This document has been prepared on behalf of **Shoalhaven Starches Pty Ltd** by:

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Shoalhaven Starches, Independent Odour Audit (24/25)

May 2024 to April 2025

Addressee(s):	Shoalhaven Starches Pty Ltd
Report Reference:	25.1134.FR1V1
Date:	19 September 2025
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Quality Control

Study	Status	Prepared by:	Checked by:	Authorised by:
Shoalhaven Starches - Independent Odour Audit (24/25) - May 2024 to April 2025	Final	GCG	MD, GD	GCG

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
25	1134	Final	R1	V1
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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 **19 September 2025**

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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, Northstar Air Quality Pty Ltd (Northstar)) to perform the independent odour audit (IOA) (May 2024 to April 2025) of the Shoalhaven Starches Facility (the Facility) operated by Manildra Group located at Bolong Road, Bomaderry, NSW.

The purpose of the IOA is to satisfy Condition 5 of Schedule 3 of Ministers Condition of Approval (MCoA) (06_0228-Mod-29, 19 December 2024), as reproduced below:

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 development. 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:
   a) consult with **EPA** and the Department;
   b) audit the effectiveness of the odour controls on site in regard to protecting receivers against offensive odour;
   c) review the Applicant's production data (that are relevant to the odour audit) and complaint records;
   d) review the Odour Management Plan for the development;
   e) measure all key odour sources on site, and compare the results of these measurements against the predictions in the EA;
   f) determine whether the development is complying with the requirements in this consent; and, if necessary,
   g) 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.

   *Note: The **Secretary** may vary the frequency of the audit depending on the performance of the development.*

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

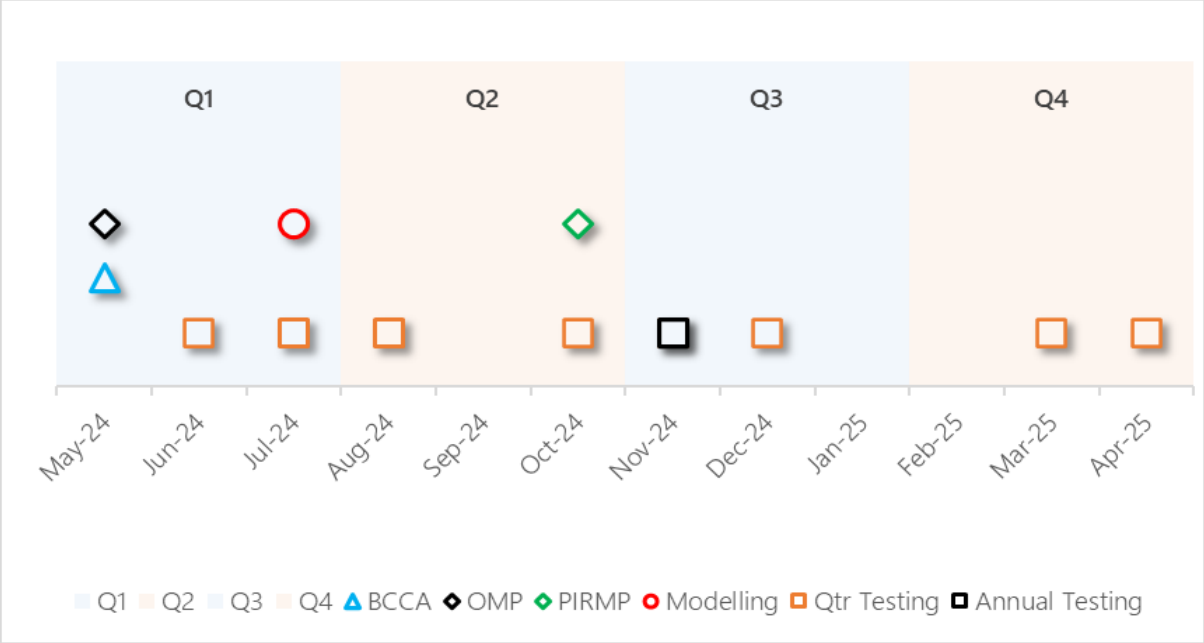
This odour audit covers the period from May 2024 to April 2025, aligned to the Environment Protection Licence (EPL) reporting period. With reference to the NSW Environment Protection Authority (EPA) website[1], it is noted that anniversary date for EPL 883 is stated as 30 April. Correspondingly, this report covers the period from May 2024 to April 2025 inclusive.

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

- Quarter 1 (Q1): May 2024 to July 2024;
- Quarter 2 (Q2): August 2024 to October 2024;
- Quarter 3 (Q3): November 2024 to January 2025; and
- Quarter 4 (Q4): February 2025 to April 2025.

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.

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

1.2. Consultation

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

1.2.1. Environment Protection Authority (EPA)

The EPA was contacted by email on 6 August 2025, and an email response was provided on 7 August 2025 which is reproduced below:

> *"Thanks for your time today to discuss the upcoming annual odour audit at Shoalhaven Starches. The EPA has the following comments for your consideration:*
>
> - *Starches provided the Stage 3 odour pollution reduction study to EPA in July 2025. The study was a requirement of Condition U3 of the Environment Protection Licence (EPL) No 883. The study was prepared by GHD, dated 31 July 2024 (Project No 12582891, Rev 0). The report included a dispersion modelling study, which EPA is currently reviewing, and a series of recommendations. These included (but not limited to):*
> - *Undertake a focus source mitigation investigation*
> - *Biofilter performance review; and*
> - *Investigate the potential feasibility for real-time monitoring of key odour sources and sensitive areas.*
> - *Noting the report date was 2024, the EPA would be keen to understand if these recommendations have been implemented in the audit period.*
> - *During a site familiarisation inspection in February 2025, EPA officers noted odours near the ethanol storage area and fermenters. The odour smelt like cheap dark rum (i.e. solvent).*
> - *During a site inspection in May 2025, EPA officers inspected biofilter 3 and noted the following:*
> - *Potentially offensive solvent odours coming from the biofilter. The odours were considered more offensive than the sweet odours identified in the biofilter inlet pipe.*
> - *The media in biofilter 3 had some rocks in it.*
> - *By comparison, biofilter 1 and 2 were less odorous.*
> - *In the audit period, EPA has received 3 complaints in relation to odour:*
> - *26 Feb 2025. Reports of a 'vegemite' odour.*
> - *13 April 2025. Report of an offensive odour described as a "toxic smell" at the corner of* [location] *in Nowra. In a follow up email the complainant described the odour as yeasty.*
> - *28 April 2025. Report of a strong, invasive, yeasty odour at the corner of* [location] *in Nowra. The complainant believed the odour was from Starches."*

Reference should be made to Section 3.2 that summarises the odour complaints as reported by Manildra over the audit period. Section 3.5 discusses the biofilter condition assessments and observations, and Section 3.7 discusses the odour modelling studies performed over the audit period.

1.2.2. Department of Planning, Housing and Infrastructure (DPHI)

DPE was contacted by email on 6 August 2025.

1.3. Site Inspection

A site inspection was performed on 11 August 2025. The site inspection was facilitated by Gavin Dostal (Environment & Sustainability Leader, Manildra Group) and attended by Gary Graham (Northstar).

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 performed against the conditions presented in Schedule 3 of the Consolidated Conditions of Project Approval (MOD 21), each UIN has been labelled as **24/25-NC-n** where *n* is the Condition Number derived from MOD 28 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 5.2 which relates to the compliance with the Consolidated Conditions of Project Approval only. These are designated UIN 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 5.1 and Table 13 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 following relevant management plans in place during the audit period have been reviewed:

- Shoalhaven Starches (2025) Shoalhaven Starches Ethanol Upgrade Odour Management Plan (ref: EN-P-247 1.0.I. April 2025) (TOU, May 2025); and
- Shoalhaven Starches (2024) Pollution Incident Response Management Plan (ref: EN-P-248 1.0.Q. Oct 2024) (Manildra, 2024)

3.1.1. Odour Management Plan

The version of the Odour Management Plan (OMP) in force during the audit period was revision 1.0.I (April 2025 (TOU, May 2025).

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 which is unchanged from previous iterations:

> *"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

The version of the PIRMP relevant to the audit period is revision 1.0.P (Aug 2024) and revision 1.0.Q (Oct 2024).

The document revision record on p2/48 of the PIRMP outlines the changes in the versions in place during the audit period as:

- 1.0.P (Aug 2024): *"Update of site maps, dangerous goods register, contact details"*
- 1.0.Q (Oct 2024): *"Update of contacts list"*

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, response and follow-up are presented (in full, but redacted for personal information) in Appendix E.

Table 2 Odour complaints over the audit period

Date / Time	Route	Complaint Ref (CC-ESCHOAL-)	Location	Description	Likely Cause	Action	Review	Complaint Status
4 Nov 2024	Direct	101	N/D	Odour complaint received evening of 3/11/2024 via the community complaints hotline. No information, contact details or description of smell was recorded	Investigation was unable to determine the replicate the odour complaint and cause unknown	Walk along river edge on afternoon 4/11/2024 to smell for biogas and confirm line isn't leaking. Review of SCAN to confirm no abnormal operations around day leading up to complaint	Theory that partially rotting grain post silo collapse that was exposed at low tide may have contributed to odour however unable to verify due to lack of details from complaint	Logged
4 Nov 2024	Direct	102	N/D	Second odour complaint received evening of 3/11/2024 via the community complaints hotline. No information, contact details or description of smell was recorded	Investigation was unable to determine the replicate the odour complaint and cause unknown	Walk along river edge on afternoon 4/11/2024 to smell for biogas and confirm line isn't leaking Review of wind direction to try and workout possible causes and locations of complainant	Theory that partially rotting grain post silo collapse that was exposed at low tide may have contributed to odour however unable to verify due to lack of details from complaint	Logged

27 Feb 2025	Direct	108	Coolangatta	[Complainant] just called. She lives at [location] (near Coolangatta) and advised there is often a smell coming from Manildra however today it has been very strong. She just wants to know where the smell is coming from and how long it will smell like that?	Cause couldn't be identified but may have been related to other nearby farming activities outside of Manildra operations	- John Studdert & Luke Elliot went for a drive on the afternoon of 26/2[*note: complaint was on 26/02 and logged on 27/02*] however the wind was blowing NE and in the opposite direction of the farm (no substantial odour was noted) - Luke investigated BVF and noted that it was under pressure and no leaks at time of complaint - Farm operations were mulching pivot 4 on that day and may have disturbed spread grain but thought unlikely to smell and travel that far - Was identified that another farmer on Bolong Rd was spreading fertiliser on this day (may explain increase on said day). - John called <complainant> to ask for more information but did not leave answer, message was left but no call back as of 27/2	Cause unidentified and complainant never followed up despite attempts to contact	Logged
8 Apr 2025	Direct	112	Bomaderry	Lodging a complaint and seeking information about	Odour from Biofilter is likely cause of the complaint -	- Review weather station data for days recorded 2nd & 3rd at 2:45pm, 4th at 12:00pm	The Odour Unit attended site May 2025 to complete full suite of tests - A number of	Logged

Date / Time	Route	Complaint Ref (CC-ESCHOAL-)	Location	Description	Likely Cause	Action	Review	Complaint Status
				the smell that occurs at 2:30pm each day. Described as vegemite/ yeasty and has logged multiple instance in April	Recent results suggest not performing 100%	and 8th at 2:30pm. In all instances the wind direction was 5-10km/hr and blowing E-SE which is consistent with direction from site to residence. - Review on SCAN of biofilter assets, no obvious issues with temperature or blower fan - Recent biofilter quarterly odour testing reveal high inlet odours and outlet not achieving desired results (this is a change from recent results) - Seek to engage The Odour Unit to come back to site for yearly review and fix issue because we have been given the guarantee that it would work	potential causes and actions identified.	

Date / Time	Route	Complaint Ref (CC-ESCHOAL-)	Location	Description	Likely Cause	Action	Review	Complaint Status
14 Apr 2025	Direct	113	Bomaderry	[Complaint] (caller from previous odour complaint on 8th April) in Bomaderry called community complaint hotline to let us know that the odour was described as "10x worse" than previous at approximately 11:15am 13/4/25. No other details received.	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%	Wind direction at time of complaint SE (matches direction from Plant - The Odour Unit to come to site in May 2025 to investigate performance of biofilters	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.	Logged
15 May 2025	EPA	116	Bomaderry	There's a factory in Bomaderry called Manildra. The smell they emit is getting more and more wide spread and strong. Why are they allowed to do this. It's unpleasant and it wasn't something that was as noticeable at all when we left Bomaderry. Now it's sometimes so noticeable I can't open windows on a beautiful day	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%	The Odour Unit to come to site May 2025 to inspect Biofilter performance and report on options for reducing odour.	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.	Logged

Date / Time	Route	Complaint Ref (CC-ESCHOAL-)	Location	Description	Likely Cause	Action	Review	Complaint Status
16 May 2025	EPA	117	Nowra	Caller advised a strong, invasive yeasty odour at the corner of North Street and Shoalhaven Street in Nowra. There was little to no wind at the time. The complainant believes the source is Manildra/Shoalhaven Starches (EPA Licence number EPL883, 160 Bolong Road, Bomaderry NSW 2541), noting that the smell recurs during northern breezes, correlating with the factory's location. No commercial bakeries are located nearby.	Odour from Biofilter may be cause of the complaint - Recent results suggest not performing 100% HOWEVER this location is very far away from the site and it is unlikely that the smell would travel that far.	Checked environmental farm wind data - Confirmed ENE/NE - Respond to EPA notifying of issue and planned works	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.	Logged

Date / Time	Route	Complaint Ref (CC-ESCHOAL-)	Location	Description	Likely Cause	Action	Review	Complaint Status
2 Jun 2025	Direct	118	Bomaderry	Odour Complaint over the weekend from [location], the complainant described the smell as yeasty/vegemite and having been noted on both Saturday 31st May & Sunday 1st June around midday. The complainant also commented that this is the third direct complaint in recent months and will now escalate the issue to EPA and local authorities.	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%	- Email to Managers letting them know of complaint - Review wind direction (lines up with times and location) - Waiting on results from TOU	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.	Logged

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

As noted in Section 1.2.1, the EPA reported three odour complaints received by them over this audit period, on 26 February 2025, 13 April 2025 and 28 April 2025. The dates and the descriptions provided appear to potentially match up with complaint records CC-ESCHOAL108 (27 February 2025) and CC-ESHOAL-113 (14 April 2025). The records do not show any corresponding record on/around 28 April 2025.

Recommendation A (24/25)

It is recommended that the line of communication between the EPA and the Manildra complaint record is reviewed to ensure that complaints reported to the EPA are communicated and recorded as complaints in the Manildra complaint system.

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 May 2024 to April 2025

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 ($L \cdot day^{-1}$)	Annual Production Rate Equivalent ($ML \cdot yr^{-1}$)
1	27/06/2024	867 655	317
	4/07/2024	830 872	303
	9/07/2024	1 019 199	372
	25/07/2024	674 679	246
2	29/08/2024	787 190	287
	1/10/2024	797 944	291
	3/10/2024	788 851	288
	6/11/2024	207 938	76
3	19/11/2024	519 271	190
	21/11/2024	561 302	205

Quarter	Date of Quarterly Odour Sampling	Daily Ethanol Production ($L \cdot day^{-1}$)	Annual Production Rate Equivalent ($ML \cdot yr^{-1}$)
	26/11/2024	807 454	295
	28/11/2024	509 302	186
4	26/03/2025	694 384	253
	2/04/2025	826 481	302
	16/04/2025	698 788	255
Minimum		207 938	76
Maximum		1 019 199	372
Mean		706 087	258
Range (Max/Min)		4.9	4.9

For comparison purposes only, the production rates contemporaneous with the quarterly and annual testing reported in the previous audit periods are reported in Table 4.

