

# northstar

## AIR QUALITY



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

**Northstar Air Quality Pty Ltd,**

Suite 1504, 275 Alfred Street, North Sydney, NSW 2060

[www.northstarairquality.com](http://www.northstarairquality.com) | Tel: +61 (02) 9071 8600

### **Shoalhaven Starches, Independent Odour Audit (2020-2021)**

Addressee(s): Shoalhaven Starches Pty Ltd

Report Reference: 21.1142.DR1V2

Date: 10 September 2021

Status: Final

## Quality Control

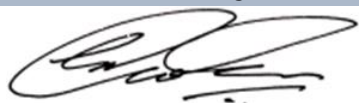
Study	Status	Prepared by:	Checked by:	Authorised by:
INTRODUCTION	Final	GCG	MD, JS	GCG
ODOUR AUDIT REQUIREMENTS	Final	GCG	MD, JS	GCG
ODOUR AUDIT EVIDENCE	Final	GCG	MD, JS	GCG
ODOUR AUDIT FINDINGS	Final	GCG	MD, JS	GCG
SUMMARY	Final	GCG	MD, JS	GCG

## Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(Rx)	(Vx)
21	1142	Final	R1	V1
Based upon the above, the specific reference for this version of the report is:				21.1142.FR1V1

## Final Authority

This report must be 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**

**10 September 2021**

### © Northstar Air Quality Pty Ltd 2021

Copyright in the drawings, information and data recorded in this document (the information) is the property of Northstar Air Quality Pty Ltd. This report has been prepared with the due care and attention of a suitably qualified consultant. Information is obtained from sources believed to be reliable, but is in no way guaranteed. No guarantee of any kind is implied or possible where predictions of future conditions are attempted. This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the addressee(s) and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report.

## Contents

<b>1.</b>	<b>INTRODUCTION .....</b>	<b>6</b>
<b>1.1.</b>	<b>Auditing Period .....</b>	<b>6</b>
<b>1.2.</b>	<b>Consultation .....</b>	<b>7</b>
1.2.1.	Environment Protection Authority (EPA) .....	7
1.2.2.	Department of Planning, Industry and Environment (DPI&E) .....	8
<b>1.3.</b>	<b>Site Inspection .....</b>	<b>9</b>
<b>2.</b>	<b>ODOUR AUDIT REQUIREMENTS .....</b>	<b>10</b>
<b>2.1.</b>	<b>Audit Procedure .....</b>	<b>10</b>
<b>2.2.</b>	<b>Audit Compliance Status Descriptors.....</b>	<b>11</b>
<b>2.3.</b>	<b>Audit Recommendations .....</b>	<b>11</b>
<b>2.4.</b>	<b>Consolidated Odour Conditions and Summary of Compliance .....</b>	<b>11</b>
<b>3.</b>	<b>ODOUR AUDIT EVIDENCE .....</b>	<b>12</b>
<b>3.1.</b>	<b>Review of Management Plans .....</b>	<b>12</b>
3.1.1.	Odour Management Plan.....	12
3.1.2.	Pollution Incident Response Management Plan (Updated 2019) .....	13
<b>3.2.</b>	<b>Odour Complaints .....</b>	<b>13</b>
<b>3.3.</b>	<b>Review of Production Data .....</b>	<b>15</b>
<b>3.4.</b>	<b>Independent Environmental Audit.....</b>	<b>16</b>
<b>3.5.</b>	<b>Biofilter Capacity and Condition Assessments.....</b>	<b>16</b>
<b>3.6.</b>	<b>Odour Monitoring Results.....</b>	<b>17</b>
3.6.1.	Process Conditions during the Monitoring .....	18
3.6.2.	Summary of Measurements – Annual Testing.....	19
3.6.3.	Summary of Measurements – Quarterly Testing.....	19
3.6.4.	Variability of Measurements .....	22
3.6.5.	Variability in Measurements from the Biofilters and Pellet Plant.....	25
<b>3.7.</b>	<b>Odour Modelling .....</b>	<b>26</b>
<b>4.</b>	<b>ODOUR AUDIT FINDINGS.....</b>	<b>31</b>
<b>5.</b>	<b>SUMMARY .....</b>	<b>42</b>

5.1.	Identified Non-Compliances.....	42
5.2.	Recommendations.....	43

## Appendices

Appendix A – Director General’s Letter of Appointment

Appendix B – Biofilter Photographs

Appendix C – DDG Biofilter & Capacity & Condition Assessment Reports

Appendix D – Annual and Quarterly Odour Emission Surveys

Appendix E – Odour Modelling Assessment

Appendix F – Odour Complaint Records



## Tables

Table 1	Odour audit compliance criteria	11
Table 2	Odour complaints	13
Table 3	Odour monitoring and production rates	15
Table 4	Biofilter capacity and condition report (#24) – operating parameters	17
Table 5	Biofilter capacity and condition reports – odour measurements	17
Table 6	Summary of annual odour monitoring results	19
Table 7	Summary of quarterly odour monitoring results	21
Table 8	Observed variability in the measured odour emission rate (by quarter)	22
Table 9	Observed variability in the measured odour emission rate (by audit year)	24
Table 10	Observed variability in the measured odour concentration and volumetric discharge rate	25
Table 11	Observed variability in the measured odour emission rate (by audit year)	26
Table 12	Summary of odour modelling results (99 <sup>th</sup> percentile 1-second OU)	29
Table 13	Consolidated odour conditions and summary of compliance (MOD 16, Schedule 3)	32
Table 14	Independent odour audit non-compliances	42
Table 15	Independent odour audit recommendations	43

## Figures

Figure 1	Variation in measured emission rates (range and mean)	23
Figure 2	Comparison of measured and modelled odour emission rates	28
Figure 3	Ground level odour predictions (GHD, 2021)	30

## 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  $20 \text{ OU} \cdot \text{m}^3 \cdot \text{s}^{-1}$  and not  $20 \text{ OU}/\text{m}^3/\text{s}$

## 1. INTRODUCTION

Shoalhaven Starches Pty Ltd (on behalf of the Manildra Group) has engaged Gary Graham, Director of Northstar Air Quality Pty Ltd (Northstar Air Quality) to perform the independent odour audit (2020-2021) of the Shoalhaven Starches Facility (the facility) which operates at Bolong Road, Bomaderry, NSW.

As stipulated in the NSW Government (May 2020) *Independent Audit – Post Approval Requirements* (DPIE, 2020) I 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 entirety in **Table 13 (Section 4)**, with a reference to the sections of the report that provide evidence and commentary on the compliance (or otherwise) with each condition related to odour.

### 1.1. Auditing Period

This odour audit covers the period from Q1 2020/21 to Q4 2020/21, aligned to the EPL reporting period. With reference to the NSW EPA website<sup>1</sup>, it is noted that anniversary date for EPL 883 is stated as 30 April. Correspondingly, this report covers the period from **1 May 2020 to 30 April 2021**.

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

- Quarter 1 (Q1): May 2020 to July 2020;
- Quarter 2 (Q2): August 2020 to October 2020;
- Quarter 3 (Q3): November 2020 to January 2021; and
- Quarter 4 (Q4): February 2021 to April 2021.

---

<sup>1</sup> <http://www.epa.nsw.gov.au/prpoeoapp/>

## 1.2. Consultation

As required under Condition 5, consultation with the relevant regulatory bodies (EPA and DPI&E) was performed as part of this odour audit.

