Whilst it is acknowledged that the biofilters are achieving a high degree of odour control (i.e. >90 %), the flow-weighted average odour concentration is not achieving the de-facto 500 OU standard. This matter remains an unresolved issue and it is recommended that it is resolved.	Ongoing
20/21-REC-C	It is recommended that a source apportionment study is completed as a component of the next odour modelling performed, to further understand the relationship between emission rates and the relative contribution of sources to aggregated off-site impacts.	Ongoing
2019-20 Odour Audit Recommendations		
2019-20-IOA-A	As identified at **Section 3.1** and **Section 3.6**, and as stated in the Biofilter Capacity and Condition Assessment report #23, the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing
2018-19 Odour Audit Recommendations		
2018-19-IOA-B	As identified at Section 2.4, Section 2.9.3 (of the 2018-19 audit) and stated in the Biofilter Capacity and Condition Assessment report #22 (June 2019), the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing
2017-18 Odour Audit Recommendations		
2017-18-IOA-C	As identified at Section 2.3 (of the 2017-18 audit) and stated in the Biofilter Capacity and Condition Assessment report #21 (April 2018), the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing

Appendix A – Director General's Letter of Appointment

NSW GOVERNMENT Planning & Infrastructure

Contact: Deana Burn
Phone: (02) 9228 6453
Email: deana.burn@planning.nsw.gov.au

Mr John Studdert
Quality Assurance & Environmental Coordinator
Manildra Group
PO Box 123
NOWRA NSW 2541

Ref: 10/06422-9

Shoalhaven Starches Ethanol Expansion Project (06_0228)
Independent Environmental Audit and Independent Odour Audit 2016

Dear Mr Studdert

I refer to your email of 1 March 2016 seeking approval for Edge Environment Pty Ltd (Edge) to undertake the Independent Environmental Audit and Northstar Air Quality Pty Ltd (Northstar) to undertake the Independent Odour Audit for the above project.

Independent Environmental Audit – Schedule 4 Condition 4
The Department approves the proposed audit team, including Jon Panic from Edge, Gary Graham from Northstar and Matthew Verth from Resonate Acoustics. In undertaking the audit, Edge must ensure the audit:

- is conducted in accordance with AS/NZS ISO 19011:2003 *Australian/New Zealand Standard: Guidelines for quality and/or environmental management systems auditing*;
- includes a compliance table indicating the compliance status of each condition of approval (and any other statutory instrument required to be audited);
- avoids terms such as "partial compliance". An audit is to make findings of either "compliance", "non-compliance" or "inability to be determined";
- includes recommended actions in response to non-compliances;
- identifies opportunities for improved environmental management and performance;
- covers all modifications to the project approval; and
- includes detailed consideration of odour, noise, wastewater and traffic management.

Please ensure that Edge, Northstar and Resonate Acoustics are advised of these requirements. Should Edge wish to discuss the scope of the audit with the Department, please advise them to contact myself or Deana Burn.

Independent Odour Audit – Schedule 3 Condition 5
Having considered the qualifications and experience of Mr Gary Graham from Northstar, approval is granted for Mr Graham to conduct the independent odour audit. Please ensure the scope of the audit addresses the requirements of condition 5a) to 5g) and 6A, 6C, 6D and 6E.

Finally, the Department requests that you:

- review both the audit reports to ensure they comply with the relevant conditions of approval, prior to submitting the reports to the Secretary; and
- submit an action plan detailing your response to the auditor's recommendations and timeframes to implement the recommendations.

Should you have any enquiries, please contact Deana Burn on 9228 6453.

Yours sincerely

C. Ritchie 8/3/16.

Chris Ritchie
Director - Industry Assessments
as the Secretary's nominee

Bridge St Office 23-33 Bridge St SYDNEY NSW 2000 GPO Box 39 SYDNEY NSW 2001
Telephone (02) 9228 6338 Facsimile (02) 9228 6455 DX 10181 Sydney Stock Exchange Website planning.nsw.gov.au

Declaration of Independence Form

Project Name:	Shoalhaven Starches
Consent Number:	06_0228
Description of Project	Shoalhaven Starches Independent Odour Audit (2021-2022)
Project Address	160 Bolong Road, Bomaderry, NSW 2541
Proponent	Shoalhaven Starches Pty Ltd
Title of Audit	Shoalhaven Starches Independent Odour Audit (2021-2022)
Date	20 October 2022

I declare that:

i. I am not related to any proponent, owner, operator or other entity involved in the delivery of the project. Such a relationship includes that of employer/employee, a business partnership, sharing a common employer, a contractual arrangement outside an Independent Audit, or that of a spouse, partner, sibling, parent, or child;
ii. I do not have any pecuniary interest in the project, proponent or related entities. Such an interest includes where there is a reasonable likelihood or expectation of financial gain (other than being reimbursed for performing the audit) or loss to the auditor, or their spouse, partner, sibling, parent, or child;
iii. I have not provided services (not including independent reviews or auditing) to the project with the result that the audit work performed by themselves or their company, except as otherwise declared to the Department prior to the audit;
iv. I am not an Environmental Representative for the project; and
v. I will not accept any inducement, commission, gift or any other benefit from auditee organisations, their employees or any interested party, or knowingly allow colleagues to do so. Notes:

Notes:

a) Under section 10.6 of the Environmental Planning and Assessment Act 1979 a person must not include false or misleading information (or provide information for inclusion in) in a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows thatthe information is false or misleading in a material respect. The proponent of an approved project must not fail to include information in (or provide information for inclusion in) a report of monitoring data or an audit report produced to the Minister in connection with an audit if the person knows that the information is materially relevant to the monitoring or audit. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000; and

b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 307B (giving false or misleading information – maximum penalty 2 years imprisonment or 200 penalty units, or both)

Name of Auditor	Gary Graham
Qualification	BSc(hons), MSc, CSci, CEnv, CAQP
Company	Northstar Air Quality Pty Ltd
Company Address	Suite 1504, 275 Alfred Street, North Sydney NSW 2060
Signature	

APPENDIX B – BIOFILTER PHOTOGRAPHS

Biofilter A (Shoalhaven Starches, photographed on 01/08/22)

Biofilter B (Shoalhaven Starches, photographed on 01/08/22)

APPENDIX C – DDG BIOFILTER & CAPACITY & CONDITION ASSESSMENT REPORTS

TO: **JOHN STUDDERT**
COMPANY: **MANILDRA GROUP, SHOALHAVEN STARCHES**
FROM: **MICHAEL ASSAL**
DATE: **6 APRIL 2022**
SUBJECT: **DDG BIOFILTER PERFORMANCE AND CONDITION ASSESSMENT 25 – 9 DECEMBER 2021**

1. Introduction

In December 2011, Shoalhaven Starches commissioned The Odour Unit Pty Ltd (**TOU**) to carry out regular inspections of the Dried Distillers Grain (**DDG**) Biofilter System. The objective of these assessments is to provide feedback to Shoalhaven Starches on the condition and performance of the biofilter-based odour control system on an as required basis.

The assessments are currently carried out on a half-yearly basis. The following report covers the findings of Biofilter Assessment 25, undertaken on 9 December 2021 by TOU.

2. Biofilter Design – DDG Biofilters 1 & 2

The designs for Biofilters 1 & 2 are identical and summarised below:

Construction:	Concrete, twin-cells
Bed area:	Two cells, each 55 m^2, total surface area of 110 m^2
Bed depth:	1.8 m
Medium:	Proprietary bark/green waste compost blend
Design airflow:	15,000 m^3/hr per biofilter
Design loading rates:	137 m^3/m^2/hr, 76 m^3/m^3/hr, 48 seconds EBRT at 15,000 m^3/hr per biofilter
Moisture control:	Pre-humidified airstream

It is understood that the medium in Biofilter 2 was replaced mid-October 2020 and that Biofilter 1 has not been refurbished since mid-2019.

3. Assessment Methodology

The assessment followed an identical methodology to that used in all previous assessments, as follows:

- Velocity and airflow into each biofilter;
- Temperature and relative humidity measurements into the biofilters;
- Pressure readings in each inlet duct;

- Visual inspection and pressure reading at biofilter drain sumps;
- Spatial surface outflow readings on the biofilter beds (see below); and
- A visual and olfactory assessment of the biofilter by the assessor.

The spatial testing involves the use of a TOU sampling hood, systematically placed at selected locations on the biofilter surface. The readings for velocity are taken from the 100 mm Polyvinyl Chloride (**PVC**) vent pipe on the lid of the hood. Due to the low velocities in the vent pipe and the exposed location on the biofilter surface, the measurement technique is prone to the effects of ambient wind conditions. The high wind velocities can upset the measured velocities in the vent pipe. At the time of this assessment, the prevailing winds were suitable for the undertaking of spatial testing on the DDG biofilter system.

The sampling port installed in the main duct to the DDG biofilters, upstream of the flow splitter junction has enabled more accurate measurement of airflow velocity to the overall system. In this assessment, the airflow to DDG Biofilter 1 was determined as the difference between the combined readings from this common inlet location and the new Dryer duct, and the reading into DDG Biofilter 2.

4. Physical Assessment Results – Main Duct into DDG Biofilter System

The **Main Duct** measurements yielded the following results in this assessment:

Airflow:	16.23 m/s, 18,210 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	46.0 °C
Inlet air pressure:	+220 Pa

The **DDG Biofilter 2** measurements yielded the following results:

Airflow:	8.41 m/s, 8,500 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	44.6 °C
Inlet air pressure:	+78 Pa (+86 Pa Cell 1, +70 Pa Cell 2)
Biofilter outlet air humidity:	saturated
Duct pressure in header manifold:	+190 Pa
Biofilter under-bed drain pressure:	+31 Pa Cell 1, +35 Pa Cell 2

Dryer #4 Duct measurements yielded the following results in this assessment, noting that Dryer #4 was offline:

Airflow:	10.26 m/s, 2,880 m^3/hr (ϕ = 300 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	33.0°C
Inlet air pressure:	+350 Pa

The derived results for the **DDG Biofilter 1** are as follows:

Airflow:	9,600 m^3/hr
Inlet air relative humidity:	100%
Inlet air temperature:	44.4ºC
Inlet air pressure:	+70 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	40.6ºC (mean)

The combined total flow to the biofilters is 18,210 m^3/hr

The distribution of airflow to the two biofilters is relatively even.

5. Spatial Testing Results

The spatial testing locations are shown in **Figure 5.1** & **Figure 5.2** for DDG Biofilter 1 & DDG Biofilter 2, with the spatial testing results presented in **Table 5.1** & **Table 5.2**, respectively. The spatial testing results for DDG Biofilter 1 & DDG Biofilter 2 are visually depicted in **Figure 5.3** & **Figure 5.4**.

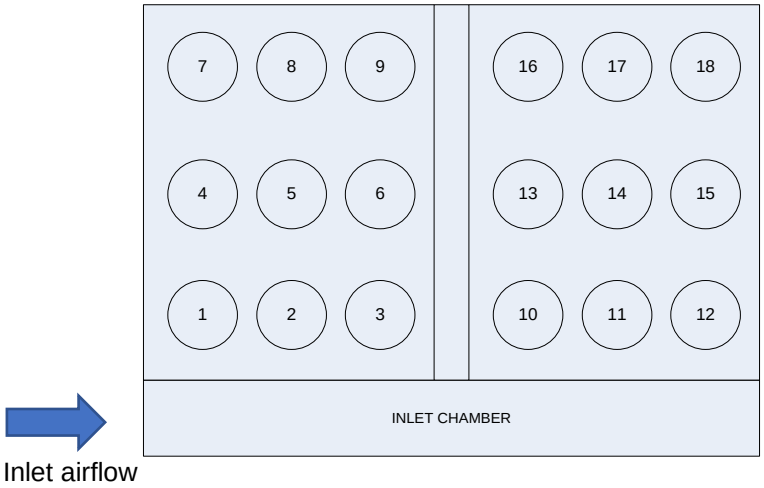


Figure 5.1 – Spatial Testing Locations – DDG Biofilter 1

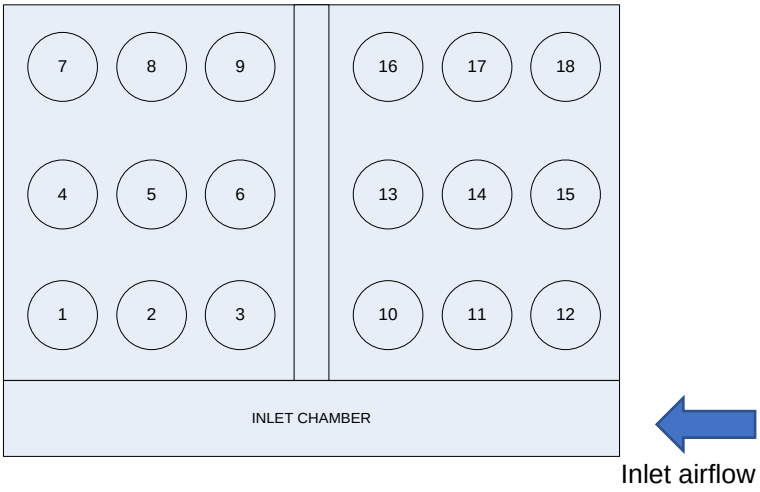


Figure 5.2 – Spatial Testing Locations – DDG Biofilter 2

Table 5.1 – Spatial airflow results: DDG Biofilter 1: 9 December 2021			
Biofilter Cell	**Location ID**	**Outflow Velocity (m/s)**	**Mean Outlet Temperature (^{0}C)**
Cell 1 (Northern Cell)	Location 1	0.93	Refer to **Section 4**
	Location 2	0.81	
	Location 3	0.73	
	Location 4	0.65	
	Location 5	0.61	
	Location 6	0.63	
	Location 7	0.70	
	Location 8	0.58	
	Location 9	0.67	
Cell 2 (Southern Cell)	Location 10	0.77	
	Location 11	0.76	
	Location 12	0.93	
	Location 13	0.66	
	Location 14	0.63	
	Location 15	0.72	
	Location 16	0.66	
	Location 17	0.64	
	Location 18	0.70	
Spatial Outflow Statistical Analysis		**Cell 1**	**Cell 2**
Average (m/s)		0.70	0.72
Standard deviation (m/s)		± 0.1	± 0.09
Percentage variation (%)		1.5	1.1

Table 5.2 – Spatial airflow results: DDG Biofilter 2: 9 December 2021			
Biofilter Cell	**Location ID**	**Outflow Velocity (m/s)**	**Mean Outlet Temperature (°C)**
Cell 1 (Southern Cell)	Location 1	0.81	Refer to **Section 4**
	Location 2	0.86	
	Location 3	0.90	
	Location 4	0.88	
	Location 5	0.74	
	Location 6	0.97	
	Location 7	0.87	
	Location 8	0.88	
	Location 9	0.74	
Cell 2 (Northern Cell)	Location 10	0.65	
	Location 11	0.80	
	Location 12	0.90	
	Location 13	0.97	
	Location 14	0.89	
	Location 15	0.74	
	Location 16	0.93	
	Location 17	0.86	
	Location 18	0.85	
Spatial Outflow Statistical Analysis		**Cell 1**	**Cell 2**
Average (m/s)		0.85	0.84
Standard deviation (m/s)		± 0.07	± 0.09
Percentage variation (%)		0.6	1.0

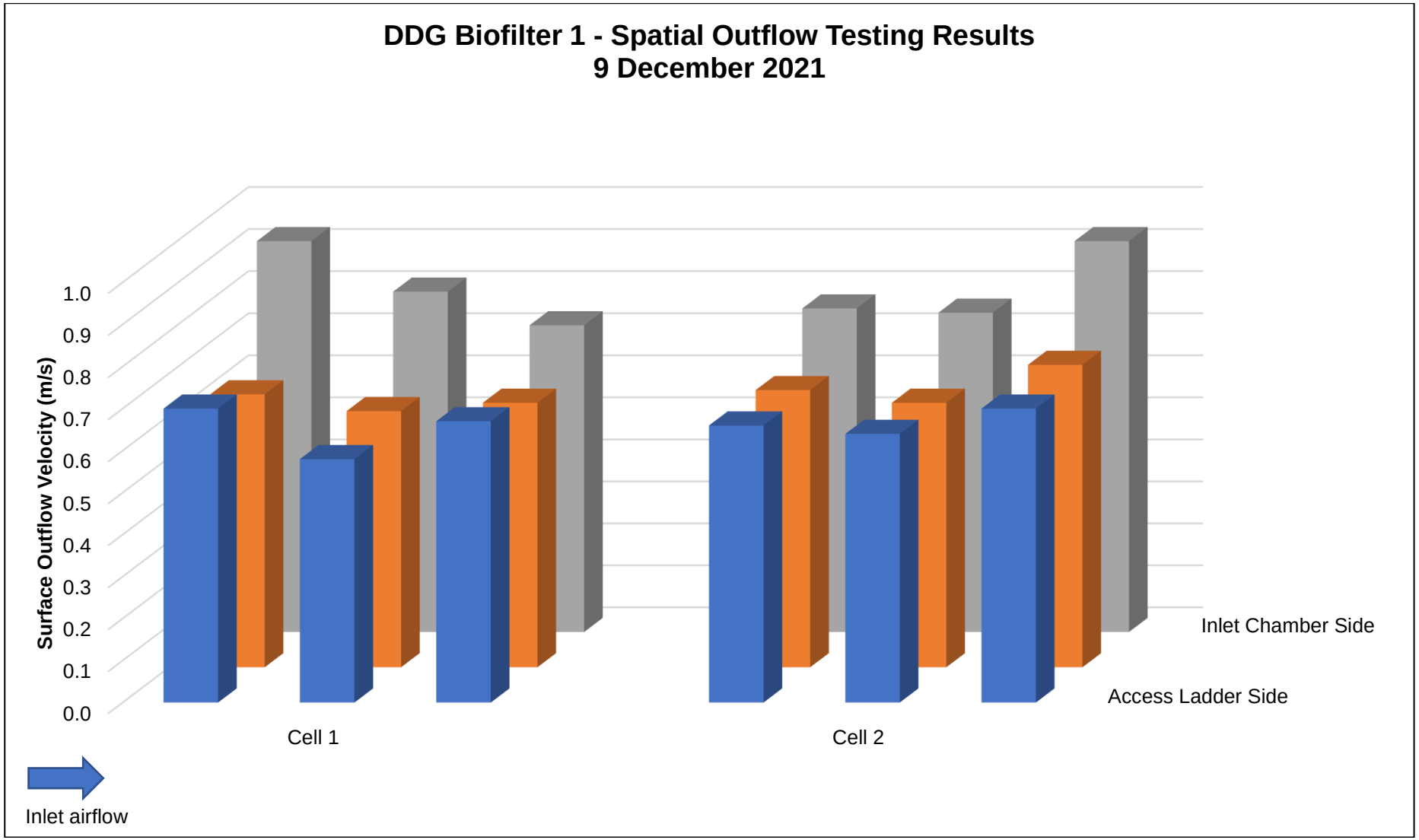


Figure 5.3 – Biofilter 1: Spatial Outflow Testing Results on 9 December 2021

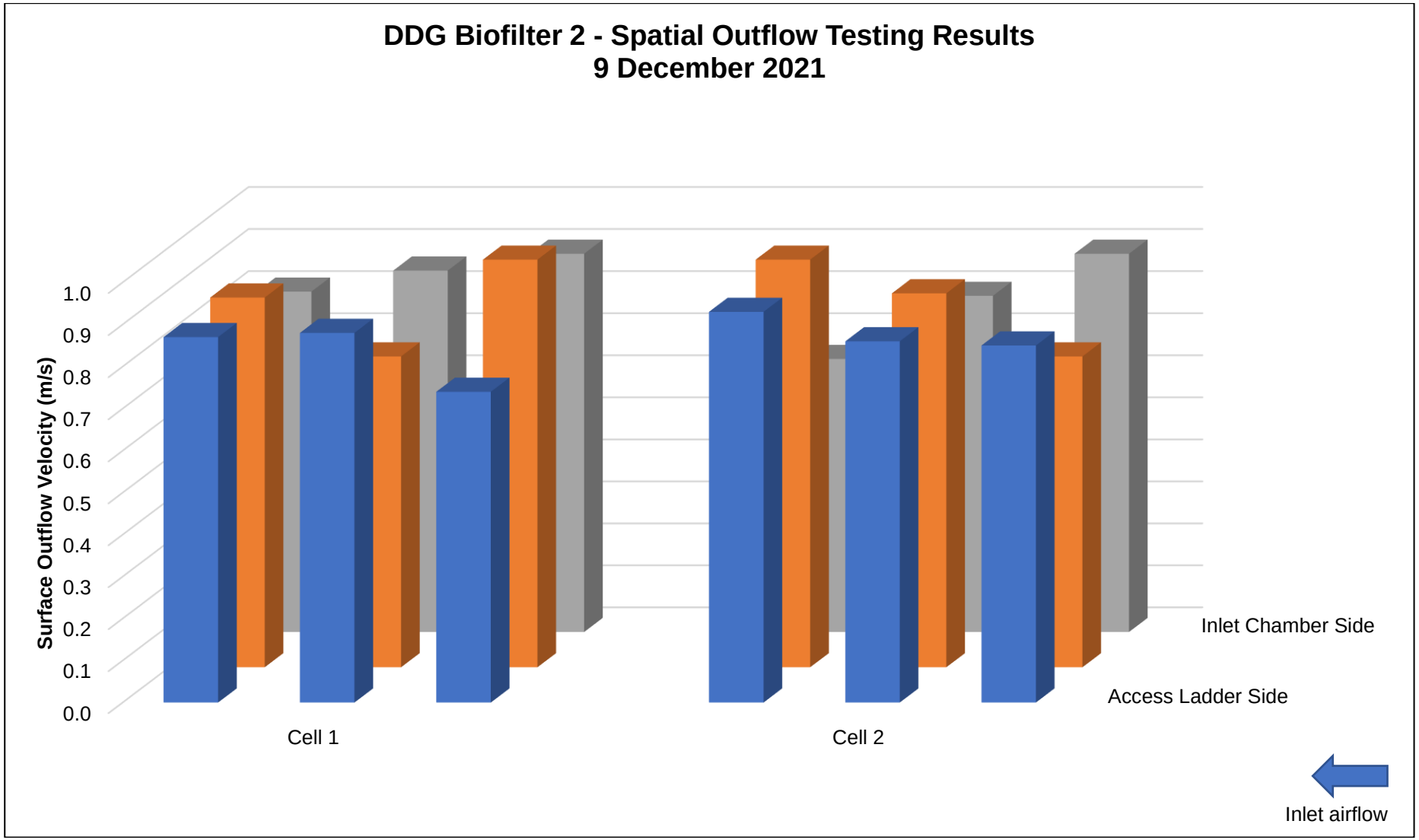


Figure 5.4 – Biofilter 2: Spatial Outflow Testing Results on 9 December 2021

6. Odour Destruction Efficiency Results

As with previous assessments, odour samples were collected from the DDG biofilters' common inlet duct, and outlet samples from the surface of each cell from both Biofilters 1 & 2. A sample was not collected from the Dryer #4 duct as it was offline for the duration of this assessment. Each surface sample was a composite, prepared from three locations across the biofilter beds. One biofilter inlet sample was collected and tested on this occasion. The results of the odour testing of these samples are appended to this report, and are summarised as follows:

Common Biofilter Inlet:	8,930 ou (grain, oil)
Dryer #4 Duct:	N/A (offline)
Flow Weighted Inlet to biofilters:	8,930 ou
Biofilter 2 Cell 2 Outlet – Southern Cell:	1,330 ou (grain, oil, fermented)
Biofilter 2 Cell 1 Outlet – Northern Cell:	4,470 ou (grain, oil, fermented)
Biofilter 1 Cell 2 Outlet – Southern Cell:	5,790 ou (grain, oil, fermented)
Biofilter 1 Cell 1 Outlet – Northern Cell:	6,890 ou (grain, oil, fermented)
Mean Result:	3,920 ou
Mean Odour Destruction Efficiency:	56%

The above results indicate that neither biofilter met the target outlet concentration of 500 ou.

7. Trend Data Analyses

Commencing with the testing results following the commissioning of DDG Biofilter 2 in October 2011, the results of the regular assessments are plotted for key parameters, to identify potentially adverse trends as they occur. These have been plotted as **Figure 7.1** to **Figure 7.5** and include temperature, airflow, back-pressure, and odour concentration, respectively.