Table 4 Inter-year comparison of ethanol production during emission testing

Aduit Period	Ethanol Production Rates ($kL \cdot day^{-1}$)		
	Minimum	Mean	Maximum
2024-2025 (this audit)	208	706	1 019
2023-2024	594	784	952
2022-2023	562	777	994
2021-2022	461	696	879

The mean production rate during the May 2024 to April 2025 audit period was lower than those in the previous audit year by a factor of around 10 %.

3.4. Independent Environmental Audit

Whilst some developments documented in the independent environmental audit report (Malo Sustainability Consulting (2024) *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. It was noted that the IEA did not offer any interpretation on odour management issues not covered by this IOA.

It is understood that the most recent IEA is that completed in February 2024.

3.5. Biofilter Capacity and Condition Assessments

DDG Biofilter Capacity and Condition Assessment (BCCA) report #28 was completed during the audit period.

A copy of DDG BCCA #27 performed by The Odour Unit is presented in Appendix C. This 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 $m^3 \cdot hr^{-1}$ per biofilter.

The operating conditions of the biofilters are summarised in Table 5.

Table 5 Biofilter capacity and condition report (#27) – operating parameters

Date	Position	Airflow ($m^3 \cdot hr^{-1}$)	RH (%)	Observation	Air Temp (°C)	Surface Temp (°C)	UB Pressure (Pa)
25-Jun-2024 (#27)	Main duct	18 290	100%	NR	55.4	NR	124
	Dryer 4 duct	2 070	100%	NR	28.7	NR	170
	Biofilter A Cell 1	4 500	100%	saturated	54.1	NR	33
	Biofilter B & C duct	10 170	100%	saturated	53.2	NR	32
	Biofilter B Cell 1	2 660	100%	saturated	53.2	NR	11
	Biofilter B Cell 2	3 180	100%	saturated	53.2	NR	11
	Biofilter C	10 020	100%	NR	NR	NR	NR

Notes: bf – biofilter

NR – not reported

Table 6 presents the measured odour concentrations. The flow weighted average odour concentration of 678 OU (BCCA #27, June 2024) was measured which exceeds the *de facto* standard of 500 OU, although it is noted to be achieving a 95 % destruction efficiency which is a significant improvement on the results measured during BCCA # 26.

Table 6 Biofilter capacity and condition reports – odour measurements

Date	BCCA (#)	Inlet (OU)	DDG BF A (OU)			DDG BF B (OU)			DDG BF C (OU)					Flow weighted (OU)	Efficiency (%)
			South cell	North cell	Mean	South cell	North cell	Mean	North cell (1)	North cell (2)	South cell (1)	South cell (2)	Mean		
12-Sep-17	20	23 200	395	332	nd	59	64	nd	nd	nd	nd	nd	nd	273	98.8
10-Apr-18	21	98 300	2 050	512	nd	197	2 900	nd	nd	nd	nd	nd	nd	1 360	98.6
11-Jun-19	22	173 000	776	891	nd	74	588	nd	nd	nd	nd	nd	nd	683	99.6
9-Mar-20	23	10 770	675	388	nd	588	675	nd	nd	nd	nd	nd	nd	582	94.6
2-Feb-21	24	35 700	2 900	1 720	nd	4 870	4 100	nd	nd	nd	nd	nd	nd	3 160	91.2
6-Apr-22	25	8 930	5 790	6 890	nd	1 330	4 470	nd	nd	nd	nd	nd	nd	8 930	56
1-May-23	26	7 510	7 510	7 510	nd	8 190	4 870	nd	nd	nd	nd	nd	nd	6 890	8
25-Jun-24	27	15 000	1 220	3 760	2 140	664	1 020	823	395	332	395	279	347	678	95

Recommendation B (24/25)

Based upon the data presented in Table 6, the biofilters (BF A, B, C) are not achieving the *de facto* 500 OU standard. It is recommended that the biofilters are operated to achieve a lower odour outlet concentration, although it is noted that BCA #27 demonstrates improved odour destruction efficiency compared to BCA #26.

During the consultation with the NSW EPA (see Section 1.2.1), the EPA noted a solvent-like odour from the biofilters, particularly from biofilter 3. During the site inspection (see Section 1.3), a slight solvent-like odour was observed near to the biofilters.

The NSW EPA also note that during an inspection in May 2025 biofilter 3 had some rocks in the biofilter media. Photographs of the biofilter 3 were taken during the site inspection and rocks were noted on the surface of the media of biofilter 3 (see Appendix B). It is unknown whether the rocks are present at depth or present just on the surface after the media was installed. Evidently, biofilter media should not contain rocks as they offer no absorption capacity, and the significance of their presence cannot be determined without knowing the extent of the contamination. It is noted that if the rocks are just present on the surface, then the extent of the contamination is considered to be unlikely to affect biofilter performance.

Recommendation C (24/25)

It is recommended that the extent of the rock contamination in biofilter 3 media is determined and the contamination removed.

3.6. Odour Monitoring Results

The results of the monitoring programs performed over the audit period are presented in Table 8, Table 9 and Table 10. Copies of the monitoring reports are presented in Appendix D of this report.

These data are taken from the following reports:

- Ektimo (2024) R017104 Odour Emission Testing Report Quarter 1 2024-2025 (measurements taken during June and July 2024) (Ektimo, Aug 2024)
- Ektimo (2024) R017703 Odour Emission Testing Report Quarter 2 2024-2025 (measurements taken during August and October 2024) (Ektimo, Nov 2024)
- Ektimo (2024) R18090 Odour Emission Testing Report (measurements taken during November 2024 on Boiler 4 (EPA ID 42 only) (Ektimo, Nov 2024)
- Ektimo (2025) R018121r Odour Emission Testing Report Quarter 3 2024-2025 (measurements taken during November and December 2024) (Ektimo, Jan 2025)
- Ektimo (2025) R018635 Odour Emission Testing Report Quarter 4 2024-2025 (measurements taken during March and April 2025) (Ektimo, May 2025)

3.6.1. Process Conditions during the Monitoring

The Ektimo monitoring reports (see Appendix D) provide comments relating to the plant operation conditions during testing. From the monitoring data summary (see Section 3.6.3), it is noted that the following EPL discharge points were not tested and/or had other limitations during the testing:

Table 7 Odour sources not tested or with limitations during the audit period

EPA ID	Source	Reason (as stated in the test report)
Q1		
8	No1 Gluten Dryer Baghouse	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.
10	No 3 Gluten Dryer Baghouse	EPA ID 10 No. 3 Gluten Dryer Baghouse was not sampled this quarter as it was not operational during the testing period.
13	No 3 Starch Dryer	EPA ID 13 No. 3 Starch Dryer Scrubber … not sampled this quarter due to safety concerns.
14	No 4 Starch Dryer	EPA ID 14 No. 4 Starch Dryer Scrubber … not sampled this quarter due to safety concerns.
Q2		
8	No1 Gluten Dryer Baghouse	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.
12	No1 Starch Dryer Scrubber	EPA ID 12 No. 1 Starch Dryer Scrubber was not in operation on the day of odour sampling.
13	No3 Starch Dryer Scrubber	EPA ID 13 No. 3 Starch Dryer Scrubber … not sampled this quarter due to safety concerns.
14	No4 Starch Dryer Scrubber	… EPA ID 14 No. 4 Starch Dryer Scrubber … not sampled this quarter due to safety concerns.
Q3		
8	No 1 Gluten Dryer Baghouse	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.
12	No1 Starch Dryer Scrubber	EPA ID 12 - No. 1 Starch Dryer Scrubber … not in operation on the date of odour sampling.
13	No3 Starch Dryer Scrubber	Flow rate, velocity, temperature, and moisture were also determined at all locations except for … EPA ID 13 – No. 3 Starch Dryer Scrubber…[(B)]
14	No4 Starch Dryer Scrubber	Flow rate, velocity, temperature, and moisture were also determined at all locations except for …EPA ID 14 – No. 4 Starch Dryer Scrubber…[(B)]
19	Effluent Pond 1	Not tested[(A)]
20	Effluent Pond 2	Not tested[(A)]
21	Effluent Pond 3	Not tested[(A)]
22	Effluent Pond 4	Not tested[(A)]

EPA ID	Source	Reason (as stated in the test report)
25	Effluent Pond 5	Flow rate, velocity, temperature, and moisture were also determined at all locations except for … EPA ID 25 – Sulfur Oxidation Pond.
35	Combined Stack Boilers 5&6	EPA ID 35 – Combined Boiler 5 & 6 … not in operation on the date of odour sampling.
Q4		
8	No 1 Gluten Dryer Baghouse	Flow rate, velocity, temperature, and moisture were also determined at all locations except for EPA ID 8 – No. 1 Gluten Dryer Baghouse…
12	No1 Starch Dryer Scrubber	EPA ID 12 - No. 1 Starch Dryer Scrubber and EPA ID 35 – Combined Boiler 5 & 6 were not in operation on the date of odour sampling.
13	No3 Starch Dryer Scrubber	Flow rate, velocity, temperature, and moisture were also determined at all locations except for … EPA ID 13 – No. 3 Starch Dryer Scrubber …
14	No4 Starch Dryer Scrubber	Flow rate, velocity, temperature, and moisture were also determined at all locations except for … EPA ID 14 – No. 4 Starch Dryer Scrubber
35	EPA ID 35 – Combined Boiler 5 & 6	EPA ID 12 - No. 1 Starch Dryer Scrubber and EPA ID 35 – Combined Boiler 5 & 6 were not in operation on the date of odour sampling.

Note (A) It is advised that Effluent Ponds 1-4 (EPL 19, 20, 21, 22) are no longer in operational use..

(B) It is advised that the reason for the change in SD3 & SD4 is that it was discovered that the sample point of the stack is within the operational blast zone for each of the dryers. The Manildra Safety Team determined that access is restricted during operation. Consequently, a sampling port was installed to allow for odour monitoring purposes but removes the ability to measure flow and other parameters as described.

Recommendation D (24/25)

It is recommended that the EPL monitoring requirements for Effluent Ponds 1-4 (EPL 19, 20, 21, 22) are discussed with NSW EPA due to their non-operation.

Recommendation E (24/25)

It is recommended that the EPL monitoring requirements for No3 and No4 starch drier are discussed with NSW EPA due to the health and safety risks identified.

A check of the NSW EPA public register database[2] for EPL 883 notes that Notice 1622790, issued on 1 November 2022 varied the testing requirements on EPA ID 42 "Boiler No 4". As stated on page 2 of that Notice:

[2] https://app.epa.nsw.gov.au/prpoeoapp/

The following variations have been made to the licence:
• Condition L2.4, M2.2 - The air monitoring limits for Discharge Point 42 have been removed, and the requirements and frequency have been amended.

A cross check of Section M2.2 of EPL 883 shows that the requirement for odour testing on EPA ID 42 has been removed.

Recommendation F (24/25)

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.*" Shoalhaven Starches have advised that access is limited due to the addition of a silencer on this discharge point for noise control purposes. It is recommended that the access restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed.

3.6.2. Summary of Measurements – Annual Testing

Table 8 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 8 Summary of annual odour monitoring results

EPA Ref	Location	Frequency	Q3 and Annual (OU)
19	Effluent Pond 1	Annual	nd (see Table 7)
20	Effluent Pond 2	Annual	nd (see Table 7)
21	Effluent Pond 3	Annual	nd (see Table 7)
22	Effluent Pond 4	Annual	nd (see Table 7)
23	Effluent Pond 5	Annual	290
24	Effluent Pond 6	Annual	120
25	Sulphur Oxidation Pond	Annual	140

Note: nd no data.

3.6.3. Summary of Measurements – Quarterly Testing

Table 9 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.

Table 9 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	410	nd	280	nd	410	nd	96	nd
9	No 2 Gluten / Starch Dryer	Quarterly	870	12 180	780	10 140	450	5 850	1 100	15 400
10	No 3 Gluten Dryer	Quarterly	nd	nd	490	25 970	760	34 960	2 600	104 000
11	No 4 Gluten Dryer	Quarterly	870	28 710	540	16 740	700	25 200	1 500	46 500
12	No 1 Starch Dryer	Quarterly	720	13 680	nd	nd	nd	nd	nd	nd
13	No 3 Starch Dryer	Quarterly	nd	nd	nd	nd	170	nd	120	nd
14	No 4 Starch Dryer	Quarterly	nd	nd	nd	nd	440	nd	220	nd
16	CO_2 Scrubber Outlet	Quarterly	24 000	48 000	29 000	31 900	6 900	7 590	39 000	58 500
--	CO_2 Scrubber Inlet	Quarterly	34 000	64 600	44 000	52 800	12 000	13 200	43 000	64 500
35	Combined Stack Boilers No5&6	Quarterly	2 000	32 000	3 700	62 900	nd	nd	nd	nd
39	Inlet Pipe Biofilters A&B (DDG1-3)	Quarterly	57 000	125 400	52 000	171 600	5 200	7 800	34 000	95 200
39A	Inlet Pipe Biofilters A&B (DDG#4)	Quarterly	94 000	122 200	94 000	112 800	6 100	2 867	83 000	99 600
40	Outlet of Biofilter A (east)	Quarterly	6 400	nr	2 300	nr	350	nr	11 000	nr
	Outlet of Biofilter A (west)	Quarterly	8 200	nr	2 900	nr	400	nr	8 700	nr
41	Outlet of Biofilter B (east)	Quarterly	5 400	nr	1 400	nr	570	nr	8 700	nr
	Outlet of Biofilter B (west)	Quarterly	9 000	nr	53 000	nr	920	nr	10 000	nr
44	Fermenters	Quarterly	57 000	17 100	24 000	2 640	12 000	1 320	33 000	6 600
46	DDG Pellet Plant Stack	Quarterly	1 700	40 800	4 900	122 500	2 200	26 400	19 000	399 000
47	No 5 Starch Dryer	Quarterly	410	20 090	370	18 870	170	9 350	310	15 190

Note: (a) nd = no data.

(b) nr = no reported data relating to odour volumetric flow rate provided in the relevant reports.

Regarding biofilters A and B, it is noted that biofilter odour concentration measurements taken during the Q1, Q2 and Q4 tests exceed the *de facto* emission standard of 500 OU.