### 1.2.1. Environment Protection Authority (EPA)

The EPA was contacted by email on 2 September 2021 and a telephone conversation was held on 9 September 2021. Confirmation of that discussion was received from Amanda Fletcher on 10 September 2021, which is partially reproduced below:

*“I refer to your email on 2 September advising of the upcoming 2020-2021 annual independent odour audit for Shoalhaven Starches (‘the licensee’) and requesting EPA’s comments on any issues that need to be raised in the audit. I also refer to the subsequent conversation on 9 September 2021. As discussed during the conversation, the EPA has the following comments regarding the annual independent odour audit. The EPA understands that some of these comments may be outside of the scope of the audit, however they have still been provided for your consideration.*

*The EPA received an odour complaint on 16 July 2020, and EPA’s investigation did not find conclusive evidence that the odour could be attributed to the licensee. The EPA also received an odour and air quality complaint on 15 October 2020. The EPA’s investigation found that the current licence limits for Total Solid Particles were being met at points 35, 42 and 45.*

*The EPA considers that it would be useful if the annual independent odour audit report includes information around how any actions in response to complaints, faulty control equipment, or underperforming control equipment compare against the specific actions required under the Odour Management Plan or any relevant environmental management plans. This information may help:*

- *the EPA understand to what extent the licensee follows internal procedures;*
- *the licensee to identify opportunities of improved environmental management and performance;*
- *demonstrate that the licensee does not rely on quarterly monitoring, the audit or complaints to identify operating issues; and*
- *the EPA to understand the licensee’s commitment to:*
  - *The proper and efficient operation of the plant and control equipment;*
  - *Undertaking regular and proactive maintenance of the control equipment;*
  - *Regularly monitoring parameters used to evaluate the performance of the control equipment.*

*Other information that may be included in the audit include:*

- *Comparison of monitoring results against historical data. This comparison can be used to identify trends and changes in emission from the on-site sources.*
- *Identification on how the changes in emissions from the on-site sources may affect ground level concentrations and impacts beyond the boundary.”*

The requirements of complaint receipt and investigation outlined in the OMP has been identified and discussed in **Section 3.1.1**. The odour complaints recorded during the audit period are discussed in **Section 3.2**, and a discussion has been added to provide commentary of whether the odour complaint procedure has been followed.

In regard to undertaking regular maintenance and control and also identifying opportunities for overall improvement, in respect to this Independent Odour Audit this would specifically relate to the performance of the biofilters, and this is discussed in the review of the Biofilter Capacity and Condition Assessments (see **Section 3.5**). Other aspects of emission control are more appropriately addressed through the Environmental Audit which is separate to the scope of this targeted odour audit. Where other opportunities for improvement are noted through the odour audit, these are identified as recommendations (see **Section 2.3**).

Regarding the comparison of measured odour data, it is noted that **Section 3.6.3** presents a summary of emission concentrations and emission rates by monitoring period (for this audit year). Further to this, **Section 3.6.4** provides a tabulated summary of measured odour emission rates over the monitoring period to identify the sources with the most significant variability, and this is summarised in **Table 8** and illustrated in **Figure 1**. Additional to this, **Table 10** disaggregates this variability by (i) odour concentration and (ii) volumetric flow rate to provide a further analysis of the cause(s) of any identified variability.

The inter-year variability in measured odour emission rates for all EPA sources is presented in **Table 9**, and is further illustrated in the quarterly and annual odour reports. How this variability relates to off-site impacts is beyond the scope of this odour audit, but a recommendation has been added in **Section 3.7** for a source apportionment assessment to be considered during the next odour modelling study.

In regard to providing a summary of odour controls, a recommendation has been provided in **Section 3.7** for a summary to be provided to NSW EPA at the earliest convenience to provide clarification of implemented odour controls.

#### 1.2.2. Department of Planning, Industry and Environment (DPI&E)

Shaun Williams was contacted by email on 2 September 2021 and provided a response on 6 September 2021, including:

*“Thank you for reaching out to allow the Department to provide input into the Odour Audit*

*From reviewing recently prepared Air Quality Impact Assessment reports for upcoming modification applications, there has been some instances of elevated odour emissions in recent sampling periods. The elevated odour emissions contributors have been identified as follows:*

- Biofilters A and B (odour emissions increased by 358% and 426% respectively compared to Mod 19)
- Ethanol Recovery Scrubber Discharge (odour emissions increased by 25% compared to Mod 19)
- Gluten dryers 3 and 4 and Starch dryer 3 (odour emissions increased by 152%, 120% and 79% respectively compared to Mod 19)

*The Department notes proposed modifications include further biofilters to reduce the performance load on Biofilters A and B.*

*The Department notes operations of the sites pellet plant have also been a source of increased odour emissions over recent years.*

*It would be much appreciated if the audit could take a closer look at these recorded increases in emissions to identify if there are any failures in compliance and any further odour management/mitigation measures required to improve the sites odour emissions performance.”*

As addressed in **Section 1.2.1**, the inter-year variability in measured odour emission rates for all EPA sources is presented in **Table 9**, and is further illustrated in the quarterly and annual odour reports. The variability of emissions from the biofilters and Pellet Plant have been specifically addressed in **Section 3.6.5**.

Audit of compliance is performed as part of the annual independent odour audit, and additionally recommendations have been made historically regarding the odour emissions from Biofilters A & B to comply with the *de facto* emission limit of 500 OU. It is noted that this is not a condition of consent but has been provided as a recommendation.

### 1.3. Site Inspection

As a derogation to the methodology adopted during the independent odour audits performed during previous years, a site inspection was not performed this year due to travel restrictions imposed by NSW Department of Health in response to the SARS-CoV-2 (COVID-19) virus outbreak. This limitation was discussed with Shoalhaven Starches and all evidence was supplied to Gary Graham (Northstar) by John Studdert (Manildra) via email, including a series of photographs.

Reference should be made to **Appendix B** for photographs of the biofilters supplied by Shoalhaven Starches to facilitate this ‘work-around’.

## 2. ODOUR AUDIT REQUIREMENTS

### 2.1. Audit Procedure

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

*The Audit Table must set out the following information for each requirement to be complied with (compliance requirement):*

1. *condition of consent number;*
2. *the exact wording of the compliance requirement;*
3. *a blank column to record the evidence used to assess and determine whether each requirement has been complied with;*
4. *a blank column for commentary on findings and recommendations;*
5. *a blank column for recording the status of compliance, and*
6. *a unique identification non compliance number.*

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

For each **non-compliance**, a unique identification number (UIN) has been assigned as required under the PAR (DPIE, 2020). As this odour audit is against the conditions presented in Schedule 3 of the Consolidated Conditions of Project Approval (MOD 19), each UIN has been labelled as **20/21-NC-n** where *n* is the Condition Number derived from MOD 19 and replicated in the first column of **Table 13**. Reference to UINs in previous odour audit reports will adopt the same nomenclature as previously reported (as sequential numbers rather than condition numbers) to avoid any confusion.