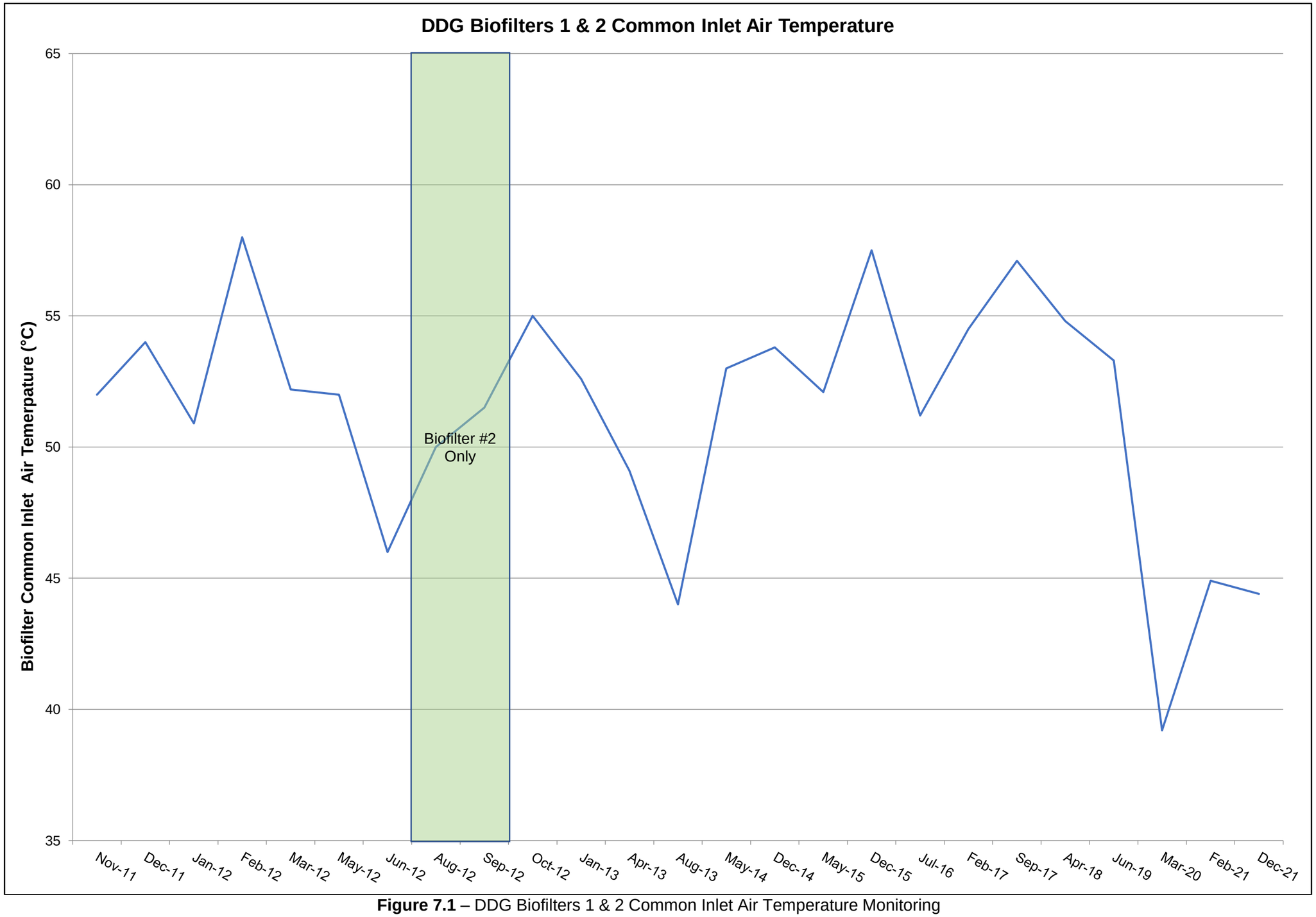


Figure 7.1 – DDG Biofilters 1 & 2 Common Inlet Air Temperature Monitoring

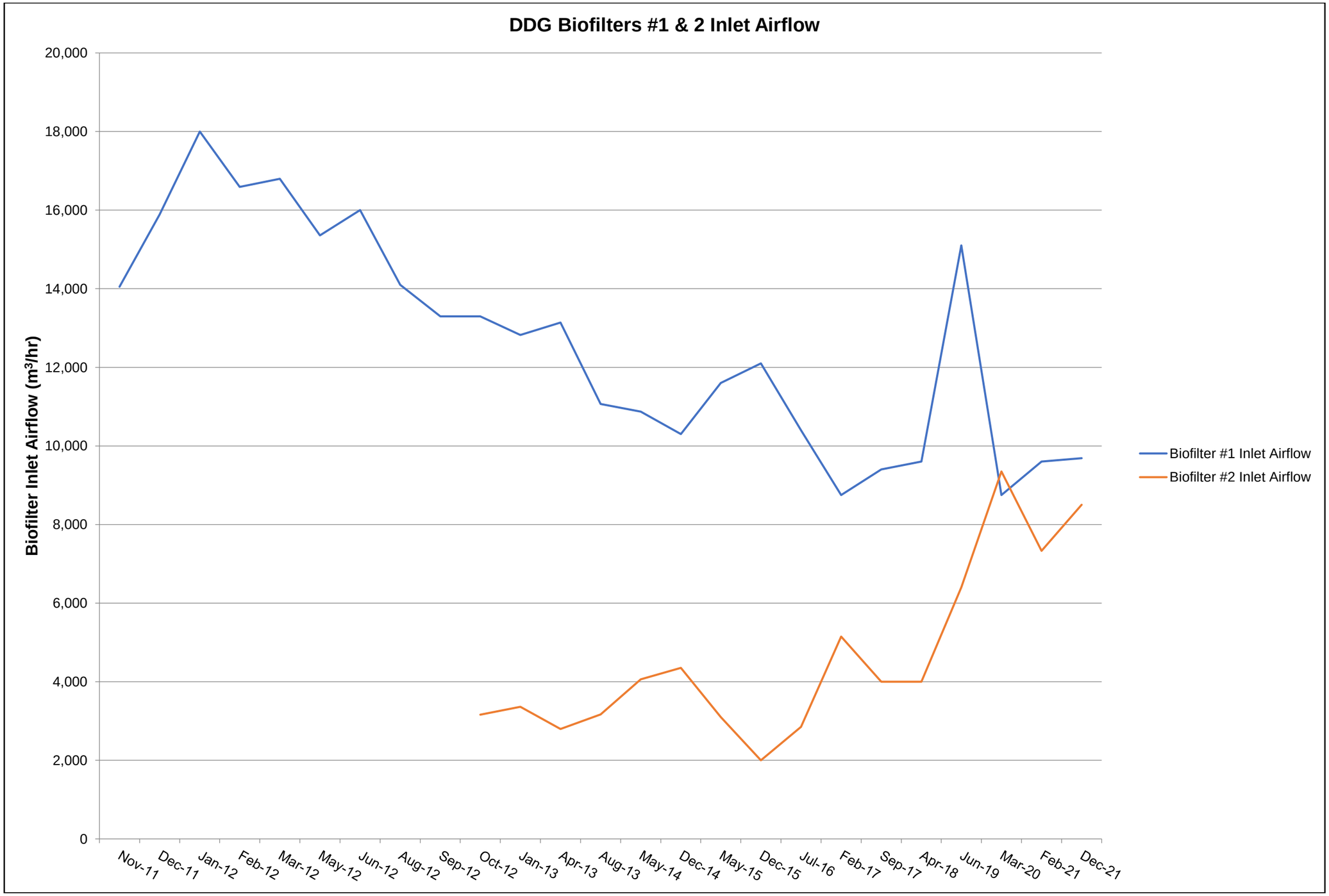


Figure 7.2 – DDG Biofilters 1 & 2 Inlet Airflows

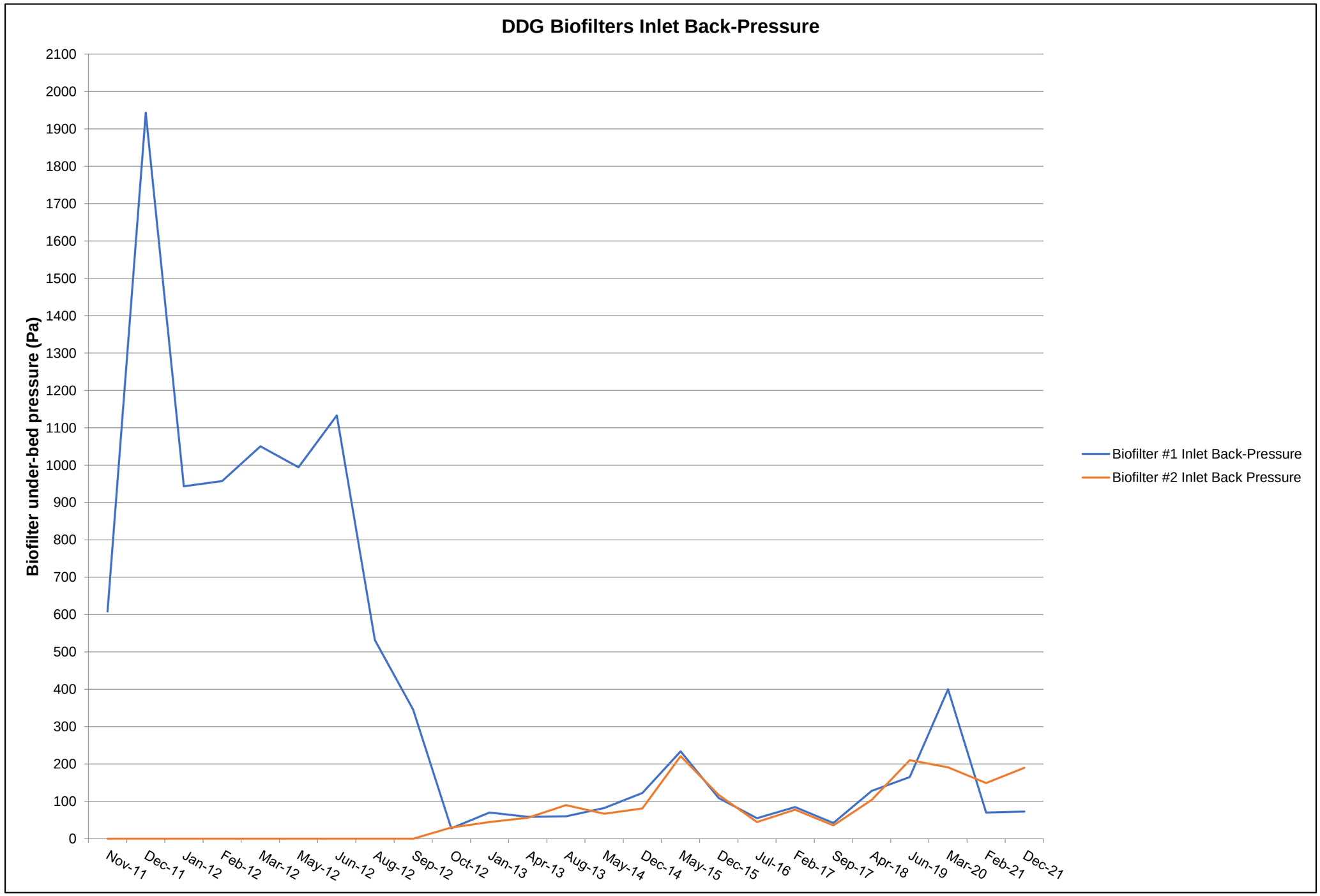


Figure 7.3 – DDG Biofilters 1 & 2 Inlet Back-Pressures

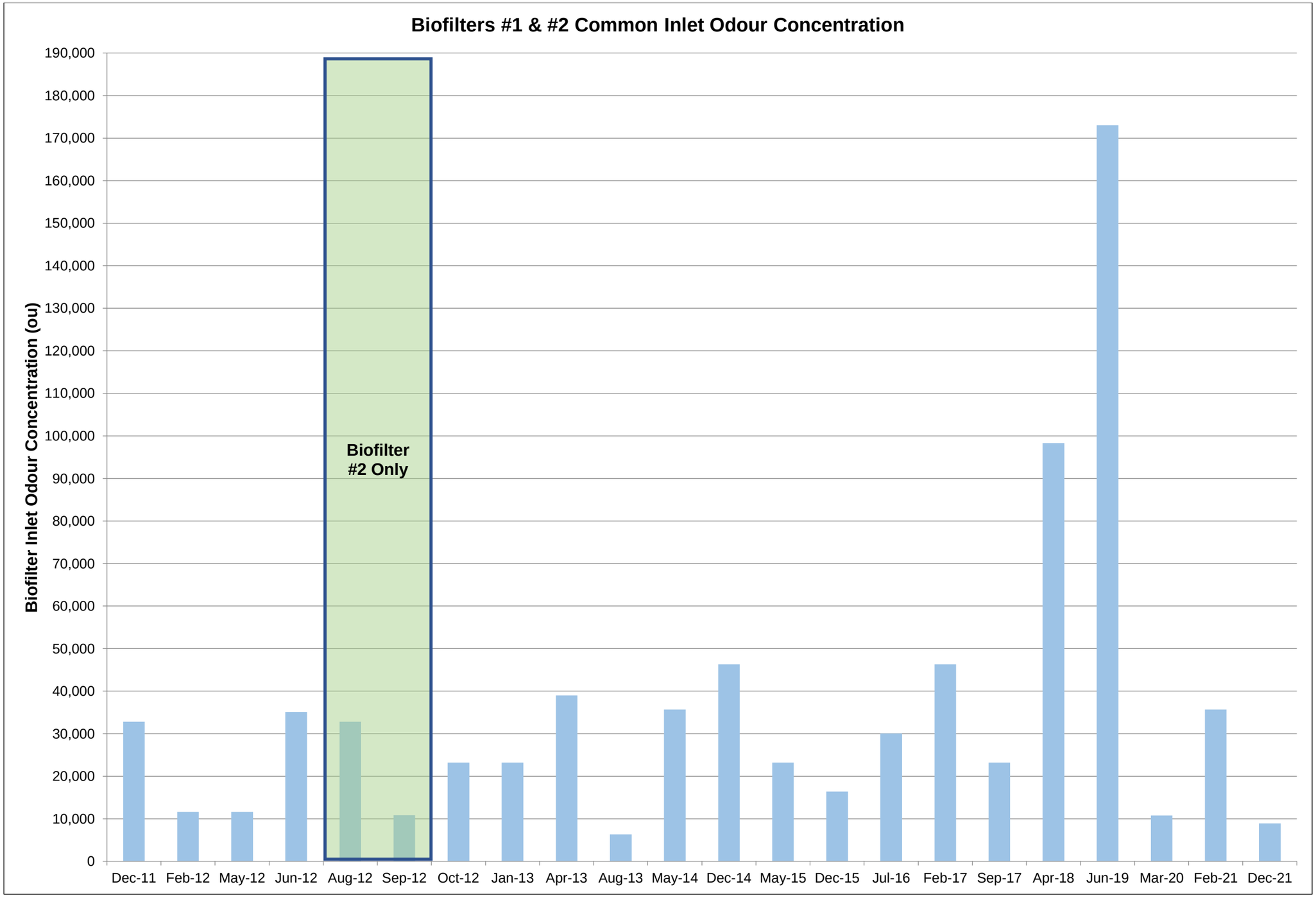


Figure 7.4 – DDG Biofilters 1 & 2 Common Inlet Odour Concentration

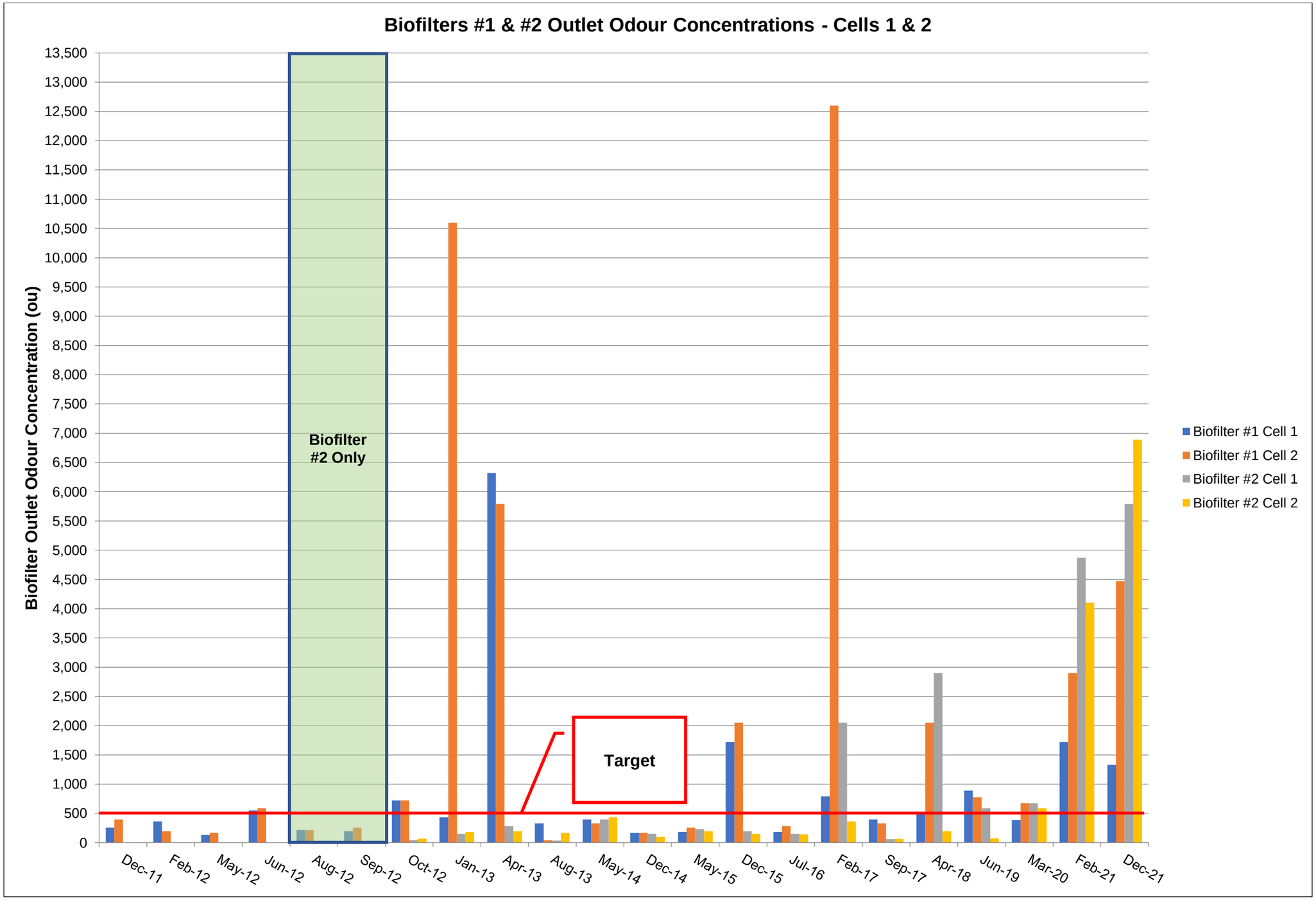


Figure 7.5 – DDG Biofilters 1 & 2 Outlet Odour Concentrations

8. Visual and Olfactory Assessment

During the assessment, the condition of the DDG biofilter medium was visually assessed, with the performance also assessed by an olfactory evaluation.

Photo 1 – A view of DDG Biofilter 1 as found on 9 December 2021

Photo 2 – A view of DDG Biofilter 2 as found on 9 December 2021

The medium in both biofilters, although of different ages, appeared to be in good condition.

The odour emitted from the DDG biofilter system still contained residual inlet odour. This odour was detectable beyond the perimeter of the biofilter. This issue is discussed below.

It is understood that the medium age of Biofilter 1 is over 24 months old, with Biofilter 2 refurbished in late-October 2020.

9. Biofilter Drainage

The drainage flows from the biofilter appeared normal.

10. Discussion and Recommendations

The following comments are made based on the assessment results:

- The airflow to the biofilter system has maintained the historical airflow rate. The distribution of airflow between the two biofilters is very even (53%/47%, in favour of Biofilter 1) and within the historical range. This balance is expected and acceptable from both a performance and medium life perspective;

- The mean flow-weighted outlet odour concentration of 4,250 ou significantly exceeded the nominal 500 ou target concentration. The presence of residual DDG odour character in the treated samples indicates that full odour removal is not occurring. The fact that all four biofilter cells exceeded the target concentration suggests that the loading rate on the system may now be excessive for the current configuration, rather than a specific problem with one or more cells

- Notwithstanding the above comment, the inlet odour concentration was typical of the pre-April 2018 levels and lower than the 2018 and 2019 results;

- The temperature of the inlet air has been maintained in the mid-40°C range but lies below the historical mean for this parameter. This biofilter system has shown itself to be resilient to elevated and variable temperatures. These minor variations are likely due to changes in operating conditions, and are normal for this biofilter system;

- Biofilter back-pressures and spatial outflow distribution results are within the normal range and are acceptable; and

- The inlet air relative humidity remains in a saturated condition.

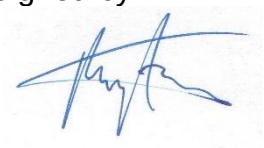
11. Concluding Remarks

In summary, the reason for the decrease in odour removal performance for this biofilter system is being investigated by TOU and Shoalhaven Starches with gas speciation laboratory samples collected as part of this assessment (including an outlet sample from Bioflter 1 and Biofilter 2, a common inlet sample to the biofilter and a sample from DDG Dryer 1 Exhaust Fan). The outcomes from the gas speciation laboratory analysis is reported in a separate documentation. However, if follow-up testing confirms this level of performance the capacity of the biofilters may need to be increased and/or refurbished.

The next assessment is scheduled for **August 2022**.

The Odour Unit Pty Ltd

Signed by:



Michael Assal MEngSc, B. Eng (Hon)/B.Sc, AMIChemE, MIEAust, CAQP
Operations Manager

Isaac Farrugia B.Eng (Chem)
Consultant Engineer

Attachment:

- Odour Concentration Laboratory Results: 9 December 2021

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

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MASCOT NSW 2020

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Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 163 061

NATA
Accreditation Number: 14974

Odour Concentration Measurement Report

The measurement was commissioned by:

Organisation	Manildra Group	Telephone	(02) 4423 8200
Contact	J. Studdert	Facsimile	(02) 4423 8331
Sampling Site	Bomaderry, NSW	Email	John.studdert@manildra.com.au
Sampling Method	Drum & Pump	Sampling Team	TOU

Order details:

Order requested by	J. Studdert	Order accepted by	M. Assal
Date of order	Refer to correspondence	TOU Project #	N1752L
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	J. Studdert	Panel Operator	A. Schulz

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 ºC ±3 ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: TOU-OLF-004.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.280$ Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.076$ Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.
Traceability	The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: 14 January 2022

Panel Roster Number: SYD20211210_113-1

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20211210_113-1

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Sample Odour Concentration (ou)
Sample 2 – DDG Biofilter #1 Cell 1 (North)	SC21837	09/12/2021 13:40 hrs	10/12/2021 10:07 hrs	4	8	1,330
Sample 3 - DDG Biofilter #1 Cell 2 (South)	SC21838	09/12/2021 13:48 hrs	10/12/2021 10:37 hrs	4	8	4,470
Sample 4 – DDG Biofilter #2 Cell 1 (North)	SC21839	09/12/2021 13:54 hrs	10/12/2021 11:32 hrs	4	8	5,790
Sample 5 – DDG Biofilter #2 Cell 2 (South)	SC21840	09/12/2021 13:59 hrs	10/12/2021 12:03 hrs	4	8	6,890
Sample 6 – DDG Biofilter Common Inlet (Pre DDG 4)	SC21841	09/12/2021 14:05 hrs	10/12/2021 14:51 hrs	4	8	8,930

Samples Received in Laboratory – From: A. Schulz Date: 10/12/2021 Time: 0900 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:

1. The collection of samples by the methods of AS/NZS 4323.4 and the calculation of Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20211210_113	51,000	$20 \leq \chi \leq 80$	861	59	Yes

Comments

Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC21837	grainy, oil, fermented cabbage
SC21838	grainy, oil, fermented cabbage
SC21839	grainy, oil, fermented
SC21840	grainy, oil, fermented
SC21481	grainy, oil

Disclaimers

1. Parties, other than The Odour Unit Pty Ltd, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd.

Report Status

Status	Version	Date	Prepared by	Checked by	Change	Reason
Draft	0.1	14.01.2022	M. Gilbert	I. Farrugia	-	-
Final	1.0	14.01.2022	I. Farrugia	M. Assal	-	-
Revised	-	-	-	-	-	-

END OF DOCUMENT

APPENDIX D – ANNUAL AND QUARTERLY ODOUR EMISSION SURVEYS

Ektimo

REPORT NUMBER R011036

Odour Emission Testing Report , Quarter 1 2021-22
Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry

Document Information

Template Version; 160621

Client Name:	Manildra Group
Report Number:	R011036
Date of Issue:	30 September 2021
Attention:	John Studdert
Address:	160 Bolong Rd. Bomaderry NSW 2541
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

NATA Accredited Laboratory
No. 14601

Zoe Parker
Air Monitoring Consultant

Steven Cooper
Ektimo Signatory

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1 EXECUTIVE SUMMARY

1.1 *Background*

Ektimo was engaged by Manildra Group to perform odour and emission testing at their Bomaderry plant.

1.2 *Project Objectives*

The objectives of the project were to conduct a monitoring programme to quantify odour emissions from 19 discharge points to comply with Shoalhaven Starches' Environment Protection Licence 883.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 8 – No. 1 Gluten Dryer Baghouse	22 July 2021	Odour, oxygen
EPA ID 9 – No. 2 Gluten Dryer / Starch Dryer Baghouse		
EPA ID 10 - No. 3 Gluten Dryer Baghouse	8 June 2021	
EPA ID 11 - No. 4 Gluten Dryer Baghouse		
EPA ID 12 – No. 1 Starch Dryer Scrubber	22 July 2021	
EPA ID 13 – No. 3 Starch Dryer Scrubber	20 July 2021	
EPA ID 14 – No. 4 Starch Dryer Scrubber		
EPA ID 16 – CO_2 Scrubber Outlet	22 July 2021	
EPA ID 35 - Combined Boiler 5 & 6 Stack	8 June 2021	
EPA ID 39A - Biofilter inlet	7 June 2021	Odour
EPA ID 40 - Biofilter A	7 June 2021	Duplicate odour
EPA ID 41 - Biofilter B		
EPA ID 42 - Boiler 4	8 June 2021	Odour, oxygen
EPA ID 44 – Fermenter	22 July 2021	Odour
EPA ID 39 - Biofilter Inlet	7 June 2021	
EPA ID 45 - Boiler 2	8 June 2021	Odour, oxygen
EPA ID 46 - DDG Pellet Plant Stack	19 July 2021	Odour
EPA ID 47 - No. 5 Starch Dryer Scrubber	7 June 2021	Odour, oxygen
CO_2 Scrubber Inlet	22 July 2021	

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP (except odour wet – STP).
Plant operating conditions have been noted in the report.

2 RESULTS

2.1 *Results summary*

Location	Date	Odour		Hedonic Tone	Character
		Concentration [ou]	Mass Rate [oum^3/min]		
EPA ID 8 - No. 1 Gluten Dryer Baghouse	22/07/2021	970	-	Mildly unpleasant	Wet wheat & oats, chemical, fizzy
EPA ID 9 - No. 2 Gluten Dryer/Starch Dryer Baghouse	22/07/2021	680	660,000	Mildly unpleasant	Wet wheat & oats, dough, chemical, fizzy
EPA ID 10 - No. 3 Gluten Dryer Baghouse	8/06/2021	530	2,100,000	Neutral	Dough, playdough
EPA ID 11 - No. 4 Gluten Dryer Baghouse	8/06/2021	750	1,400,000	Mildly unpleasant	Wet, soil, dough
EPA ID 12 - No. 1 Starch Dryer Scrubber	22/07/2021	190	240,000	Mildly unpleasant	Grain, bread, dough, starch
EPA ID 13 - No. 3 Starch Dryer Scrubber	20/07/2021	89	100,000	Neutral	Flour, musty
EPA ID 14 - No. 4 Starch Dryer Scrubber	20/07/2021	230	280,000	Neutral	Sweet, playdough
EPA ID 16 - CO_2 Scrubber Outlet	22/07/2021	20,000	2,300,000	Mildly pleasant	Alcohol, fruit, sweet
EPA ID 35 - Combined Boiler 5 & 6 Stack	8/06/2021	480	930,000	Mildly unpleasant	Sulfur, chlorine
EPA ID 39 - Biofilter Inlet	7/06/2021	4,900	970,000	Mildly unpleasant	Bread, dough, yeast
EPA ID 39A - Biofilter Inlet	7/06/2021	60,000	2,700,000	Mildly unpleasant	Bread, dough, yeast
EPA ID 40 - Biofilter A East	7/06/2021	7,100	16,000,000	Very unpleasant	Yeast, vegemite
EPA ID 40 - Biofilter A West	7/06/2021	8,100	18,000,000	Very unpleasant	Yeast, vegemite
EPA ID 41 - Biofilter B East	7/06/2021	6,200	14,000,000	Very unpleasant	Yeast, vegemite
EPA ID 41 - Biofilter B West	7/06/2021	8,700	19,000,000	Very unpleasant	Yeast, vegemite
EPA ID 42 - Boiler 4	8/06/2021	1,900	1,500,000	Very unpleasant	Sulfur, chlorine
EPA ID 44 - Fermenter 11	22/07/2021	11,000	770,000	Very unpleasant	Alcohol, fruit, sweet, stale
EPA ID 45 - Boiler 2	8/06/2021	440	140,000	Mildly unpleasant	Sulfur, chlorine
EPA ID 46 - DDG Pellet Plant Stack	19/07/2021	1,300	1,800,000	Neutral	Sweet, bread, grain
EPA ID 47 - No. 5 Starch Dryer Scrubber	7/06/2021	1,400	920,000	Neutral	Glue, bread, starch
CO_2 Scrubber Inlet	22/07/2021	14,000	1,600,000	Mildly unpleasant	Alcohol, fruit, sweet

2.2 *EPA ID 8 – No. 1 Gluten Dryer Baghouse*

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 8 - No. 1 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details	
Sampling plane dimensions	2400 x 2560 mm
Sampling plane area	6.14 m²
Sampling port size, number	Tested from exit
Access & height of ports	Stairs & ladders 22 m
Duct orientation & shape	Horizontal Rectangular
Sample plane compliance to AS4323.1	Non-compliant

Comments

Sampling was undertaken at the exit of the stack as it was the only accessible area for the samples to be taken. No temperature or flow rate readings could be taken due to access issues.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters	
Moisture content, %v/v	5.3
Gas molecular weight, g/g mole	28.4 (wet)
Gas density at STP, kg/m³	1.27 (wet)
Velocity difference, %	<1

Gas Analyser Results	Average
Sampling time	1200 - 1259
	Concentration
	% v/v
Oxygen	20.9

Odour	Results
Sampling time	1209 - 1219
	Concentration
	ou
Results	970
Lower uncertainty limit	680
Upper uncertainty limit	1400
Hedonic tone	Mildly unpleasant
Odour character	Wet wheat & oats, chemical, fizzy
Analysis date & time	23/07/21, 1000
Holding time	22 hours
Dilution factor	1
Bag material	Teflon™
Butanol threshold (ppb)	73.6
Laboratory temp (°C)	22
Last calibration date	October 2020

2.3 *EPA ID 9 – No. 2 Gluten Dryer / Starch Dryer Baghouse*

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 9 - No. 2 Gluten Dryer / Starch Dryer
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210720

Sampling Plane Details	
Sampling plane dimensions	1190 mm
Sampling plane area	1.11 m²
Sampling port size, number & depth	2" BSP (x4), 90 mm
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	4.3	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.94	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1145 & 1245	
Temperature, °C	63	
Temperature, K	336	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/s	22	
Volumetric flow rate (wet STP), m³/s	16	
Volumetric flow rate (dry STP), m³/s	15	
Mass flow rate (wet basis), kg/hour	74000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1146 - 1244
	Concentration
	%v/v
Oxygen	20.9

Odour	Results	
Sampling time	1220 - 1230	
	Concentration	Mass Rate
	ou	oum³/min
Results	680	660000
Lower uncertainty limit	470	
Upper uncertainty limit	980	
Hedonic tone	Mildly unpleasant	
Odour character	Wet wheat & oats, dough, chemical, fizzy	
Analysis date & time	23/07/21, 1000	
Holding time	22 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	73.6	
Laboratory temp (°C)	22	
Last calibration date	October 2020	

2.4 *EPA ID 10 - No. 3 Gluten Dryer Baghouse*

Date	8/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 10 - No. 3 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details		
Sampling plane dimensions	2100 x 2400 mm	
Sampling plane area	5.04 m²	
Sampling port size, number	2" Ball valve (x3)	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Exit 5 D	
Upstream disturbance	Change in diameter 2.5 D	
No. traverses & points sampled	3 21	
Sample plane compliance to AS4323.1	Non-compliant	

Comments

The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The gas velocity at some or all sampling points is less than 3 m/s
The highest to lowest differential pressure ratio exceeds 9:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	6.4	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.99	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1425 & 1525	
Temperature, °C	74	
Temperature, K	347	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/s	83	
Volumetric flow rate (wet STP), m³/s	65	
Volumetric flow rate (dry STP), m³/s	61	
Mass flow rate (wet basis), kg/hour	300000	
Velocity difference, %	2	

Gas Analyser Results	Average
Sampling time	1425 - 1526
	Concentration %v/v
Oxygen	20.8

Odour	Results	
Sampling time	1411 - 1421	
	Concentration ou	Mass Rate oum³/min
Results	530	2100000
Lower uncertainty limit	370	
Upper uncertainty limit	750	
Hedonic tone	Neutral	
Odour character	Dough, playdough	
Analysis date & time	09/06/21, 1400-1500	
Holding time	24 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	47.1	
Laboratory temp (°C)	22.65	
Last calibration date	October 2020	

2.5 *EPA ID 11 - No. 4 Gluten Dryer Baghouse*

Date	8/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 11 - No. 4 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details	
Sampling plane dimensions	1400 x 1700 mm
Sampling plane area	2.38 m²
Sampling port size, number	4" BSP (x3)
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	3 12
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	4.1	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.00	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1550 & 1650	
Temperature, °C	74	
Temperature, K	347	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/s	39	
Volumetric flow rate (wet STP), m³/s	31	
Volumetric flow rate (dry STP), m³/s	29	
Mass flow rate (wet basis), kg/hour	140000	
Velocity difference, %	2	

Gas Analyser Results	Average
Sampling time	1550 - 1649
	Concentration %v/v
Oxygen	20.7

Odour	Results	
Sampling time	1640 - 1650	
	Concentration ou	Mass Rate oum³/min
Results	750	1400000
Lower uncertainty limit	530	
Upper uncertainty limit	1100	
Hedonic tone	Mildly unpleasant	
Odour character	Wet, soil, dough	
Analysis date & time	09/06/21, 1400-1500	
Holding time	21 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	47.1	
Laboratory temp (℃)	22.65	
Last calibration date	October 2020	

2.6 *EPA ID 12 – No. 1 Starch Dryer Scrubber*

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 12 - No. 1 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210720

Sampling Plane Details	
Sampling plane dimensions	1500 x 1500 mm
Sampling plane area	2.25 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 25 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Silencer 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The highest to lowest differential pressure ratio exceeds 9:1
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	4.1	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1245 & 1345	
Temperature, °C	34	
Temperature, K	307	
Velocity at sampling plane, m/s	10	
Volumetric flow rate, actual, m³/s	23	
Volumetric flow rate (wet STP), m³/s	20	
Volumetric flow rate (dry STP), m³/s	19	
Mass flow rate (wet basis), kg/hour	93000	
Velocity difference, %	2	

Gas Analyser Results	Average
Sampling time	1247 - 1346
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1302 - 1312	
	Concentration ou	Mass Rate oum³/min
Results	190	240000
Lower uncertainty limit	140	
Upper uncertainty limit	280	
Hedonic tone	Mildly unpleasant	
Odour character	Grain, bread, dough, starch	
Analysis date & time	23/07/21, 1000	
Holding time	21 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	73.6	
Laboratory temp (℃)	22	
Last calibration date	October 2020	

2.7 *EPA ID 13 – No. 3 Starch Dryer Scrubber*

Date	20/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 13 - No. 3 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210720*

Sampling Plane Details	
Sampling plane dimensions	1000 x 1050 mm
Sampling plane area	1.05 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Change in diameter 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	3.6	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1245 & 1345	
Temperature, °C	28	
Temperature, K	301	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/s	21	
Volumetric flow rate (wet STP), m³/s	19	
Volumetric flow rate (dry STP), m³/s	18	
Mass flow rate (wet basis), kg/hour	88000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1245 - 1344
	Concentration
	% v/v
Oxygen	20.8

Odour	Results	
Sampling time	1328 - 1338	
	Concentration	Mass Rate
	ou	oum³/min
Results	89	100000
Lower uncertainty limit	62	
Upper uncertainty limit	130	
Hedonic tone	Neutral	
Odour character	Flour, musty	
Analysis date & time	21/07/21, 0930-1030	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	51.9	
Laboratory temp (°C)	22.7	
Last calibration date	October 2020	

2.8 *EPA ID 14 – No. 4 Starch Dryer Scrubber*

Date	20/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 14 - No. 4 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210720*

Sampling Plane Details	
Sampling plane dimensions	1000 x 1050 mm
Sampling plane area	1.05 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Change in diameter 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	5.8	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1245 & 1345	
Temperature, °C	37	
Temperature, K	310	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/s	23	
Volumetric flow rate (wet STP), m³/s	20	
Volumetric flow rate (dry STP), m³/s	19	
Mass flow rate (wet basis), kg/hour	92000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1245 - 1344
	Concentration
	% v/v
Oxygen	20.4

Odour	Results	
Sampling time	1301 - 1311	
	Concentration	Mass Rate
	ou	oum³/min
Results	230	280000
Lower uncertainty limit	160	
Upper uncertainty limit	330	
Hedonic tone	Neutral	
Odour character	Sweet, playdough	
Analysis date & time	21/07/21, 0930-1030	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	51.9	
Laboratory temp (°C)	22.7	
Last calibration date	October 2020	