3.6.4. Variability of Measurements

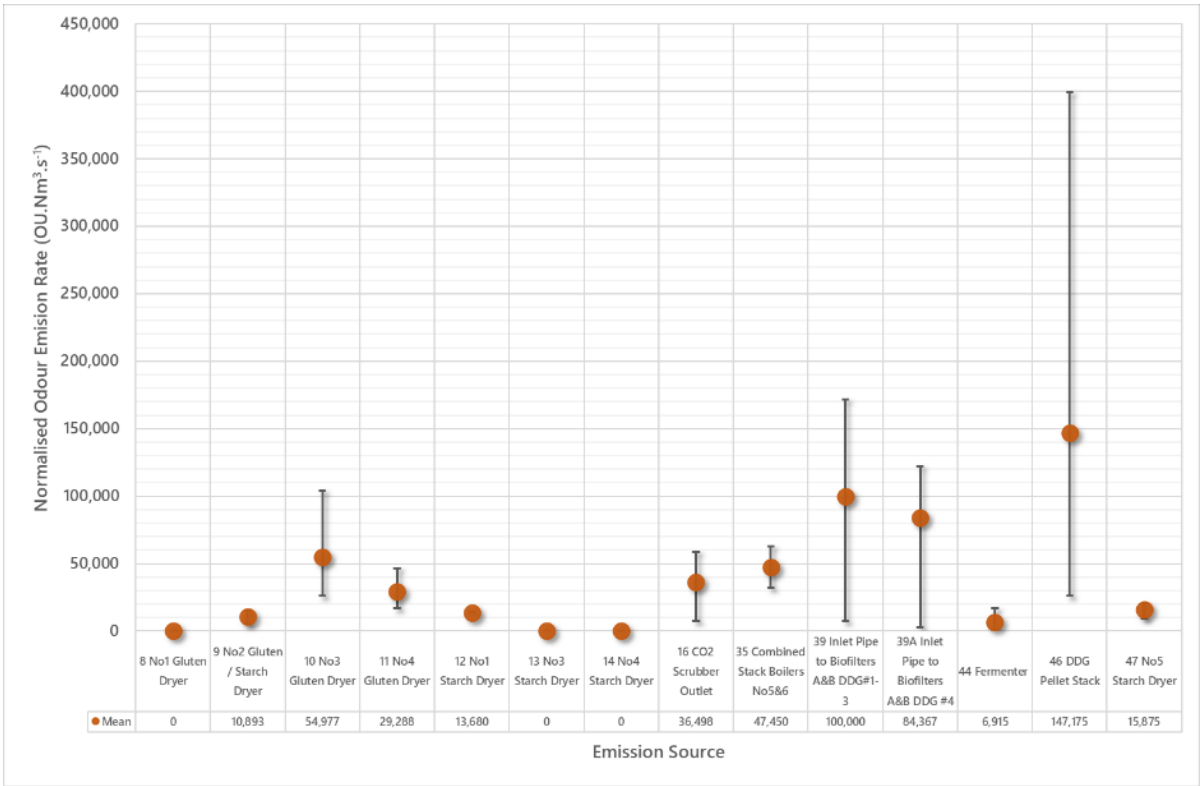
In terms of assessing the odour emission variability, the MOER (as $OU \cdot Nm^3 \cdot s^{-1}$) is the critical metric and is the product of the measured odour concentration (OU) and the measured volumetric discharge rate ($Nm^3 \cdot s^{-1}$). The variability in the MOER across the audit period is presented in Table 10. Any variability (max/min) greater than a factor of 10 (nominal threshold) are discussed.

Table 10 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	5 850	15 400	10 893	3 999	2.6
10	No 3 Gluten Dryer	3	25 970	104 000	54 977	42 693	4.0
11	No 4 Gluten Dryer	4	16 740	46 500	29 288	12 527	2.8
12	No 1 Starch Dryer	1	13 680	13 680	13 680	nd	1.0
13	No 3 Starch Dryer	0	nd	nd	nd	nd	nd
14	No 4 Starch Dryer	0	nd	nd	nd	nd	nd
16	CO_2 Scrubber Outlet	4	7 590	58 500	36 498	22 160	7.7
35	Combined Stack Boilers No5&6	2	32 000	62 900	47 450	21 850	2.0
39	Inlet Pipe to Biofilters A&B	4	7 800	171 600	100 000	69 030	22.0
39A	Inlet Pipe to Biofilters A&B (DDG4)	4	2 867	122 200	84 367	55 118	42.6
44	Fermenter	4	1 320	17 100	6 915	7 151	13.0
46	DDG Pellet Stack	4	26 400	399 000	147 175	173 135	15.1
47	No 5 Starch Dryer	4	9 350	20 090	15 875	4 823	2.1

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

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



It is noted that for the following emission points there is a noted to be a significant (i.e. greater than a factor of 10) variability in the rate of odour emissions (estimated as a ratio of max/min), notably (in order of magnitude):

- EPA 39 Inlet Pipe to Biofilters A&B
- EPA 39A Inlet Pipe to Biofilters A&B (DDG4)
- EPA 44 Fermenter
- EPA 46 DDG Pellet Stack

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 $0.7OU < OU < 1.4OU$. 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 four odour audit periods are presented in Table 11 below:

Table 11 Observed variability in the measured mean odour emission rate (by audit year)

EPA Ref	Source	MOER (OU·Nm^3·s^{-1})					
		24-25	23-24	22-23	21-22	20-21	19-20
8	No1 Gluten Dryer	nd	nd	nd	nd	7 979	6 375
9	No2 Gluten / Starch Dryer	10 893	2 980	8 793	6 520	6 287	6 225
10	No3 Gluten Dryer	54 977	38 195	67 810	23 050	23 780	15 675
11	No4 Gluten Dryer	29 288	23 498	29 265	14 578	12 923	11 600
12	No1 Starch Dryer	13 680	7 720	10 523	5 683	4 353	3 130
13	No3 Starch Dryer	nd	902	10 105	1 940	5 181	9 513
14	No4 Starch Dryer	nd	1 804	11 103	2 989	3 549	6 285
16	CO_2 Scrubber Outlet	36 498	69 267	25 685	41 330	14 470	19 950
35	Combined Stack Boilers No5&6	47 450	57 285	37 440	17 315	55 982	52 750
39	Inlet Pipe to Biofilters A&B	100 000	41 130	31 185	22 165	46 149	56 900
39A	Inlet Pipe to Biofilters A&B DDG#4	84 367	47 705	29 380	23 260	15 307	8 500
44	Fermenter 15/16[(A)]	6 915	13 548	9 128	4 355	2 168	3 412
46	DDG Pellet Plant Stack	147 175	69 300	28 900	27 653	66 514	40 167
47	No5 Starch Dryer	15 875	23 108	42 128	33 153	17 676	21 621
aggregate (OU·Nm^3·s^{-1})		547 116	396 440	346 008	241 487	308 181	292 902
mean ethanol production rate (ML·yr^{-1})		258	286	284	254	212	182
odour emission intensity (OU·ML^{-1})		2 123	1 386	1 200	951	1 452	1 607

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 rate to derive a "odour emission intensity" to provide a benchmark of emissions against the production rates. As may be observed, 2024-25 shows an increased in the estimated *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 12 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.

Table 12 Observed variability in the measured odour concentration and volumetric discharge rate

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate ($Nm^3 \cdot s^{-1}$)			
		Max	Mean	Min	Max/ Min	Max	Mean	Min	Max/ Min
8	No1 Gluten Dryer	410	299	96	4.3	nd	nd	nd	nd
9	No2 Gluten / Starch Dryer	1 100	800	450	2.4	14.0	13.5	13.0	1.1
10	No3 Gluten Dryer	2 600	1 283	490	5.3	53.0	46.3	40.0	1.3
11	No4 Gluten Dryer	1 500	903	540	2.8	36.0	32.8	31.0	1.2
12	No1 Starch Dryer	720	720	720	1.0	19.0	19.0	19.0	1.0
13	No3 Starch Dryer	170	145	120	1.4	nd	nd	nd	nd
14	No4 Starch Dryer	440	330	220	2.0	nd	nd	nd	nd
16	CO_2 Scrubber Outlet	39 000	24 725	6 900	5.7	2.0	1.4	1.1	1.8
35	Combined Stack Boilers No5&6	3 700	2 850	2 000	1.9	17.0	16.5	16.0	1.1
39	Inlet Pipe to Biofilters A&B	57 000	37 050	5 200	11.0	3.3	2.5	1.5	2.2
39A	Inlet Pipe to Biofilters A&B DDG4	94 000	69 275	6 100	15.4	1.3	1.0	0.5	2.8
44	Fermenter	57 000	31 500	12 000	4.8	0.3	0.2	0.1	2.7
46	DDG Pellet Stack	19 000	6 950	1 700	11.2	25.0	20.5	12.0	2.1
47	No5 Starch Dryer	410	315	170	2.4	55.0	51.0	49.0	1.1

3.7. Odour Modelling

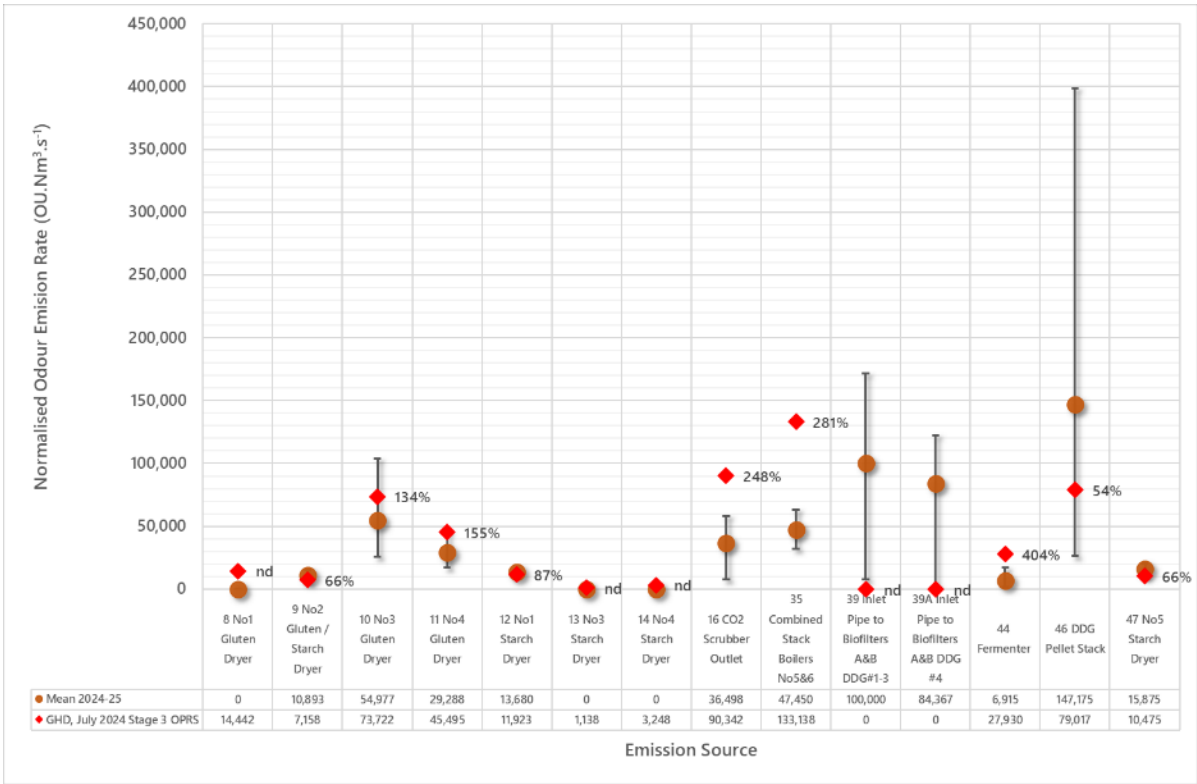
During the audit period, odour modelling was performed for the Odour Pollution Reduction Study, Stage 3 (GHD, July 2024). The purpose of that report is stated as:

> *"GHD was engaged by Manildra to undertake Stage 3 of the odour PRS issued by the NSW EPA as part of an amendment to EPL No. 883. Odour PRS Stage 3 works included undertaking a dispersion modelling study to identify major contributors to off-site odour impacts, providing a biofilter update and outlining the conclusions and actions from the Odour PRS"*

Odour emission rates for the EPL sources were provided at actual emission conditions, and for the purposes of comparison with measured odour emissions at normalised gas conditions, the modelled odour emission rates have been normalised to 273 K from the discharge temperature stated in the modelling report.

Provided below in Figure 3 is a graphical summary of the comparison between measured and modelled odour emissions. Where the data permits, the modelled data is shown as a percentage value of the mean measured odour emission rate over the audit period.

Figure 3 Comparison between modelled and measured odour emissions (EPL sources)



It is noted that the modelled odour emission rate from EPA 46 DDG Pellet Stack was reported in (GHD, July 2024) as 71 667 OU·m^3·s^{-1} (at 301 K) which equates to 79 017 OU·Nm^3·s^{-1} (at 273 K). With reference to Table 10, the mean OER from EPA 46 was 147 175 OU·Nm^3·s^{-1} (at 273 K), and the modelled OER was 54 % of the mean measured value over the audit period. With refence to the summary of measured data presented in Table 9, it can be seen that the Q4 OER measured on EPA 46 is significantly higher than measured during previous quarters which may explain the discrepancy.

A simple sum of the corresponding values show that modelled emissions were approximately 91 % of those measured and reported in this odour audit report.

3.8. Pollution Reduction Program

During the period 1 May 2023 to 30 April 2024, NSW EPA varied EPL 883 to include Condition U32 ('Odour Pollution Reduction Study (Stage 3)'). Condition U3 states:

> ***U3 Odour Pollution Reduction Study (Stage 3)***
>
> ***U3.1 Dispersion modelling to identify major contributors to offsite impacts***
>
> *A dispersion modelling study must be undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW to identify the odour sources that contribute most significantly to predicted offsite ground level concentrations. In undertaking this dispersion modelling study, the following must be addressed as a minimum:*

a. Demonstrate that the meteorological modelling is representative of on-site meteorological conditions, including:

i. The incorporation of site-specific data.

ii. The validation of the meteorological modelling against data recorded at the Bureau of Meteorology (BoM) automatic weather station at Nowra airport.

b. Identify, quantify and evaluate the odour sources that contribute most significantly to off-site odour impacts.

c. The results must:

i. Be representative of Shoalhaven Starches' operating hours.

ii. Include figure(s) presenting predicted ground level concentrations.

iii. Include additional assessment locations (i.e. sensitive receptors) representative of predicted peak ground level concentrations.

d. Assess the odour risk of the site. This must include but not necessarily limited to:

i. A statistical analysis of the predicted odour concentrations to understand the range and frequency of odour concentrations predicted at the most sensitive receptors.

ii. A sensitivity analysis to investigate the sensitivity of the predicted modelling results to changes in the emission rates.

e. Any assumptions made during the preparation of the dispersion modelling study must be accompanied by a detailed description, supporting evidence and must be robustly justified.

The summary (normalised) odour emission data from the Stage 3 Odour Pollution Reduction Study dispersion modelling assessment is presented in Section 3.7.

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 29, 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 E. The number of odour complaints received in this period is eight (8) (see Section 3.2), which have been investigated and are closed.	NSW EPA has not issued any infringement notices against EPL 883 regarding offensive odour, as defined in Section 129 of the POEO Act.	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

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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.	--
	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

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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	--
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

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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 been subject to DPHI review.	Compliant
	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

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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
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 DPHI	Consultation performed and recommendations for the odour audit adopted	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	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
	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 eight (8) (#101, #102, #108, #112, #113, #116, #117, #118). All complaints are closed out i.e. adequately actioned.	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 OMP revision 1.0.I was in force. There are no material changes to the OMP relevant to this IOAQ from the last revision.	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. The comparison against modelling assessment provided in Section 3.7	The quarterly and annual emission testing has been completed over the auditing period.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	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
	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	--

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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.	--
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 is summarised in Table 9. It is observed that EPA ID 46 (DDG Pellet Plant Stack) was tested during each quarter of the audit period.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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). EPA 47, No5 Starch Dryer was tested during each quarter of the audit period.	Compliant
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.	Odour modelling is discussed in Section 3.7.	Modelled odour emission rates were estimated to represent approximately 91 % of measured odour emission rates (at assumed normalised conditions).	Compliant
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 audit period May 2024 to April 2025 and any remaining unresolved recommendations from the previous audits are summarised in Table 15.