## 2.2. Audit Compliance Status Descriptors

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

**Table 1** Odour audit compliance criteria

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

The following is also noted:

*“The terms partial compliance, partial non-compliance, not verified or administrative non-compliance or other similar terms must not be used.*

*As part of the Audit evaluation, the auditor may make observations, including identifying any opportunities for improvement in relation to any compliance requirement or any other aspect of the project. Any observations or notes are in addition to the compliance status descriptor assigned to each compliance requirement, limited to the descriptors listed in Table 2 (as reproduced in Table 1).*

## 2.3. Audit Recommendations

Where recommendations are noted, these are expressed in **Section 3** and are not replicated in **Section 4** which relates to the compliance with the Consolidated Conditions of Compliance only. These are designated identifiers as **20/21-REC-x** (where x is a sequential letter designator) and do not carry the Condition reference to avoid compliance issues. Recommendations are provided for any observed opportunity for improved odour performance and are not solely related to compliance with the Consolidated Conditions of Project Approval.

## 2.4. Consolidated Odour Conditions and Summary of Compliance

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

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

### 3. ODOUR AUDIT EVIDENCE

#### 3.1. Review of Management Plans

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

- Shoalhaven Starches (2019) Shoalhaven Starches Ethanol Upgrade Odour Management Plan (ref: EN-P-247 1.0.F. 30 August 2019); and
- Shoalhaven Starches (2020) Pollution Incident Response Management Plan (ref: EN-P-248 1.0.J. 23-Jun-2020).

##### 3.1.1. Odour Management Plan

The current version is revision 10.F (Aug 2019).

Subsequent to the last odour audit it is noted that there have been no updates to the Odour Management Plan.

At the request on NSW EPA, the odour complaint procedure presented in the OMP has been reviewed, to facilitate a review of how the reported complaints have been recorder and responded to.

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

1. *The Environmental Complaints Handling procedure must reflect the requirements of Licence No. 883 set out in sections M5 of the licence.*
2. *The Environmental Manager and Site Manager have ownership of the system and have authority and responsibility to ensure that necessary corrective actions are taken.*
3. *Environmental complaints can be received through any of the following avenues:*
  - a. *Environment Protection Authority (EPA)*
  - b. *24 hour a day complaints hotline*
  - c. *Ringling 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 given to the Quality Assurance department and the details entered into the Environmental Complaints section in the Fastrack Document Control system.
- f. A copy of the complaint is forwarded to the Site Manager and relevant Plant Manager as required.
5. Details of complaints received direct from the EPA are sent to the Environmental Manager for investigation and dealt with as per the above procedure.
6. If the complaint is the same as one received directly by the company, then the EPA reference Number is added to the existing complaint (hence so doubling up does not occur).
7. Environmental Complaints are reviewed on an annual basis as part of the company's Annual Environmental Report. This annual review includes comparison with previous years.

### 3.1.2. Pollution Incident Response Management Plan (Updated 2019)

The current version is revision 10.K (Feb 2021).

Subsequent to the last odour audit it is noted that there has been one update of the PIRMP:

- Version 1.0.K: 15/02/21. "Figure 2 updated. Additional spill response detailed in section 11.2.1. Table 7.1 updated."

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; or (ii) indirectly through the EPA.

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

**Table 2 Odour complaints**

Date / Time	Route	Complaint	Description	Action	Complaint Status
20/07/20	EPA	Odour (059)	The complainant has described the odour as an electrical, acrid smell that also smelled similar to a combination of yeast and smoke.	Investigation into the complaint was unable to identify a likely cause. A response was sent to the EPA on 20-7-20. No further complaints received of this nature. No further correspondence received from the EPA.	Closed

Date / Time	Route	Complaint	Description	Action	Complaint Status
				No further action taken.	
20/10/20	EPA	Odour (060)	The complaint is mostly about the strength of the odour coming from Shoalhaven Starches, and is predominantly affected by odour during SE winds, and in the mornings and night. He says the odour varies and can smell like vegemite, methylated spirits, baking cakes, and rotten eggs. He says this has been an ongoing issue for the last 8 years	A detailed response was submitted to the EPA in response to a number of questions relating to changes to the processes. No further correspondence received from the EPA. No further action taken.	Closed
22/10/20	Direct	Odour (061)	Odour comes and goes, and is more pronounced during the mornings	A drive around the Bomaderry area at approximately 2.30pm on the day of the complaint detected a very faint 'DDG' odour downwind of the plant... which could not be detected... near the complainant's location. A review of the factory's odour recovery / treatment systems at the time of the complaint were noted to be operating as normal. No further complaints received of this nature. No further action taken.	Closed
22/03/21	Direct	Odour (063)	Fermenter / yeasty odour	The details of the complaint and odour recovery systems on site were discussed with the complainant. A drive around... on the day of the complaint identified a slight DDG type odour. The wind was noted to be light,	Closed

Date / Time	Route	Complaint	Description	Action	Complaint Status
				from the ESE direction, downwind from the Plant. The site's normal odour recovery / treatment systems at the time of the complaint were noted to be operating as normal. No further complaints received of this nature. No further action taken.	

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

### 3.3. Review of Production Data

As required, a review of the facility's production data at the times of the monitoring has been performed.

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

- Manildra Ethanol Production Volumes 2020-21 (measurements taken between 12 May 2020 and 7 December 2020). It is noted that there is no Q4 sampling data and correspondingly there are no dates against which to document production rates.

Copies of the monitoring reports are presented in **Appendix D** of this report.

The production volumes relevant to the odour monitoring events is presented below in **Table 3**.

**Table 3 Odour monitoring and production rates**

Quarter	Date of Quarterly Odour Sampling	Daily Ethanol Production (L)	Annual Production Rate Equivalent (ML-yr <sup>-1</sup> )
1	12/05/2020	665 565	243
	14/05/2020	590 755	216
	21/05/2020	707 683	258
	4/06/2020	618 966	226
2	5/08/2020	625 062	228
	12/08/2020	679 471	248
	8/10/2020	571 960	209

Quarter	Date of Quarterly Odour Sampling	Daily Ethanol Production (L)	Annual Production Rate Equivalent (ML·yr <sup>-1</sup> )
	28/10/2020	420 764	154
3	18/11/2020	396 159	145
	24/11/2020	519 121	189
	7/12/2020	603 009	220
4	nd	nd	nd
Minimum		396 159	145
Maximum		707 683	258
Mean		581 683	212
Range (Max/Min)		1.79	1.79

Notes: nd – no data

For comparison purposes only, the production rates reported in the 2019-20 independent odour audit report were in the range of 267 461 L·day<sup>-1</sup> (98 ML·y<sup>-1</sup>) to 618 289 L·day<sup>-1</sup> (226 ML·y<sup>-1</sup>) with a mean of 499 241 L·day<sup>-1</sup> (182 ML·y<sup>-1</sup>). The production rates during the testing periods during the 2020-21 period were higher than those in the previous year by a factor of around 17 % as a comparison of the calculated mean values.

### 3.4. Independent Environmental Audit

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

### 3.5. Biofilter Capacity and Condition Assessments

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

- DDG Biofilter Capacity and Condition Assessment #24 – 2 February 2021 (report dated 29 April 2021)

The reports presented in **Appendix C** have 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<sup>3</sup>·hr<sup>-1</sup>. The combined inlet flow is reported as 16 930 m<sup>3</sup>·hr<sup>-1</sup> which is 113% of the design airflow.