2.9 *EPA ID 16 – CO_2 Scrubber Outlet*

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 16 - CO2 Scrubber Outlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210720*

Sampling Plane Details	
Sampling plane dimensions	505 mm
Sampling plane area	0.2 m²
Sampling port size, number & depth	3" BSP (x1), 60 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction >10 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	1	
Gas molecular weight, g/g mole	42.1 (wet)	42.4 (dry)
Gas density at STP, kg/m³	1.88 (wet)	1.89 (dry)
Gas density at discharge conditions, kg/m³	1.75	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1005 & 1045	
Temperature, °C	18	
Temperature, K	291	
Velocity at sampling plane, m/s	10	
Volumetric flow rate, actual, m³/s	2.1	
Volumetric flow rate (wet STP), m³/s	1.9	
Volumetric flow rate (dry STP), m³/s	1.9	
Mass flow rate (wet basis), kg/hour	13000	
Velocity difference, %	-1	

Gas Analyser Results	Average
Sampling time	0932 - 1031
	Concentration
	%v/v
Oxygen	0.3

Odour	Results	
Sampling time	1016 - 1026	
	Concentration	Mass Rate
	ou	oum³/min
Results	20000	2300000
Lower uncertainty limit	14000	
Upper uncertainty limit	29000	
Hedonic tone	Mildly pleasant	
Odour character	Alcohol, fruit, sweet	
Analysis date & time	23/07/21 1000	
Holding time	24 hours	
Dilution factor	8	
Bag material	Teflon™	
Butanol threshold (ppb)	73.6	
Laboratory temp (℃)	22	
Last calibration date	October 2020	

2.10 *EPA ID 35 - Combined Boiler 5 & 6 Stack*

Date	8/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 35 - Combined Boiler 5 & 6 Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details	
Sampling plane dimensions	1985 mm
Sampling plane area	3.09 m²
Sampling port size, number & depth	4" BSP (x4), 100 mm
Access & height of ports	Stairs & ladders 40 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction 4 D
No. traverses & points sampled	2 20
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	5.4	
Gas molecular weight, g/g mole	29.5 (wet)	30.2 (dry)
Gas density at STP, kg/m³	1.32 (wet)	1.35 (dry)
Gas density at discharge conditions, kg/m³	0.91	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1110 & 1310	
Temperature, °C	121	
Temperature, K	394	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/s	47	
Volumetric flow rate (wet STP), m³/s	32	
Volumetric flow rate (dry STP), m³/s	31	
Mass flow rate (wet basis), kg/hour	150000	
Velocity difference, %	5	

Gas Analyser Results	Average
Sampling time	1125 - 1302
	Concentration %v/v
Oxygen	8.9

Odour	Results	
Sampling time	1246 - 1256	
	Concentration ou	Mass Rate oum³/min
Results	480	930000
Lower uncertainty limit	340	
Upper uncertainty limit	680	
Hedonic tone	Mildly unpleasant	
Odour character	Sulfur, chlorine	
Analysis date & time	09/06/21, 1400-1500	
Holding time	25 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	47.1	
Laboratory temp (℃)	22.65	
Last calibration date	October 2020	

2.11 *EPA ID 39 - Biofilter Inlet*

Date	7/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 39 - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details	
Sampling plane dimensions	600 mm
Sampling plane area	0.283 m²
Sampling port size, number & depth	1 x 1 inch port, 45 mm
Access & height of ports	Ground 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	1 6
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	4	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.06	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1540 & 1640	
Temperature, °C	38	
Temperature, K	312	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/s	4	
Volumetric flow rate (wet STP), m³/s	3.3	
Volumetric flow rate (dry STP), m³/s	3.2	
Mass flow rate (wet basis), kg/hour	15000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1336 - 1435
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1540 - 1550	
	Concentration ou	Mass Rate oum³/min
Results	4900	970000
Lower uncertainty limit	3400	
Upper uncertainty limit	6900	
Hedonic tone	Mildly unpleasant	
Odour character	Bread, dough, yeast	
Analysis date & time	08/06/21, 1100-1230	
Holding time	19 hours	
Dilution factor	2	
Bag material	Teflon™	
Butanol threshold (ppb)	50.0	
Laboratory temp (°C)	23.35	
Last calibration date	October 2020	

2.12 *EPA ID 39A - Biofilter inlet*

Date	7/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 39A - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details	
Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m²
Sampling port size, number	1 x 1 inch port
Access & height of ports	Ground 0.6 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1.5 D
Upstream disturbance	Inlet >2 D
No. traverses & points sampled	1 4
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.16	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1450 & 1550	
Temperature, °C	29	
Temperature, K	302	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/s	0.82	
Volumetric flow rate (wet STP), m³/s	0.74	
Volumetric flow rate (dry STP), m³/s	0.72	
Mass flow rate (wet basis), kg/hour	3400	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1450 - 1549
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1450 - 1452	
	Concentration ou	Mass Rate oum³/min
Results	60000	2700000
Lower uncertainty limit	42000	
Upper uncertainty limit	85000	
Hedonic tone	Mildly unpleasant	
Odour character	Bread, dough, yeast	
Analysis date & time	08/06/21, 1100-1230	
Holding time	20 hours	
Dilution factor	9	
Bag material	Nalophan	
Butanol threshold (ppb)	50.0	
Laboratory temp (℃)	23.35	
Last calibration date	October 2020	

2.13 *EPA ID 40 - Biofilter A East*

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A East
Date	7/06/2021	**Plant/Site**	Ethanol Plant
Report No.	R011036		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Steven Cooper		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	74
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	26
Sampling Results	
Sampling time, hrs	1511 - 1521
Sample dilution	1
Odour concentration, ou	**7100**
Hedonic tone	Very unpleasant
Odour character	Yeast, Vegemite
95% Confidence Interval	5000 - 10000
Odour Flux Rate, ou/m²/min	**5200**
Odour mass rate, ou/min	**520000**

2.14 *EPA ID 40 - Biofilter A West*

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A West
Date	7/06/2021	**Plant/Site**	Ethanol Plant
Report No.	R011036		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Steven Cooper		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	63
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	22
Sampling Results	
Sampling time, hrs	1456 - 1506
Sample dilution	1
Odour concentration, ou	**8100**
Hedonic tone	Very unpleasant
Odour character	Yeast, Vegemite
95% Confidence Interval	5700 - 12000
Odour Flux Rate, ou/m²/min	**5100**
Odour mass rate, ou/min	**510000**

2.15 *EPA ID 41 - Biofilter B East*

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B East
Date	7/06/2021	**Plant/Site**	Ethanol Plant
Report No.	R011036		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Steven Cooper		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	74
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	26
Sampling Results	
Sampling time, hrs	1440 - 1450
Sample dilution	1
Odour concentration, ou	**6200**
Hedonic tone	Very unpleasant
Odour character	Yeast, Vegemite
95% Confidence Interval	4400 - 8800
Odour Flux Rate, ou/m²/min	**4600**
Odour mass rate, ou/min	**460000**

2.16 *EPA ID 41 - Biofilter B West*

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B West
Date	7/06/2021	**Plant/Site**	Ethanol Plant
Report No.	R011036		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Steven Cooper		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	76
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	27
Sampling Results	
Sampling time, hrs	1425 - 1435
Sample dilution	1
Odour concentration, ou	**8700**
Hedonic tone	Very unpleasant
Odour character	Yeast, Vegemite
95% Confidence Interval	6100 - 12000
Odour Flux Rate, ou/m²/min	**6600**
Odour mass rate, ou/min	**660000**

2.17 *EPA ID 42 - Boiler 4*

Date	8/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 42 - Boiler 4
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210525*

Sampling Plane Details		
Sampling plane dimensions	1140 mm	
Sampling plane area	1.02 m²	
Sampling port size, number & depth	4" BSP (x2), 100 mm	
Access & height of ports	Stairs 30 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >3 D	
Upstream disturbance	Change in diameter 1 D	
No. traverses & points sampled	2 16	
Sample plane compliance to AS4323.1	Compliant but non-ideal	
The sampling plane is deemed to be non-ideal due to the following reasons:		
The upstream disturbance is <2D from the sampling plane		

Stack Parameters		
Moisture content, %v/v	4.3	
Gas molecular weight, g/g mole	29.0 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m³	0.78	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1540 & 1640	
Temperature, °C	176	
Temperature, K	449	
Velocity at sampling plane, m/s	21	
Volumetric flow rate, actual, m³/s	21	
Volumetric flow rate (wet STP), m³/s	13	
Volumetric flow rate (dry STP), m³/s	12	
Mass flow rate (wet basis), kg/hour	60000	
Velocity difference, %	2	

Gas Analyser Results	Average
Sampling time	1540 - 1639
	Concentration
	% v/v
Oxygen	14.2

Odour	Results	
Sampling time	1546 - 1606	
	Concentration	Mass Rate
	ou	oum³/min
Results	1900	1500000
Lower uncertainty limit	1400	
Upper uncertainty limit	2700	
Hedonic tone	Very unpleasant	
Odour character	Sulfur, chlorine	
Analysis date & time	09/06/21, 1400-1500	
Holding time	22 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	47.1	
Laboratory temp (°C)	22.65	
Last calibration date	October 2020	

2.18 *EPA ID 44 – Fermenter 11*

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 44 - Fermenter 11
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210720*

Sampling Plane Details	
Sampling plane dimensions	295 mm
Sampling plane area	0.0683 m²
Sampling port size, number & depth	3" BSP (x1), 75 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 10 D
Upstream disturbance	Junction 2 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The stack or duct does not have the required number of access holes (ports)

The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.9	
Gas molecular weight, g/g mole	34.3 (wet)	34.8 (dry)
Gas density at STP, kg/m³	1.53 (wet)	1.55 (dry)
Gas density at discharge conditions, kg/m³	1.38	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0950 & 1000	
Temperature, °C	28	
Temperature, K	301	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/s	1.3	
Volumetric flow rate (wet STP), m³/s	1.2	
Volumetric flow rate (dry STP), m³/s	1.2	
Mass flow rate (wet basis), kg/hour	6500	
Velocity difference, %	<1	

Odour	Results	
Sampling time	0953 - 0958	
	Concentration ou	Mass Rate oum³/min
Results	11000	770000
Lower uncertainty limit	7500	
Upper uncertainty limit	15000	
Hedonic tone	Very unpleasant	
Odour character	Alcohol, fruit, sweet, stale	
Analysis date & time	23/07/21, 1000	
Holding time	24 hours	
Dilution factor	4	
Bag material	Nalophan	
Butanol threshold (ppb)	73.6	
Laboratory temp (°C)	22	
Last calibration date	October 2020	

2.19 *EPA ID 45 - Boiler 2*

Date	8/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 45 - Boiler 2
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210525*

Sampling Plane Details		
Sampling plane dimensions	1070 mm	
Sampling plane area	0.899 m²	
Sampling port size, number & depth	4" Flange (x2), 180 mm	
Access & height of ports	Ladders 20 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Change in diameter 5 D	
No. traverses & points sampled	2 16	
Sample plane compliance to AS4323.1	Compliant but non-ideal	
The sampling plane is deemed to be non-ideal due to the following reasons:		
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D		

Stack Parameters		
Moisture content, %v/v	4.3	
Gas molecular weight, g/g mole	29.3 (wet)	29.8 (dry)
Gas density at STP, kg/m³	1.31 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m³	0.76	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1429 & 1529	
Temperature, °C	193	
Temperature, K	467	
Velocity at sampling plane, m/s	9.9	
Volumetric flow rate, actual, m³/s	8.9	
Volumetric flow rate (wet STP), m³/s	5.2	
Volumetric flow rate (dry STP), m³/s	4.9	
Mass flow rate (wet basis), kg/hour	24000	
Velocity difference, %	-1	

Gas Analyser Results	Average
Sampling time	1429 - 1528
	Concentration
	% v/v
Oxygen	12.1

Odour	Results	
Sampling time	1445 - 1505	
	Concentration	Mass Rate
	ou	oum³/min
Results	440	140000
Lower uncertainty limit	310	
Upper uncertainty limit	620	
Hedonic tone	Mildly unpleasant	
Odour character	Sulfur, chlorine	
Analysis date & time	09/06/21, 1400-1500	
Holding time	23 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	47.1	
Laboratory temp (°C)	22.65	
Last calibration date	October 2020	

2.20 *EPA ID 46 - DDG Pellet Plant Stack*

Date	19/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 46 - DDG Pellet Plant Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker	**State**	NSW
Process Conditions	Please refer to client records.		*210720*

Sampling Plane Details	
Sampling plane dimensions	1460 mm
Sampling plane area	1.67 m²
Sampling port size, number	4" Flange (x1)
Access & height of ports	Elevated work platform 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Junction 2.1 D
No. traverses & points sampled	1 16
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	2.6	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.08	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1105 & 1125	
Temperature, °C	51	
Temperature, K	324	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	29	
Volumetric flow rate (wet STP), m³/s	24	
Volumetric flow rate (dry STP), m³/s	24	
Mass flow rate (wet basis), kg/hour	110000	
Velocity difference, %	<1	

Odour	Results	
Sampling time	1109 - 1119	
	Concentration ou	Mass Rate oum³/min
Results	1300	1800000
Lower uncertainty limit	870	
Upper uncertainty limit	1800	
Hedonic tone	Neutral	
Odour character	Sweet, bread, grain	
Analysis date & time	19/07/21, 1345-1410	
Holding time	2 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	73.6	
Laboratory temp (°C)	24.05	
Last calibration date	October 2020	

2.21 *EPA ID 47 - No. 5 Starch Dryer Scrubber*

Date	7/06/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	EPA ID 47 - No. 5 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		210525

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 120 mm	
Access & height of ports	Stairs 20 m	
Duct orientation & shape	Horizontal Circular	
Downstream disturbance	Bend 9 D	
Upstream disturbance	Bend 3.75 D	
No. traverses & points sampled	2 16	
Sample plane compliance to AS4323.1	Compliant but non-ideal	

Sampling was undertaken from an alternative sampling location upstream of the actual emission point as directed by

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	4.4	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1320 & 1420	
Temperature, °C	58	
Temperature, K	331	
Velocity at sampling plane, m/s	26	
Volumetric flow rate, actual, m³/s	13	
Volumetric flow rate (wet STP), m³/s	11	
Volumetric flow rate (dry STP), m³/s	10	
Mass flow rate (wet basis), kg/hour	49000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1336 - 1435
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1325 - 1335	
	Concentration ou	Mass Rate oum³/min
Results	1400	920000
Lower uncertainty limit	1000	
Upper uncertainty limit	2000	
Hedonic tone	Neutral	
Odour character	Glue, bread, starch	
Analysis date & time	08/06/21, 1100-1230	
Holding time	22 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	50.0	
Laboratory temp (°C)	23.35	
Last calibration date	October 2020	

2.22 CO_2 Scrubber Inlet

Date	22/07/2021	**Client**	Manildra Group
Report	R011036	**Stack ID**	CO2 Scrubber Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Scott Woods & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210720

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	1 inch ball valve, 80 mm
Access & height of ports	Ground level 1.5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 2
Sample plane compliance to AS4323.1	Non-compliant

Comments

Flow measurement readings were applied from EPA ID 16, the CO2 scrubber outlet, as flow was unable to be measured at this location.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	<0.4	
Gas molecular weight, g/g mole	42.4 (wet)	42.5 (dry)
Gas density at STP, kg/m³	1.89 (wet)	1.90 (dry)
Gas density at discharge conditions, kg/m³	1.70	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1031 & 1130	
Temperature, °C	28	
Temperature, K	301	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	2.1	
Volumetric flow rate (wet STP), m³/s	1.9	
Volumetric flow rate (dry STP), m³/s	1.9	
Mass flow rate (wet basis), kg/hour	13000	

Gas Analyser Results	Average
Sampling time	1031 - 1130
	Concentration % v/v
Oxygen	0.2

Odour	Results	
Sampling time	1040 - 1050	
	Concentration ou	Mass Rate oum³/min
Results	14000	1600000
Lower uncertainty limit	9900	
Upper uncertainty limit	20000	
Hedonic tone	Mildly unpleasant	
Odour character	Alcohol, fruit, sweet	
Analysis date & time	23/07/21, 1000	
Holding time	23 hours	
Dilution factor	8	
Bag material	Teflon™	
Butanol threshold (ppb)	73.6	
Laboratory temp (°C)	22	
Last calibration date	October 2020	

3 PLANT OPERATING CONDITIONS

See Manildra Group records for complete process conditions.

4 TEST METHODS

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	USEPA Method 1	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW TM-2	NSW TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW TM-22	NSW TM-22	19%	✓	✓
Molecular weight	NA	NSW TM-23	not specified	NA	✓
Oxygen	NSW TM-25	NSW TM-25	13%	✓	✓
Odour	NSW OM-7	NSW OM-7¥	Refer to results	✓	✓
Odour Characterisation	NA	direct observation	NA	NA	*

210607

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

¥ Odour analysis conducted at the Unanderra, NSW laboratory, by forced choice olfactometry, NATA accreditation number 14601.
Results were reported on 8 June 2021 in report number ON-00082.
Results were reported on 9 June 2021 in report number ON-00083.
Results were reported on 19 July 2021 in report number ON-00087.
Results were reported on 21 July 2021 in report number ON-00088.
Results were reported on 23 July 2021 in report number ON-00089.

5 QUALITY ASSURANCE/QUALITY CONTROL INFORMATION

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised worldwide.

6 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
Lower Bound	Defines values reported below detection as equal to zero.
Medium Bound	Defines values reported below detection are equal to half the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative Accuracy Test Audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration will be determined by matching the integrated area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test Method
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity Difference	The percentage difference between the average of initial flows and afterflows.
Vic EPA	Victorian Environment Protection Authority
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray Diffractometry
Upper Bound	Defines values reported below detection are equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 APPENDIX 1: SITE PHOTOS

EPA ID 39 - Biofilter Inlet

EPA ID 39A - Biofilter Inlet

EPA ID 47 - Starch Dryer 5

EPA ID 40 - Biofilter A

EPA ID 41 - Biofilter B

EPA ID 10 - Gluten Dryer 3

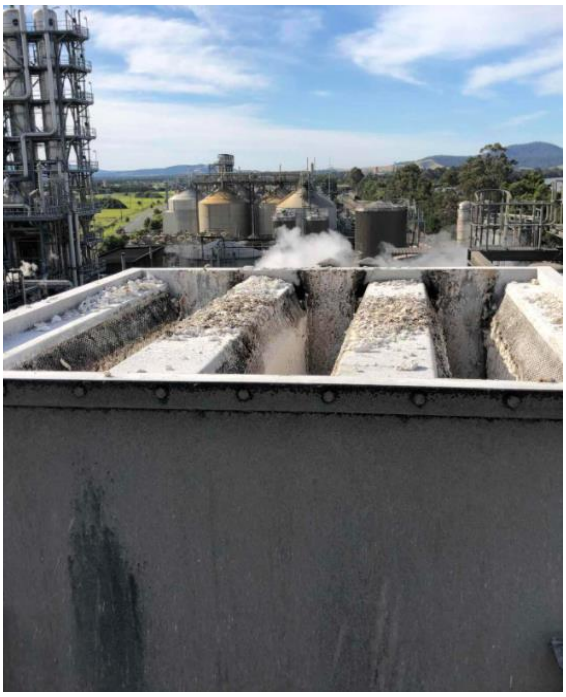
EPA ID 11 - Gluten Dryer 4

EPA ID 35 - Combined Boilers 5 & 6

EPA ID 42 - Boiler 4

EPA ID 45 - Boiler 2

EPA ID 9 – No. 2 Gluten Dryer



EPA ID 12 – No. 1 Starch Dryer Scrubber

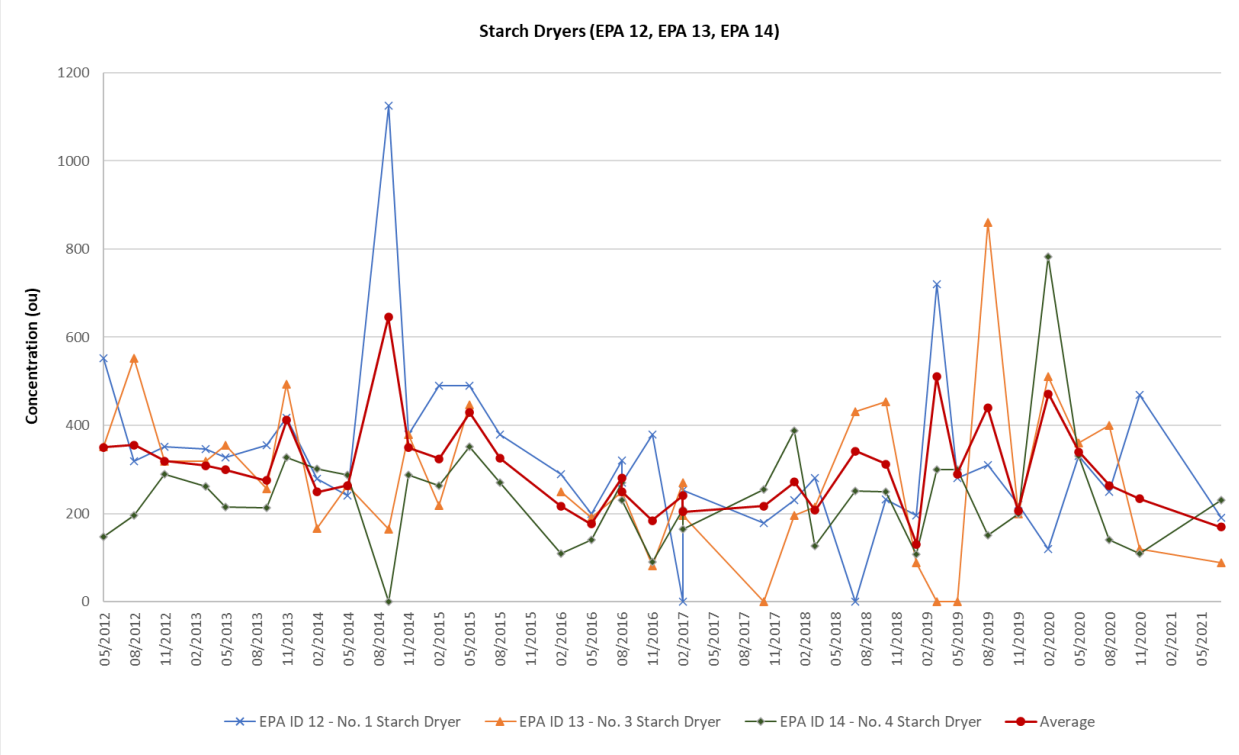
EPA ID 13 – No. 3 Starch Dryer Scrubber

EPA ID 14 – No. 4 Starch Dryer Scrubber

EPA ID 46 – DDG Pellet Plant Stack

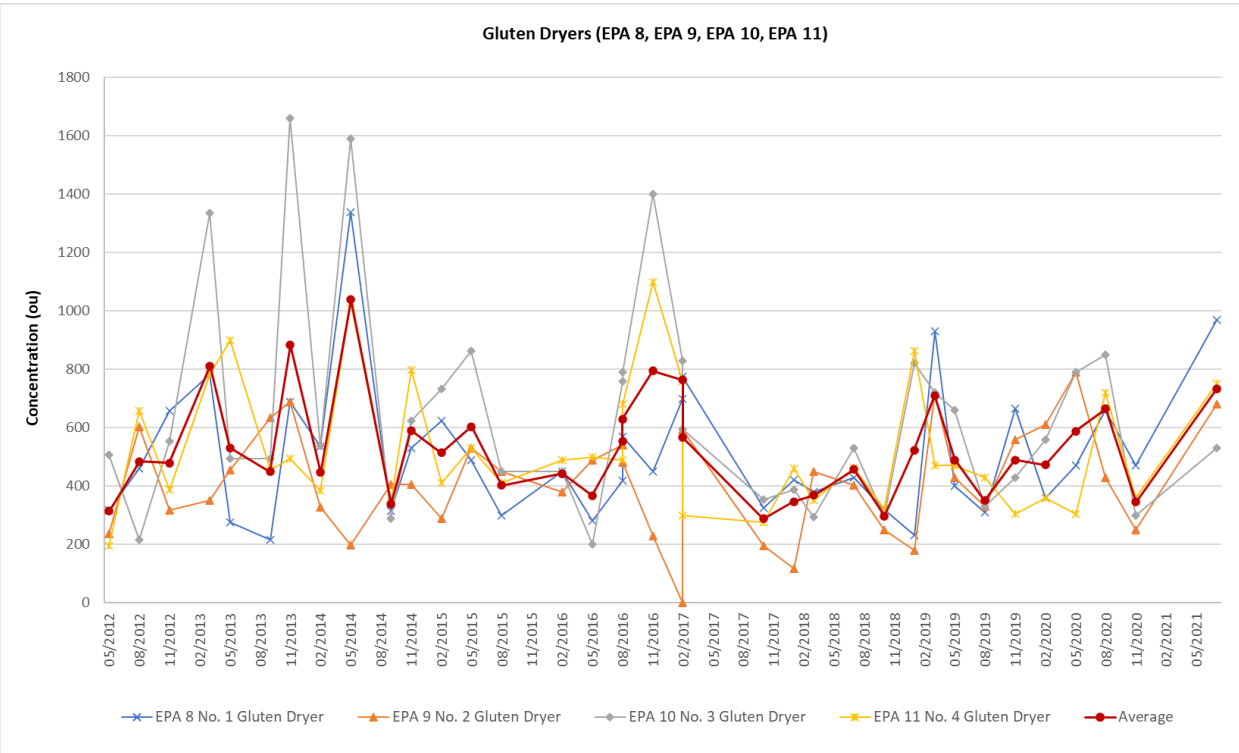
8 APPENDIX 2: HISTORICAL ODOUR RESULTS

Figure 1. Starch Dryers No 1, 3 & 4 (EPA 12, EP13, EPA14)



Zero result represents Dryer not operating on days of testing

Figure 2. Gluten Dryers No 1,2,3 & 4 (EPA 8, EPA 9, EPA 10, EPA 11)



Zero result represents Dryer not operating on days of testing

Figure 3. Starch Dryer 5 (EPA 47)

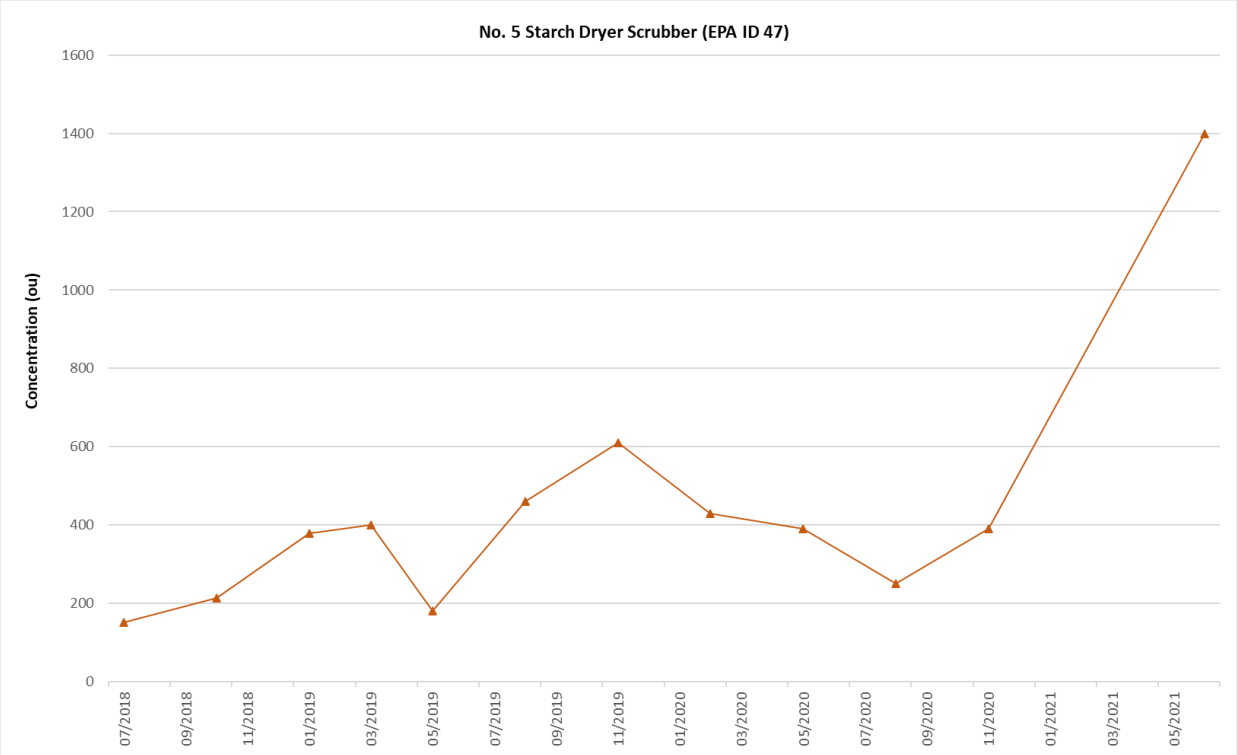
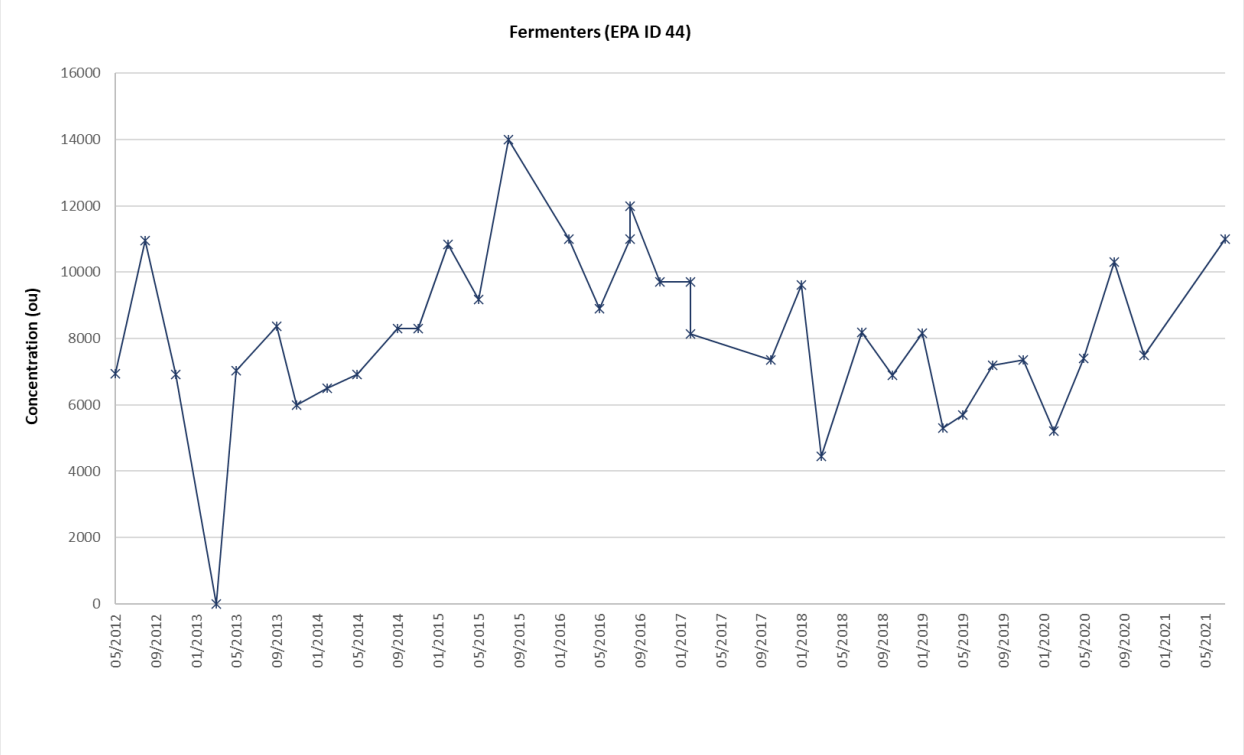