Table 15 Independent odour audit recommendations

Reference	Recommendation	Implementation
2024-25 Odour Audit Recommendations		
Recommendation A (24/25)	Section 3.2: It is recommended that the line of communication between the EPA and the Manildra complaint record is reviewed to ensure that complaints reported to the EPA are communicated and recorded as complaints in the Manildra complaint system.	Identified in this audit (page 20)
Recommendation B (24/25)	Section 3.5: Based upon the data presented in Table 6, the biofilters (BF A, B, C) are not achieving the *de facto* 500 OU standard. It is recommended that the biofilters are operated to achieve a lower odour outlet concentration, although it is noted that BCA #27 demonstrates improved odour destruction efficiency compared to BCA #26.	Identified in this audit (page 24)
Recommendation C (24/25)	Section 3.5: It is recommended that the extent of the rock contamination in biofilter 3 media is determined and the contamination removed.	Identified in this audit (page 24)
Recommendation D (24/25)	It is recommended that the EPL monitoring requirements for Effluent Ponds 1-4 (EPL 19, 20, 21, 22) are discussed with NSW EPA due to their non-operation.	Identified in this audit (page 26)

Reference	Recommendation	Implementation
Recommendation E (24/25)	It is recommended that the EPL monitoring requirements for No3 and No4 starch drier are discussed with NSW EPA due to the health and safety risks identified.	Identified in the audit (page 26)
Recommendation F (24/25)	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.*" Shoalhaven Starches have advised that access is limited due to the addition of a silencer on this discharge point for noise control purposes. It is recommended that the access restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed.	Identified in this audit (page 27)
2023-24 Odour Audit Recommendations		
23/24-REC-A	Based upon the data presented in Table 5, the biofilters are not achieving the de facto 500 OU standard and are not achieving a satisfactory degree of odour control (measured as 8 % efficiency). It is acknowledged that Shoalhaven Starches have recently brought a third biofilter online (Biofilter C) to redistribute the flow to achieve the design capacity flow rate through all biofilters.	Ongoing
23/24-REC-B	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." Shoalhaven Starches have advised that access is limited due to the addition of a silencer on this discharge point for noise control purposes. It is recommended that the access restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed.	Ongoing
23/24-REC-C	It is recommended that the access limitations preventing EPA 46 (DDG Pellet Stack) is resolved to ensure that the emissions are available to be tested during the following testing periods.	Resolved
2022-23 Odour Audit Recommendations		
22/23-REC-B	The biofilters are not achieving the de facto 500 OU standard and are not achieving a satisfactory degree of odour control (measured as 8 % efficiency). It is acknowledged that Shoalhaven Starches are currently constructing a duplicate set of biofilters to redistribute the flow to achieve the design capacity flow rate through all biofilters. The performance of the biofilters	Ongoing

Reference	Recommendation	Implementation
	remains an unresolved issue and it is recommended that it is resolved at the earliest opportunity.	
22/23-REC-C	It is recommended that the access limitations preventing EPA 46 (DDG Pellet Stack) are resolved to ensure that EPA 46 is available to be tested during the following testing periods.	Ongoing
22/23-REC-D	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."* Shoalhaven Starches have advised that access is limited due to the addition of a silencer on this discharge point for noise control purposes. It is recommended that the access restrictions to EPA ID 8 are resolved to enable compliant odour monitoring to be performed.	Ongoing
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.	Ongoing
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. (See also 22/23-REC-D).	Ongoing
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
2019-20 Odour Audit Recommendations		

Reference	Recommendation	Implementation
2019-20-IOA-A	As identified at Section 3.1 and Section 3.5, 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

6. REFERENCES

DPIE. (2020). *Independent Audit – Post Approval Requirements (SF20/40224).*

Ektimo. (Aug 2024). *Odour Emission Testing Report, Quarter 1 2024-25 (R017104).*

Ektimo. (Jan 2025). *Odour Emission Testing Report, Quarter 3 2024-25 (R018121r).*

Ektimo. (May 2025). *Odour Emission Testing Report, Quarter 4 2024-25 (R018635).*

Ektimo. (Nov 2024). *Odour Emission Testing Report (R018090).*

Ektimo. (Nov 2024). *Odour Emission Testing Report, Quarter 2 2024-25 (R07703).*

GHD. (July 2024). *Shoalhaven Starches Odour Pollution Reduction Study, Stage 3 Report (ref: 1258291-REP_Manidra Odour PRS Stage 3 report).*

Manildra. (2024). *Pollution Incident Response Management Plan (Rev Q).*

TOU. (May 2025). *Shoalhaven Starches Ethanol Upgrade Odour Managament Plan (N1511L version 1.0.I).*

Appendix A – Director General's Letter of Appointment

Department of Planning, Housing & Infrastructure

NSW GOVERNMENT

Our ref: Portal reference

Mr John Studdert
Quality Assurance & Environmental Coordinator
Shoalhaven Starches Pty Ltd
36 Bolong Road
BOMADERRY NSW 2541
16/09/2025

Subject: Shoalhaven Starches Plant, Annual Independent Odour Auditor 2025

Dear Mr Studdert

I refer to your request of 7 September 2025 seeking approval of Mr Gary Graham of Northstar Air Quality Pty Ltd as the independent auditor for the upcoming Annual Independent Odour Audit of Shoalhaven Starches Plant (the development), in accordance with Schedule 3, Condition 5 of the development consent MP 06_0228, as modified (the consent).

Having considered the qualifications and experience of Mr Graham, I, as the nominee of the Planning Secretary endorse the appointment of Mr Graham to undertake the Annual Independent Odour Audit in accordance with Schedule 3, Condition 5 of the consent. This approval is conditional on Mr Graham being independent of the development and maintaining the relevant qualifications and/or certification.

The NSW Department of Planning, Housing and Infrastructure (NSW Planning) reserves the right to request an alternate auditor or audit team for future audits.

Please ensure this correspondence is appended to the Audit Report.

The audit is to be conducted in accordance with AS/NZS ISO 19011 Australian/New Zealand Standard: Guidelines for quality and/or environmental management systems auditing. Auditors may wish to have regard to the Independent Audit Guideline dated May 2020. A copy of this guideline can be located at https://www.planning.nsw.gov.au/sites/default/files/2023-02/independent-audit-par-202005.pdf.

The Audit Report is to include the following:

- consultation with NSW Planning and the Environment Protection Authority (EPA);
- audit of the effectiveness of the odour controls on site in regard to protecting receivers against offensive odour;
- review of the production data (that are relevant to the odour audit) and complaint records;
- review of the Odour Management Plan for the development;
- measure all key odour sources on site, and compare the results of these measurements against the predictions in the EA;
- determine whether the development is complying with the requirements in this consent; and
- 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.

Within six weeks of the completion of the Annual Independent Odour Audit, you are to submit a copy of the Audit Report to the Planning Secretary and the EPA, together with your response to any recommendations contained in the Audit Report and a timetable to implement the recommendations. Prior to submitting the

Audit Report to the Planning Secretary, it is recommended that you review the report to ensure it complies with the relevant approval condition.

Failure to meet these requirements will require revision and resubmission of the Audit Report.

Should you have any enquiries in relation to this matter, please contact Georgia Dragicevic, Senior Compliance Officer, on (02) 4247 1852 or by email to Georgia.Dragicevic@planning.nsw.gov.au.

Yours sincerely

Jennifer Rowe
A/Team Leader Compliance - South
Compliance

As nominee of the Planning Secretary

Declaration of Independence Form

Project Name:	Shoalhaven Starches
Consent Number:	06_0228
Description of Project	Shoalhaven Starches Independent Odour Audit (2023-2024)
Project Address	160 Bolong Road, Bomaderry, NSW 2541
Proponent	Shoalhaven Starches Pty Ltd
Title of Audit	Shoalhaven Starches Independent Odour Audit (2023-2024)
Date	19 September 2025

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, MEIANZ
Company	Northstar Air Quality Pty Ltd
Company Address	Suite 1504, 275 Alfred Street, North Sydney NSW 2060
Signature	

APPENDIX B – BIOFILTER PHOTOGRAPHS


CMACGM
APL
Hapag-Lloyd

APPENDIX C – DDG BIOFILTER & CAPACITY & CONDITION ASSESSMENT REPORTS

TO: **GAVIN DOSTAL**
COMPANY: **MANILDRA GROUP, SHOALHAVEN STARCHES**
FROM: **DARCY BROCKEL & JAMES SCHULZ**
DATE: **16 JULY 2025**
SUBJECT: **DDG BIOFILTERS PERFORMANCE AND CONDITION ASSESSMENT #28: 26 MAY 2025**

1. Introduction

In December 2011, Shoalhaven Starches commissioned The Odour Unit (**TOU**) to undertake routine inspections of the biofilter-based odour control system (**OCS**) servicing the Dried Distillers Grain (**DDG**) operations at 160 Bolong Road, Bomaderry, New South Wales (the **Manildra Facility**). The objective of these assessments is to provide feedback to Shoalhaven Starches on the condition and performance of the OCS on an as-required basis. The assessments are currently carried out on a half-yearly basis. The following report covers the findings of Assessment 28 completed on 26 May 2025 by TOU.

1.1 Relevant Background and Context

From Assessment 28, naming nomenclature will continue to refer to each biofilter as Biofilter A, Biofilter B and Biofilter C, ordered from North to South respectively. Biofilter C was constructed in January 2024 to increase the airflow load treated by the OCS to keep up with the demand required by the Manildra Facility, including the treatment of DDG Lines 4 and 5, which are included as part of Assessment 28.

2. Biofilter Design – DDG Biofilters A, B & C

The designs for Biofilters A & B are identical and summarised as follows:

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

The design for Biofilter C is summarised as follows:

Construction:	Concrete, twin-cells
Bed area:	Two cells, 114 m^2, total surface area of 228 m^2
Bed depth:	2.0 m
Medium:	Oversized timber mulch/pine bark
Design airflow:	30,000 m^3/hr
Design loading rate:	133 m^3/m^2/hr, 67 m^3/m^3/hr, 54 seconds EBRT at 30,000 m^3/hr

All inlet air flowing to the biofilter system is pre-humidified and saturated.

2.1 Biofilter Condition Status

At the time of Assessment 28, it is understood that the status of each biofilter system is as follows:

- Biofilter A has not been refurbished since middle 2019;
- Biofilter B medium was replaced in September 2022;
- Biofilter C medium was installed in January 2024; and
- All three (3) biofilters were online and in operational condition.

3. Assessment Methodology

Assessment 28 followed an identical methodology to that used in all previous assessments conducted by TOU, namely:

- Velocity and airflow into each biofilter and from both inlet lines;
- Temperature and relative humidity measurements into the biofilters and both inlet lines;
- Pressure readings in each inlet duct;
- Visual inspection and pressure reading at biofilter drain sumps;
- Spatial surface outflow readings on the biofilter beds; and
- A visual and olfactory assessment of the biofilters by the assessor/s.
- A visual inspection of the biofilter medium.

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 high ambient wind conditions. At the time of Assessment 28, the prevailing winds were considered suitable for the undertaking of spatial testing on the DDG biofilter system. The meteorological conditions during testing on the 26 May 2025 were clear skies, calm wind speed (< 0.5 m/s) with no rainfall during the Assessment 28.

The sampling port installed in the main duct to the DDG biofilters, upstream of the flow splitter junction, has enabled more accurate measurement of volumetric airflow to the overall biofilter system, along with a new port located following the Biofilter B outlet, allowing physical measurements from Biofilter C to be taken directly (as opposed to calculation by difference as per previous assessments).

4. Physical Assessment Results – 26 May 2025

The **Main Duct** measurements yielded the following results in Assessment 28:

Airflow:	12.2 m/s, 12,900m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%

Inlet air temperature:	52.6°C
Inlet air pressure:	+196Pa

Dryer #4 + 5 Duct measurements yielded the following results in Assessment 28:

Airflow:	18.7 m/s, 4,850 m^3/hr (ϕ = 300 mm)
Inlet air relative humidity:	100 %
Inlet air temperature:	30.0°C
Inlet air pressure:	+412Pa

The **Biofilter A** measurements yielded the following results in Assessment 28:

Airflow:	1.82 m/s 2,490 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	50.0°C
Inlet air pressure:	+54 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	30.4°C

The **common duct** for **Biofilter B & C** measurements yielded the following results in Assessment 28:

Airflow (by balance):	10.1 m/s, 10,460 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	49.3°C
Inlet air pressure:	+34 Pa
Biofilter outlet air humidity:	saturated

The **Biofilter B Cell 1** measurements yielded the following results in Assessment 28:

Airflow:	1.6 m/s 1,870 m^3/hr (ϕ = 440 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	48.0°C
Inlet air pressure:	+10 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	31.3°C

The **Biofilter B Cell 2** measurements yielded the following results in Assessment 28:

Airflow:	3.6 m/s 1,970 m^3/hr (ϕ = 440 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	53.2°C
Inlet air pressure:	+11 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	31.3°C

The **DDG Biofilter C** measurements yielded the following results in Assessment 28:

Airflow:	1.0 m/s, 4,200 m^3/hr (ϕ = 1200 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	48.0°C
Inlet air pressure:	+31Pa
Biofilter outlet air humidity:	saturated

Biofilter surface air temperature: 32.4°C

4.1 Key Findings

The distribution of airflow into Biofilter A and Biofilter B was 2,490 m^3/hr and 3,840 m^3/hr respectively. This is within the design airflow capacity of 15,000 m^3/hr for each biofilter. Biofilter C is receiving 4,200 m^3/hr, which is also within the design airflow capacity of 30,000 m^3/hr. Based on the collected measurements during Assessment 28, total derived inlet airflow to Biofilters A-C was 17,750 m^3/hr. This is consistent with previous trends collected as part of previous assessments at the Manildra Facility.

It should be noted that there is a difference between the measured airflow entering the OCS and the total derived inlet airflow is likely due to the extreme moisture levels inside the ductwork and non-complaint measurement location points, which has likely impacted measurement uncertainty. Notwithstanding this, the derived airflows are a reasonable estimate for the purposes of Assessment 28.

The inlet humidity measurements indicate that the incoming airstreams to the OCS are saturated, which is ideal for maintaining optimum biofilter bed moisture conditions. The measured inlet temperature of the incoming airstreams is similar to the previous assessment conducted by TOU in June 2024 and are considered to be higher than otherwise desirable. It is recommended that measures are made to reduce the overall inlet temperature to the OCS as far as reasonably practicable. This is further discussed in **Section 12**, as it is potentially impacting odour removal performance.

5. Spatial Testing Results

The spatial testing locations and results are shown in **Figure 5.1**, **Figure 5.2** and **Figure 5.3** for Biofilter A, Biofilter B and Biofilter C, with the spatial testing results presented in **Table 5.1**, **Table 5.2 and Table 5.3**, respectively. The spatial testing results for Biofilter A, Biofilter B & Biofilter C are visually depicted in **Figure 5.4, Figure 5.5** and **Figure 5.6**, respectively.