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

**Table 4 Biofilter capacity and condition report (#24) – operating parameters**

Date	Position	Airflow (m <sup>3</sup> ·hr <sup>-1</sup> )	RH (%)	Observation	Air Temp (°C)	Surface Temp (°C)	UB Pressure (Pa)
2-Feb-21 (#24)	Main duct	14 120	100%	NR	46.1	NR	193
	DDG bf#2	7 330	100%	saturated	43.9	38.9	63
	Dryer 4 duct	2 810	100%	NR	34.0	NR	323
	DDG bf#1	9 600	100	saturated	44.9	40.6	70

Notes: bf – biofilter  
NR – not reported

**Table 5 Biofilter capacity and condition reports – odour measurements**

Date	BCCA (#)	Inlet (OU)	DDG bf#1 (OU)		DDG bf#2 (OU)		Flow weighted (OU)	Efficiency (%)
			South cell	North cell	South cell	North cell		
2-Feb-21	24	35 700	2 900	1 720	4 870	4 100	3 160	91.2

Notes: BCCA – biofilter capacity and condition assessment

With reference to **Table 5**, flow weighted average odour concentration of 3,160 OU was measured which exceeds the *de facto* standard of 500 OU.

It is additionally noted that the flow-weighted inlet odour concentration of 35,700 OU measured in BCCA #24 is higher than the measured odour concentration of 10,770 reported in BCCA #23 but significantly lower than 173 000 OU reported in BCCA #22.

#### Recommendation 1: 20/21-REC-A

Whilst it is acknowledged that the biofilters are achieving a high degree of odour control, 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 convenience.

### 3.6. Odour Monitoring Results

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

These data are taken from the following reports:

- SEMA (2020) EPL Odour Emission Survey Quarter 1, 2020-2021 (measurements taken on 12, 14, 21 May and 4 June 2020);
- SEMA (2020) EPL Odour Emission Survey Quarter 2 2020-2021 (measurements taken on 5, 12 August 2020 and 8, 28 October 2020); and
- SEMA (2020) EPL Odour Emission Survey Annual & Quarter 3 2020-2021 (measurements taken on 18, 24 November and 7 December 2020).

There has been no odour testing in Quarter 4 2020-2021 due to limited availability of the emissions testing team to attend site. Correspondence to NSW EPA has been provided and there is noted to be no follow up on this matter from the NSW EPA

#### Recommendation 2: 20/21-REC-B

There has been no odour testing in Quarter 4 2020-2021 due to limited availability of the emissions testing team to attend site. It is recommended that the emission testing is recommenced at the earliest opportunity.

#### 3.6.1. Process Conditions during the Monitoring

As detailed in the monitoring reports, the following derogations from the requisite monitoring are noted:

##### SEMA (2020) EPL Odour Emission Survey Quarter 1, 2020-2021

*Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.*

##### SEMA (2020) EPL Odour Emission Survey Quarter 2 2020-2021

*Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.*

*Regarding Gluten Dryer No.2 (EPA ID 9), odour measurements were able to be taken. However, due to structural issues with the roof, resulting in access to the duct no longer being available, flow measurements were unable to be taken. To enable calculation of the MOER, flow measurements have been estimated, based on the Quarter 1, 2019 results. Refer to Table A1, Appendix A for details.*

*One exception is that Gluten Dryer No.1 (EPA ID 8) has had a new silencer and supporting ductwork installed to replace the previous unit. However, the sampling ports have not been re-installed in this new ductwork. Therefore, access to the inside of the duct is no longer available. Thus, exhaust gas flow measurements were unable to be taken.*

*However, odour measurements were taken from the duct outlet to atmosphere. To enable calculation of the Mass Odour Emission Rate (MOER), exhaust gas flow measurements have been based on the most recent previous quarterly monitoring results; that is, Quarter 1, 2020 results.*

Access to the DDG Pellet Plant Stack (EPA 46) was inaccessible, so measurements were taken from the DDG Pellet Cooler East and the DDG Pellet Silo, which have a partial contribution to EPA 46.

SEMA (2020) EPL Odour Emission Survey Annual & Quarter 3 2020-2021

Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.

One exception is that Gluten Dryer No.1 (EPA ID 8) has had a new silencer and supporting ductwork installed to replace the previous unit. However, the sampling ports have not been re-installed in this new ductwork. Therefore, access to the inside of the duct is no longer available. Thus, exhaust gas flow measurements were unable to be taken.

However, odour measurements were taken from the duct outlet to atmosphere. To enable calculation of the Mass Odour Emission Rate (MOER), exhaust gas flow measurements have been based on the most recent previous quarterly monitoring results; that is, Quarter 1, 2020 results.

### 3.6.2. Summary of Measurements – Annual Testing

**Table 6** presents a summary of the annual odour tests over the reporting period, conducted on the effluent storage dams (EPA ID nos 1, 2, 3, 5 & 6) and the sulphur oxidation pond (EPA ID 25).

**Table 6 Summary of annual odour monitoring results**

EPA Ref	Location	Frequency	Q4 and Annual (OU)
19	Effluent Storage Dam 1	Annual	360
20	Effluent Storage Dam 2	Annual	nd
21	Effluent Storage Dam 3	Annual	280
23	Effluent Storage Dam 5	Annual	63
24	Effluent Storage Dam 6	Annual	38
25	Sulphur Oxidation Pond	Annual	63

**Note:** nd no data. SEMA (2020) EPL Odour Emission Survey Annual & Quarter 3 2020-2021 states: "unsafe for sampling".

### 3.6.3. Summary of Measurements – Quarterly Testing

**Table 7** presents a summary of the quarterly monitoring results measured over the reporting period. The table has been presented by source (EPA source ref) and by testing quarter (Q1 to Q3, with the corresponding dates). The data is presented as odour concentrations (OU) and as mass odour emission rates (MOER) ( $\text{OU} \cdot \text{Nm}^3 \cdot \text{s}^{-1}$ ).