Figure 4. Fermenters (EPA 44)



Zero result represents Fermenter not operating on days of testing

Figure 5. Carbon dioxide Scrubber Outlet (EPA 16)

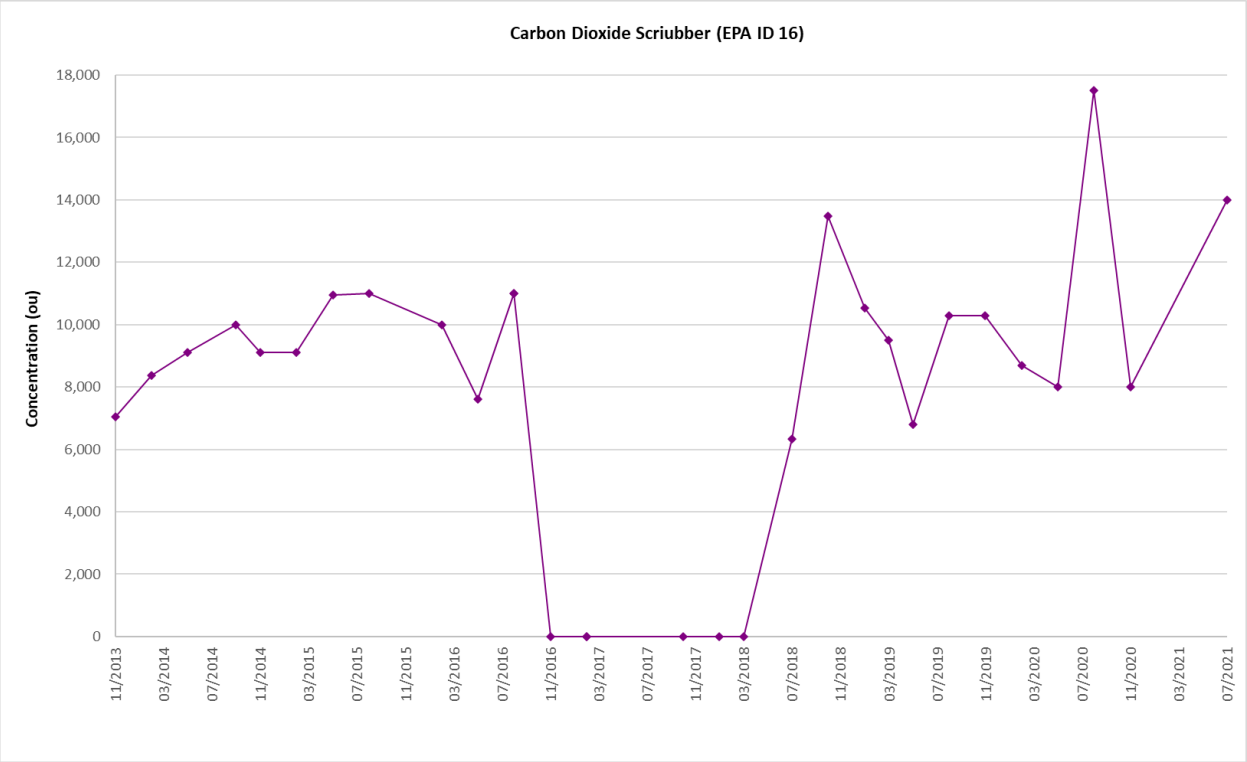


Figure 6. Combined Boiler 5 & 6 Stack (EPA 35)

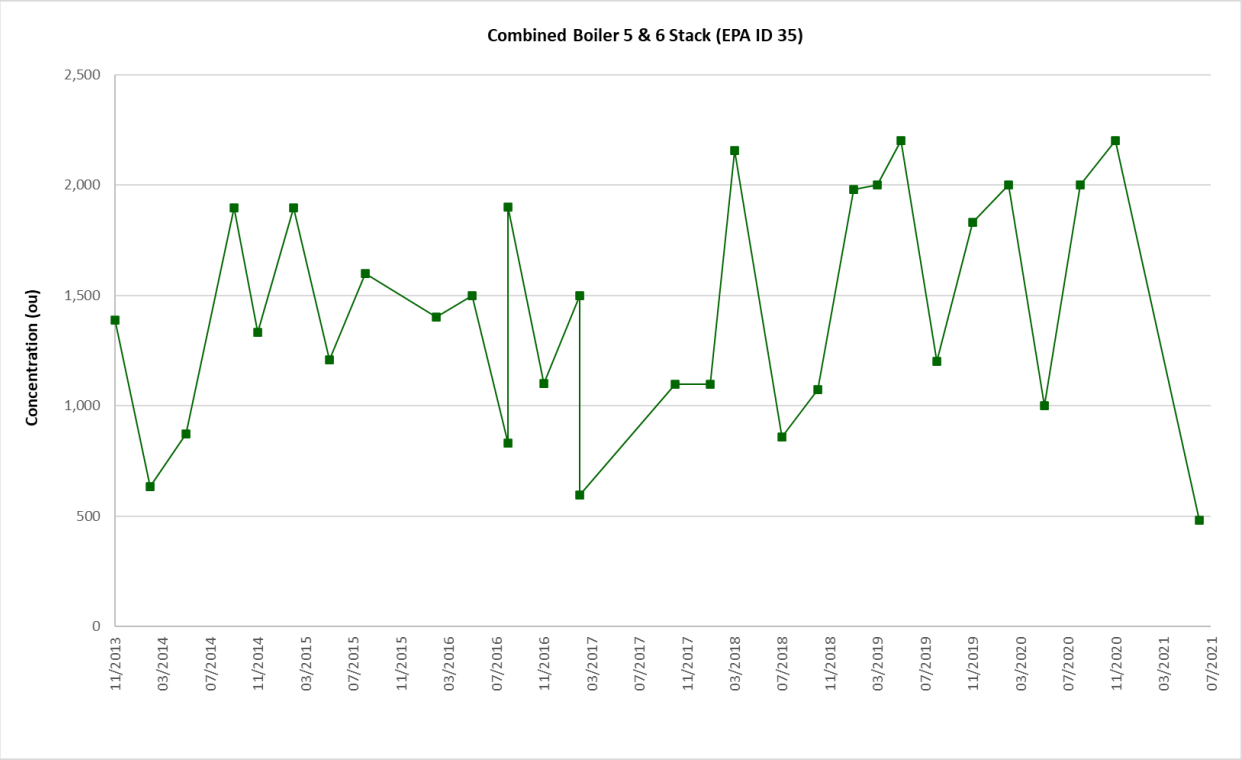


Figure 7. Boiler 4 Stack (EPA 42)

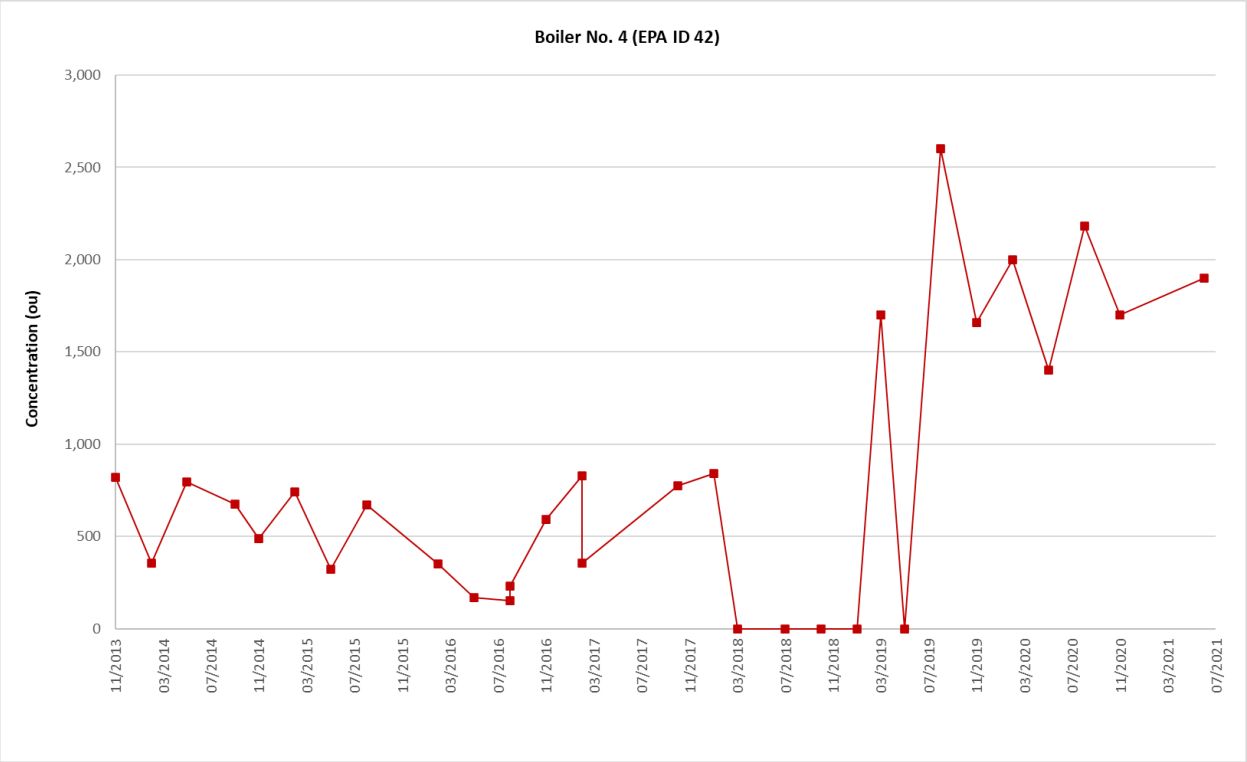


Figure 8. Boiler 2 Stack (EPA 45)

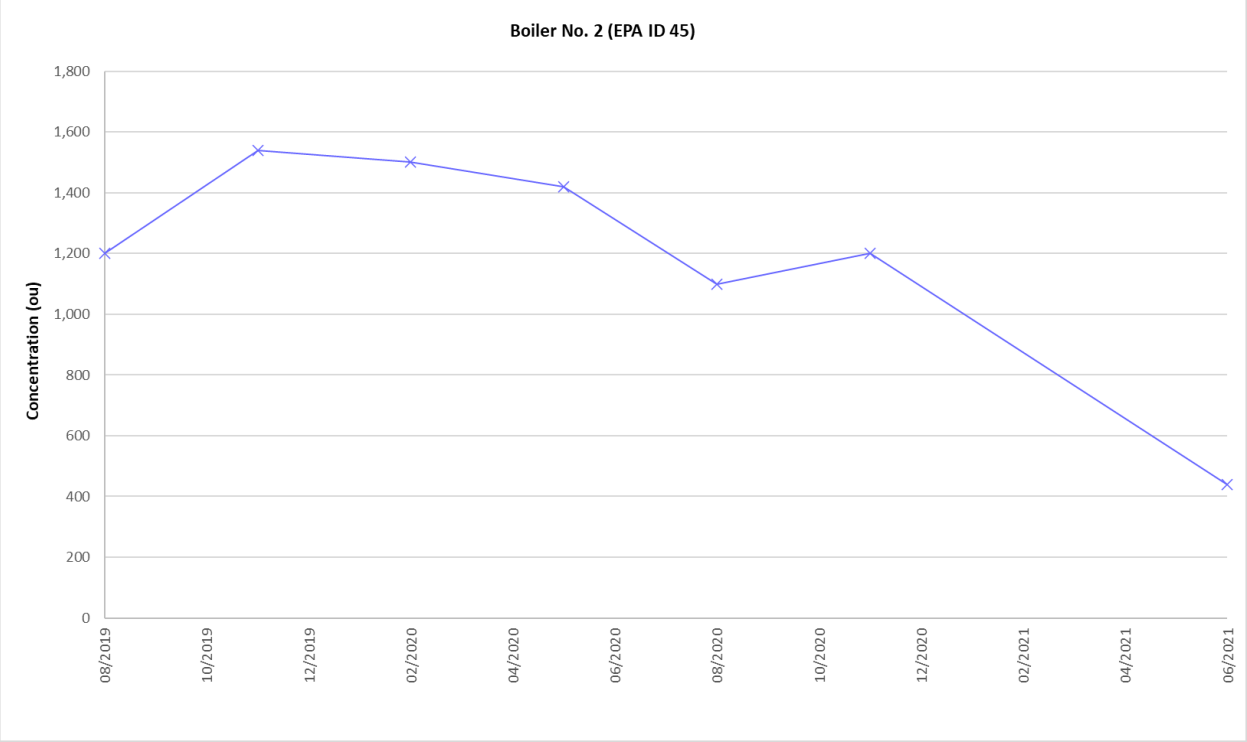
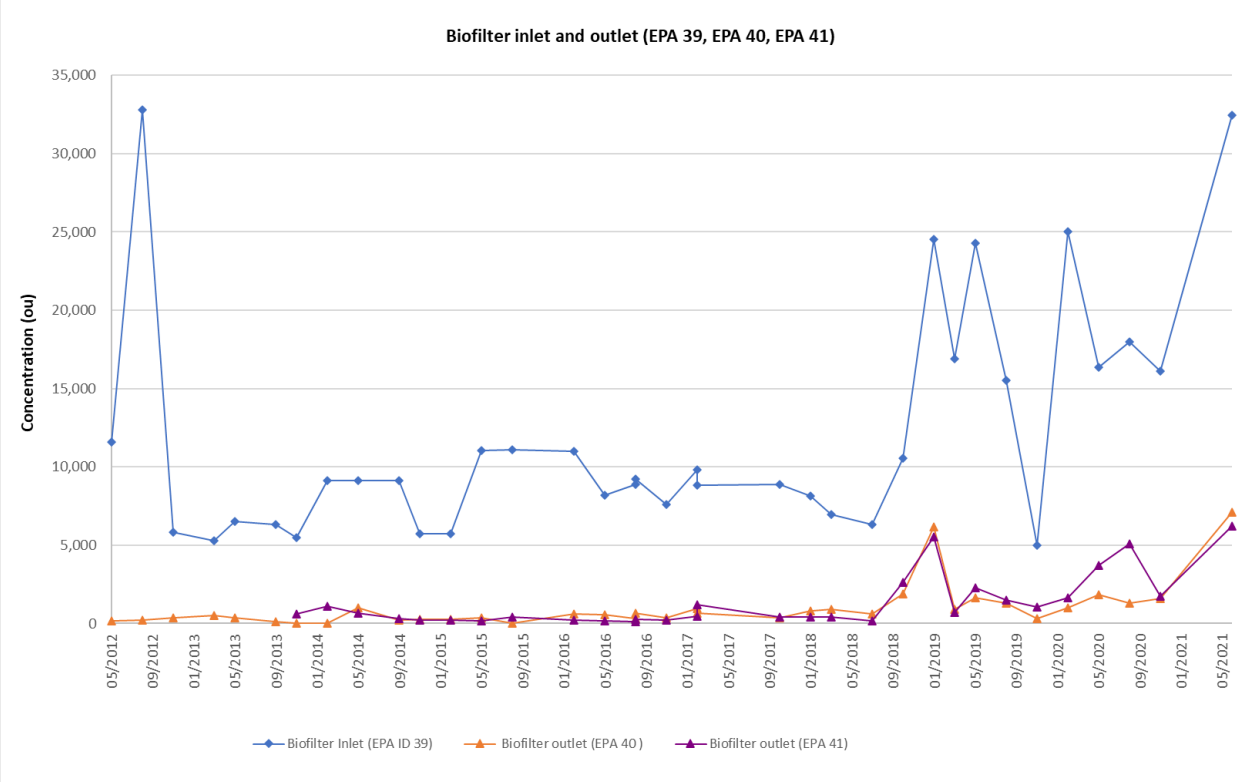
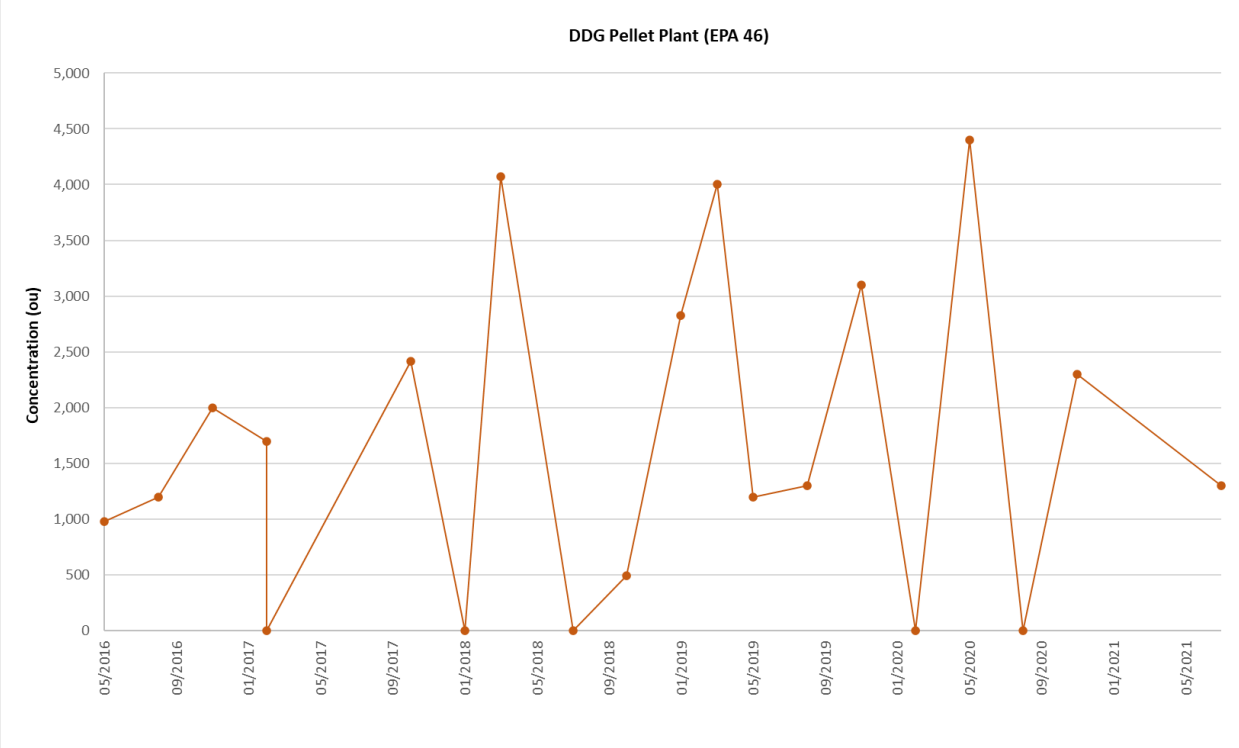


Figure 9. Biofilters (EPA 39,40, 41)



Zero result represents Biofilter not available to be sampled for that event

Figure 10. DDG Pellet Plant (EPA 46)



Zero result represents DDG Pellet Plant not sampled for that event

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Ektimo

REPORT NUMBER R011744

Odour Emission Testing Report, Quarter 2 2021-22
Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry

Document Information

Template Version: 230621

Client Name:	Manildra Group
Report Number:	R011744
Date of Issue:	7 January 2022
Attention:	John Studdert
Address:	160 Bolong Rd Bomaderry NSW 2541
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Zoe Parker **Air Monitoring Consultant**	NATA Accredited Laboratory No. 14601	**Steven Cooper** **Ektimo Signatory**

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 EXECUTIVE SUMMARY

1.1 Background

Ektimo was engaged by Manildra Group to perform odour and emission testing at their Bomaderry plant.

1.2 Project Objectives

The objectives of the project were to conduct a monitoring programme to quantify odour emissions from 21 discharge points to comply with Shoalhaven Starches' Environment Protection Licence 883.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
CO_2 Scrubber Inlet	30 September 2021	Odour, oxygen
EPA ID 16 – CO_2 Scrubber Outlet		
EPA ID 44 – Fermenter 12		Odour
EPA ID 8 – No. 1 Gluten Dryer Baghouse	5 October 2021	Odour, oxygen
EPA ID 9 – No. 2 Gluten Dryer Baghouse		
EPA ID 10 - No. 3 Gluten Dryer Baghouse		
EPA ID 11 - No. 4 Gluten Dryer Baghouse		
EPA ID 12 – No. 1 Starch Dryer Scrubber		
EPA ID 13 – No. 3 Starch Dryer Scrubber		
EPA ID 14 – No. 4 Starch Dryer Scrubber		
EPA ID 47 - No. 5 Starch Dryer Scrubber	6 October 2021	Odour, oxygen
EPA ID 40 - Biofilter A		Odour
EPA ID 41 - Biofilter B		
EPA ID 39A - Biofilter inlet		
EPA ID 46 - DDG Pellet Plant Stack		
DDG Dryer 1 & 2 – Air Leakage Fan		
DDG Dryer 3 – Air Leakage Fan		
EPA ID 39 - Biofilter Inlet		
EPA ID 35 - Combined Boilers 5 & 6 Stack	20 October 2021	Odour, oxygen
EPA ID 42 - Boiler 4		
EPA ID 45 - Boiler 2		

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP (except odour wet – STP).

Plant operating conditions have been noted in the report.

2 RESULTS

2.1 Results Summary

Location	Date	Odour		Hedonic Tone	Character
		Concentration [ou]	Mass Rate [oum^3/min]		
EPA ID 8 - No. 1 Gluten Dryer Baghouse	5/10/2021	130	-	Neutral	Starch, bread dough
EPA ID 9 - No. 2 Gluten Dryer/Starch Dryer Baghouse	5/10/2021	450	420,000	Mildly unpleasant	Damp, bread
EPA ID 10 - No. 3 Gluten Dryer Baghouse	5/10/2021	310	730,000	Mildly pleasant	Starch
EPA ID 11 - No. 4 Gluten Dryer Baghouse	5/10/2021	440	710,000	Mildly unpleasant	Bread dough
EPA ID 12 - No. 1 Starch Dryer Scrubber	5/10/2021	87	110,000	Neutral	Sweet
EPA ID 13 - No. 3 Starch Dryer Scrubber	5/10/2021	79	93,000	Mildly pleasant	Starch, sweet
EPA ID 14 - No. 4 Starch Dryer Scrubber	5/10/2021	62	67,000	Neutral	Starch, bread
EPA ID 16 - CO_2 Scrubber Outlet	30/09/2021	51,000	5,900,000	Mildly pleasant	Cider, sweet
EPA ID 35 - Combined Boiler 5 & 6 Stack	20/10/2021	400	830,000	Mildly unpleasant	Sulfur, gas, combustion
EPA ID 39 - Biofilter Inlet	6/10/2021	5,400	1,200,000	Mildly pleasant	Bread, wet, grain
EPA ID 39A - Biofilter Inlet	6/10/2021	10,000	310,000	Neutral	Bread, sweet
EPA ID 40 - Biofilter A East	6/10/2021	10,000	750,000	Mildly pleasant	Vegemite, sweet, bread
EPA ID 40 - Biofilter A West	6/10/2021	7,500	550,000	Mildly unpleasant	Burnt toast, bread dough
EPA ID 41 - Biofilter B East	6/10/2021	9,600	820,000	Mildly unpleasant	Toast
EPA ID 41 - Biofilter B West	6/10/2021	9,400	680,000	Mildly unpleasant	Vegemite, bread
EPA ID 42 - Boiler 4	20/10/2021	400	310,000	Mildly unpleasant	Sulfur
EPA ID 44 - Fermenter 12	30/09/2021	11,000	93,000	Mildly pleasant	Cider, sweet
EPA ID 45 - Boiler 2	20/10/2021	520	160,000	Very unpleasant	Sulfur
EPA ID 46 - DDG Pellet Plant Stack	6/10/2021	2,000	2,100,000	Neutral	Bread, gas
EPA ID 47 - No. 5 Starch Dryer Scrubber	6/10/2021	1,600	5,800,000	Mildly pleasant	Vegemite
CO_2 Scrubber Inlet	30/09/2021	65,000	7,600,000	Mildly unpleasant	Cider, vinegar
DDG Dryer 1 & 2 - Air Leakage Fan	6/10/2021	14,000	23,000	Mildly pleasant	Wet, grain, sweet
DDG Dryer 3 - Air Leakage Fan	6/10/2021	6,200	150,000	Mildly pleasant	Bread, wet, grain

2.2 EPA ID 8 – No. 1 Gluten Dryer Baghouse

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 8 - No. 1 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details	
Sampling plane dimensions	2400 x 2560 mm
Sampling plane area	6.14 m²
Sampling port size, number	Sampled from exit
Access & height of ports	Stairs & ladders 22 m
Duct orientation & shape	Horizontal Rectangular
Sample plane compliance to AS4323.1	Non-compliant

Comments

Sampling was undertaken at the exit of the stack as it was the only accessible area for the samples to be taken. No temperature or flow rate readings could be taken due to access issues.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters	
Moisture content, %v/v	
Gas molecular weight, g/g mole	29.0 (dry)
Gas density at STP, kg/m³	1.29 (dry)

Gas Analyser Results	Average
Sampling time	1227 - 1326
	Concentration
	%v/v
Oxygen	20.8

Odour	Results
Sampling time	1213 - 1223
	Concentration
	ou
Results	130
Lower uncertainty limit	94
Upper uncertainty limit	190
Hedonic tone	Neutral
Odour character	Starch, bread dough
Analysis date & time	06/10/21, 1000-1130
Holding time	22 hours
Dilution factor	1
Bag material	Nalophan
Butanol threshold (ppb)	67.1
Laboratory temp (℃)	23.15
Last calibration date	October 2020

2.3 EPA ID 9 – No. 2 Gluten Dryer / Starch Dryer Baghouse

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 9 - No. 2 Gluten Dryer/ Starch Dryer
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details	
Sampling plane dimensions	1190 mm
Sampling plane area	1.11 m²
Sampling port size, number & depth	4" BSP (x2), 90 mm
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	4.5	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.94	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1120 & 1220	
Temperature, °C	62	
Temperature, K	335	
Velocity at sampling plane, m/s	19	
Volumetric flow rate, actual, m³/s	21	
Volumetric flow rate (wet STP), m³/s	16	
Volumetric flow rate (dry STP), m³/s	15	
Mass flow rate (wet basis), kg/hour	72000	
Velocity difference, %	3	

Gas Analyser Results	Average
Sampling time	1120 - 1219
	Concentration %v/v
Oxygen	20.8

Odour	Results	
Sampling time	1148 - 1158	
	Concentration ou	Mass Rate oum³/min
Results	450	420000
Lower uncertainty limit	310	
Upper uncertainty limit	630	
Hedonic tone	Mildly unpleasant	
Odour character	Damp, bread	
Analysis date & time	06/10/21, 1000-1130	
Holding time	22 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.4 EPA ID 10 - No. 3 Gluten Dryer Baghouse

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 10 - No. 3 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details		
Sampling plane dimensions	2100 x 2400 mm	
Sampling plane area	5.04 m²	
Sampling port size, number	2" Ball valve (x3)	
Access & height of ports	Stairs 15 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Exit 5 D	
Upstream disturbance	Change in diameter 2.5 D	
No. traverses & points sampled	3 21	
Sample plane compliance to AS4323.1	Non-compliant	

Comments

The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The gas velocity at some or all sampling points is less than 3 m/s
The highest to lowest differential pressure ratio exceeds 9:1
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	4.4	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.00	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1340 & 1440	
Temperature, °C	74	
Temperature, K	347	
Velocity at sampling plane, m/s	9.9	
Volumetric flow rate, actual, m³/s	50	
Volumetric flow rate (wet STP), m³/s	39	
Volumetric flow rate (dry STP), m³/s	38	
Mass flow rate (wet basis), kg/hour	180000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1340 - 1439
	Concentration %v/v
Oxygen	20.7

Odour	Results	
Sampling time	1355 - 1405	
	Concentration ou	Mass Rate oum³/min
Results	310	730000
Lower uncertainty limit	220	
Upper uncertainty limit	440	
Hedonic tone	Mildly pleasant	
Odour character	Starch	
Analysis date & time	06/10/21, 1000-1130	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.5 EPA ID 11 - No. 4 Gluten Dryer Baghouse

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 11 - No. 4 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details	
Sampling plane dimensions	1400 x 1700 mm
Sampling plane area	2.38 m²
Sampling port size, number	4" BSP (x3)
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	3 12
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	4.4	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.00	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1250 & 1350	
Temperature, °C	74	
Temperature, K	347	
Velocity at sampling plane, m/s	14	
Volumetric flow rate, actual, m³/s	34	
Volumetric flow rate (wet STP), m³/s	27	
Volumetric flow rate (dry STP), m³/s	25	
Mass flow rate (wet basis), kg/hour	120000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1250 - 1349
	Concentration % v/v
Oxygen	20.6

Odour	Results	
Sampling time	1320 - 1334	
	Concentration ou	Mass Rate oum³/min
Results	440	710000
Lower uncertainty limit	310	
Upper uncertainty limit	630	
Hedonic tone	Mildly unpleasant	
Odour character	Bread dough	
Analysis date & time	06/10/21, 1000-1130	
Holding time	21 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.6 EPA ID 12 – No. 1 Starch Dryer Scrubber

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 12 - No. 1 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	1500 x 1500 mm
Sampling plane area	2.25 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 25 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Silencer 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The highest to lowest differential pressure ratio exceeds 9:1
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	5.8	
Gas molecular weight, g/g mole	28.4 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.11	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1138 & 1255	
Temperature, °C	37	
Temperature, K	310	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	24	
Volumetric flow rate (wet STP), m³/s	21	
Volumetric flow rate (dry STP), m³/s	20	
Mass flow rate (wet basis), kg/hour	95000	
Velocity difference, %	3	

Gas Analyser Results	Average
Sampling time	1140 - 1239
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1243 - 1253	
	Concentration ou	Mass Rate oum³/min
Results	87	110000
Lower uncertainty limit	61	
Upper uncertainty limit	120	
Hedonic tone	Neutral	
Odour character	Sweet	
Analysis date & time	06/10/21, 1000-1130	
Holding time	21 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.7 EPA ID 13 – No. 3 Starch Dryer Scrubber

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 13 - No. 3 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details		
Sampling plane dimensions	1000 x 1050 mm	
Sampling plane area	1.05 m²	
Sampling port size, number	Sampled at exit	
Access & height of ports	Stairs & ladders 20 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Exit 0 D	
Upstream disturbance	Change in diameter 0 D	
No. traverses & points sampled	3 15	
Sample plane compliance to AS4323.1	Non-compliant	