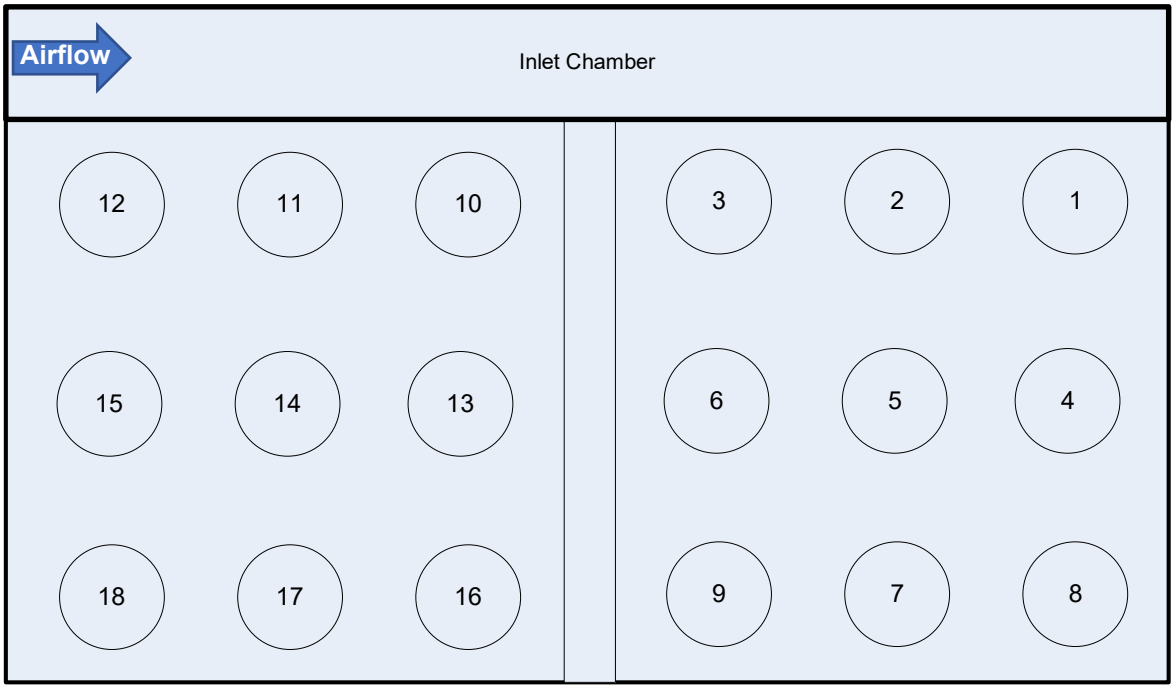


Figure 5.1 – Spatial Testing Locations – Biofilter A

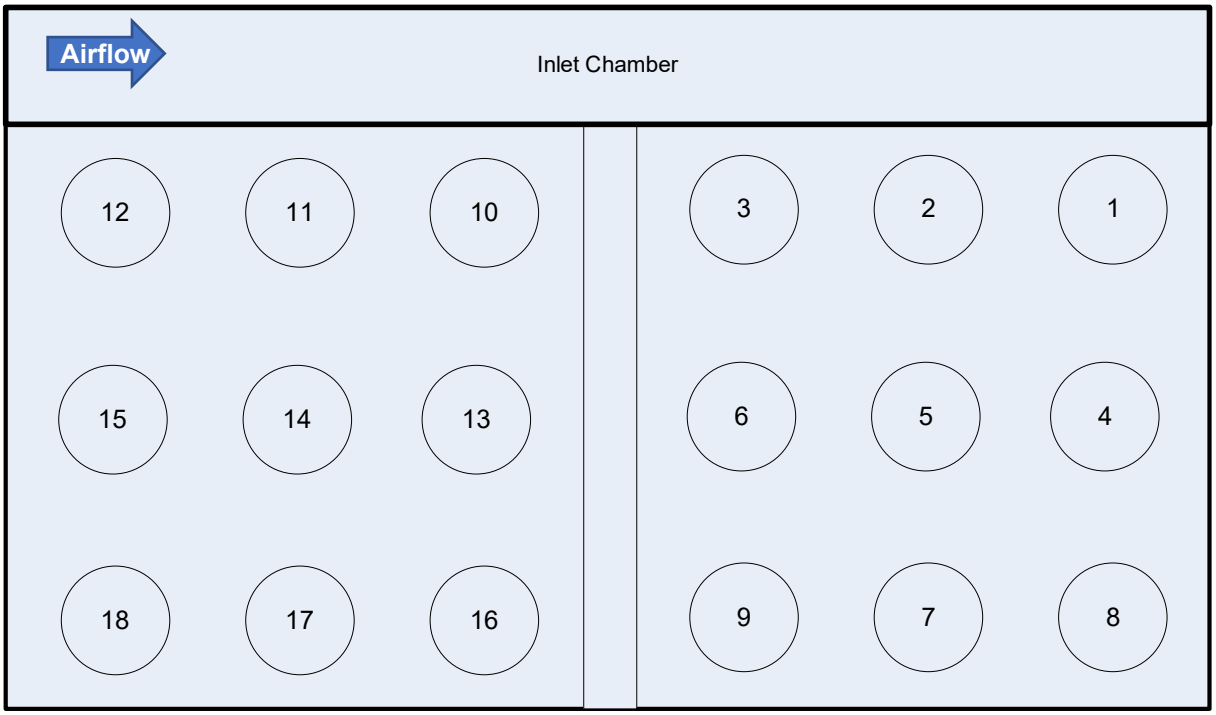


Figure 5.2 – Spatial Testing Locations – Biofilter B

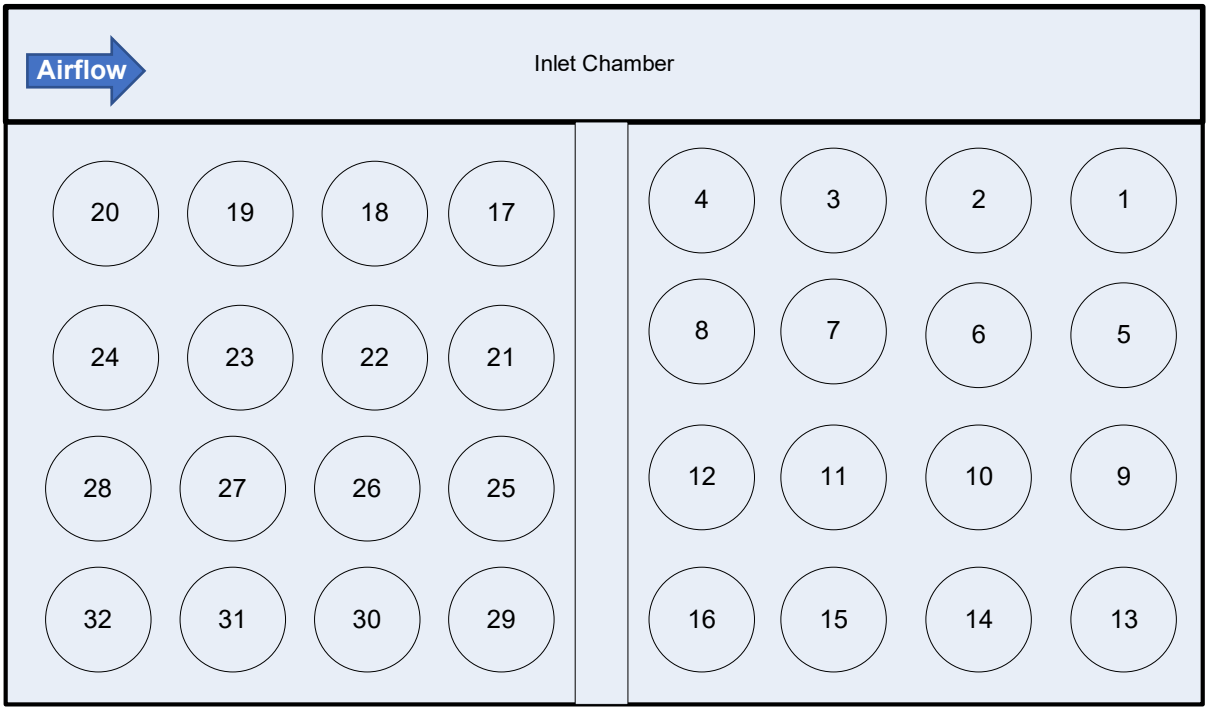


Figure 5.3 – Spatial Testing Locations – Biofilter C

Table 5.1 – Spatial airflow results: DDG Biofilter A : 26 May 2025		
Biofilter A Cell	**Location ID**	**Outflow Velocity (m/s)**
Cell 1 (Northern Cell)	Location 1	0.29
	Location 2	0.26
	Location 3	0.20
	Location 4	0.46
	Location 5	0.41
	Location 6	0.42
	Location 7	0.49
	Location 8	0.45
	Location 9	0.55
Cell 2 (Southern Cell)	Location 10	0.36
	Location 11	0.50
	Location 12	0.29
	Location 13	0.31
	Location 14	0.48
	Location 15	0.45
	Location 16	0.41
	Location 17	0.43
	Location 18	0.58
Spatial Outflow Statistical Analysis		
Average (m/s)		0.41
Standard deviation (m/s)		± 0.10
Percentage variation (%)		± 25%

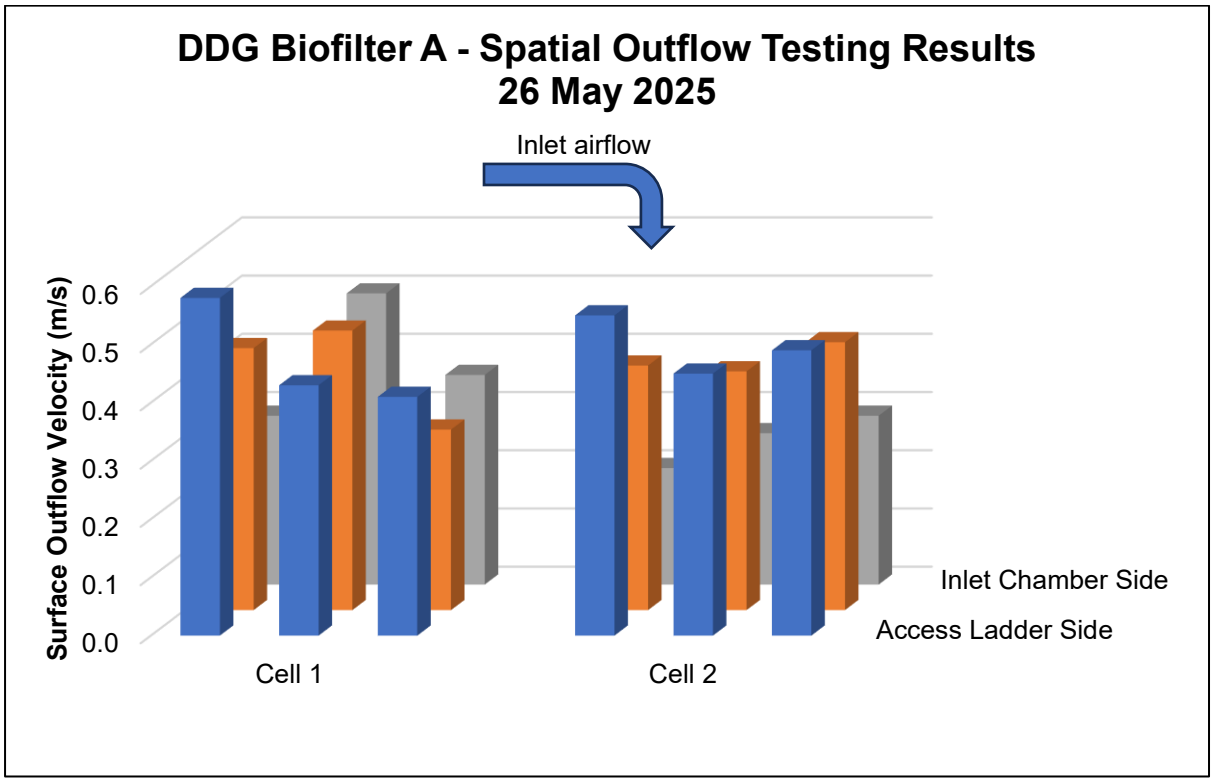


Figure 5.4 – Biofilter A: Spatial Outflow Testing Results on 26 May 2025

Table 5.2 – Spatial airflow results: DDG Biofilter B: 26 May 2025		
Biofilter Cell	**Location ID**	**Outflow Velocity (m/s)**
Cell 1 (Northern Cell)	Location 1	0.57
	Location 2	0.56
	Location 3	0.53
	Location 4	0.64
	Location 5	0.52
	Location 6	0.45
	Location 7	0.71
	Location 8	0.65
	Location 9	0.65
Cell 2 (Southern Cell)	Location 10	0.60
	Location 11	0.59
	Location 12	0.61
	Location 13	0.45
	Location 14	0.44
	Location 15	0.54
	Location 16	0.53
	Location 17	0.56
	Location 18	0.58
Spatial Outflow Statistical Analysis		
Average (m/s)		0.571
Standard deviation (m/s)		0.074
Percentage variation (%)		13%