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

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

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



**Table 7 Summary of quarterly odour monitoring results**

EPA Ref	Location	Frequency	Q1		Q2		Q3		Q4	
			OU	OU·Nm <sup>3</sup> ·s <sup>-1</sup>	OU	OU·Nm <sup>3</sup> ·s <sup>-1</sup>	OU	OU·Nm <sup>3</sup> ·s <sup>-1</sup>	OU	OU·Nm <sup>3</sup> ·s <sup>-1</sup>
8	No 1 Gluten Dryer	Quarterly	470	7 000	660	9 800	470	7 136	nd	nd
9	No 2 Gluten / Starch Dryer	Quarterly	790	9 500	430	6 000	250	3 362	nd	nd
10	No 3 Gluten Dryer	Quarterly	790	27 800	850	32 000	300	11 540	nd	nd
11	No 4 Gluten Dryer	Quarterly	305	9 000	720	20 000	360	9 768	nd	nd
12	No 1 Starch Dryer	Quarterly	330	3 500	250	3 200	470	6 358	nd	nd
13	No 3 Starch Dryer	Quarterly	360	6 800	400	6 800	120	1 942	nd	nd
14	No 4 Starch Dryer	Quarterly	330	6 300	140	2 500	110	1 848	nd	nd
16	CO <sub>2</sub> Scrubber Outlet	Quarterly	8 000	4 000	17 500	28 800	8 000	10 609	nd	nd
--	CO <sub>2</sub> Scrubber Inlet	Quarterly	8 700	nd	11 300	nd	10 600	nd	nd	nd
35	Combined Stack Boilers No5&6	Quarterly	1 000	30 200	2 000	66 000	2 200	71 745	nd	nd
39	Inlet Pipe Biofilters A&B	Quarterly	18 500	61 200	15 600	49 100	9 500	28 146	nd	nd
39A	Inlet Pipe Biofilters A&B (DDG#4)	Quarterly	14 200	7 200	41 900	13 200	70 400	25 522	nd	nd
40	Outlet of Biofilter A (east)	Quarterly	2 200	2 000	1 200	1 100	1 200	1 054	nd	nd
	Outlet of Biofilter A (west)	Quarterly	2 200	2 000	1 200	1 100	1 200	1 054	nd	nd
41	Outlet of Biofilter B (east)	Quarterly	5 200	5 700	4 000	3 700	1 680	1 615	nd	nd
	Outlet of Biofilter B (west)	Quarterly	5 200	5 700	4 000	3 700	1 680	1 615	nd	nd
42	Boiler 4	Quarterly	1 400	13 000	2 180	26 000	1 700	20 388	nd	nd
44	Fermenters	Quarterly	7 400	1 700	10 300	2 000	7 500	2 804	nd	nd
45	Boiler No2 Outlet	Quarterly	1 420	7 500	1 100	5 800	1 200	4 904	nd	nd
46	DDG Pellet Plant Stack	Quarterly	4 400	88 200	15 000	70 900	2 300	40 442	nd	nd
47	No 5 Starch Dryer	Quarterly	390	20 600	250	13 000	390	19 428	nd	nd

**Note:** (a) nd = no data.  
(b) No data relating to odour volumetric flow rate provided in the relevant reports.

### 3.6.4. Variability of Measurements

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

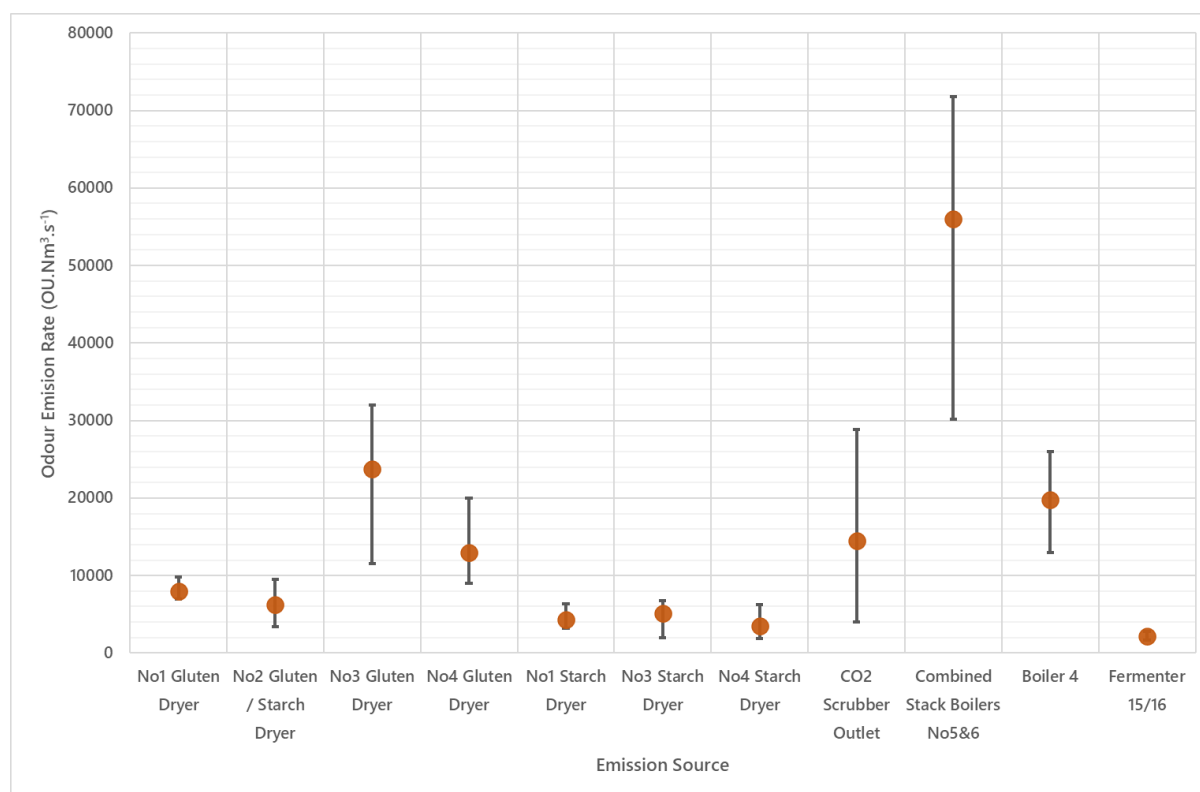
In terms of assessing the odour emission variability, the MOER (as  $\text{OU}\cdot\text{Nm}^3\cdot\text{s}^{-1}$ ) is the critical metric and is the product of the measured odour concentration (OU) and the measured volumetric discharge rate ( $\text{Nm}^3\cdot\text{s}^{-1}$ ). The variability in the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

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

EPA Ref	Location	MOER ( $\text{OU}\cdot\text{Nm}^3\cdot\text{s}^{-1}$ )					
		Count	Min.	Max.	Mean	$\pm\text{STDev}$	Max/Min
8	No 1 Gluten Dryer	3	7 000	9 800	7 979	1 579	1.4
9	No 2 Gluten / Starch Dryer	3	3 362	9 500	6 287	3 079	2.8
10	No 3 Gluten Dryer	3	11 540	32 000	23 780	10 806	2.8
11	No 4 Gluten Dryer	3	9 000	20 000	12 923	6 141	2.2
12	No 1 Starch Dryer	3	3 200	6 358	4 353	1 743	2.0
13	No 3 Starch Dryer	3	1 942	6 800	5 181	2 805	3.5
14	No 4 Starch Dryer	3	1 848	6 300	3 549	2 404	3.4
16	CO <sub>2</sub> Scrubber Outlet	3	4 000	28 800	14 470	12 843	7.2
35	Combined Stack Boilers No5&6	3	30 200	71 745	55 982	22 512	2.4
39	Inlet Pipe to Biofilters A&B	3	28 146	61 200	46 149	16 723	2.2
39A	Inlet Pipe to Biofilters A&B (DDG4)	3	7 200	25 522	15 307	9 341	3.5
42	Boiler 4	3	13 000	26 000	19 796	6 520	2.0
44	Fermenter 15/16	3	1 700	2 804	2 168	571	1.6
45	Boiler No2 Outlet	3	4 904	7 500	6 068	1 319	1.5
46	DDG Pellet Stack	3	40 442	88 200	66 514	24 179	2.2
47	No 5 Starch Dryer	3	13 000	20 600	17 676	4 092	1.6

The variation in odour emission rates, as range (represented by the observed minimum and maximum) and the arithmetic mean are illustrated in **Figure 1**.

**Figure 1 Variation in measured emission rates (range and mean)**



It is noted that for a number of emission points there is a noted variation in the rate of odour emissions (as  $\text{OU.Nm}^3.\text{s}^{-1}$ ). Notably the measured odour emission rates from EPA 16 (CO2 Scrubber Outlet) varies by a factor of  $\times 7.2$  (although the quantum of emissions is relatively low). All of the other variation factors are  $\leq 3.5$ , which is low compared to previous years.