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	6.5	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1010 & 1110	
Temperature, °C	40	
Temperature, K	313	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/s	23	
Volumetric flow rate (wet STP), m³/s	20	
Volumetric flow rate (dry STP), m³/s	18	
Mass flow rate (wet basis), kg/hour	90000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1010 - 1109
	Concentration
	% v/v
Oxygen	20.7

Odour	Results	
Sampling time	1046 - 1056	
	Concentration	Mass Rate
	ou	oum³/min
Results	79	93000
Lower uncertainty limit	55	
Upper uncertainty limit	110	
Hedonic tone	Mildly pleasant	
Odour character	Starch, sweet	
Analysis date & time	06/10/21, 1000-1130	
Holding time	23 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.8 EPA ID 14 – No. 4 Starch Dryer Scrubber

Date	5/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 14 - No. 4 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details		
Sampling plane dimensions	1000 x 1050 mm	
Sampling plane area	1.05 m²	
Sampling port size, number	Sampled at exit	
Access & height of ports	Stairs & ladders 20 m	
Duct orientation & shape	Vertical Rectangular	
Downstream disturbance	Exit 0 D	
Upstream disturbance	Change in diameter 0 D	
No. traverses & points sampled	3 15	
Sample plane compliance to AS4323.1	Non-compliant	

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	6.9	
Gas molecular weight, g/g mole	28.2 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1013 & 1113	
Temperature, °C	40	
Temperature, K	313	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/s	21	
Volumetric flow rate (wet STP), m³/s	18	
Volumetric flow rate (dry STP), m³/s	17	
Mass flow rate (wet basis), kg/hour	82000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1013 - 1112
	Concentration %v/v
Oxygen	20.6

Odour	Results	
Sampling time	1026 - 1036	
	Concentration ou	Mass Rate oum³/min
Results	62	67000
Lower uncertainty limit	43	
Upper uncertainty limit	88	
Hedonic tone	Neutral	
Odour character	Starch, Bread	
Analysis date & time	06/10/21, 1000-1130	
Holding time	24 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	23.15	
Last calibration date	October 2020	

2.9 EPA ID 16 – CO2 Scrubber Outlet

Date	30/09/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 16 - CO2 Scrubber Outlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	505 mm
Sampling plane area	0.2 m²
Sampling port size, number & depth	3" BSP (x1), 60 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction >10 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments
The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	42.0 (wet)	42.3 (dry)
Gas density at STP, kg/m³	1.87 (wet)	1.89 (dry)
Gas density at discharge conditions, kg/m³	1.73	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0948 & 1022	
Temperature, °C	24	
Temperature, K	297	
Velocity at sampling plane, m/s	10	
Volumetric flow rate, actual, m³/s	2.1	
Volumetric flow rate (wet STP), m³/s	1.9	
Volumetric flow rate (dry STP), m³/s	1.9	
Mass flow rate (wet basis), kg/hour	13000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	0950 - 1020
	Concentration %v/v
Oxygen	0.3

Odour	Results	
Sampling time	1007 - 1009	
	Concentration ou	Mass Rate oum³/min
Results	51000	5900000
Lower uncertainty limit	36000	
Upper uncertainty limit	74000	
Hedonic tone	Mildly pleasant	
Odour character	Cider, sweet	
Analysis date & time	01/10/21, 0900-1100	
Holding time	23 hours	
Dilution factor	9	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (℃)	2165	
Last calibration date	October 2020	

2.10 EPA ID 35 - Combined Boiler 5 & 6 Stack

Date	20/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 35 - Boiler 5 & 6 Combined Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		*211014*

Sampling Plane Details	
Sampling plane dimensions	1985 mm
Sampling plane area	3.09 m²
Sampling port size, number & depth	4" BSP (x4), 100 mm
Access & height of ports	Stairs & ladders 40 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction 4 D
No. traverses & points sampled	2 20
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	5.1	
Gas molecular weight, g/g mole	29.8 (wet)	30.4 (dry)
Gas density at STP, kg/m³	1.33 (wet)	1.36 (dry)
Gas density at discharge conditions, kg/m³	0.91	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1240 & 1340	
Temperature, °C	125	
Temperature, K	399	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/s	50	
Volumetric flow rate (wet STP), m³/s	35	
Volumetric flow rate (dry STP), m³/s	33	
Mass flow rate (wet basis), kg/hour	170000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1240 - 1340
	Concentration %v/v
Oxygen	9.4

Odour	Results	
Sampling time	1250 - 1300	
	Concentration ou	Mass Rate oum³/min
Results	400	830000
Lower uncertainty limit	280	
Upper uncertainty limit	570	
Hedonic tone	Mildly unpleasant	
Odour character	Sulfur, gas, combustion	
Analysis date & time	21/10/21, 1000-1100	
Holding time	21 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	68.1	
Laboratory temp (°C)	22.6	
Last calibration date	October 2021	

2.11 EPA ID 39 - Biofilter Inlet

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 39 - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	600 mm
Sampling plane area	0.283 m²
Sampling port size, number & depth	1 x 1 inch port, 45 mm
Access & height of ports	Ground 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	1 6
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	5.7	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.03	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1135 & 1205	
Temperature, °C	38	
Temperature, K	311	
Velocity at sampling plane, m/s	16	
Volumetric flow rate, actual, m³/s	4.5	
Volumetric flow rate (wet STP), m³/s	3.6	
Volumetric flow rate (dry STP), m³/s	3.4	
Mass flow rate (wet basis), kg/hour	17000	
Velocity difference, %	<1	

Odour	Results	
Sampling time	1146 - 1156	
	Concentration ou	Mass Rate oum³/min
Results	5400	1200000
Lower uncertainty limit	3800	
Upper uncertainty limit	7700	
Hedonic tone	Mildly pleasant	
Odour character	Bread, wet, grain	
Analysis date & time	07/10/21, 0930-1130	
Holding time	21 hours	
Dilution factor	2	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (°C)	23.25	
Last calibration date	October 2020	

2.12 EPA ID 39A - Biofilter inlet

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 39A - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details	
Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m²
Sampling port size, number	1 x 1 inch port
Access & height of ports	Ground 0.6 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1.5 D
Upstream disturbance	Inlet >2 D
No. traverses & points sampled	1 4
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	2.7	
Gas molecular weight, g/g mole	28.7 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.13	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1100 & 1115	
Temperature, °C	36	
Temperature, K	310	
Velocity at sampling plane, m/s	8	
Volumetric flow rate, actual, m³/s	0.56	
Volumetric flow rate (wet STP), m³/s	0.5	
Volumetric flow rate (dry STP), m³/s	0.48	
Mass flow rate (wet basis), kg/hour	2300	
Velocity difference, %	-2	

Odour	Results	
Sampling time	1106 - 1108	
	Concentration ou	Mass Rate oum³/min
Results	10000	310000
Lower uncertainty limit	7300	
Upper uncertainty limit	15000	
Hedonic tone	Neutral	
Odour character	Bread, sweet	
Analysis date & time	07/10/21, 0930-1130	
Holding time	22 hours	
Dilution factor	9	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (°C)	23.25	
Last calibration date	October 2020	

2.13 EPA ID 40 - Biofilter A East

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A East
Date	6/10/2021	**Plant/Site**	Ethanol Plant
Report No.	R011744		Bomaderry, NSW
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	72
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	24
Sampling Results	
Sampling time, hrs	1145 - 1158
Sample dilution	3
Odour concentration, ou	**10000**
Hedonic tone	Mildly pleasant
Odour character	Vegemite, sweet, bread
95% Confidence Interval	7300 - 15000
Odour Flux Rate, ou/m²/min	**7500**
Odour mass rate, ou/min	**750000**

2.14 EPA ID 40 - Biofilter A West

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A West
Date	6/10/2021	**Plant/Site**	Ethanol Plant
Report No.	R011744		Bomaderry, NSW
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	73
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	24
Sampling Results	
Sampling time, hrs	1125 - 1138
Sample dilution	5
Odour concentration, ou	**7500**
Hedonic tone	Mildly unpleasant
Odour character	Burnt toast, bread dough
95% Confidence Interval	5300 - 11000
Odour Flux Rate, ou/m²/min	**5500**
Odour mass rate, ou/min	**550000**

2.15 EPA ID 41 - Biofilter B East

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B East
Date	6/10/2021	**Plant/Site**	Ethanol Plant
Report No.	R011744		Bomaderry, NSW
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	85
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	28
Sampling Results	
Sampling time, hrs	1105 - 1118
Sample dilution	3
Odour concentration, ou	**9600**
Hedonic tone	Mildly unpleasant
Odour character	Toast
95% Confidence Interval	6700 - 14000
Odour Flux Rate, ou/m²/min	**8200**
Odour mass rate, ou/min	**820000**

2.16 EPA ID 41 - Biofilter B West

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B West
Date	6/10/2021	**Plant/Site**	Ethanol Plant
Report No.	R011744		Bomaderry, NSW
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz		***210617***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	72
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	24
Sampling Results	
Sampling time, hrs	1042 - 1055
Sample dilution	3.5
Odour concentration, ou	**9400**
Hedonic tone	Mildly unpleasant
Odour character	Bread, vegemite
95% Confidence Interval	6600 - 13000
Odour Flux Rate, ou/m²/min	**6800**
Odour mass rate, ou/min	**680000**

2.17 EPA ID 42 - Boiler 4

Date	20/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 42 - Boiler 4
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		211014

Sampling Plane Details	
Sampling plane dimensions	1140 mm
Sampling plane area	1.02 m²
Sampling port size, number & depth	4" BSP (x2), 100 mm
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >3 D
Upstream disturbance	Change in diameter 1 D
No. traverses & points sampled	2 16
Sample plane compliance to AS4323.1	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The upstream disturbance is <2D from the sampling plane

Stack Parameters		
Moisture content, %v/v	4.8	
Gas molecular weight, g/g mole	29.1 (wet)	29.7 (dry)
Gas density at STP, kg/m³	1.30 (wet)	1.32 (dry)
Gas density at discharge conditions, kg/m³	0.82	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1118 & 1252	
Temperature, °C	164	
Temperature, K	437	
Velocity at sampling plane, m/s	20	
Volumetric flow rate, actual, m³/s	21	
Volumetric flow rate (wet STP), m³/s	13	
Volumetric flow rate (dry STP), m³/s	12	
Mass flow rate (wet basis), kg/hour	61000	
Velocity difference, %	-6	

Gas Analyser Results	Average
Sampling time	1024 - 1130
	Concentration %v/v
Oxygen	14.1

Odour	Results	
Sampling time	1234 - 1244	
	Concentration ou	Mass Rate oum³/min
Results	400	310000
Lower uncertainty limit	280	
Upper uncertainty limit	570	
Hedonic tone	Mildly unpleasant	
Odour character	Sulfur	
Analysis date & time	21/10/21, 1000-1100	
Holding time	22 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	68.1	
Laboratory temp (°C)	22.6	
Last calibration date	October 2021	

2.18 EPA ID 44 – Fermenter 12

Date	30/09/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 44 - Fermenter 12
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	295 mm
Sampling plane area	0.0683 m²
Sampling port size, number & depth	3" BSP (x1), 75 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 10 D
Upstream disturbance	Junction 2 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The gas velocity at some or all sampling points is less than 3 m/s
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.6	
Gas molecular weight, g/g mole	32.4 (wet)	32.6 (dry)
Gas density at STP, kg/m³	1.45 (wet)	1.46 (dry)
Gas density at discharge conditions, kg/m³	1.31	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1025 & 1040	
Temperature, °C	29	
Temperature, K	302	
Velocity at sampling plane, m/s	2.2	
Volumetric flow rate, actual, m³/s	0.15	
Volumetric flow rate (wet STP), m³/s	0.14	
Volumetric flow rate (dry STP), m³/s	0.13	
Mass flow rate (wet basis), kg/hour	710	
Velocity difference, %	-1	

Odour	Results	
Sampling time	1035 - 1037	
	Concentration ou	Mass Rate oum³/min
Results	11000	93000
Lower uncertainty limit	7900	
Upper uncertainty limit	16000	
Hedonic tone	Mildly pleasant	
Odour character	Cider, sweet	
Analysis date & time	01/10/21, 0900-1100	
Holding time	23 hours	
Dilution factor	9	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	21.65	
Last calibration date	October 2020	

2.19 EPA ID 45 - Boiler 2

Date	20/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 45 - Boiler 2
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Steven Cooper	**State**	NSW
Process Conditions	Please refer to client records.		211014

Sampling Plane Details		
Sampling plane dimensions	1070 mm	
Sampling plane area	0.899 m²	
Sampling port size, number & depth	4" Flange (x2), 180 mm	
Access & height of ports	Ladders 20 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Change in diameter 5 D	
No. traverses & points sampled	2 16	
Sample plane compliance to AS4323.1	Compliant but non-ideal	

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	4.7	
Gas molecular weight, g/g mole	29.4 (wet)	29.9 (dry)
Gas density at STP, kg/m³	1.31 (wet)	1.33 (dry)
Gas density at discharge conditions, kg/m³	0.77	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1345 & 1445	
Temperature, °C	197	
Temperature, K	470	
Velocity at sampling plane, m/s	9.9	
Volumetric flow rate, actual, m³/s	8.9	
Volumetric flow rate (wet STP), m³/s	5.2	
Volumetric flow rate (dry STP), m³/s	5	
Mass flow rate (wet basis), kg/hour	25000	
Velocity difference, %	4	

Gas Analyser Results	Average
Sampling time	1345 - 1445
	Concentration %v/v
Oxygen	12.7

Odour	Results	
Sampling time	1350 - 1400	
	Concentration ou	Mass Rate oum³/min
Results	520	160000
Lower uncertainty limit	360	
Upper uncertainty limit	740	
Hedonic tone	Very unpleasant	
Odour character	Sulfur	
Analysis date & time	21/10/21, 1000-1100	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	68.1	
Laboratory temp (℃)	22.6	
Last calibration date	October 2021	

2.20 EPA ID 46 – DDG Pellet Plant Stack

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 46 - DDG Pellet Plant Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details	
Sampling plane dimensions	1460 mm
Sampling plane area	1.67 m²
Sampling port size, number	4" Flange (x1)
Access & height of ports	Elevated work platform 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Junction 2.1 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.5	
Gas molecular weight, g/g mole	28.6 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.08	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1005 & 1035	
Temperature, °C	50	
Temperature, K	323	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/s	20	
Volumetric flow rate (wet STP), m³/s	17	
Volumetric flow rate (dry STP), m³/s	17	
Mass flow rate (wet basis), kg/hour	79000	
Velocity difference, %	<1	

Odour	Results	
Sampling time	1010 - 1023	
	Concentration ou	Mass Rate oum³/min
Results	2000	2100000
Lower uncertainty limit	1400	
Upper uncertainty limit	2900	
Hedonic tone	Neutral	
Odour character	Bread, gas	
Analysis date & time	07/10/21, 0930-1130	
Holding time	23 hours	
Dilution factor	1.5	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (°C)	23.25	
Last calibration date	October 2020	

2.21 EPA ID 47 - No. 5 Starch Dryer Scrubber

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	EPA ID 47 - No. 5 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details		
Sampling plane dimensions	2400 mm	
Sampling plane area	4.52 m²	
Sampling port size, number	4" Flange (x2)	
Access & height of ports	Stairs 20 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Change in diameter 3 D	
No. traverses & points sampled	2 20	
Sample plane compliance to AS4323.1	Compliant but non-ideal	

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	4.4	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.02	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1230 & 1330	
Temperature, °C	67	
Temperature, K	340	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	75	
Volumetric flow rate (wet STP), m³/s	60	
Volumetric flow rate (dry STP), m³/s	58	
Mass flow rate (wet basis), kg/hour	280000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1230 - 1329
	Concentration %v/v
Oxygen	20.3

Odour	Results	
Sampling time	1252 - 1306	
	Concentration ou	Mass Rate oum³/min
Results	1600	5800000
Lower uncertainty limit	1100	
Upper uncertainty limit	2300	
Hedonic tone	Mildly pleasant	
Odour character	Vegemite	
Analysis date & time	07/10/21, 0930-1130	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (°C)	23.25	
Last calibration date	October 2020	

2.22 CO2 Scrubber Inlet

Date	30/09/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	CO2 Scrubber Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Scott Woods	**State**	NSW
Process Conditions	Please refer to client records.		210907

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	1 inch ball valve, 80 mm
Access & height of ports	Ground level 1.5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 2
Sample plane compliance to AS4323.1	Non-compliant

Comments

Flow measurement readings were applied from EPA ID 16, the CO2 scrubber outlet, as flow was unable to be measured at this location.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	1.1	
Gas molecular weight, g/g mole	41.7 (wet)	42.0 (dry)
Gas density at STP, kg/m³	1.86 (wet)	1.87 (dry)
Gas density at discharge conditions, kg/m³	1.72	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0948 & 1022	
Temperature, °C	24	
Temperature, K	297	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	2.1	
Volumetric flow rate (wet STP), m³/s	1.9	
Volumetric flow rate (dry STP), m³/s	1.9	
Mass flow rate (wet basis), kg/hour	13000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1030 - 1100
	Concentration %v/v
Oxygen	0.3

Odour	Results	
Sampling time	1055 - 1057	
	Concentration ou	Mass Rate oum³/min
Results	65000	7600000
Lower uncertainty limit	46000	
Upper uncertainty limit	93000	
Hedonic tone	Mildly unpleasant	
Odour character	Cider, vinegar	
Analysis date & time	01/10/21, 0900-1100	
Holding time	22 hours	
Dilution factor	8.9	
Bag material	Nalophan	
Butanol threshold (ppb)	67.1	
Laboratory temp (°C)	2165	
Last calibration date	October 2020	

2.23 DDG Dryer 1 & 2 – Air Leakage Fan

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	DDG Dryer 1 & 2 - Air Leakage Fan
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	145 mm
Sampling plane area	0.0165 m²
Sampling port size, number & depth	2" BSP (x1), 45 mm
Access & height of ports	Ground 1.8 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 5 D
Upstream disturbance	Bend 1.5 D
No. traverses & points sampled	1 2
Sample plane compliance to AS4323.1	Non-compliant

Comments
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-compliant due to the following reasons:
The gas velocity at some or all sampling points is less than 3 m/s
The upstream disturbance is <2D from the sampling plane

Stack Parameters		
Moisture content, %v/v	10	
Gas molecular weight, g/g mole	27.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.24 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1340 & 1405	
Temperature, °C	45	
Temperature, K	318	
Velocity at sampling plane, m/s	2	
Volumetric flow rate, actual, m³/s	0.033	
Volumetric flow rate (wet STP), m³/s	0.029	
Volumetric flow rate (dry STP), m³/s	0.026	
Mass flow rate (wet basis), kg/hour	130	
Velocity difference, %	-4	

Odour	Results	
Sampling time	1351 - 1401	
	Concentration ou	Mass Rate oum³/min
Results	14000	23000
Lower uncertainty limit	9700	
Upper uncertainty limit	20000	
Hedonic tone	Mildly pleasant	
Odour character	Wet, grain, sweet	
Analysis date & time	07/10/21, 0930-1130	
Holding time	19 hours	
Dilution factor	4.3	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (℃)	23.25	
Last calibration date	October 2020	

2.24 DDG Dryer 3 – Air Leakage Fan

Date	6/10/2021	**Client**	Manildra Group
Report	R011744	**Stack ID**	DDG Dryer 3 - Air Leakage Fan
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker, Steven Cooper & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*210907*

Sampling Plane Details	
Sampling plane dimensions	145 mm
Sampling plane area	0.0165 m²
Sampling port size, number & depth	2" BSP (x1), 45 mm
Access & height of ports	Ground 1 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 1.5 D
No. traverses & points sampled	1 2
Sample plane compliance to AS4323.1	Non-compliant

Comments
The discharge is assumed to be composed of dry air and moisture

The sampling plane is deemed to be non-compliant due to the following reasons:
The upstream disturbance is <2D from the sampling plane

Stack Parameters		
Moisture content, %v/v	6.3	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1315 & 1345	
Temperature, °C	60	
Temperature, K	333	
Velocity at sampling plane, m/s	30	
Volumetric flow rate, actual, m³/s	0.5	
Volumetric flow rate (wet STP), m³/s	0.4	
Volumetric flow rate (dry STP), m³/s	0.37	
Mass flow rate (wet basis), kg/hour	1800	
Velocity difference, %	-2	

Odour	Results	
Sampling time	1332 - 1342	
	Concentration ou	Mass Rate oum³/min
Results	6200	150000
Lower uncertainty limit	4400	
Upper uncertainty limit	8900	
Hedonic tone	Mildly pleasant	
Odour character	Bread, wet, grain	
Analysis date & time	07/10/21, 0930-1130	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	39.6	
Laboratory temp (℃)	23.25	
Last calibration date	October 2020	

3 PLANT OPERATING CONDITIONS

See Manildra Group records for complete process conditions.

4 TEST METHODS

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	NSW EPA TM-1	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2	NSW EPA TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22	NSW EPA TM-22	19%	✓	✓
Molecular weight	NA	NSW EPA TM-23	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23	not specified	NA	✓
Oxygen	NSW EPA TM-25	NSW EPA TM-25	13%	✓	✓
Odour	NSW EPA OM-7	NSW EPA OM-7	refer to results	✓	✓¥
Odour characterisation	NA	direct observation	NA	NA	×
Odour from diffuse sources	NSW EPA OM-8	AS4323.3	refer to results	✓	✓¥

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

¥ Odour analysis conducted at the Unanderra, NSW laboratory by forced choice olfactometry, NATA accreditation number 14601. Results were reported on:
1 October 2021 in report ON-00098.
6 October 2021 in report ON-00099.
7 October 2021 in report ON-00100.
21 October 2021 in report ON-00102.

5 QUALITY ASSURANCE/QUALITY CONTROL INFORMATION

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

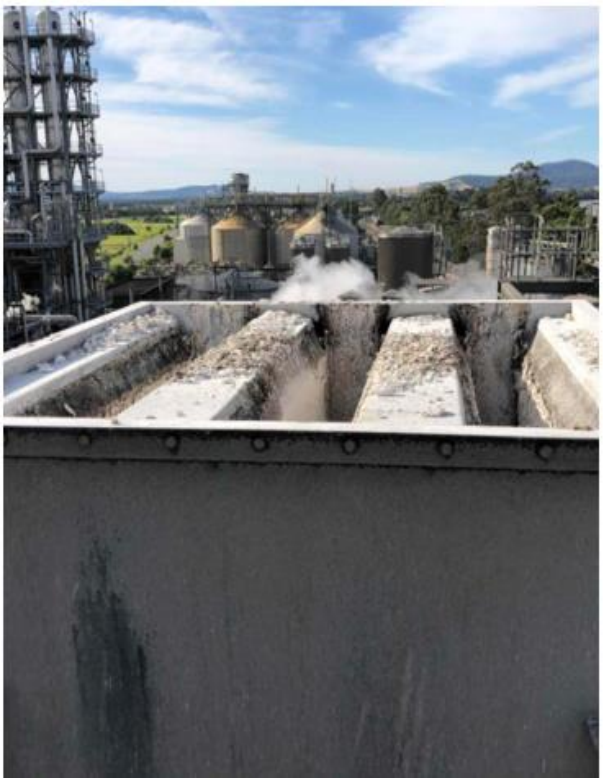
% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 APPENDIX 1: SITE PHOTOS

EPA ID 9 – No. 2 Gluten Dryer Baghouse

EPA ID 10 – No. 3 Gluten Dryer Baghouse

EPA ID 11 – No. 4 Gluten Dryer Baghouse



EPA ID 12 – No. 1 Starch Dryer Scrubber

EPA ID 13 – No. 3 Starch Dryer Scrubber

EPA ID 14 – No. 4 Starch Dryer Scrubber

EPA ID 35 - Combined Boiler 5 & 6 Stack

EPA ID 39 - Biofilter Inlet

EPA ID 39A - Biofilter Inlet

EPA ID 40 - Biofilter A

EPA ID 41 - Biofilter B

EPA ID 42 - Boiler 4

EPA ID 45 - Boiler 2

EPA ID 46 – DDG Pellet Plant Stack

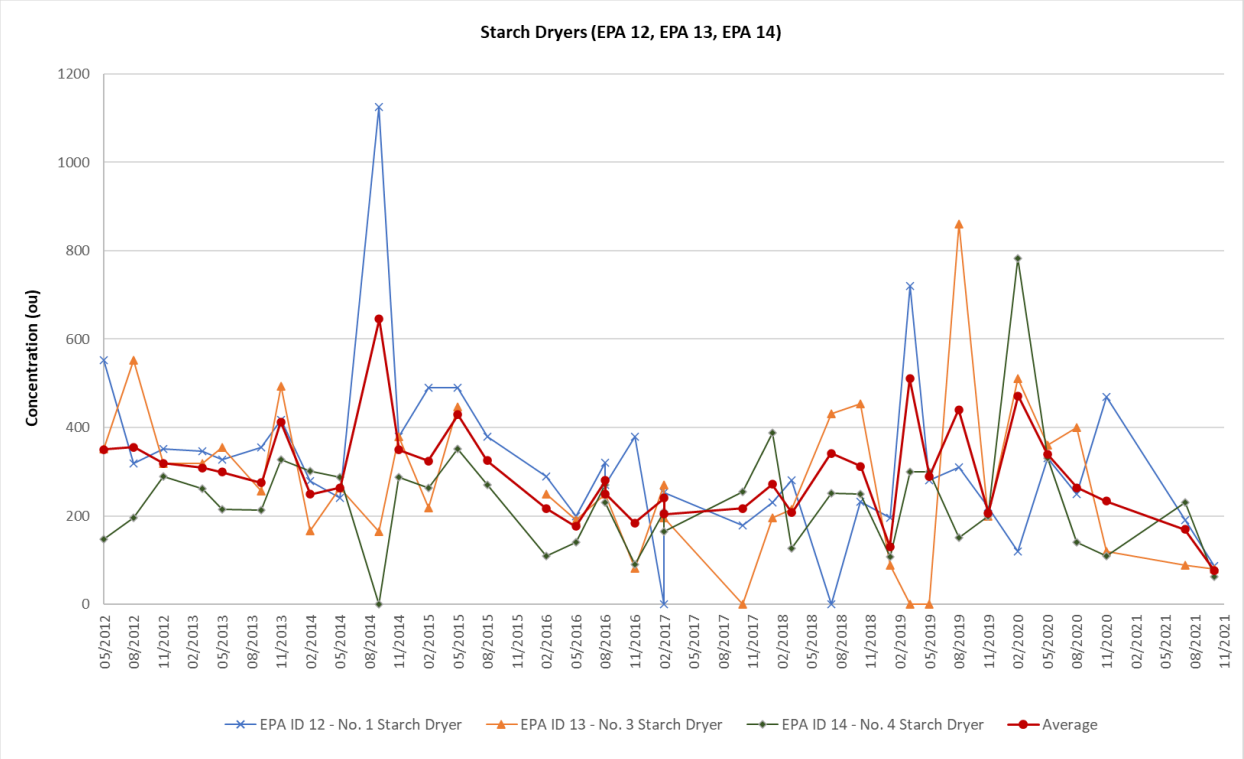
EPA ID 47 - Starch Dryer 5

DDG Dryer 1 & 2 – Air Leakage Fan

DDG 3 – Air Leakage Fan

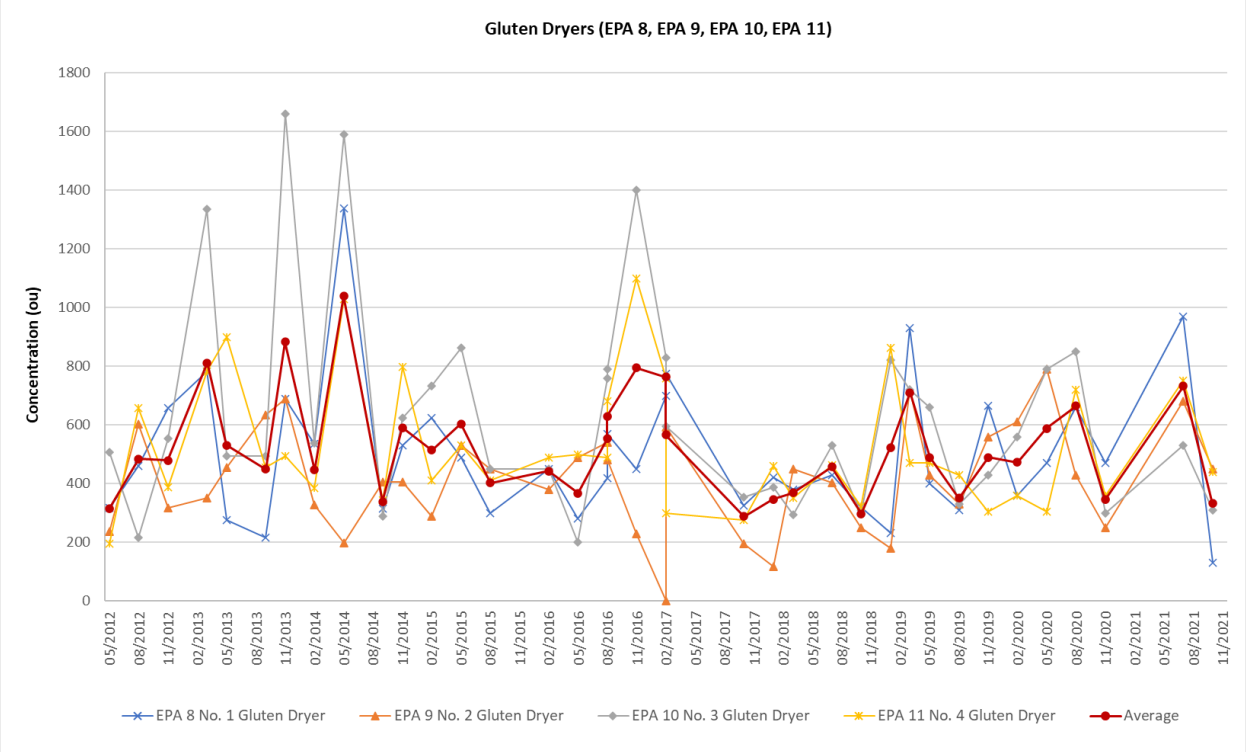
8 APPENDIX 2: HISTORICAL ODOUR RESULTS

Figure 1. Starch Dryers No 1, 3 & 4 (EPA 12, EPA13, EPA14)



Zero result represents Dryer not operating on days of testing

Figure 2. Gluten Dryers No 1,2,3 & 4 (EPA 8, EPA 9, EPA 10, EPA 11)



Zero result represents Dryer not operating on days of testing

Figure 3. Starch Dryer 5 (EPA 47)