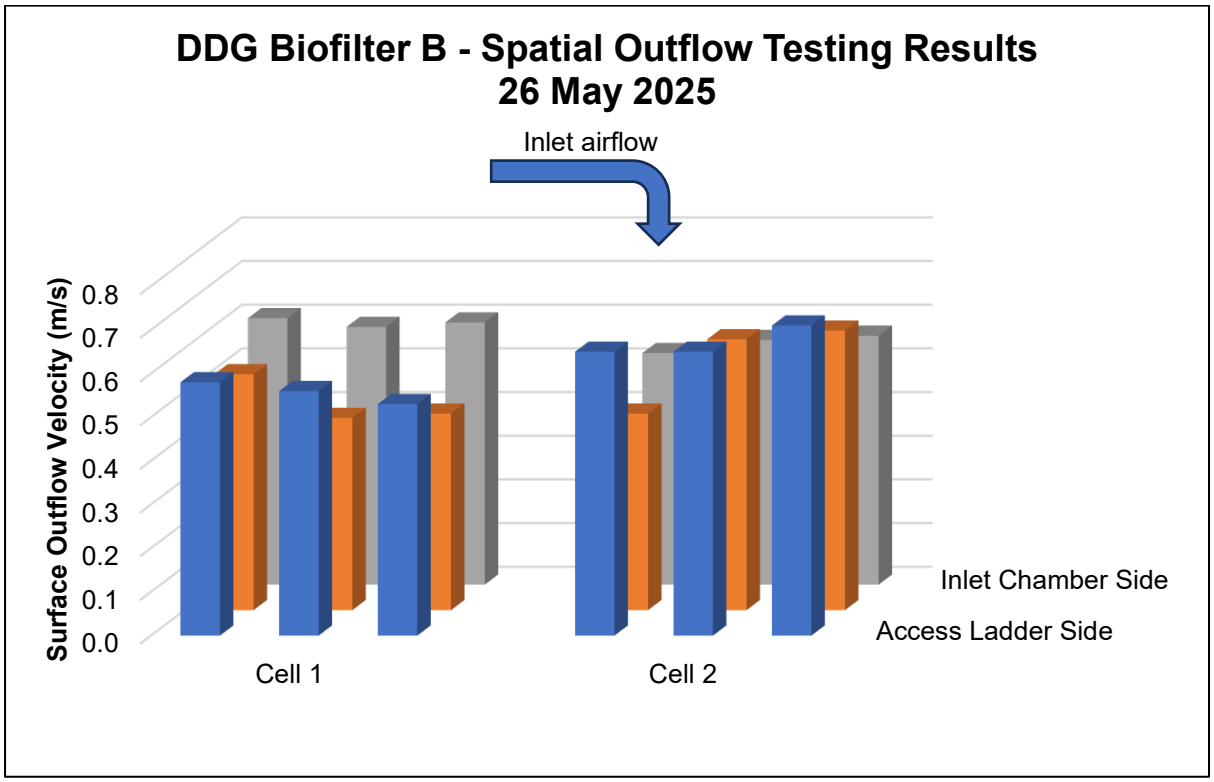


Figure 5.5 – Biofilter B: Spatial Outflow Testing Results on 26 May 2025

Table 5.3 – Spatial airflow results: DDG Biofilter C: 26 May 2025		
Biofilter Cell	**Location ID**	**Outflow Velocity (m/s)**
Cell 1 (Southern Cell)	Location 1	0.53
	Location 2	0.66
	Location 3	0.72
	Location 4	0.52
	Location 5	0.70
	Location 6	0.62
	Location 7	0.62
	Location 8	0.67
	Location 9	0.56
	Location 10	0.56
	Location 11	0.59
	Location 12	0.55
	Location 13	0.56
	Location 14	0.64
	Location 15	0.51
	Location 16	0.70
Cell 2 (Northern Cell)	Location 17	0.55
	Location 18	0.64
	Location 19	0.70
	Location 20	0.75
	Location 21	0.63
	Location 22	0.74
	Location 23	0.60
Cell 2 (Northern Cell)	Location 24	0.72
	Location 25	0.57
	Location 26	0.70
	Location 27	0.74
	Location 28	0.67
	Location 29	0.61
	Location 30	0.66
	Location 31	0.64
	Location 32	0.53
Spatial Outflow Statistical Analysis		
Average (m/s)		0.630
Standard deviation (m/s)		0.067
Percentage variation (%)		11%

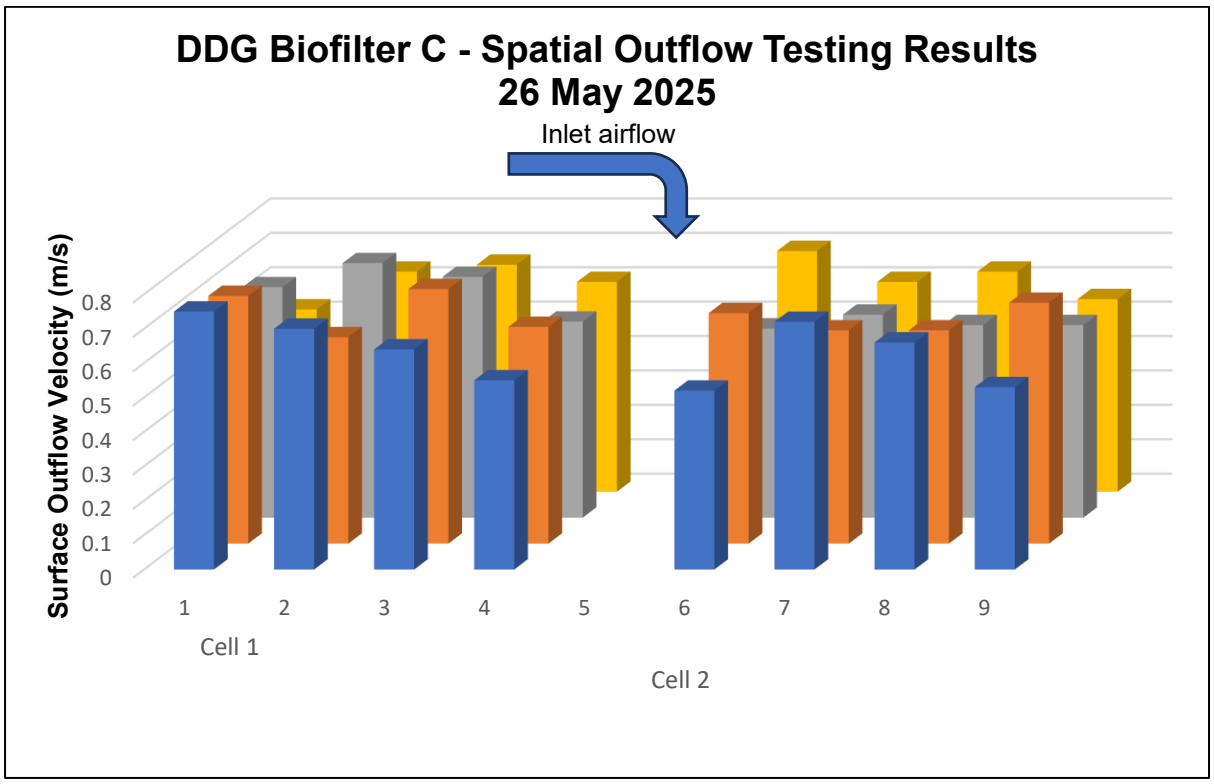


Figure 5.6 – Biofilter C: Spatial Outflow Testing Results on 26 May 2025

6. Trend Data Analysis

Commencing with the testing results following the commissioning of Biofilter B 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 in **Figure 7.1** to **Figure 7.5**, including temperature, airflow, back-pressure, and odour concentration. Biofilter C has been included in the two (2) most recent data points following its commissioning prior to June 2024.

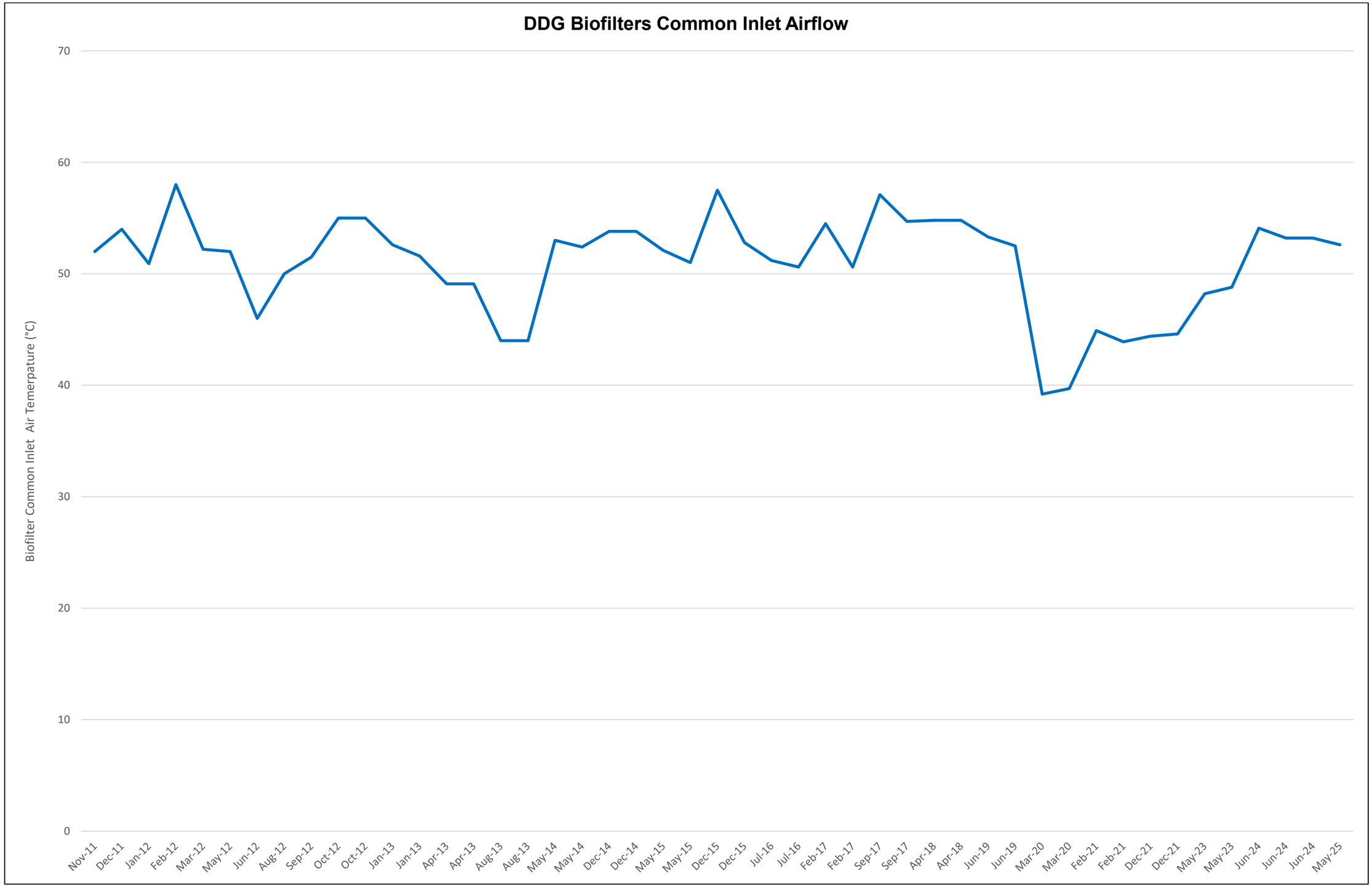


Figure 7.1 –Biofilters A, B & C - Common Inlet Air Temperature Monitoring Trend to 26 May 2025