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) 3 times the determined value (as stated in Table 6-1 of SEMA (2020) EPL Odour Emission Survey Annual & Quarter 3 2020-2021).

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

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

EPA Ref	Source	MOER (OU·Nm <sup>3</sup> ·s <sup>-1</sup> )			
		2020-21	2019-20	2018-19	2017-18
8	No1 Gluten Dryer	7 979	6 375	7 152	6,758
9	No2 Gluten / Starch Dryer	6 287	6 225	4 915	4,792
10	No3 Gluten Dryer	23 780	15 675	19 411	14,315
11	No4 Gluten Dryer	12 923	11 600	14 355	9,831
12	No1 Starch Dryer	4 353	3 130	6 068	3,262
13	No3 Starch Dryer	5 181	9 513	5 376	3,504
14	No4 Starch Dryer	3 549	6 285	3 824	4,172
16	CO2 Scrubber Outlet	14 470	19 950	18 171	9,409
35	Combined Stack Boilers No5&6	55 982	52 750	43 831	35,532
39	Inlet Pipe to Biofilters A&B	46 149	56 900	31 757	24,396
39A	Inlet Pipe to Biofilters A&B DDG#4	15 307	8 500	nd	nd
42	Boiler 4	19 796	23 633	18 926	3,453
44	Fermenter 15/16 <sup>(A)</sup>	2 168	3 412	1 303	2,137
45	Boiler No.2 Outlet	6 068	7 167	nd	nd
46	DDG Pellet Plant Stack	66 514	40 167	46 073	47,900
47	No5 Starch Dryer	17 676	21 621	nd	nd
aggregate (OU·Nm <sup>3</sup> ·s <sup>-1</sup> )		308 181	292 902	221 160	169 460
mean ethanol production rate (ML·yr <sup>-1</sup> )		212	182	223	237
odour emission intensity (OU·ML <sup>-1</sup> )		1 452	1 607	993	715

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

The mean ethanol production rates (as ML·year<sup>-1</sup>) have been referenced 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-Q3 testing, expressed as an annualised production volume only, and is not the total measured ethanol production rate. The aggregated MOER has been divided by the annual ethanol production rates to derive a “odour emission intensity” to provide a benchmark of emissions against the production rates. As may be observed, the odour emission intensity is showing a general increasing trend (although it is noted that the 2020-21 odour emission intensity is lower than 2019-20), although 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<sup>3</sup>·s<sup>-1</sup>) expressed as OU·Nm<sup>3</sup>·s<sup>-1</sup>. **Table 10** below presents a breakdown of the two component factors to the MOER, to add some light on whether the odour concentration and/or the volumetric discharge rate is overly influencing the variability in the MOER.

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

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate (Nm <sup>3</sup> ·s <sup>-1</sup> )			
		Max	Mean	Min	Max/Min	Max	Mean	Min	Max/Min
8	No1 Gluten Dryer	660	533	470	1.4	15.18	14.98	14.85	1.0
9	No2 Gluten / Starch Dryer	790	490	250	3.2	13.95	13.14	12.03	1.2
10	No3 Gluten Dryer	850	647	300	2.8	38.47	37.10	35.19	1.1
11	No4 Gluten Dryer	720	462	305	2.4	29.51	28.14	27.13	1.1
12	No1 Starch Dryer	470	350	250	1.9	13.53	12.31	10.61	1.3
13	No3 Starch Dryer	400	293	120	3.3	17.00	16.59	16.18	1.1
14	No4 Starch Dryer	330	193	110	3.0	19.09	17.92	16.80	1.1
16	CO <sub>2</sub> Scrubber Outlet	17 500	11 167	8 000	2.2	1.65	1.16	0.50	3.3
35	Combined Stack Boilers No5&6	2 200	1 733	1 000	2.2	33.00	31.94	30.20	1.1
39	Inlet Pipe to Biofilters A&B	18 500	14 533	9 500	1.9	3.15	3.06	2.96	1.1
39A	Inlet Pipe to Biofilters A&B DDG #4	70 400	42 167	14 200	5.0	0.51	0.39	0.32	1.6
42	Boiler 4	2 180	1 760	1 400	1.6	11.99	11.96	11.93	1.0
44	Fermenter 15/16	10 300	8 400	7 400	1.4	0.37	0.27	0.19	1.9
45	Boiler No.2 Outlet	1 420	1 240	1 100	1.3	2.50	2.14	1.78	1.4
46	DDG Pellet Stack	15 000	7 233	2 300	6.5	17.58	11.16	4.73	3.7
47	No5 Starch Dryer	390	343	250	1.6	52.82	51.55	49.82	1.1

Further to the variability in the MOER from EPA 16 (CO<sub>2</sub> Scrubber Outlet) by a factor of × 7.2 (see **Table 8**), **Table 10** shows that the measured odour concentration is relatively constant (a factor of 2.2) and the measured volumetric discharge rate, with a factor of 3.3 is a more significant driver (relative to the odour concentration).

### 3.6.5. Variability in Measurements from the Biofilters and Pellet Plant

As requested by NSW and DPIE, further analysis of the changing emissions from the biofilters and Pellet Plant has been performed, although it is noted that this does not relate to compliance with the Development Consent conditions.

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

EPA Ref	Source	MOER (OU·Nm <sup>3</sup> ·s <sup>-1</sup> )			
		2020-21	2019-20	2018-19	2017-18
Emission Rates (as OU·Nm <sup>3</sup> ·s <sup>-1</sup> by year)					
EPA source aggregate (OU·Nm <sup>3</sup> ·s <sup>-1</sup> )		308 181	292 902	221 160	169 460
39	Inlet Pipe to Biofilters A&B	46 149	56 900	31 757	24 396
39A	Inlet Pipe to Biofilters A&B DDG#4	15 307	8 500	nd	nd
46	DDG Pellet Stack	66 514	40 167	46 073	47 900
Emission Rates (as % EPA source total, by year)					
39	Inlet Pipe to Biofilters A&B	15%	19%	14%	14%
39A	Inlet Pipe to Biofilters A&B DDG#4	5%	3%	nd	nd
46	DDG Pellet Stack	22%	14%	21%	28%
Emission Rates (as index of minimum MOER I=1)					
39	Inlet Pipe to Biofilters A&B	1.89	2.33	1.30	1.00
39A	Inlet Pipe to Biofilters A&B DDG#4	1.80	1.00	nd	nd
46	DDG Pellet Stack	1.66	1.00	1.15	1.19

The recommendation regarding the performance of the biofilter emissions to achieve the *de facto* odour emission concentration of 500 OU is provided in [Recommendation 1: 20/21-REC-A](#).

### 3.7. Odour Modelling

The GHD odour modelling assessment *Manildra Group – Manildra Modification 21 Air Quality Assessment* (ref: 12548374, dated August 2021) (GHD, 2021) is reproduced in [Appendix E](#).