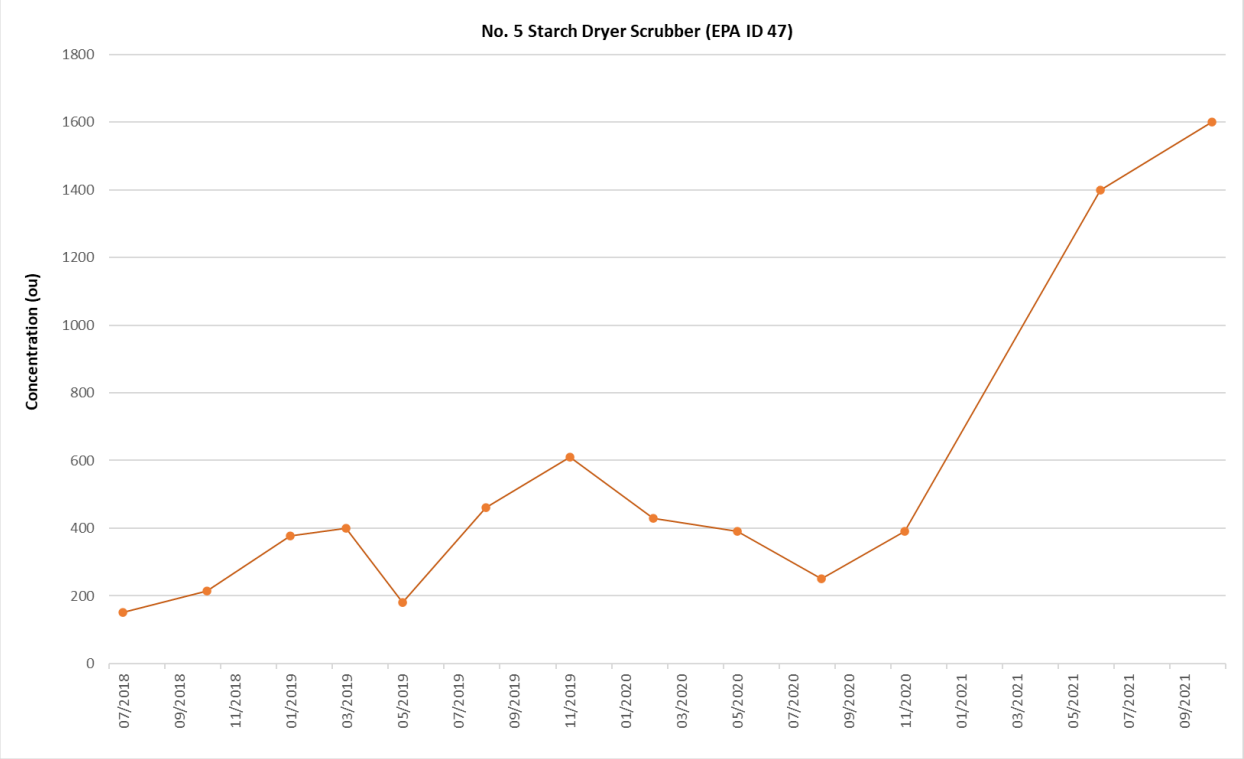
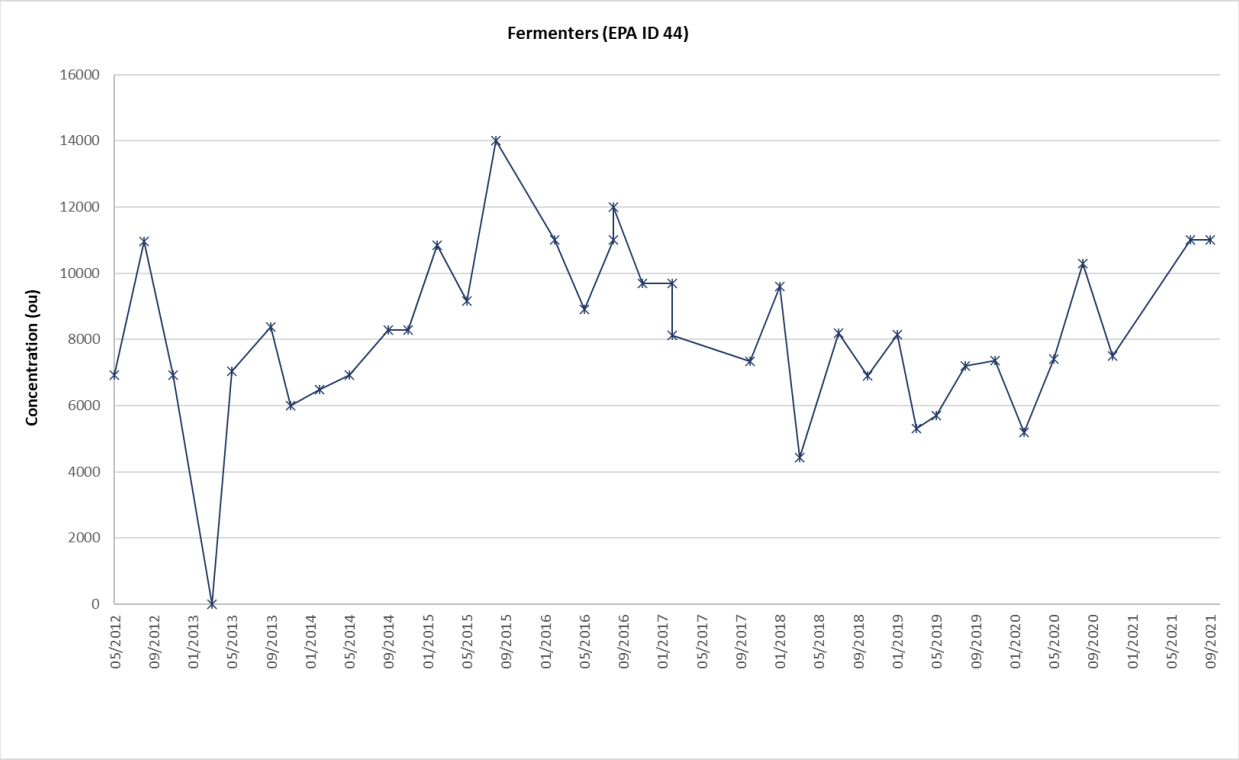


Figure 4. Fermenters (EPA 44)



Zero result represents Fermenter not operating on days of testing

Figure 5. Carbon Dioxide Scrubber Outlet (EPA 16)

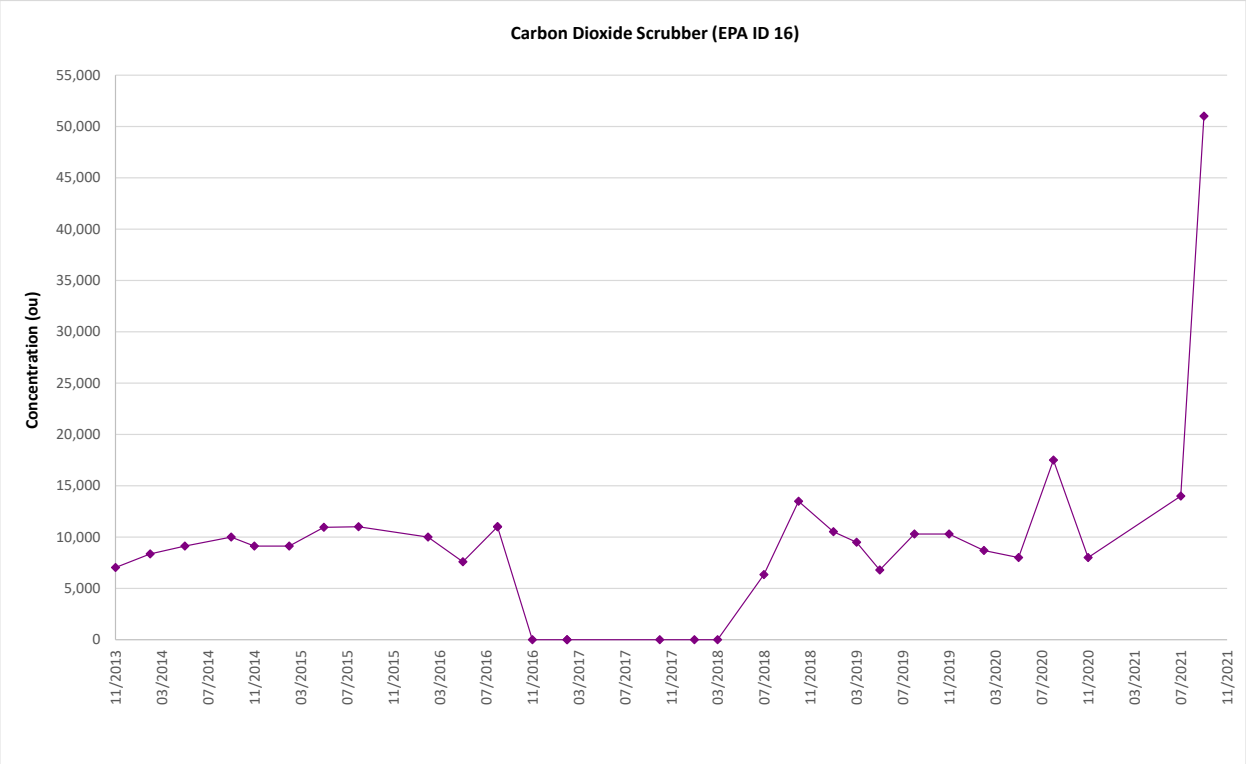


Figure 6. Combined Boiler 5 & 6 Stack (EPA 35)

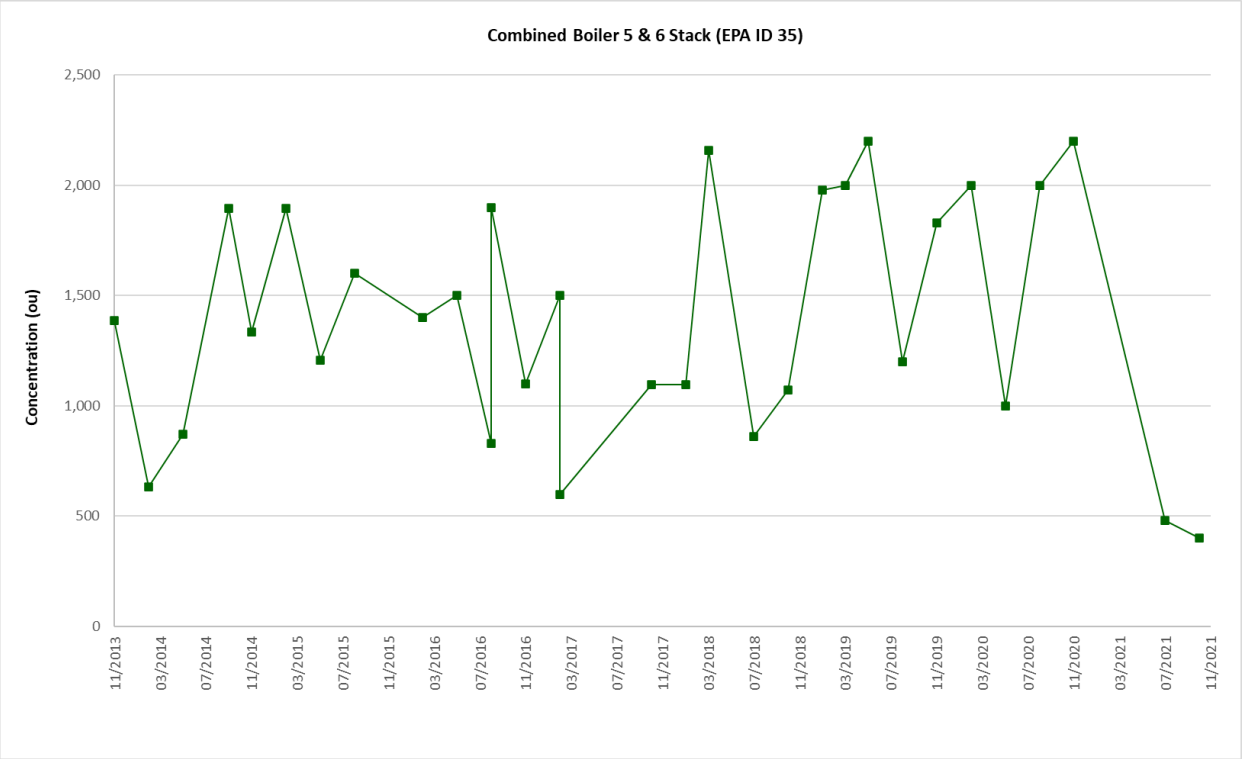


Figure 7. Boiler 4 Stack (EPA 42)

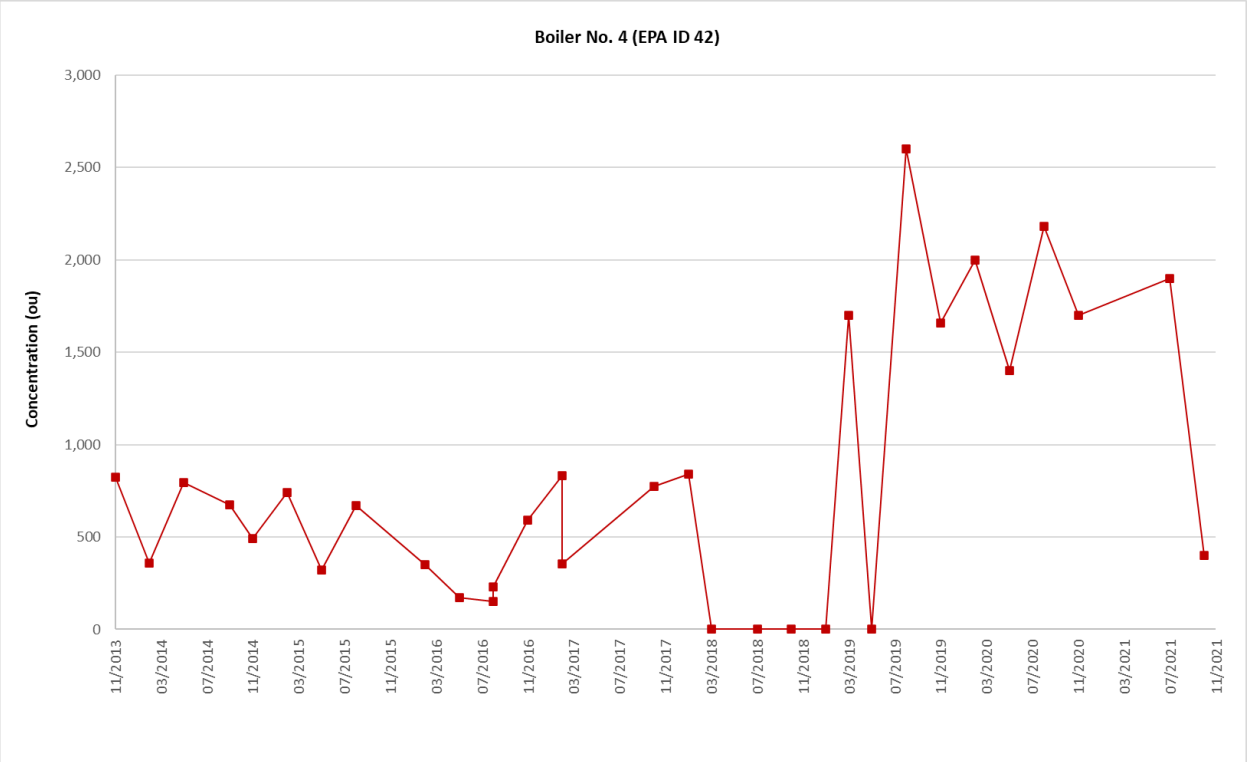


Figure 8. Boiler 2 Stack (EPA 45)

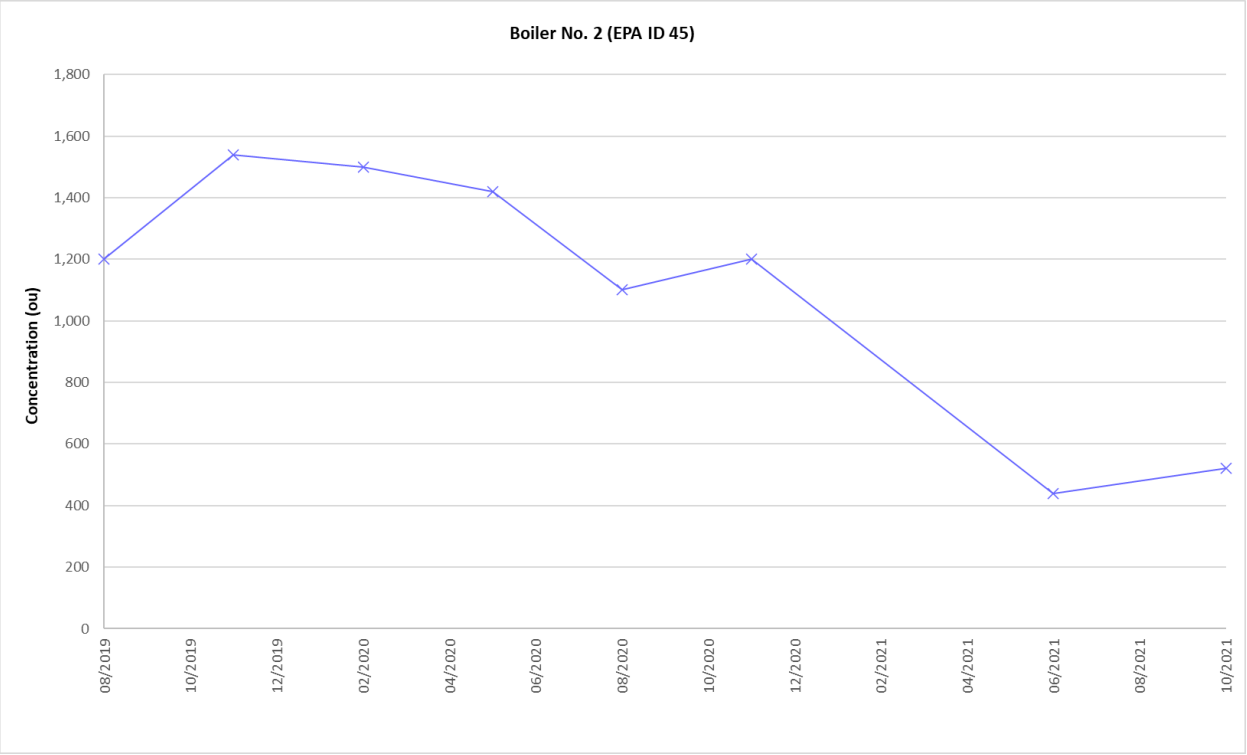
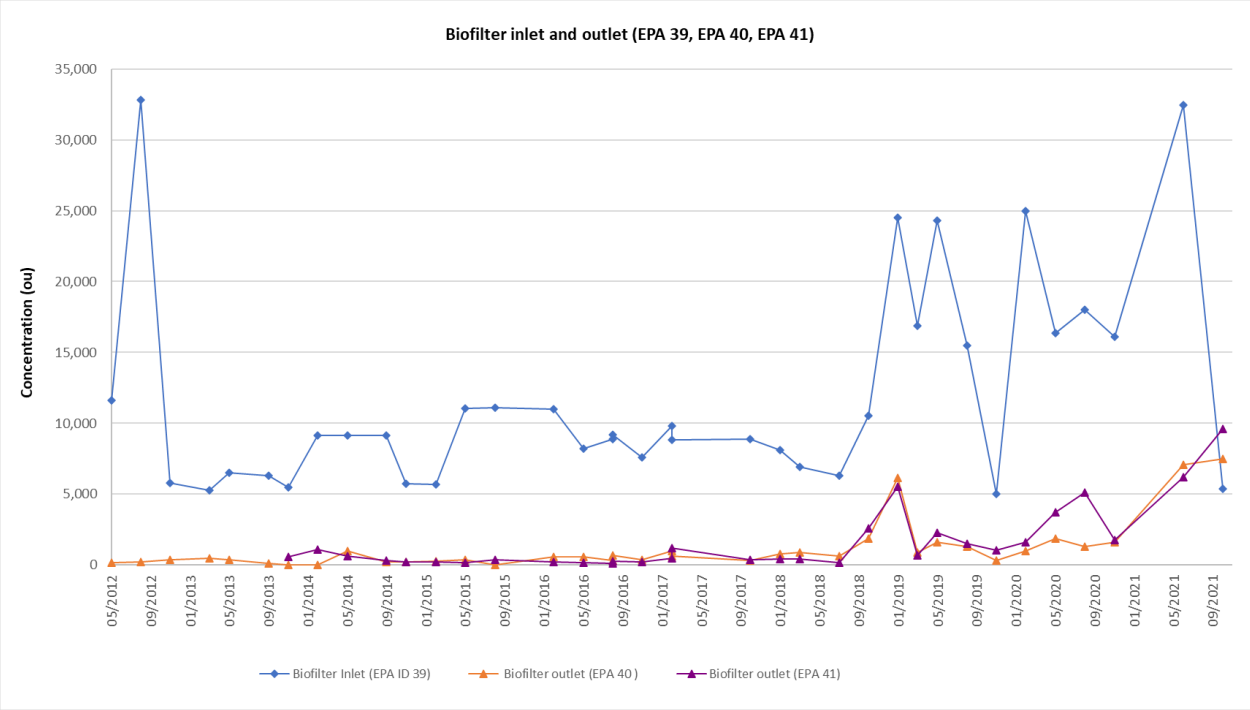
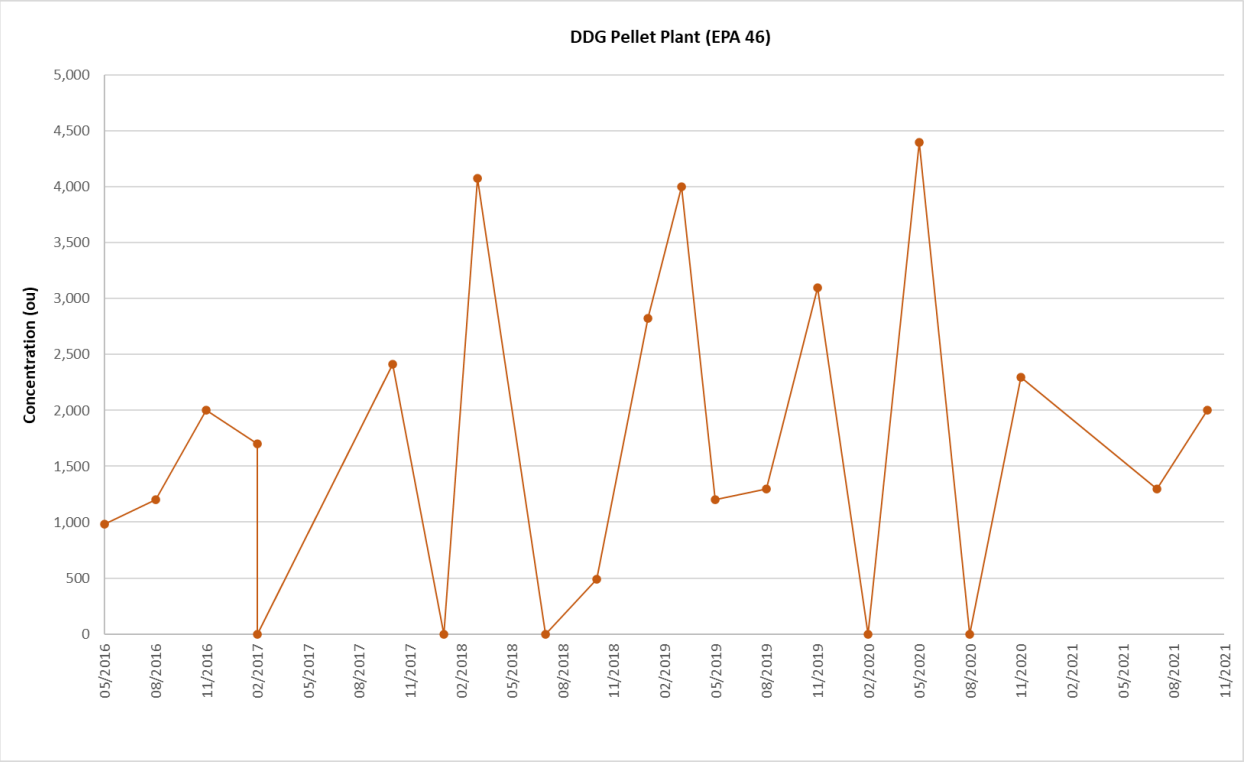


Figure 9. Biofilters (EPA 39, 40, 41)



Zero result represents Biofilter not available to be sampled for that event

Figure 10. DDG Pellet Plant (EPA 46)



Zero result represents DDG Pellet Plant not sampled for that event

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Ektimo

Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry

Odour Emission Testing Report, Quarter 3 2021 - 22

Report Number R012022

Document Information

Template Version 211117

Client Name:	Manildra Group
Report Number:	R012022
Date of Issue:	1 February 2022
Attention:	John Studdert
Address:	160 Bolong Rd Bomaderry NSW 2541
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Zoe Parker **Air Monitoring Consultant**	NATA Accredited Laboratory No. 14601	**Steven Cooper** **Ektimo Signatory**

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 Executive Summary

1.1 Background

Ektimo was engaged by Manildra Group to perform odour and emission testing at their Bomaderry plant.

1.2 Project Objective

The objectives of the project were to conduct a monitoring programme to quantify odour emissions from 23 discharge points to comply with Shoalhaven Starches' Environment Protection Licence 883.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 10 – No. 3 Gluten Dryer Baghouse	9 December 2021	Odour, oxygen
EPA ID 11 – No. 4 Gluten Dryer Baghouse		
EPA ID 45 - Boiler 2	14 December 2021	Odour, oxygen
EPA ID 35 – Combined Boilers 5 & 6 Stack		
CO_2 Scrubber Inlet		
EPA ID 16 - CO_2 Scrubber Outlet		
EPA ID 44 - Fermenter 14		Odour
EPA ID 8 – No. 1 Gluten Dryer Baghouse	15 December 2021	Odour, oxygen
EPA ID 9 – No. 2 Gluten Dryer Baghouse		
EPA ID 12 – No. 1 Starch Dryer Scrubber		
EPA ID 13 – No. 3 Starch Dryer Scrubber		
EPA ID 14 – No. 4 Starch Dryer Scrubber		
EPA ID 47 – No. 5 Starch Dryer Scrubber		
EPA ID 46 – DDG Pellet Plant Stack	16 December 2021	Odour
EPA ID 19 - Effluent Pond 1	20 December 2021	Odour
EPA ID 21 - Effluent Pond 3		
EPA ID 23 - Effluent Pond 5		
EPA ID 24 - Effluent Pond 6		
EPA ID 25 - Sulfur Oxidation Pond		
EPA ID 40 - Biofilter A	21 December 2021	Odour
EPA ID 41 - Biofilter B		
EPA ID 39A – Biofilter Inlet		
EPA ID 39 – Biofilter Inlet		Odour, oxygen

* Flow rate, velocity, temperature and moisture were also determined except at EPA ID 8

All results are reported on a dry basis at STP (except odour wet – STP).

EPA ID 20 Effluent Pond 2 was unsafe to access for odour sampling.

EPA ID 22 Effluent Pond 4 was covered and was not able to be sampled.

EPA ID 42 Boiler 4 was not operating during the dates sampling was undertaken.