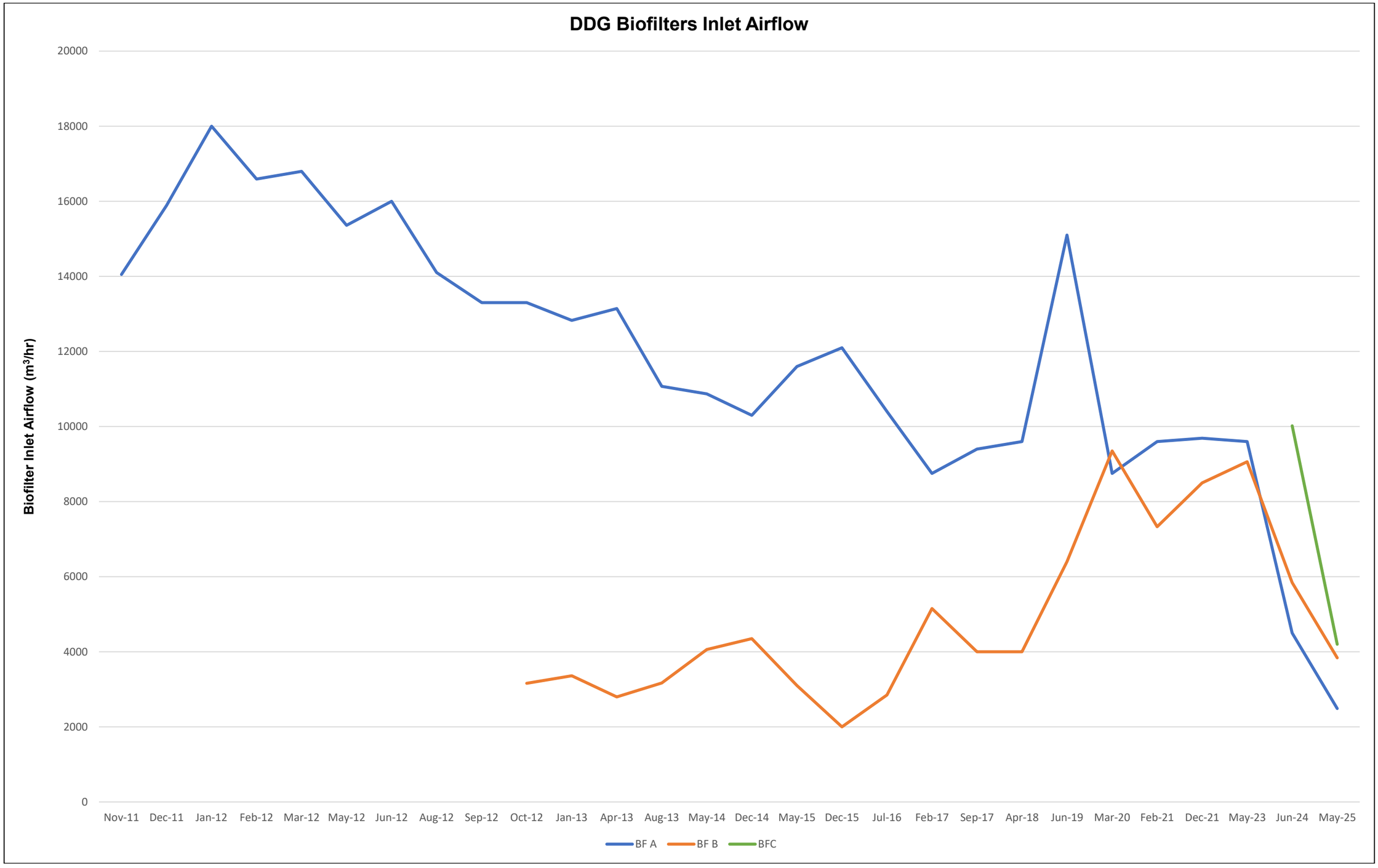


Figure 7.2 – DDG Biofilters A, B & C - Inlet Airflows Trend to 26 May 2025

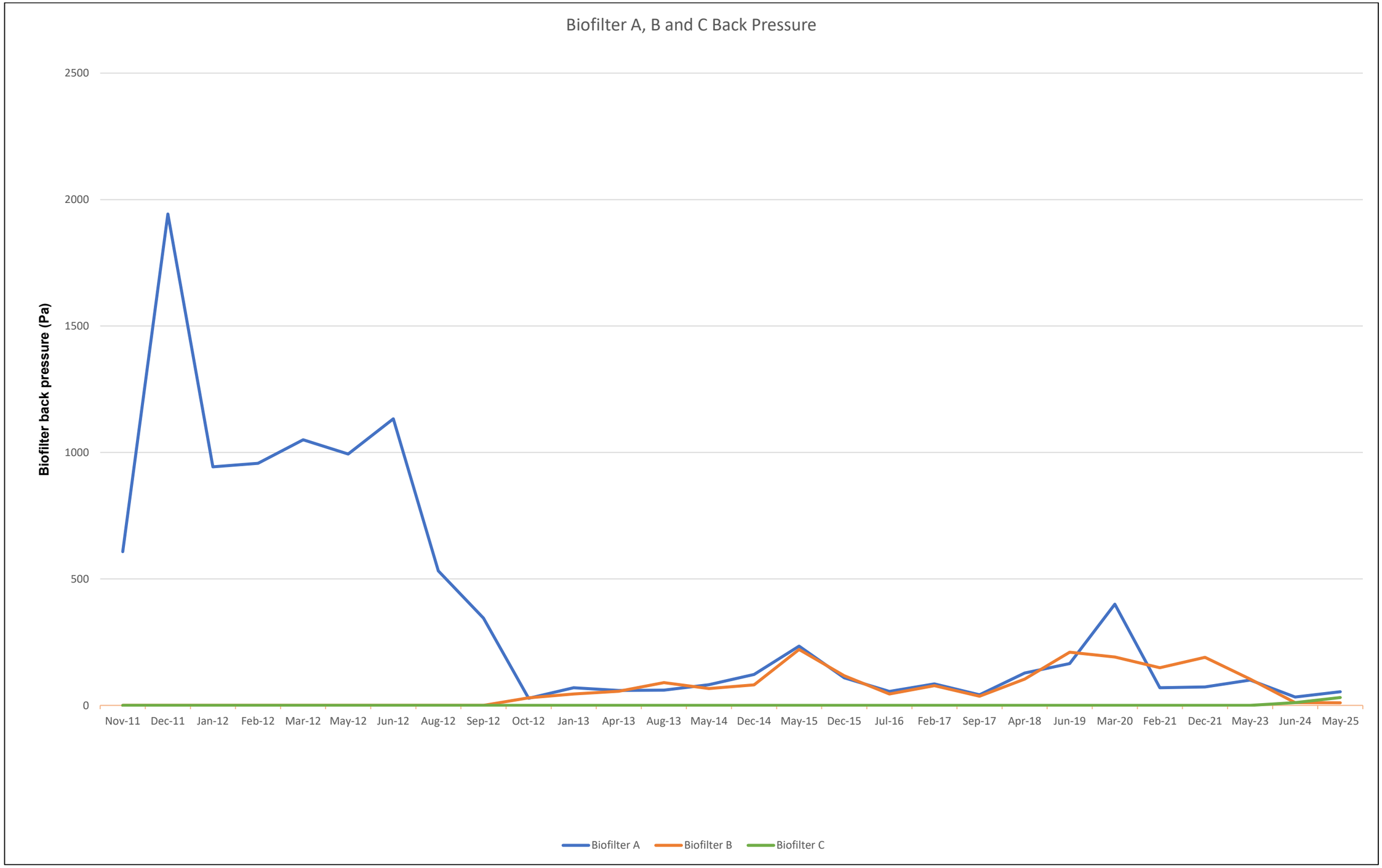


Figure 7.3 – DDG Biofilters A, B & C Inlet Back-Pressures to 26 May 2025

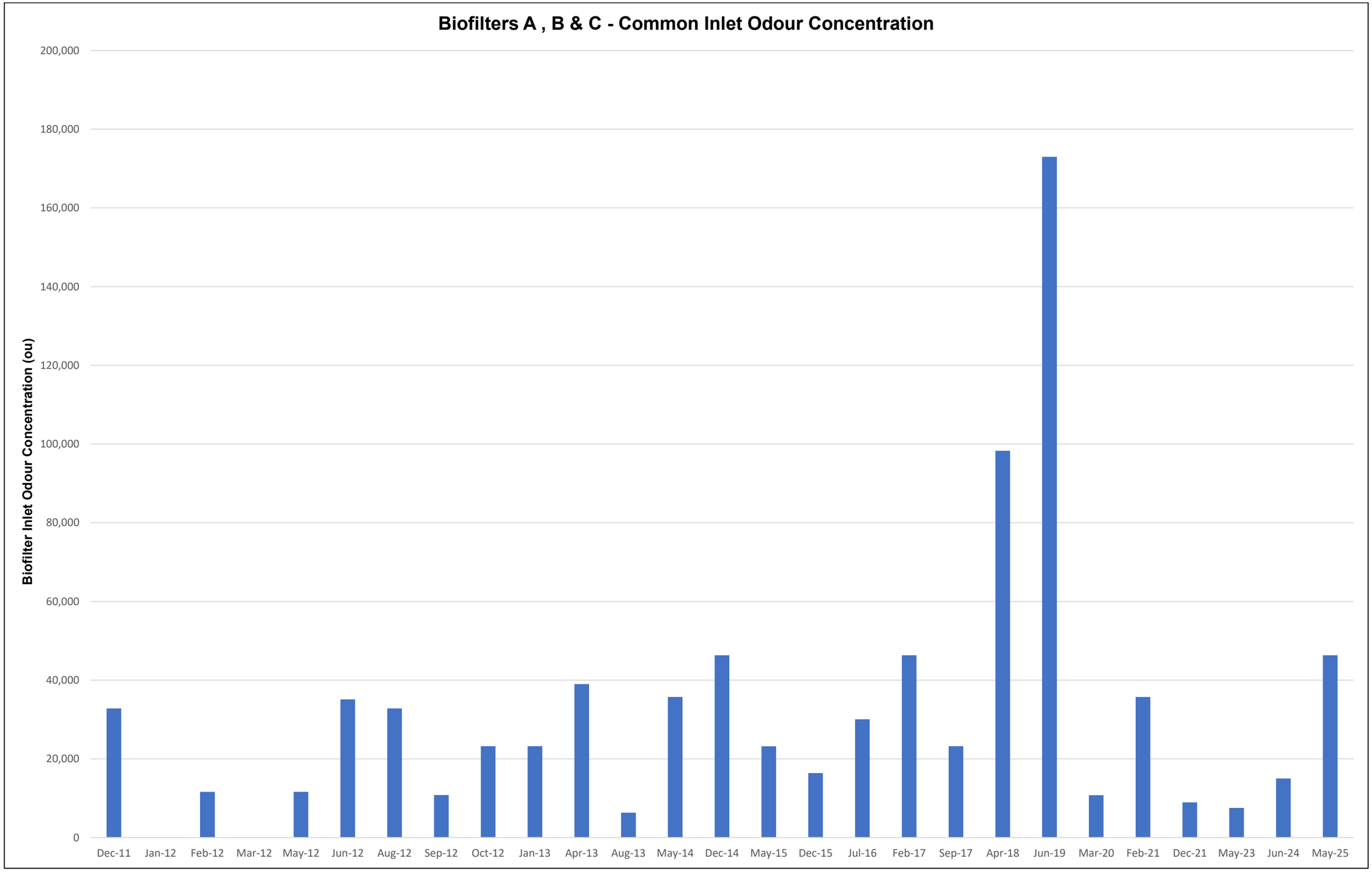


Figure 7.4 – DDG Biofilters A, B & C - Common Inlet Odour Concentration

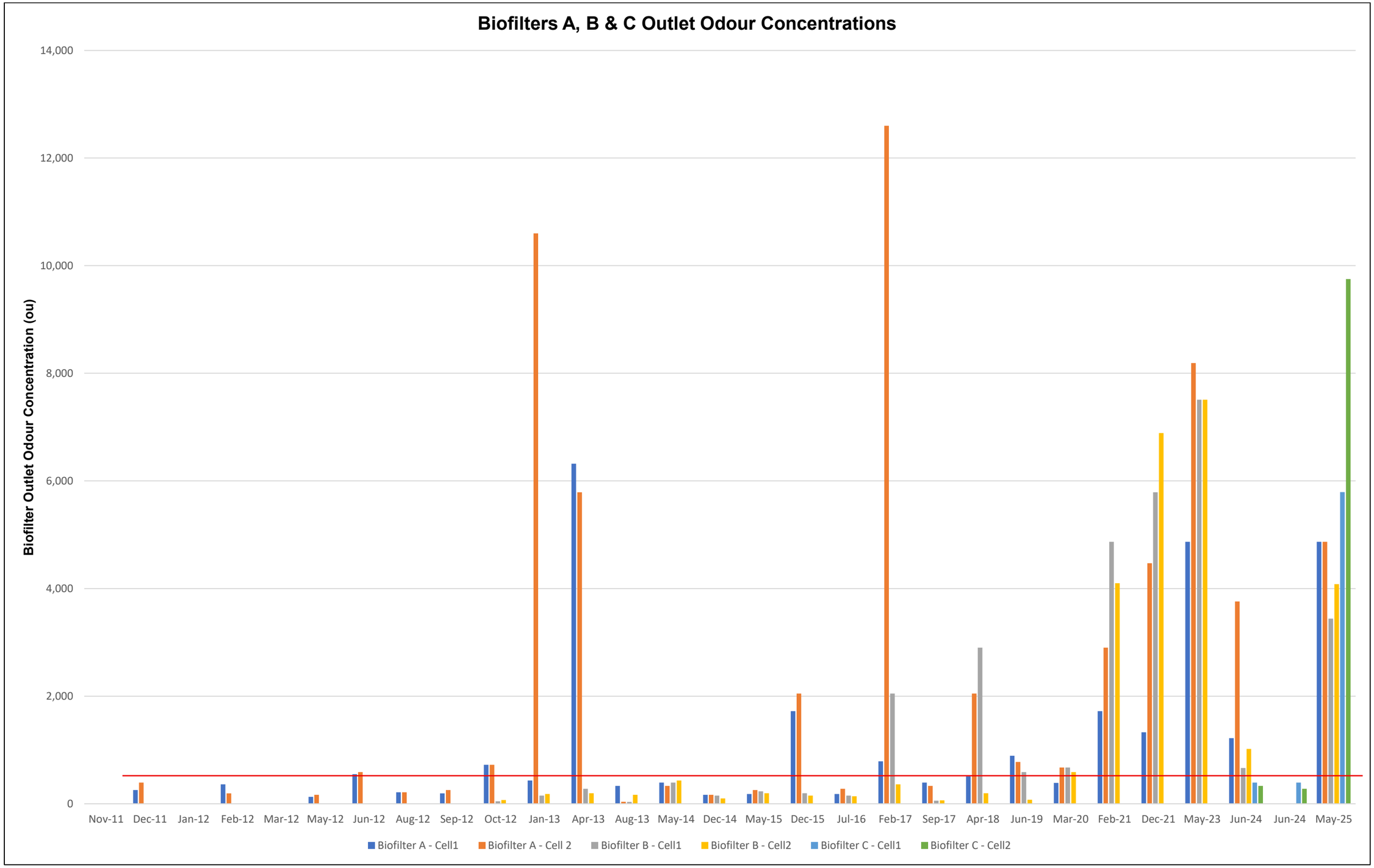


Figure 7.5 – Biofilters A, B & C - Outlet Odour Concentrations with a 500 ou nominal target

7. Odour Destruction Efficiency Results

A total of three (3) inlet gas samples were collected as part of Assessment 28, including:

- DDG 4 + 5 inlet duct connection;
- Main Duct and the ductwork; and
- Post DDG 4 + 5 Inlet which includes both airstreams.

As with previous assessments, all outlet samples were collected as composite samples from two (2) different locations across the biofilter surface. For Biofilter A & B, these samples were taken on each of the two cells (northern and southern), giving two (2) odour results per biofilter cell.

Due to the large size of Biofilter C, there were two (2) composites taken per cell giving, resulting a total of four (4) samples collected from the northern and southern cells. These samples were taken from the North-Western and South-Eastern corner of each respective cell. The results of the odour testing of these samples are **appended** to the report and are summarised in **Table 7.1**

Table 7.1 – Biofilter System Odour Testing Results: 27 May 2025

Sample Location	Odour Concentration (ou)	Odour Character
DDG 4 + 5	60,100	grainy, oily, nutty, sour
Main Duct	42,500	grainy, oily, nutty
Post – DDG 4 + 5 Inlet	46,300	grainy, oily, sour
Biofilter A Cell 1 Outlet – Northern Cell	4,870	grainy, oily
Biofilter A Cell 2 Outlet – Southern Cell	4,870	grainy, oily
Biofilter A Outlet (Geomean)	**4,870**	
Biofilter B Cell 1 Outlet – Northern Cell	3,440	grainy, oily, fermented, dirt soil, sour
Biofilter B Cell 2 Outlet – Southern Cell	4,080	grainy, oily, fermented, dirt soil
Biofilter B Outlet (Geomean)	**3,750**	
Biofilter C Cell 1 Outlet – Northern Cell (closer to inlet duct)	4,870	grainy, oily, fermented, nutty, sour
Biofilter C Cell 1 Outlet – Northern Cell (furthest from inlet duct)	6,890	grainy, oily, fermented, nutty, sour
Biofilter C Cell 2 Outlet – Southern Cell (closer to inlet duct)	13,800	grainy, oily, fermented, nutty, sour
Biofilter C Cell 2 Outlet – Southern Cell (furthest from inlet duct)	6,890	grainy, oily, fermented, nutty, sour
Biofilter C Outlet (Geomean)	**7,520**	
Global Geomean Biofilter Outlet Result	**5,670**	
Mean Odour Destruction Efficiency	88%	

The above results indicate that the odour destruction efficiency is 88%. However, the outlet odour concentration results are well above the target of 500 ou or less. This is further discussed in **Section 12**.

8. Visual and Olfactory Assessment

During Assessment 28, the condition of the biofilter medium was visually assessed, with the performance also assessed by an olfactory evaluation. A view of the DDG biofilters at the Manildra Facility is shown in **Photo 8.1**.

Photo 8.1 – A view of DDG Biofilters as found on 26 May 2025

The observations for Biofilter A were as follows:

- Soft and spongey underfoot;
- Biofilter bed was moist;
- The biofilter medium depth was approximately 200 to 300 mm from the top wall; and
- There was a significant patch of gravel that had been placed in one corner of the biofilter.

The observations for Biofilter B were as follows:

- The medium for DDG B appeared in good condition and moist; and
- The biofilter medium depth was approximately 100 mm from the top wall.

The observations for Biofilter C were as follows:

- The medium for Biofilter C is in good condition, moist and evenly distributed throughout the biofilter surface bed; and

- The medium is approximately 300 to 400 mm from the top wall, especially lower around the front and side edges of the biofilter walls.

9. Biofilter Drainage

The drainage flows from the Biofilter A and Biofilter B to the sump pits appeared normal. The drainage to Biofilter DDG C was not observable.

10. Assessment Findings

The following comments are made based on the results obtained as part of Assessment 28:

- Biofilter A, B and C are receiving 19%, 30% and 51% of the total derived airflow of 17,750 m^3/hr, respectively. This data is backed up by the spatial testing averages taken from each Biofilter surface which correlate velocities recorded within proportion to these airflows.

- The common inlet odour concentration of 46,300 ou is significantly higher than June 2024 (15,020 ou) but within reasonable historical results and design parameters;

- The geomean for Biofilter A outlet odour concentration is 4,870 ou, which is significantly higher than the nominal 500 ou targeted concentration;

- The geomean for Biofilter B outlet odour concentration is 3,750 ou, which is significantly higher the nominal 500 ou targeted concentration;

- The geomean for Biofilter C outlet odour concentration is 7,520 ou; which is significantly higher than the nominal 500 ou targeted concentration;

- The temperature of the inlet air has marginally increased to approximately 52°C but remains within the historical mean for this parameter. These minor variations are likely due to changes in operating and ambient weather conditions and are normal for this biofilter system. However, given the odour removal performance, these operating temperatures are considered higher than otherwise desirable. It is recommended that measures are made to reduce the overall inlet temperature to the OCS as far as reasonably practicable to optimise biofilter performance. This is further discussed in **Section 12**, as it is potentially impacting odour removal performance;

- Biofilter back-pressures results are within the normal range and are acceptable. No clear short-circuiting or wall effects were observable;

- The mean percentage variation for the spatial outflow distribution for Biofilters A, B and C Biofilter A is 25%, 13%, and 11%, respectively. This result is very similar to Assessment 27, with Biofilter A being notably higher than Biofilter B and C. The spatial outflow distribution is at the edges tolerance for Biofilter A, while Biofilter B and Biofilter C are well within design tolerance; and

- The inlet air relative humidity remains in a saturated condition, which is ideal for maintaining optimum bed moisture.