#### *MOD 21 Modelling - Emissions Inventory*

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

- *Peak odour emission rates were sourced from the odour monitoring conducted by SEMA in the previous four quarters for EPA ID sources. The sources were scaled to an ethanol production rate of 300 ML per year production. The quarter with the maximum measured total OER was selected for use in the assessment and is consistent with guidance in the Approved Methods and the recommendation from EPA (16 February 2017) that peak emissions should be assessed. The peak period was found to be quarter 2, 2020 (August 2020).*
- *The exit velocities and temperatures for EPA ID sources were adjusted to the modelled quarter. These measurements include the mitigation modifications made to No. 3 and No. 4 gluten dryer exhausts as part of the Mod 11 and 12 air quality assessment recommendations.*

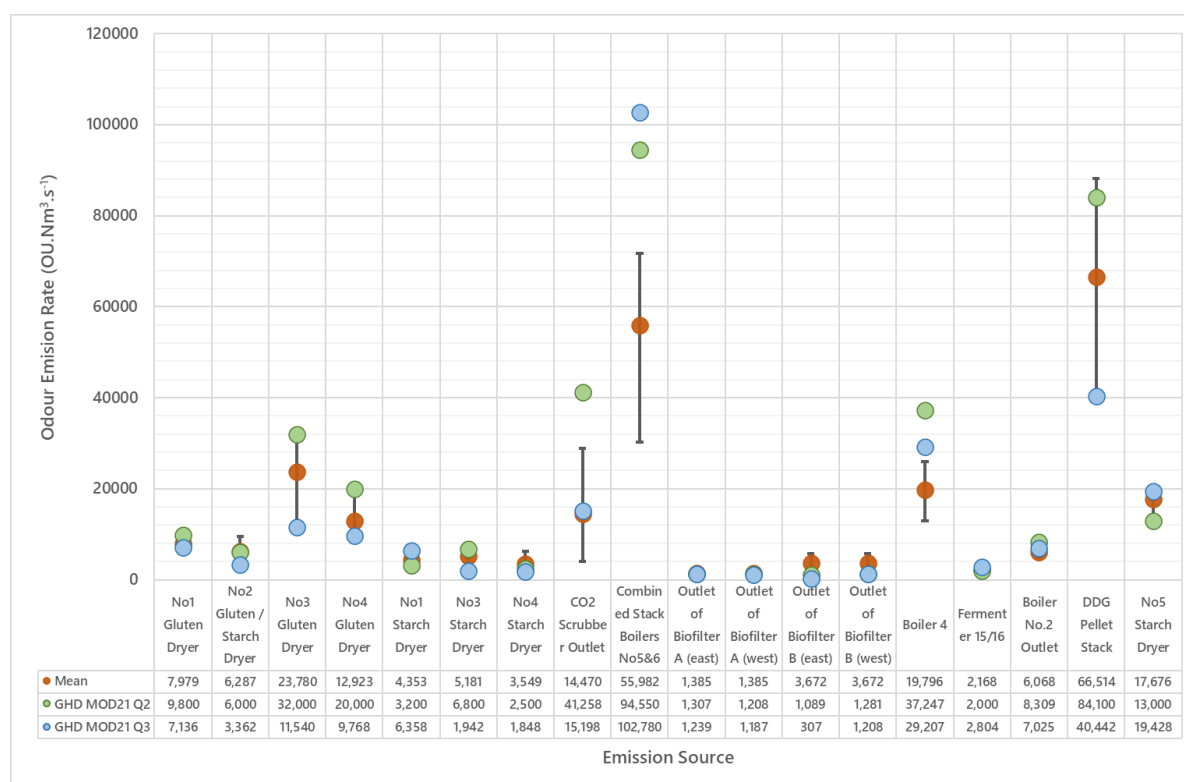
- No. 1 and No. 2 gluten dryers were proposed to be modified to starch dryers as part of 16 assessment. Therefore, the emission rates assigned to these dryers remains unchanged from the Mod 16 assessment as the dryers have not been modified yet.
- Mod 16 assessed the addition of a new gluten dryer (GD8). The emission rates assumed in Mod 16 remain unchanged as the dryer has not been constructed yet.
- Mod 17 assessed the addition of a new product dryer (No. 9) (PD9), which is planned to be installed within the speciality products building. The product dryer will comprise about 20% of the size and production capacity of the approved (but not yet constructed) Gluten Dryer 8. It is envisaged that Product Dryer 9 will be used on an interim basis to process gluten allowing for an incremental increase in processing of gluten until the approved product dryer building is constructed and gluten dryer 8 is operational.
- Once gluten dryer 8 is operational, it is envisaged that product dryer 9 will revert to processing starch. PD9 will not result in any increase in production above the current approval limit for flour processing under Mod 16 of 25,400 tonnes per week.
- For the purposes of odour modelling, as part of Mod 17, PD9 was modelled as processing gluten with odour emission rates conservatively modelled as per gluten dryer 1 (which is of a similar size). The stack from the dryer will rise above and through the roof of the speciality product building at a height of 35.6 m. The diameter of the stack is proposed to be 0.85 m. The flow rates were calculated based on 20% of the proposed gluten dryer 8.
- As part of the Mod 19 proposal, a new distillation plant (with columns and associated processing equipment) is proposed to be installed immediately to the west of the existing Ethanol Distillery Plant. One additional emission source associated with this change is the new Distillation plant Column Washing Vent (CWW2), which is a duplication of the existing source (CWW). The stack height of the new source as provided by Manildra, is 55 metres tall. Stack diameter, exit velocity and temperature were sourced from the sampling report for the similar existing source (Odour Research Laboratories Australia (2020) Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01).
- Cooling tower odours are not included in the Mod 19 emissions inventory based on improvements at the site and subsequently being removed as a EPL odour sampling point
- As part of the current proposal (Mod 21), the following changes were made:
  - Increased indirect cooking facility odour emissions by 50%.
  - Odour concentrations from the upgraded biofilters A and B were estimated based on sampling from quarter 4 of 2017-2018. A biofilter outlet odour concentration of 669.3 OU was adopted. This was the highest measured biofilter outlet value (highest quarterly value for the average of biofilters A and B outlets) in the year before odorous air from DDG4 was diverted to the biofilter.
- Odour emission rates were assumed to be unchanged for the other emission sources.

The odour emissions inventory presents assumptions for a range of sources not covered by this odour audit. However, a simple comparison of the aggregated odour emission rates measured and modelled for sources (EPA ID, 8, 9, 10, 11, 12, 13, 14, 16, 35, 39, 39A, 40(E/W), 41(E/W), 42, 44, 45, 26, 47) shows:

- Measured: 256 837 OU·Nm<sup>-3</sup>·s<sup>-1</sup>
- Modelled (MOD21 Q2): 365 649 OU·Nm<sup>-3</sup>·s<sup>-1</sup> (142 % of measured)
- Modelled (MOD21 Q2): 262 779 OU·Nm<sup>-3</sup>·s<sup>-1</sup> (102 % of measured)

The distribution of the measured and modelled odour emission rates is presented in **Figure 2**.

**Figure 2 Comparison of measured and modelled odour emission rates**





## Mod21 Modelling - Odour Modelling Results

The odour modelling results presented in (GHD, 2020) are presented in table 7-2 on page 35 of that report. These data have been extracted and reproduced below in **Table 12**.