2 Results

2.1 Results Summary

Location	Date	Odour		Hedonic Tone	Character
		Concentration [ou]	Odourant Flow Rate [oum^3/min]		
EPA ID 8 – No. 1 Gluten Dryer Baghouse	15/12/2021	680	-	Neutral	Sweet, starch
EPA ID 9 – No. 2 Gluten Dryer Baghouse	15/12/2021	310	250,000	Mildly pleasant	Bread dough
EPA ID 10 – No. 3 Gluten Dryer Baghouse	9/12/2021	440	2,200,000	Pleasant	Bread, starch, vegemite
EPA ID 11 – No. 4 Gluten Dryer Baghouse	9/12/2021	340	640,000	Mildly pleasant	Bread, starch, vegemite
EPA ID 12 – No. 1 Starch Dryer Scrubber	15/12/2021	340	410,000	Pleasant	Toast, starch
EPA ID 13 – No. 3 Starch Dryer Scrubber	15/12/2021	180	220,000	Mildly pleasant	Playdough, salty, cardboard
EPA ID 14 – No. 4 Starch Dryer Scrubber	15/12/2021	260	320,000	Mildly pleasant	Bread, starch, dry dog food
EPA ID 16 - CO_2 Scrubber Outlet	14/12/2021	15,000	1,400,000	Pleasant	Cider, apple juice
EPA ID 19 - Effluent Pond 1	20/12/2021	37	4,100	Neutral	Pond water, wet
EPA ID 21 - Effluent Pond 3	20/12/2021	34	9,200	Neutral	Earthy, dirt, clay
EPA ID 23 - Effluent Pond 5	20/12/2021	57	51,000	Neutral	Dust, green waste, wet carboard
EPA ID 24 - Effluent Pond 6	20/12/2021	49	99,000	Neutral	Pond water, sweet
EPA ID 25 - Sulfur Oxidation Pond	20/12/2021	41	18,000	Neutral	Musty
EPA ID 35 - Combined Boilers 5 & 6 Stack	14/12/2021	810	1,500,000	Neutral	Gas, sulfur, paint
EPA ID 39A – Biofilter Inlet	21/12/2021	33,000	1,400,000	Neutral	Gas, sweet, bread dough
EPA ID 39 – Biofilter Inlet	21/12/2021	11,000	2,300,000	Pleasant	Sweet, bread dough, vegemite
EPA ID 40 - Biofilter A East	21/12/2021	8,000	670,000	Neutral	Gas vinegar, vegemite, yeast
EPA ID 40 - Biofilter A West	21/12/2021	7,400	610,000	Neutral	Garbage, burnt toast, vegemite
EPA ID 41 - Biofilter B East	21/12/2021	7,300	530,000	Pleasant	Sweet, burnt, vegemite
EPA ID 41 - Biofilter B West	21/12/2021	8,100	570,000	Mildly unpleasant	Vegemite
EPA ID 44 - Fermenter 14	14/12/2021	9,600	150,000	Neutral	Cider, sweet
EPA ID 45 - Boiler 2	14/12/2021	1,000	530,000	Neutral	Gas, texta
EPA ID 46 – DDG Pellet Plant Stack	16/12/2021	740	1,100,000	Neutral	Gas, bread
EPA ID 47 – No. 5 Starch Dryer Scrubber	15/12/2021	310	1,200,000	Pleasant	Burnt toast
CO_2 Scrubber Inlet	14/12/2021	25,000	2,300,000	Neutral	Cider, sweet

2.2 EPA ID 8 - No. 1 Gluten Dryer Baghouse

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 8 - No. 1 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		

Sampling Plane Details	
Sampling plane dimensions	2400 x 2560 mm
Sampling plane area	6.14 m²
Sampling port size, number	Sampled from exit
Access & height of ports	Stairs & ladders 22 m
Duct orientation & shape	Horizontal Rectangular
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments

Sampling was undertaken at the exit of the stack as it was the only accessible area for the samples to be taken.
No temperature or flow rate readings could be taken due to access issues.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Gas Analyser Results	Average
Sampling time	1000 - 1059
	Concentration
	% v/v
Oxygen	20.9

Odour	Results
Sampling time	1035 - 1045
	Concentration
	ou
Results	680
Lower uncertainty limit	470
Upper uncertainty limit	980
Hedonic tone	Neutral
Odour character	Sweet, starch
Analysis date & time	16/12/21, 1505-1630
Holding time	29 hours
Dilution factor	1
Bag material	Nalophan
Butanol threshold (ppb)	52.3
Laboratory temp (°C)	23.2
Last calibration date	October 2021

2.3 EPA ID 9 – No. 2 Gluten Dryer / Starch Dryer Baghouse

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 9 - No. 2 Gluten Dryer / Starch Dryer
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1190 mm
Sampling plane area	1.11 m²
Sampling port size, number & depth	4" BSP (x2), 90 mm
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Horizontal Circular
Downstream disturbance	Bend 2 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	6.4	
Gas molecular weight, g/g mole	28.3 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	0.93	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1205 & 1304	
Temperature, °C	64	
Temperature, K	337	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	19	
Volumetric flow rate (wet STP), m³/s	14	
Volumetric flow rate (dry STP), m³/s	13	
Mass flow rate (wet basis), kg/hour	62000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1205 - 1304
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1220 - 1230	
	Concentration ou	Odourant Flow Rate oum³/min
Results	310	250000
Lower uncertainty limit	210	
Upper uncertainty limit	440	
Hedonic tone	Mildly pleasant	
Odour character	Bread dough	
Analysis date & time	16/12/21, 1505-1630	
Holding time	27 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.4 EPA ID 10 - No. 3 Gluten Dryer Baghouse

Date	9/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 10 - No. 3 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*211208*

Sampling Plane Details	
Sampling plane dimensions	2100 x 2400 mm
Sampling plane area	5.04 m²
Sampling port size, number	2" Ball valve (x3)
Access & height of ports	Stairs 15 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 5 D
Upstream disturbance	Change in diameter 2.5 D
No. traverses & points sampled	3 21
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments

The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	5.3	
Gas molecular weight, g/g mole	28.4 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1045 & 1145	
Temperature, °C	72	
Temperature, K	345	
Velocity at sampling plane, m/s	21	
Volumetric flow rate, actual, m³/s	100	
Volumetric flow rate (wet STP), m³/s	83	
Volumetric flow rate (dry STP), m³/s	79	
Mass flow rate (wet basis), kg/hour	380000	
Velocity difference, %	-3	

Gas Analyser Results	Average
Sampling time	1045 - 1144
	Concentration %v/v
Oxygen	20.8

Odour	Results	
Sampling time	1049 - 1109	
	Concentration ou	Odourant Flow Rate oum³/min
Results	440	2200000
Lower uncertainty limit	300	
Upper uncertainty limit	630	
Hedonic tone	Pleasant	
Odour character	Bread, starch, vegemite	
Analysis date & time	10/12/21, 1302-1357	
Holding time	26 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	20.8	
Last calibration date	October 2021	

2.5 EPA ID 11 - No. 4 Gluten Dryer Baghouse

Date	9/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 11 - No. 4 Gluten Dryer Baghouse
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Ahmad Ramiz	**State**	NSW
Process Conditions	Please refer to client records.		*211208*

Sampling Plane Details	
Sampling plane dimensions	1400 x 1700 mm
Sampling plane area	2.38 m²
Sampling port size, number	4" BSP (x3)
Access & height of ports	Stairs 30 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	3 12
Sample plane compliance to AS4323.1 (1995)	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	5	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.01	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0935 & 1040	
Temperature, °C	72	
Temperature, K	345	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	40	
Volumetric flow rate (wet STP), m³/s	32	
Volumetric flow rate (dry STP), m³/s	30	
Mass flow rate (wet basis), kg/hour	150000	
Velocity difference, %	-1	

Gas Analyser Results	Average
Sampling time	0938 - 1037
	Concentration %v/v
Oxygen	20.7

Odour	Results	
Sampling time	0941 - 1001	
	Concentration ou	Odourant Flow Rate oum³/min
Results	340	640000
Lower uncertainty limit	230	
Upper uncertainty limit	480	
Hedonic tone	Mildly pleasant	
Odour character	Bread, starch, vegemite	
Analysis date & time	10/12/21, 1302-1357	
Holding time	27 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	20.8	
Last calibration date	October 2021	

2.6 EPA ID 12 – No. 1 Starch Dryer Scrubber

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 12 - No. 1 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1500 x 1500 mm
Sampling plane area	2.25 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 25 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Silencer 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1 (1995)	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	7.1	
Gas molecular weight, g/g mole	28.2 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.09	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1103 & 1202	
Temperature, °C	42	
Temperature, K	315	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	24	
Volumetric flow rate (wet STP), m³/s	21	
Volumetric flow rate (dry STP), m³/s	19	
Mass flow rate (wet basis), kg/hour	93000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1103 - 1202
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1132 - 1142	
	Concentration ou	Odourant Flow Rate oum³/min
Results	340	410000
Lower uncertainty limit	230	
Upper uncertainty limit	480	
Hedonic tone	Pleasant	
Odour character	Toast, starch	
Analysis date & time	16/12/21, 1505-1630	
Holding time	28 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.7 EPA ID 13 – No. 3 Starch Dryer Scrubber

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 13 - No. 3 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1000 x 1050 mm
Sampling plane area	1.05 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Change in diameter 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1 (1995)	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	9	
Gas molecular weight, g/g mole	28.0 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1415 & 1515	
Temperature, °C	44	
Temperature, K	317	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/s	24	
Volumetric flow rate (wet STP), m³/s	20	
Volumetric flow rate (dry STP), m³/s	18	
Mass flow rate (wet basis), kg/hour	91000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1415 - 1514
	Concentration %v/v
Oxygen	20.8

Odour	Results	
Sampling time	1444 - 1454	
	Concentration ou	Odourant Flow Rate oum³/min
Results	180	220000
Lower uncertainty limit	130	
Upper uncertainty limit	260	
Hedonic tone	Mildly pleasant	
Odour character	Playdough, salty, cardboard	
Analysis date & time	16/12/21, 1505-1630	
Holding time	24 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.8 EPA ID 14 – No. 4 Starch Dryer Scrubber

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 14 - No. 4 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1000 x 1050 mm
Sampling plane area	1.05 m²
Sampling port size, number	Sampled at exit
Access & height of ports	Stairs & ladders 20 m
Duct orientation & shape	Vertical Rectangular
Downstream disturbance	Exit 0 D
Upstream disturbance	Change in diameter 0 D
No. traverses & points sampled	3 15
Sample plane compliance to AS4323.1 (1995)	Non-compliant

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	4.9	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.12	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1315 & 1414	
Temperature, °C	36	
Temperature, K	309	
Velocity at sampling plane, m/s	22	
Volumetric flow rate, actual, m³/s	23	
Volumetric flow rate (wet STP), m³/s	21	
Volumetric flow rate (dry STP), m³/s	20	
Mass flow rate (wet basis), kg/hour	94000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1315 - 1414
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	1252 - 1302	
	Concentration ou	Odourant Flow Rate oum³/min
Results	260	320000
Lower uncertainty limit	180	
Upper uncertainty limit	370	
Hedonic tone	Mildly pleasant	
Odour character	Bread, starch, dry dog food	
Analysis date & time	16/12/21, 1505-1630	
Holding time	26 hours	
Dilution factor	1	
Bag material	Teflon™	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.9 EPA ID 16 – CO_2 Scrubber Outlet

Date	14/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 16 - CO2 Scrubber Outlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	505 mm
Sampling plane area	0.2 m²
Sampling port size, number & depth	3" BSP (x1), 60 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction >10 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments
The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	42.6 (wet)	43.1 (dry)
Gas density at STP, kg/m³	1.90 (wet)	1.92 (dry)
Gas density at discharge conditions, kg/m³	1.70	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1007 & 1108	
Temperature, °C	32	
Temperature, K	306	
Velocity at sampling plane, m/s	8.6	
Volumetric flow rate, actual, m³/s	1.7	
Volumetric flow rate (wet STP), m³/s	1.5	
Volumetric flow rate (dry STP), m³/s	1.5	
Mass flow rate (wet basis), kg/hour	11000	
Velocity difference, %	<1	

Gas Analyser Results	Average
Sampling time	1007 - 1106
	Concentration %v/v
Oxygen	1.2

Odour	Results	
Sampling time	1050 - 1051	
	Concentration ou	Odourant Flow Rate oum³/min
Results	15000	1400000
Lower uncertainty limit	11000	
Upper uncertainty limit	22000	
Hedonic tone	Pleasant	
Odour character	Cider, apple juice	
Analysis date & time	15/12/21, 1005-1105	
Holding time	23 hours	
Dilution factor	9	
Bag material	Teflon™	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	20.9	
Last calibration date	October 2021	

2.10 EPA ID 19 – Effluent Pond 1

Client	Manildra Group	**Test Location**	EPA ID 19 - Effluent Pond 1
Date	20/12/2021	**Plant/Site**	Bomaderry, NSW
Report No.	R012022		
Ektimo Staff	Zoe Parker & Scott Woods		***211014***

Test Location Details	
Surface Description	Ducks, algae, foam
Area Classification	Industrial
Source area, m^2	3072
Sampling Method	AS4323.4 (Flux)
Sampling Results	
Sampling time, hrs	1344 - 1354
Sample dilution	1
Odour concentration, ou	**37**
Hedonic tone	Neutral
Odour character	Pond water, wet
95% Confidence Interval	27 - 52
Odour Flux Rate, ou/m²/min	**1.3**
Odourant flow rate, oum³/min	**4100**
Flux Testing Parameters	
Equilibration time, hrs	1319 - 1344
Sweep Rate @ STP, L/min	4.55
Ambient temperature, °C	27

2.11 EPA ID 21 – Effluent Pond 3

Client	Manildra Group	**Test Location**	EPA ID 21 - Effluent Pond 3
Date	20/12/2021	**Plant/Site**	Bomaderry, NSW
Report No.	R012022		
Ektimo Staff	Zoe Parker & Scott Woods		***211014***

Test Location Details	
Surface Description	Ducks
Area Classification	Industrial
Source area, m^2	7413
Sampling Method	AS4323.4 (Flux)
Sampling Results	
Sampling time, hrs	1158 - 1208
Sample dilution	1
Odour concentration, ou	**34**
Hedonic tone	Neutral
Odour character	Earthy, dirt, clay
95% Confidence Interval	25 - 48
Odour Flux Rate, ou/m²/min	**1.2**
Odourant flow rate, oum³/min	**9200**
Flux Testing Parameters	
Equilibration time, hrs	1133 - 1158
Sweep Rate @ STP, L/min	4.57
Ambient temperature, °C	26

2.12 EPA ID 23 – Effluent Pond 5

Client	Manildra Group	**Test Location**	EPA ID 23 - Effluent Pond 5
Date	20/12/2021	**Plant/Site**	Bomaderry, NSW
Report No.	R012022		
Ektimo Staff	Zoe Parker & Scott Woods		***211014***

Test Location Details	
Surface Description	Ducks, foam
Area Classification	Industrial
Source area, m^2	24282
Sampling Method	AS4323.4 (Flux)
Sampling Results	
Sampling time, hrs	1105 - 1116
Sample dilution	1
Odour concentration, ou	**57**
Hedonic tone	Neutral
Odour character	Dust, green waste, wet carboard
95% Confidence Interval	41 - 80
Odour Flux Rate, ou/m²/min	**2.1**
Odourant flow rate, oum³/min	**51000**
Flux Testing Parameters	
Equilibration time, hrs	1040 - 1105
Sweep Rate @ STP, L/min	4.58
Ambient temperature, °C	25

2.13 EPA ID 24 – Effluent Pond 6

Client	Manildra Group	**Test Location**	EPA ID 24 - Effluent Pond 6
Date	20/12/2021	**Plant/Site**	Bomaderry, NSW
Report No.	R012022		
Ektimo Staff	Zoe Parker & Scott Woods		***211014***

Test Location Details	
Surface Description	Ducks, foam, green waste
Area Classification	Industrial
Source area, m^2	56404
Sampling Method	AS4323.4 (Flux)
Sampling Results	
Sampling time, hrs	1249 - 1259
Sample dilution	1
Odour concentration, ou	**49**
Hedonic tone	Neutral
Odour character	Pond water, sweet
95% Confidence Interval	35 - 68
Odour Flux Rate, ou/m²/min	**1.8**
Odourant flow rate, oum³/min	**99000**
Flux Testing Parameters	
Equilibration time, hrs	1224 - 1249
Sweep Rate @ STP, L/min	4.57
Ambient temperature, °C	26

2.14 EPA ID 25 – Sulfur Oxidation Pond

Client	Manildra Group	**Test Location**	EPA ID 25 - Sulfur Oxidation Pond
Date	20/12/2021	**Plant/Site**	Bomaderry, NSW
Report No.	R012022		
Ektimo Staff	Zoe Parker & Scott Woods		***211014***

Test Location Details	
Surface Description	Aerated, foam
Area Classification	Industrial
Source area, m^2	12341
Sampling Method	AS4323.4 (Flux)
Sampling Results	
Sampling time, hrs	1011 - 1021
Sample dilution	1
Odour concentration, ou	**41**
Hedonic tone	Neutral
Odour character	Musty
95% Confidence Interval	29 - 57
Odour Flux Rate, ou/m²/min	**1.5**
Odourant flow rate, oum³/min	**18000**
Flux Testing Parameters	
Equilibration time, hrs	0946 - 1011
Sweep Rate @ STP, L/min	4.62
Ambient temperature, °C	23

2.15 EPA ID 35 - Combined Boilers 5 & 6 Stack

Date	14/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 35 - Boiler 5 & 6 Combined Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1985 mm
Sampling plane area	3.09 m²
Sampling port size, number & depth	4" BSP (x4), 100 mm
Access & height of ports	Stairs & ladders 40 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >6 D
Upstream disturbance	Junction 4 D
No. traverses & points sampled	2 20
Sample plane compliance to AS4323.1 (1995)	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	4.4	
Gas molecular weight, g/g mole	29.6 (wet)	30.1 (dry)
Gas density at STP, kg/m³	1.32 (wet)	1.34 (dry)
Gas density at discharge conditions, kg/m³	0.96	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1350 & 1450	
Temperature, °C	104	
Temperature, K	377	
Velocity at sampling plane, m/s	13	
Volumetric flow rate, actual, m³/s	41	
Volumetric flow rate (wet STP), m³/s	30	
Volumetric flow rate (dry STP), m³/s	29	
Mass flow rate (wet basis), kg/hour	140000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1350 - 1449
	Concentration %v/v
Oxygen	10

Odour	Results	
Sampling time	1407 - 1417	
	Concentration ou	Odourant Flow Rate oum³/min
Results	810	1500000
Lower uncertainty limit	560	
Upper uncertainty limit	1200	
Hedonic tone	Neutral	
Odour character	Gas, sulfur, paint	
Analysis date & time	15/12/21, 1005-1105	
Holding time	20 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (°C)	20.9	
Last calibration date	October 2021	

2.16 EPA ID 39 - Biofilter Inlet

Date	21/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 39 - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Harrison Handicott	**State**	NSW
Process Conditions	Please refer to client records.		211203

Sampling Plane Details	
Sampling plane dimensions	600 mm
Sampling plane area	0.283 m²
Sampling port size, number & depth	1 x 1 inch port, 45 mm
Access & height of ports	Ground 2 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1 D
Upstream disturbance	Bend 6 D
No. traverses & points sampled	1 6
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	5	
Gas molecular weight, g/g mole	28.4 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.07	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0920 & 1020	
Temperature, °C	33	
Temperature, K	306	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/s	4.3	
Volumetric flow rate (wet STP), m³/s	3.7	
Volumetric flow rate (dry STP), m³/s	3.5	
Mass flow rate (wet basis), kg/hour	17000	
Velocity difference, %	3	

Gas Analyser Results	Average
Sampling time	0923 - 1022
	Concentration %v/v
Oxygen	20.9

Odour	Results	
Sampling time	0935 - 0943	
	Concentration ou	Odourant Flow Rate oum³/min
Results	11000	2300000
Lower uncertainty limit	7600	
Upper uncertainty limit	15000	
Hedonic tone	Pleasant	
Odour character	Sweet, bread dough, vegemite	
Analysis date & time	22/12/21, 1010-1130	
Holding time	25 hours	
Dilution factor	2	
Bag material	Teflon™	
Butanol threshold (ppb)	62.3	
Laboratory temp (℃)	24.25	
Last calibration date	October 2021	

2.17 EPA ID 39A - Biofilter inlet

Date	21/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 39A - Biofilter Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Harrison Handicott	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m²
Sampling port size, number	1 x 1 inch port
Access & height of ports	Ground 0.6 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 1.5 D
Upstream disturbance	Inlet >2 D
No. traverses & points sampled	1 4
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the downstream disturbance but is greater than or equal to 1D

Stack Parameters		
Moisture content, %v/v	4.9	
Gas molecular weight, g/g mole	28.4 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.13	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1000 & 1010	
Temperature, °C	33	
Temperature, K	306	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	0.78	
Volumetric flow rate (wet STP), m³/s	0.7	
Volumetric flow rate (dry STP), m³/s	0.66	
Mass flow rate (wet basis), kg/hour	3200	
Velocity difference, %	1	

Odour	Results	
Sampling time	1003 - 1005	
	Concentration ou	Odourant Flow Rate oum³/min
Results	33000	1400000
Lower uncertainty limit	24000	
Upper uncertainty limit	46000	
Hedonic tone	Neutral	
Odour character	Gas, sweet, bread dough	
Analysis date & time	22/12/21, 1010-1130	
Holding time	24 hours	
Dilution factor	9	
Bag material	Teflon™	
Butanol threshold (ppb)	62.3	
Laboratory temp (°C)	24.25	
Last calibration date	October 2021	

2.18 EPA ID 40 - Biofilter A East

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A East
Date	21/12/2021	**Plant/Site**	Ethanol Plant
Report No.	R012022		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Harrison Handicott		*211014*

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	83
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	27
Sampling Results	
Sampling time, hrs	1013 - 1021
Sample dilution	2
Odour concentration, ou	**8000**
Hedonic tone	Neutral
Odour character	Gas vinegar, vegemite, yeast
95% Confidence Interval	5800 - 11000
Odour Flux Rate, ou/m²/min	**6700**
Odourant flow rate, oum³/min	**670000**

2.19 EPA ID 40 - Biofilter A West

Client	Manildra Group	**Test Location**	EPA ID 40 - Biofilter A West
Date	21/12/2021	**Plant/Site**	Ethanol Plant
Report No.	R012022		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Harrison Handicott		***211014***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	82
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	27
Sampling Results	
Sampling time, hrs	1028 - 1036
Sample dilution	2
Odour concentration, ou	**7400**
Hedonic tone	Neutral
Odour character	Garbage, burnt toast, vegemite
95% Confidence Interval	5400 - 10000
Odour Flux Rate, ou/m²/min	**6100**
Odourant flow rate, oum³/min	**610000**

2.20 EPA ID 41 - Biofilter B East

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B East
Date	21/12/2021	**Plant/Site**	Ethanol Plant
Report No.	R012022		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Harrison Handicott		***211014***

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	73
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	24
Sampling Results	
Sampling time, hrs	1044 - 1052
Sample dilution	2
Odour concentration, ou	**7300**
Hedonic tone	Pleasant
Odour character	Sweet, burnt, vegemite
95% Confidence Interval	5300 - 10000
Odour Flux Rate, ou/m²/min	**5300**
Odourant flow rate, oum³/min	**530000**

2.21 EPA ID 41 - Biofilter B West

Client	Manildra Group	**Test Location**	EPA ID 41 - Biofilter B West
Date	21/12/2021	**Plant/Site**	Ethanol Plant
Report No.	R012022		Bomaderry, NSW
Ektimo Staff	Zoe Parker & Harrison Handicott		*211014*

Test Location Details	
Location Description	Biofilter Outlet
Surface Description	Woodchip/Mulch
Area Classification	Industrial
Aeration rate, m^3/min	70
Source dimensions (L x W), m	14.25 x 7
Source area, m^2	99.75
Sampling Method	Collection Hood (Aeration)
Proportion of Inlet Airflow, %	23
Sampling Results	
Sampling time, hrs	1059 - 1107
Sample dilution	2
Odour concentration, ou	**8100**
Hedonic tone	Mildly unpleasant
Odour character	Vegemite
95% Confidence Interval	5800 - 11000
Odour Flux Rate, ou/m²/min	**5700**
Odourant flow rate, oum³/min	**570000**

2.22 EPA ID 44 – Fermenter 14

Date	14/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 44 - Fermenter 14
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	295 mm
Sampling plane area	0.0683 m²
Sampling port size, number & depth	3" BSP (x1), 75 mm
Access & height of ports	Stairs 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 10 D
Upstream disturbance	Junction 2 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments
The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.8	
Gas molecular weight, g/g mole	28.5 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.15	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1003 & 1010	
Temperature, °C	31	
Temperature, K	304	
Velocity at sampling plane, m/s	4.3	
Volumetric flow rate, actual, m³/s	0.29	
Volumetric flow rate (wet STP), m³/s	0.26	
Volumetric flow rate (dry STP), m³/s	0.25	
Mass flow rate (wet basis), kg/hour	1200	
Velocity difference, %	<1	

Odour	Results	
Sampling time	1005 - 1009	
	Concentration ou	Odourant Flow Rate oum³/min
Results	9600	150000
Lower uncertainty limit	6700	
Upper uncertainty limit	14000	
Hedonic tone	Neutral	
Odour character	Cider, sweet	
Analysis date & time	15/12/21, 1005-1105	
Holding time	24 hours	
Dilution factor	2	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	20.9	
Last calibration date	October 2021	

2.23 EPA ID 45 – Boiler 2

Date	14/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 45 - Boiler 2
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1070 mm
Sampling plane area	0.899 m²
Sampling port size, number & depth	4" Flange (x2), 180 mm
Access & height of ports	Ladders 20 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Change in diameter 5 D
No. traverses & points sampled	2 16
Sample plane compliance to AS4323.1 (1995)	Compliant but non-ideal

The sampling plane is deemed to be non-ideal due to the following reasons:
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	6.4	
Gas molecular weight, g/g mole	29.2 (wet)	29.9 (dry)
Gas density at STP, kg/m³	1.30 (wet)	1.34 (dry)
Gas density at discharge conditions, kg/m³	0.72	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1240 & 1340	
Temperature, °C	222	
Temperature, K	495	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	15	
Volumetric flow rate (wet STP), m³/s	8.6	
Volumetric flow rate (dry STP), m³/s	8	
Mass flow rate (wet basis), kg/hour	40000	
Velocity difference, %	-3	

Gas Analyser Results	Average
Sampling time	1240 - 1339
	Concentration
	%v/v
Oxygen	10.7

Odour	Results	
Sampling time	1320 - 1330	
	Concentration	Odourant Flow Rate
	ou	oum³/min
Results	1000	530000
Lower uncertainty limit	710	
Upper uncertainty limit	1500	
Hedonic tone	Neutral	
Odour character	Gas, texta	
Analysis date & time	15/12/21, 1005-1105	
Holding time	21 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (°C)	20.9	
Last calibration date	October 2021	

2.24 EPA ID 46 – DDG Pellet Plant Stack

Date	16/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 46 - DDG Pellet Plant Stack
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		*211203*

Sampling Plane Details	
Sampling plane dimensions	1460 mm
Sampling plane area	1.67 m²
Sampling port size, number	4" Flange (x1)
Access & height of ports	Elevated work platform 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Junction 2.1 D
No. traverses & points sampled	1 8
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments

The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:

The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	1.9	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.08	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1020 & 1150	
Temperature, °C	54	
Temperature, K	327	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	29	
Volumetric flow rate (wet STP), m³/s	24	
Volumetric flow rate (dry STP), m³/s	24	
Mass flow rate (wet basis), kg/hour	110000	
Velocity difference, %	10	

Odour	Results	
Sampling time	1116 - 1126	
	Concentration ou	Odourant Flow Rate oum³/min
Results	740	1100000
Lower uncertainty limit	510	
Upper uncertainty limit	1100	
Hedonic tone	Neutral	
Odour character	Gas, bread	
Analysis date & time	16/12/21, 1505-1630	
Holding time	4 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.25 EPA ID 47 - No. 5 Starch Dryer Scrubber

Date	15/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	EPA ID 47 - No. 5 Starch Dryer Scrubber
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		211203

Sampling Plane Details		
Sampling plane dimensions	2400 mm	
Sampling plane area	4.52 m²	
Sampling port size, number	4" Flange (x2)	
Access & height of ports	Stairs 20 m	
Duct orientation & shape	Vertical Circular	
Downstream disturbance	Exit >2 D	
Upstream disturbance	Change in diameter 3 D	
No. traverses & points sampled	2 20	
Sample plane compliance to AS4323.1 (1995)	Compliant but non-ideal	

The sampling plane is deemed to be non-ideal due to the following reasons:
The highest to lowest differential pressure ratio exceeds 9:1
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	7.9	
Gas molecular weight, g/g mole	28.1 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.26 (wet)	1.29 (dry)
Gas density at discharge conditions, kg/m³	1.02	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1515 & 1625	
Temperature, °C	62	
Temperature, K	336	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/s	78	
Volumetric flow rate (wet STP), m³/s	64	
Volumetric flow rate (dry STP), m³/s	59	
Mass flow rate (wet basis), kg/hour	290000	
Velocity difference, %	4	

Gas Analyser Results	Average
Sampling time	1523 - 1622
	Concentration %v/v
Oxygen	20.8

Odour	Results	
Sampling time	1553 - 1603	
	Concentration ou	Odourant Flow Rate oum³/min
Results	310	1200000
Lower uncertainty limit	210	
Upper uncertainty limit	440	
Hedonic tone	Pleasant	
Odour character	Burnt toast	
Analysis date & time	16/12/21, 1505-1630	
Holding time	23 hours	
Dilution factor	1	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (℃)	23.2	
Last calibration date	October 2021	

2.26 CO_2 Scrubber Inlet

Date	14/12/2021	**Client**	Manildra Group
Report	R012022	**Stack ID**	CO2 Scrubber Inlet
Licence No.	883	**Location**	Bomaderry
Ektimo Staff	Zoe Parker & Adnan Latif	**State**	NSW
Process Conditions	Please refer to client records.		211203

Sampling Plane Details	
Sampling plane dimensions	500 mm
Sampling plane area	0.196 m²
Sampling port size, number & depth	1 inch ball valve, 80 mm
Access & height of ports	Ground level 1.5 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Bend 0.5 D
Upstream disturbance	Bend 0.5 D
No. traverses & points sampled	1 2
Sample plane compliance to AS4323.1 (1995)	Non-compliant

Comments
Flow measurement readings were applied from EPA ID 16, the CO2 scrubber outlet, as flow was unable to be measured at this location.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The upstream disturbance is <2D from the sampling plane
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	2.2	
Gas molecular weight, g/g mole	42.7 (wet)	43.3 (dry)
Gas density at STP, kg/m³	1.91 (wet)	1.93 (dry)
Gas density at discharge conditions, kg/m³	1.71	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1007 & 1108	
Temperature, °C	32	
Temperature, K	305	
Velocity at sampling plane, m/s	8.5	
Volumetric flow rate, actual, m³/s	1.7	
Volumetric flow rate (wet STP), m³/s	1.5	
Volumetric flow rate (dry STP), m³/s	1.5	
Mass flow rate (wet basis), kg/hour	10000	
Velocity difference, %	1	

Gas Analyser Results	Average
Sampling time	1110 - 1210
	Concentration %v/v
Oxygen	0.7

Odour	Results	
Sampling time	1139 - 1140	
	Concentration ou	Odourant Flow Rate oum³/min
Results	25000	2300000
Lower uncertainty limit	17000	
Upper uncertainty limit	36000	
Hedonic tone	Neutral	
Odour character	Cider, sweet	
Analysis date & time	15/12/21, 1005-1105	
Holding time	23 hours	
Dilution factor	9	
Bag material	Nalophan	
Butanol threshold (ppb)	52.3	
Laboratory temp (°C)	20.9	
Last calibration date	October 2021	

3 Plant Operating Conditions

See Manildra Group records for complete process conditions.

4 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sampling points - Selection	NSW EPA TM-1	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2	NSW EPA TM-2	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22	NSW EPA TM-22	19%	✓	✓
Molecular weight	NA	NSW EPA TM-23	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23	not specified	NA	✓
Oxygen	NSW EPA TM-25	NSW EPA TM-25	13%	✓	✓
Particulate matter (PM_{10} and $PM_{2.5}$)	USEPA Method 201A	USEPA Method 201A	9%	✓	✓††
Solid particles (total)	NSW EPA TM-15	NSW EPA TM-15	3%	✓	✓††
Odour	NSW EPA OM-7	NSW EPA OM-7	refer to results	✓	✓¥
Odour characterisation	NA	direct observation	NA	NA	×
Odour from diffuse sources	NSW EPA OM-8	AS4323.3	refer to results	✓	✓¥

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

¥ Odour analysis conducted at the Unanderra, NSW laboratory by forced choice olfactometry, NATA accreditation number 14601. Results were reported on:
10 December 2021 in report ON-00106.
15 December 2021 in report ON-00107.
16 December 2021 in report ON-00109.
21 December 2021 in report ON-00112.
22 December 2021 in report ON-00113.