11. Concluding Remarks

The inlet airflow is distributed appropriately across all three (3) biofilters. The spatial surface airflow distribution throughout the biofilter beds were within the acceptable design tolerance. The outlet odour testing results for Biofilters A-C were higher than 500 ou.

Given that the airflow distribution across the three biofilter cells are within their rated design capacity, indicating that sufficient residence time is being maintained for effective biological treatment. Therefore, it is considered unlikely that mass transfer limitation due to gas residence time within the biofilter bed is the primary cause of the residual odour.

Overall, it is considered that elevated inlet temperatures are potentially increasing the volatility of certain gas compounds, resulting in partial mobilisation of residual untreated odour emissions from the aqueous phase and to the biofilter surface.

12. Assessment Recommendations

Based on the observations and findings documented in Assessment 28, the following recommendations are made:

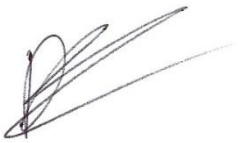
- Develop and implement a strategic plan to provide engineered cooling of the DDG process airstream to reduce the overall inlet air temperature flowing to the biofilter system. This will assist in optimising biofilter treatment performance and extending the operating medium life in the long term, whilst improving degradation of odorous volatile compounds; and

- It is proposed that up to 10,000 m³/hr of fresh air dilution be introduced to the inlet process airstream, which can be sourced upstream at multiple locations (if needed). The objective of this measure is to slightly reduce the inlet air temperature and lower the concentrations of targeted odorous compounds prior to biofiltration. This approach is proposed as a practical alternative to mechanical cooling, which is understood to be not currently feasible. It is expected that this measure would result in a reduction in outlet odour concentrations, improving overall system performance.

The next assessment is due in **January 2026**.

The Odour Unit

Report Prepared By:



Darcy Brockel B.Sc
Consultant

Report Reviewed and Approved By:

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

Attachment:

- Odour Concentration Laboratory Results: 27 May 2025

THE ODOUR UNIT

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E: qldinfo@odourunit.com.au
ABN: 87 102 255 765

Odour Concentration Measurement Report

Sampling and Laboratory Information

Organisation	Manildra Group	Telephone	(02) 4423 8200
Contact	G. Dostal	Email	Gavin.Dostal@manildra.com.au
Sampling Site	Bomaderry, NSW	Sampling Personnel	TOU (MA + IF)
Sampling Method	Drum & Pump, AS/NZS 4323.3	Laboratory Location	Mascot, NSW

Order and Project Information

Order requested by	G. Dostal	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	G. Dostal	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/NZS 4323.3). 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 °C ±3 °C.
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
Laboratory Precision	The precision of this laboratory (expressed as repeatability) for sensory quality must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3. $r = 0.182$ Compliance – Yes
Laboratory Accuracy	The accuracy of this laboratory for sensory quality must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3. $A = 0.202$ 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: Thursday, 29 May 2025

Panel Roster Number: SYD20250527_045

NATA

Accreditation Number: 14974

A. Schulz
Authorised Signatory

THE ODOUR UNIT

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20250527_045

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
1752-28-001 Biofilter A - Outlet North	SC25366	26/05/2025 1250-1300 hrs	27/05/2025 0954 hrs	4	8	4,870
1752-28-002 Biofilter A - Outlet South	SC25367	26/05/2025 1305-1315 hrs	27/05/2025 1028 hrs	4	8	4,870
1752-28-004 Biofilter B - Outlet South	SC25368	26/05/2025 1342-1352 hrs	27/05/2025 1102 hrs	4	8	4,080
1752-28-003 Biofilter B - Outlet North	SC25369	26/05/2025 1320-1330 hrs	27/05/2025 1132 hrs	4	8	3,440
1752-28-005 Biofilter C – North Cell (Northern Section)	SC25370	26/05/2025 1400-1410 hrs	27/05/2025 1207hrs	4	8	4,870
1752-28-006 Biofilter C - North Cell (Southern Section)	SC25371	26/05/2025 1412-1422 hrs	27/05/2025 1320 hrs	4	8	6,890

Samples Received in Laboratory – From: TOU (D. Brockel) Date: 27/05/2025 Time: 0900 hrs

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

1. The collection of samples by a method that is not prescribed by AS/NZS 4323.3.
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit have performed the dilution of samples.

THE ODOUR UNIT

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20250527_045

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
1752-28-007 Biofilter C – South Cell (Northern Section)	SC25372	26/05/2025 1425-1435 hrs	27/05/2025 1346 hrs	4	8	13,800
1752-28-008 Biofilter C - South Cell (Southern Section)	SC25373	26/05/2025 1437-1446 hrs	27/05/2025 1418 hrs	4	8	6,890
1752-28-009 Pre – DDG 4 & 5 Inlet	SC25374	26/05/2025 1452hrs	27/05/2025 1456 hrs	4	8	42,500
1752-28-010 Post – DDG 4 & 5 Inlet	SC25375	26/05/2025 1504 hrs	27/05/2025 1529 hrs	4	8	46,300
1752-28-011 DDG 4 + 5	SC25376	26/05/2025 1526 hrs	27/05/2025 1557 hrs	4	8	60,100

Samples Received in Laboratory – From: TOU (D. Brockel) Date: 27/05/2025 Time: 0900 hrs

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

1. The collection of samples by a method that is not prescribed by AS/NZS 4323.3.
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit have performed the dilution of samples.

THE ODOUR UNIT

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	SYD20250527_045	46,000	$20 \leq \chi \leq 80$	724	64	Yes

Comments

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

Sample ID	Laboratory ID	Character	Sample ID	Laboratory ID	Character
1752-28-001	SC25366	grainy, oily, fermented, nutty, sour	1752-28-007	SC25372	grainy, oily, fermented, nutty, sour
1752-28-002	SC25367	grainy, oily, fermented, nutty, sour	1752-28-008	SC25373	grainy, oily, fermented, nutty, sour
1752-28-004	SC25368	grainy, oily, fermented, dirt soil	1752-28-009	SC25374	grainy, oily, nutty
1752-28-003	SC25369	grainy, oily, fermented, dirt soil, sour	1752-28-010	SC25375	grainy, oily, sour
1752-28-005	SC25370	grainy, oily, fermented, nutty, sour	1752-28-011	SC25376	grainy, oily, nutty, sour
1752-28-006	SC25371	grainy, oily, fermented, nutty, sour			

Departures

Clause 9.5.3 (d) – Cross-sectional distribution of airflow and concentration from port-openings are not checked due to impracticality of the requirement .

Disclaimers

1. Parties, other than The Odour Unit, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit relinquishes The Odour Unit 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.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit.

Report Status

Status	Version	Prepared by	Date	Checked by	Date	Change	Reason
Draft	0.1	A. Schulz	29/05/2025	--	--	--	--
Final	1.0	--	--	M. Assal	29/05/2025	--	--
Revised	1.1						

END OF DOCUMENT

APPENDIX D – ANNUAL AND QUARTERLY ODOUR EMISSION SURVEYS

Please note that the test reports are provided separately to this report. The author has imposed restrictions on the pdf that do not allow these files to be inserted into this document.

APPENDIX E – ODOUR COMPLAINT RECORDS

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL101

Customer Code: SCUST90124 **Date Lodged:** 04-Nov-2024

Customer:	Community Environmental Complaint - Direct
Batch No.:	**Product:**
Complaint Detail:	Odour Complaint - 3 November 2024
Problem:	Odour complaint received evening of 3/11/2024 via the community complaints hotline. No information, contact details or description of smell was recorded
Cause Cat:	ODOUR Odour
Cause:	Investigation was unable to determine the replicate the odour complaint and cause unknown
Who To Do:	Gavin Dostal
Action Required By:	04-Nov-2024
Action:	- Walk along river edge on afternoon 4/11/2024 to smell for biogas and confirm line isn't leaking - Review of SCAN to confirm no abnormal operations around day leading up to complaint
Review:	- Theory that partially rotting grain post silo collapse that was exposed at low tide may have contributed to odour however unable to verify due to lack of details from complaint

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL102

Customer Code: SCUST90124 **Date Lodged:** 04-Nov-2024

Customer:	Community Environmental Complaint - Direct
Batch No.:	**Product:**
Complaint Detail:	Odour Complaint - 3 November 2024
Problem:	Second odour complaint received evening of 3/11/2024 via the community complaints hotline. No information, contact details or description of smell was recorded
Cause Cat:	ODOUR Odour
Cause:	Investigation was unable to determine the replicate the odour complaint and cause unknown
Who To Do:	Gavin Dostal
Action Required By:	04-Nov-2024
Action:	- Walk along river edge on afternoon 4/11/2024 to smell for biogas and confirm line isn't leaking - Review of wind direction to try and workout possible causes and locations of complainant
Review:	- Theory that partially rotting grain post silo collapse that was exposed at low tide may have contributed to odour however unable to verify due to lack of details from complaint

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL108

Customer Code: SCUST90124 **Date Lodged:** 27-Feb-2025

Customer:	Community Environmental Complaint - Direct
Batch No.: N/A	**Product:** N/A
Complaint Detail:	Odour complaint - 26 February 2025 - Far Meadow
Problem:	[redacted] just called. She lives at [redacted] (near Coolangatta) and advised there is often a smell coming from Manildra however today it has been very strong. She just wants to know where the smell is coming from and how long it will smell like that?
Cause Cat:	ODOUR Odour
Cause:	Cause couldn't be identified but may have been related to other nearby farming activities outside of Manildra operations
Who To Do:	
Action Required By:	27-Feb-2025
Action:	- John Studdert & Luke Elliot went for a drive on the afternoon of 26/2 however the wind was blowing NE and in the opposite direction of the farm (no substantial odour was noted) - Luke investigated BVF and noted that it was under pressure and no leaks at time of complaint - Farm operations were mulching pivot 4 on that day and may have disturbed spread grain but thought unlikely to smell and travel that far - Was identified that another farmer on Bolong Rd was spreading fertiliser on this day (may explain increase on said day). - John called [redacted] to ask for more information but did not leave answer, message was left but no call back as of 27/2
Review:	Cause unidentified and complainant never followed up despite attempts to contact

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL112

Customer Code: SCUST90124 **Date Lodged:** 08-Apr-2025

Customer:	Community Environmental Complaint - Direct
Batch No.:	N/A
Product:	N/A
Complaint Detail:	Odour Complaint - 8 April 2025
Problem:	[redacted] Bomaderry, NSW, Australia 2541 Lodging a complaint and seeking information about the smell that occurs at 2:30pm each day. Described as vegemite/yeasty and has logged multiple instance in April
Cause Cat:	ODOUR Odour
Cause:	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%
Who To Do:	Gavin Dostal
Action Required By:	08-Apr-2025
Action:	- Review weather station data for days recorded 2nd & 3rd at 2:45pm, 4th at 12:00pm and 8th at 2:30pm. In all instances the wind direction was 5-10km/hr and blowing E-SE which is consistent with direction from site to residence. - Review on SCAN of biofilter assets, no obvious issues with temperature or blower fan - Recent biofilter quarterly odour testing reveal high inlet odours and outlet not achieving desired results (this is a change from recent results) - Seek to engage The Odour Unit to come back to site for yearly review and fix issue because we have been given the guarantee that it would work
Review:	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL113

Customer Code: SCUST90124 **Date Lodged:** 14-Apr-2025

Customer:	Community Environmental Complaint - Direct
Batch No.: N/A	**Product:** N/A
Complaint Detail:	Odour Complaint - 13 April 2025
Problem:	[redacted] (caller from previous odour complaint on 8th April) in Bomaderry called community complaint hotline to let us know that the odour was described as "10x worse" than previous at approximately 11:15am 13/4/25. No other details received.
Cause Cat:	ODOUR Odour
Cause:	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%
Who To Do:	Gavin Dostal
Action Required By:	14-Apr-2025
Action:	- Wind direction at time of complaint SE (matches direction from Plant - The Odour Unit to come to site in May 2025 to investigate performance of biofilters
Review:	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL116

Customer Code: SCUST90123 **Date Lodged:** 15-May-2025

Customer:	Environmental Protection Authority (EPA) Queanbeyan
Batch No.:	N/A
Product:	N/A
Complaint Detail:	Odour Complaint - Bomaderry 5th May 2025
Problem:	There's a factory in Bomaderry called Manildra. The smell they emit is getting more and more wide spread and strong. Why are they allowed to do this. It's unpleasant and it wasn't something that was as noticeable at all when we left Bomaderry. Now it's sometimes so noticeable I can't open windows on a beautiful day
Cause Cat:	ODOUR Odour
Cause:	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%
Who To Do:	Gavin Dostal
Action Required By:	15-May-2025
Action:	- The Odour Unit to come to site May 2025 to inspect Biofilter performance and report on options for reducing odour.
Review:	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL117

Customer Code: SCUST90123 **Date Lodged:** 16-May-2025

Customer:	Environmental Protection Authority (EPA) Queanbeyan
Batch No.: N/A	**Product:** N/A
Complaint Detail:	Odour Complaint - Nowra - 12th May 2025
Problem:	Caller advised a strong, invasive yeasty odour at the corner of [redacted] in Nowra. There was little to no wind at the time. The complainant believes the source is Manildra/Shoalhaven Starches (EPA Licence number EPL883, 160 Bolong Road, Bomaderry NSW 2541), noting that the smell recurs during northern breezes, correlating with the factory's location. No commercial bakeries are located nearby.
Cause Cat:	ODOUR Odour
Cause:	Odour from Biofilter may be cause of the complaint - Recent results suggest not performing 100% HOWEVER this location is very far away from the site and it is unlikely that the smell would travel that far.
Who To Do:	Gavin Dostal
Action Required By:	16-May-2025
Action:	- Checked environmental farm wind data - Confirmed ENE/NE - Respond to EPA notifying of issue and planned works
Review:	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No

MANILDRA GROUP OF COMPANIES

No Title

Complaint No: CC-ESHOAL118

Customer Code: SCUST90124 **Date Lodged:** 02-Jun-2025

Customer:	Community Environmental Complaint - Direct
Batch No.:	N/A
Product:	N/A
Complaint Detail:	Odour Complaint - Bomaderry - 1st June 2025
Problem:	[redacted] - Odour Complaint over the weekend from [redacted], Bomaderry, the complainant described the smell as yeasty/vegemite and having been noted on both Saturday 31st May & Sunday 1st June around midday. The complainant also commented that this is the third direct complaint in recent months and will now escalate the issue to EPA and local authorities.
Cause Cat:	ODOUR Odour
Cause:	Odour from Biofilter is likely cause of the complaint - Recent results suggest not performing 100%
Who To Do:	
Action Required By:	02-Jun-2025
Action:	- Email to Managers letting them know of complaint - Review wind direction (lines up with times and location) - Waiting on results from TOU
Review:	The Odour Unit attended site May 2025 to complete full suite of tests - A number of potential causes and actions identified.

Status:	0 Logged	**Dept:**	SHOQA
Approved By:		**Manufacturing Site:**	Shoalhaven Starches
Date:		**Product Rejected:**	No
Recorded By:	gdostal	**Potential Claim:**	No