5 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 Definitions

The following symbols and abbreviations may be used in this test report:

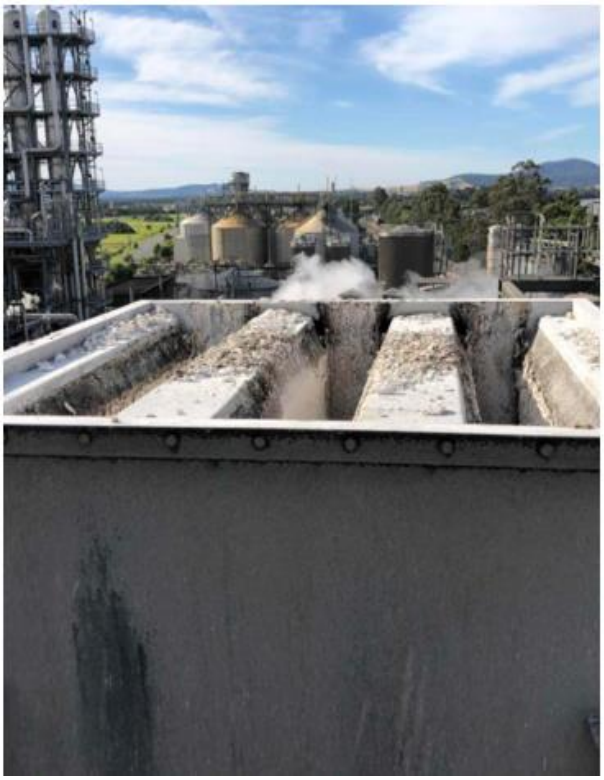
% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 Appendix 1: Site Location Photos

EPA ID 9 – No. 2 Gluten Dryer Baghouse

EPA ID 10 – No. 3 Gluten Dryer Baghouse

EPA ID 11 – No. 4 Gluten Dryer Baghouse



EPA ID 12 – No. 1 Starch Dryer Scrubber

EPA ID 13 – No. 3 Starch Dryer Scrubber

EPA ID 14 – No. 4 Starch Dryer Scrubber

EPA 19 – Effluent Pond 1

EPA 21 – Effluent Pond 3

EPA 23 – Effluent Pond 5

EPA 24 – Effluent Pond 6

EPA 25 – Sulfur Oxidation Pond

EPA ID 35 - Combined Boilers 5 & 6 Stack

EPA ID 39 - Biofilter Inlet

EPA ID 39A - Biofilter Inlet

EPA ID 40 - Biofilter A

EPA ID 41 - Biofilter B

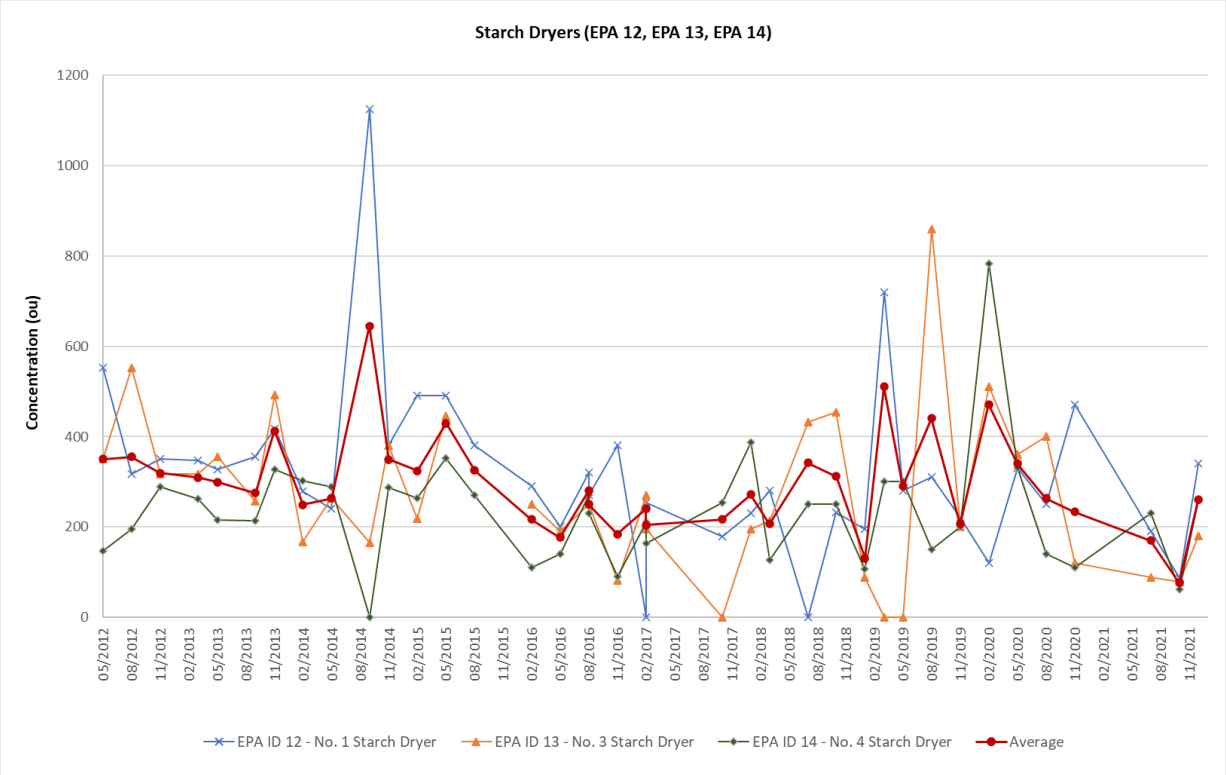
EPA ID 47 - Starch Dryer 5

EPA ID 45 - Boiler 2

EPA ID 46 – DDG Pellet Plant Stack

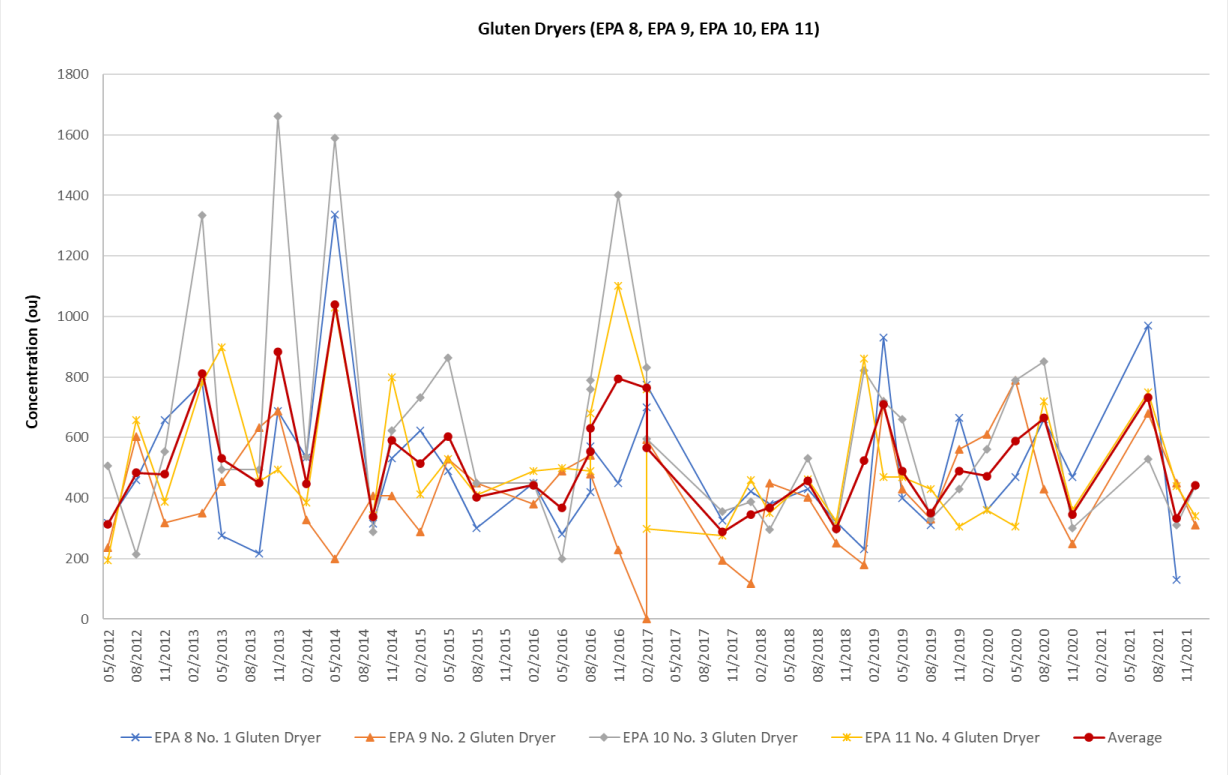
8 Appendix 2: Historical Odour Results

Figure 1. Starch Dryers No 1, 3 & 4 (EPA 12, EPA 13, EPA 14)



Zero result represents Dryer not operating on days of testing.

Figure 2. Gluten Dryers No 1, 2 ,3 & 4 (EPA 8, EPA 9, EPA 10, EPA 11)



Zero result represents Dryer not operating on days of testing.

Figure 3. Starch Dryer 5 (EPA 47)

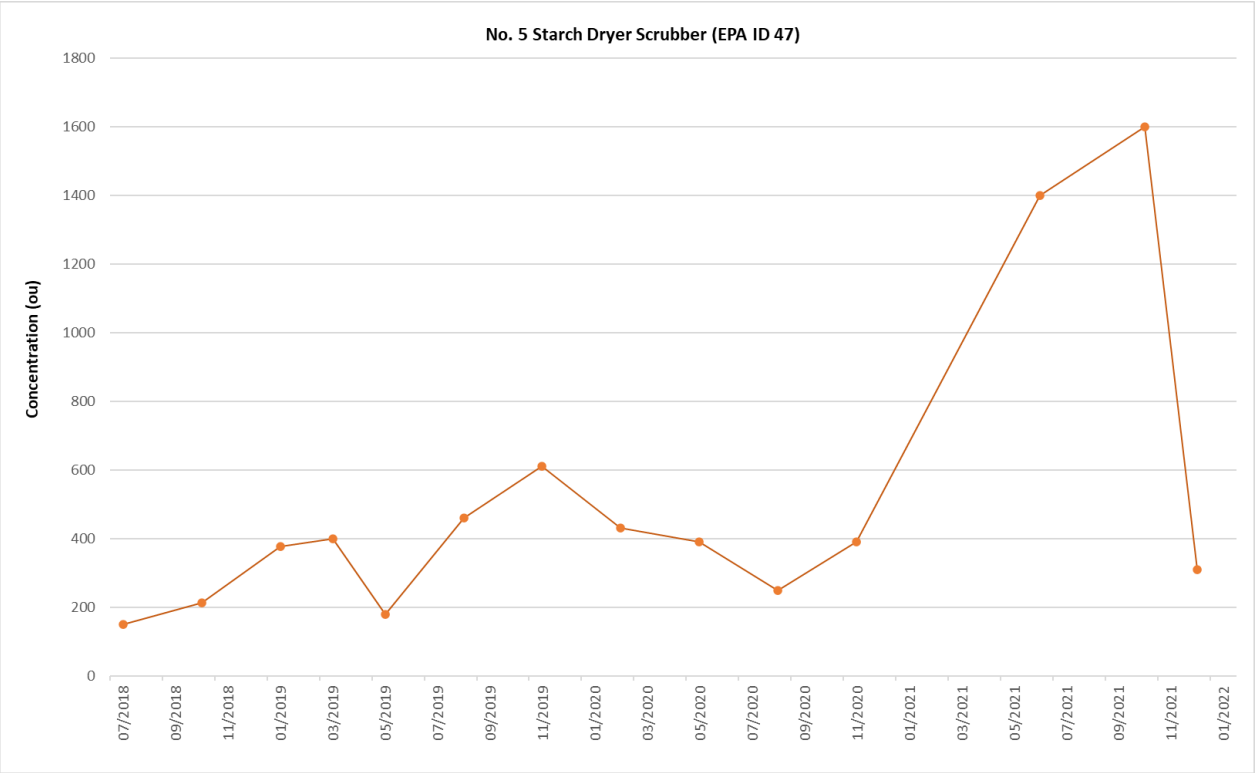
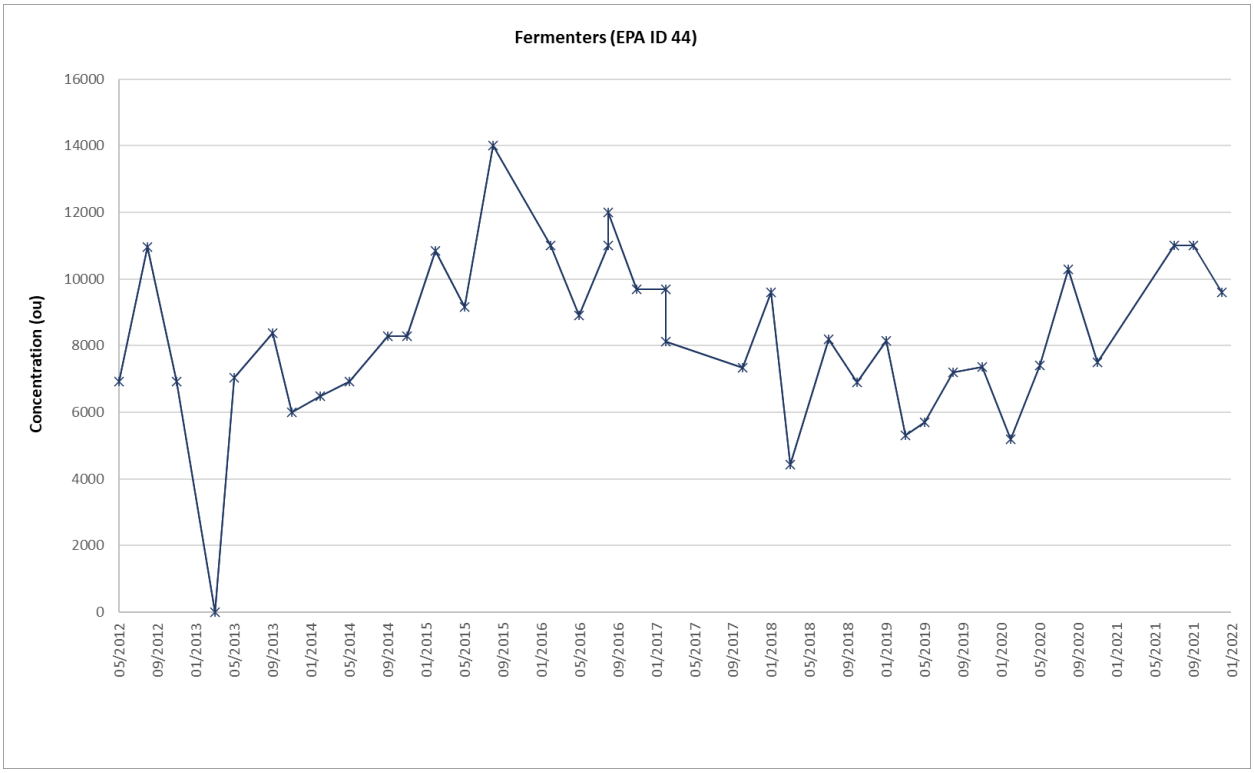


Figure 4. Fermenters (EPA 44)



Zero result represents Fermenter not operating on days of testing.

Figure 5. Carbon Dioxide Scrubber Outlet (EPA 16)

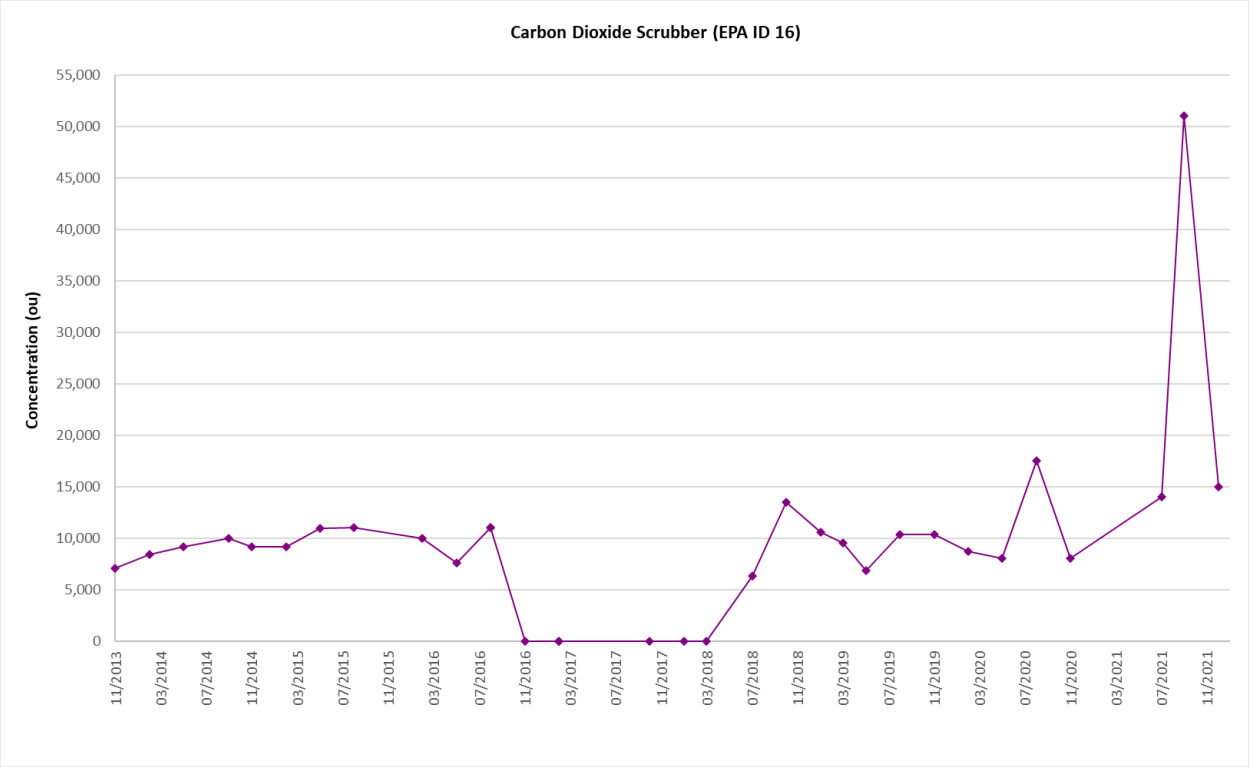


Figure 6. Combined Boiler 5 & 6 Stack (EPA 35)

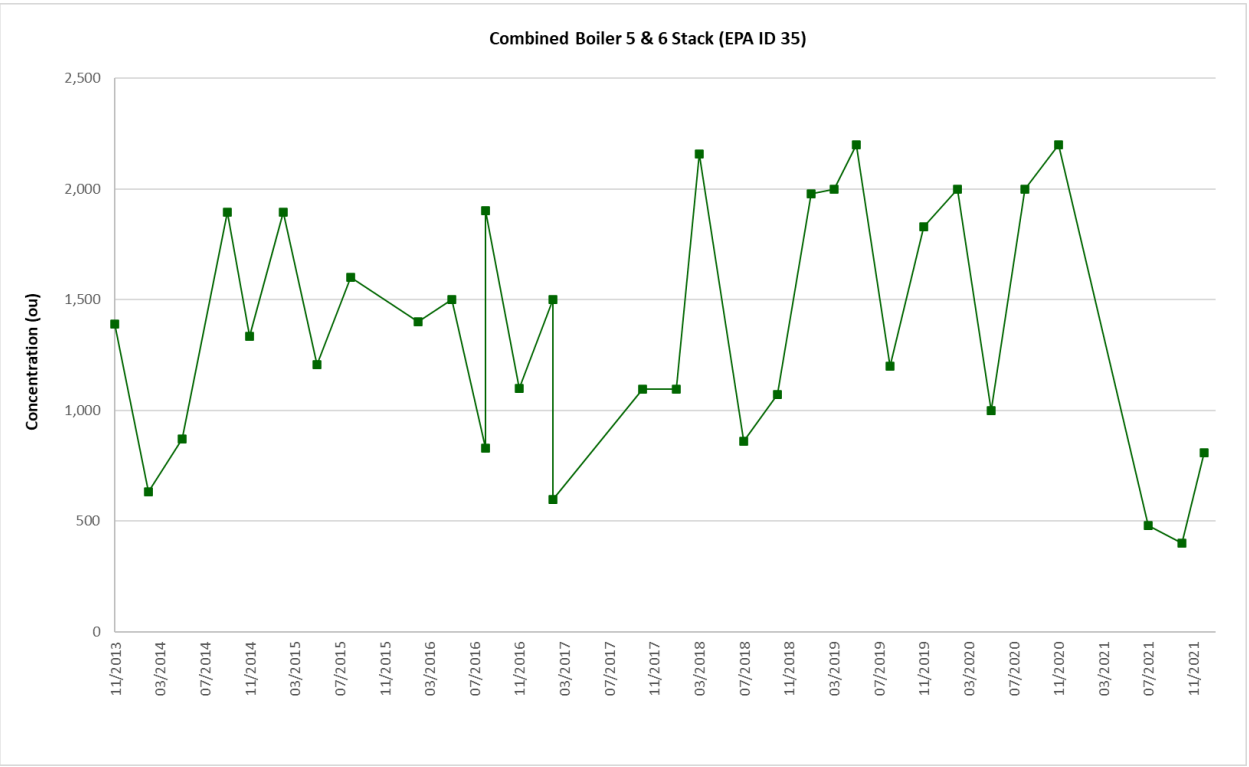


Figure 7. Boiler 2 Stack (EPA 45)

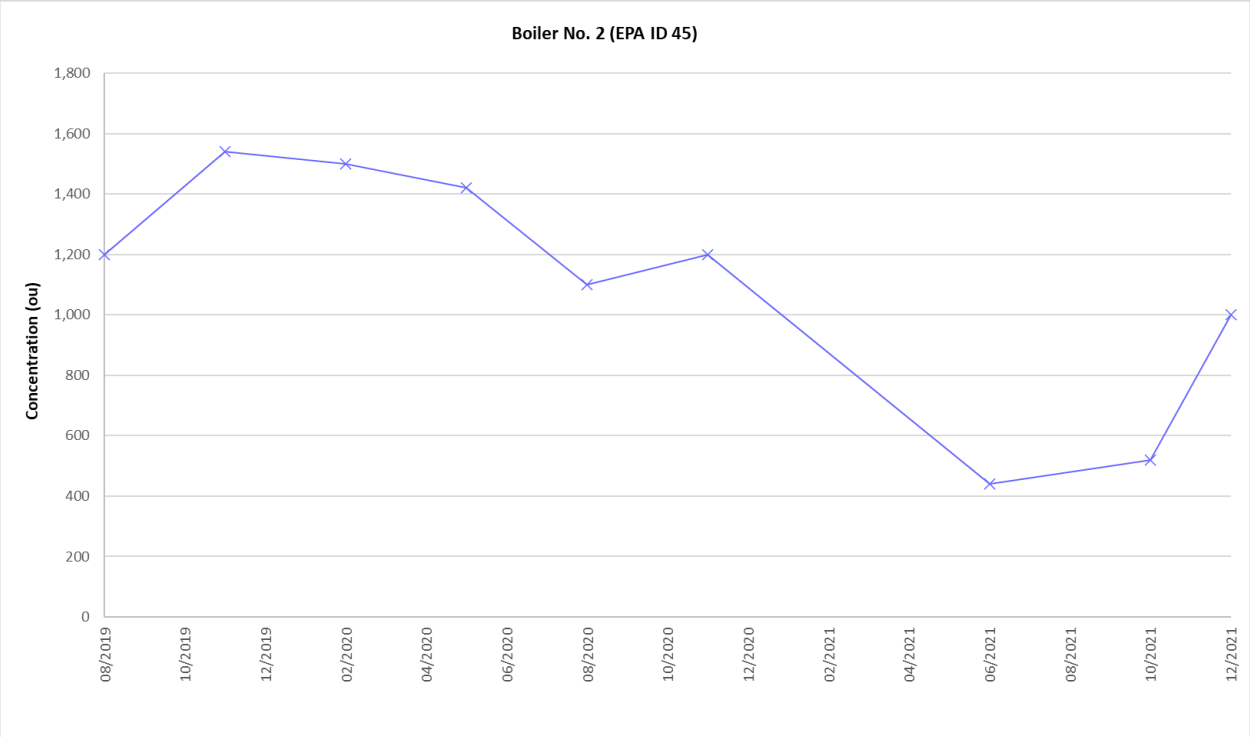
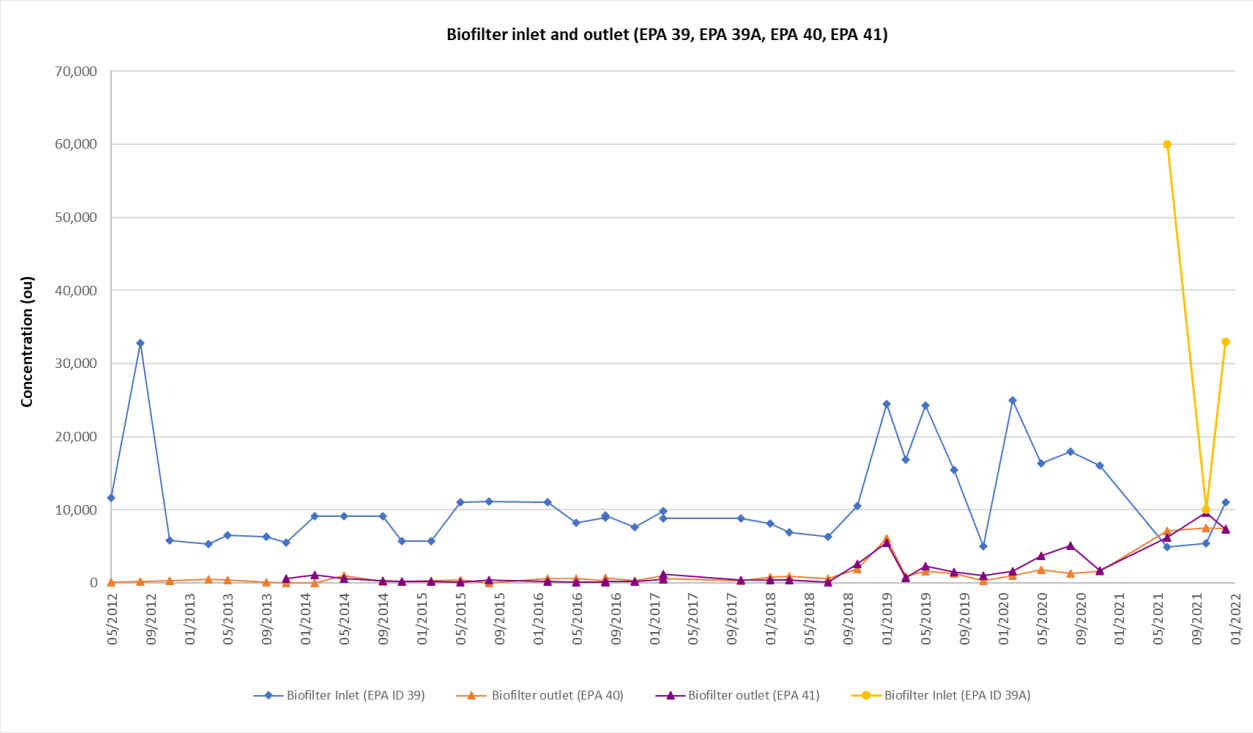
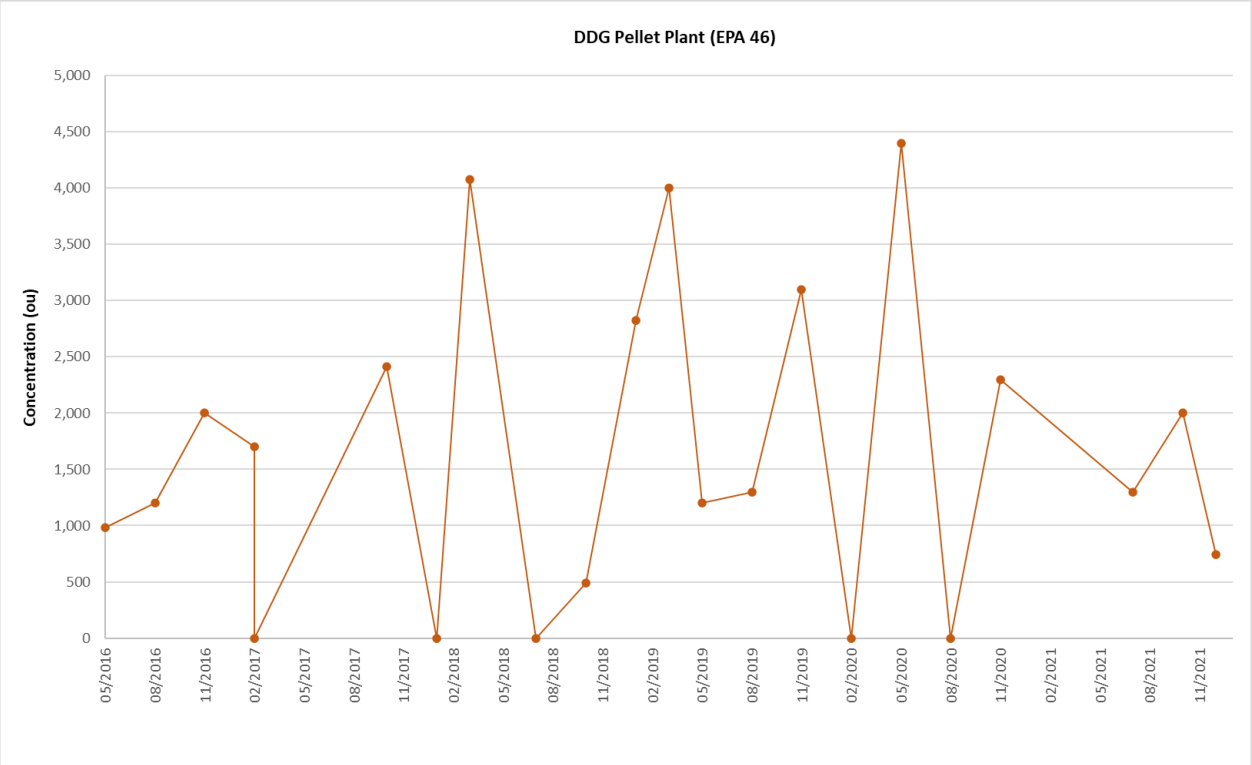


Figure 8. Biofilters (EPA 39, 39A, 40, 41)



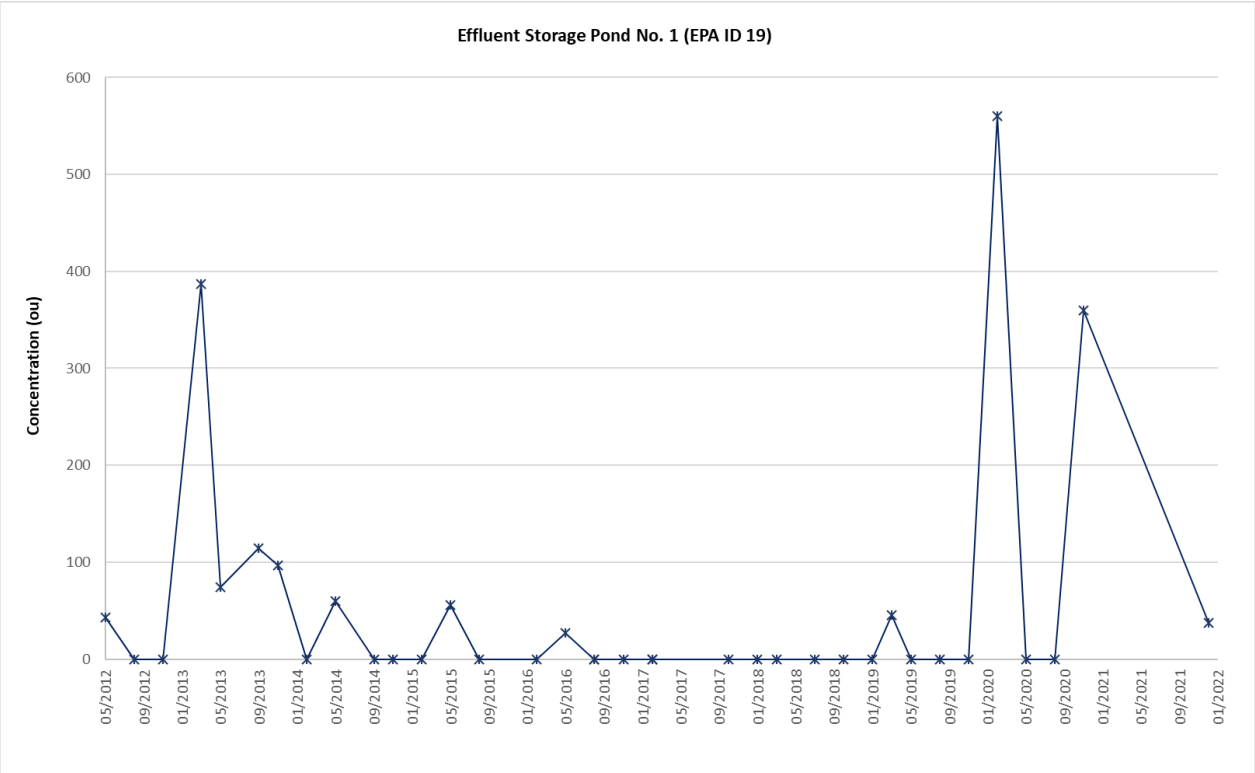
Zero result represents Biofilter not available to be sampled for that event

Figure 9. DDG Pellet Plant (EPA 46)



Zero result represents DDG Pellet Plant not sampled for that event.

Figure 10. Effluent Storage Pond No. 1 (EPA 19)



Zero results represent insufficient volume to perform sampling.