**Table 12 Summary of odour modelling results (99<sup>th</sup> percentile 1-second OU)**

Receptor	Range (m)	To nearest odour source	Dir.	Odour criterion	Odour impact, OU, 99th percentile, nose-response time					
					MOD13	MOD16	MOD17	MOD19	MOD21 Q2	MOD21 Q3
R1 Bomaderry	150	Packing plant	W	6	3.3	3.5	4	4	5	4
R2 North Nowra	1 300	Factory	SW	3	2.5	2.6	3	3	4	3
R3 Nowra	700	Factory	S	5	4	4.6	5	5	6	5
5R4 Terara	1 300	Factory	SE	5	3.7	3.7	4	4	5	4
C1	45	Factory	N	n/a	n/a	10.3	12	12	14	12
C2	20	Factory	N	n/a	n/a	5.8	8	10	10	9
C3	30	Factory	N	n/a	n/a	5.3	7	9	9	8
C4	75	Factory	NW	n/a	n/a	4.4	6	7	8	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7	8	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10	10	9
C7	55	Factory	NW	n/a	n/a	4.8	7	8	9	8

**Note:** Predicted exceedances of the relevant criterion are highlighted

It may be noted that for MOD21 the modelling predicts compliance with stated NSW EPA criteria for both the Q2 and Q3 emission estimation. The isopleth plot for the predicted odour footprints is replicated in **Figure 3** (figure 7.2 (GHD, 2021)).

### Recommendation 3: 20/21-REC-C

It is recommended that a source apportionment study is completed as a component of the next odour modelling performed, to further understand the relationship between emission rates and the relative contribution of sources to aggregated off-site impacts.

### Recommendation 4: 20/21-REC-D

It is recommended that a summary is provided to NSW EPA at the earliest convenience that provides clarification on the respective odour controls implemented across the site.



## 4. ODOUR AUDIT FINDINGS

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

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

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
Offensive Odour				
1	The Applicant shall not cause or permit the emission of offensive odours from the site, as defined under Section 129 of the POEO Act.	<b>Section 3.2</b> provides a summary of the odour complaints, and these are replicated (with redaction) in <b>Appendix F</b> .	The number of odour complaints received in this period is four (4). Three of those odour complaints (#059, #061, #063) have been investigated and are closed. The remaining odour complaint #060 is unspecific and relates to odour impacts over the last 8 years. It is not feasible to investigate the veracity of this complaint given the lack of specificity.	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
Odour Management Plan				

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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 <b>Section 3.1.1.</b>	It has been completed by The Odour Unit, who are a suitably qualified and experienced expert in odour management. It is noted that the OMP has received DPI&E review.	Compliant
	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 <b>Section 3.1.1.</b>	Section 2 and 3 of the OMP adequately addresses odour control.	Compliant
	c) identify triggers for remedial action; and	The OMP is discussed in <b>Section 3.1.1.</b>	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 <b>Section 3.1.1.</b>	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 <b>Appendix A.</b>	The Letter of Endorsement from the Director General is provided in <b>Appendix A.</b>	Compliant
	a) consult with the EPA and the Department	<b>Section 1.2</b> presents a summary of the consultation with the EPA and DP&E.	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;	<b>Section 3</b> 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;	<b>Section 3.3</b> presents a summary of the production data corresponding to the monitoring program dates. <b>Section 3.2</b> 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 <b>Table 3</b> . The number of odour complaints received in this period is four (4). Three of those odour complaints (#059, #061, #063) have been investigated and are closed. The remaining odour complaint #060 is unspecific and relates to odour impacts over the last 8 years. It is not feasible to investigate the veracity of this complaint given the lack of specificity.	Compliant
	d) review the Odour Management Plan for the project;	<b>Section 3.1.1</b> provides a summary of any relevant updates to the OMP.	During this audit period, there are no relevant updates relevant to this odour audit.	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
	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 <b>Sections 3</b> and <b>3.6</b> . The comparison against modelling assessment provided in <b>Section 3.7</b>	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant
	f) determine whether the project is complying with the requirements in this approval; and	Reference should be made to the rest of the document.	Reference should be made to the rest of the document in which specific compliance (or otherwise) is documented.	--
	g) if necessary, recommend and prioritise measures to either improve the odour controls on site and/or the Odour Management Plan, such that receivers would be protected against offensive odour from the site.	<b>Section 5</b> provides a summary of this Independent Odour Audit. <b>Section 5.1</b> provides a summary of non-compliances and <b>Section 5.2</b> provides recommendations.	Recommendations as documented in <b>Section 5.2</b> .	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	--
Odour verification (MP 06_0228 MOD 2)				

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
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 <b>Section 3.6</b> , and attached as <b>Appendix D</b> to this audit report.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-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 <b>Section 3.6</b> , and attached as <b>Appendix D</b> to this audit report.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant
6B	Deleted	None required	--	--
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 <b>Section 3.6</b> , and attached as <b>Appendix D</b> to this audit report.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-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 <b>Section 3.6</b> , and attached as <b>Appendix D</b> to this audit report.	MOD7 relates to the No5 Starch Dryer (as captured in the EPL variation dated June 2018).	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.	Section 3.7 presents a summary of the modelled odour emission rates as presented in the MOD21 air quality assessment report.	<p>The sequential process modifications have been modelled and assessed, up to MOD21, including further odour treatment options.</p> <p>A comparison presented in Section 3.7 shows modelled emissions were in the order of 96% to 138% of the corresponding measured odour emission rates. It is noted that the MOD21 modelling includes a significant number of additional sources not included within the scope of this audit. Overall, it is considered that the modelling represents the site adequately.</p>	Compliant

Condition	Requirement	Evidence	Independent Audit Findings and Recommendations	Compliance Status & UIN
6F	The Applicant shall conduct odour validation monitoring on the gluten dryers 3 and 4, following implementation of the mitigation controls required by Condition 3D. Results of the odour validation monitoring shall be included in the independent odour audit required under Condition 5 of Schedule 3.	The quarterly odour monitoring reports are discussed in <b>Section 3.6</b> , and attached as <b>Appendix D</b> to this audit report.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-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
20/21-NC-5e	Within 3 months of the implementation of the mandatory odour controls (see Appendix 3), and annually thereafter unless the Secretary directs otherwise, the Proponent 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: e. measure all key odour sources on site, and compare the results of these measurements against the predictions in the EA;	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant
20/21-NC-6A(a)	The Proponent 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	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant

UIN	Condition and Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
20/21-NC-6A(b)	The Proponent shall ensure that any Independent Odour Audit submitted to the Secretary in accordance with Condition 5 of this Schedule includes: b. quarterly odour monitoring with samples taken of single vent stack (direct to atmosphere) emissions from a filling fermenter tank	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant
20/21-NC-6C	The Proponent 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.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant
20/21-NC-6F	The Proponent 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.	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021.	Non-compliant

## 5.2. Recommendations

Recommendations from this 2020-21 audit and any remaining unresolved recommendations from the previous audits are summarised in **Table 15**.

**Table 15 Independent odour audit recommendations**

Reference	Recommendation	Implementation
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	Ongoing

Reference	Recommendation	Implementation
	standard. This matter remains an unresolved issue and it is recommended that it is resolved.	
20/21-REC-B	It is noted that the Quarter 4 monitoring has not been performed during the 2020-2021 audit period, due to limited availability of the emissions testing time, as advised by Manildra to EPA by email on 7 May 2021. It is recommended that the testing programme is restarted as soon as practicable.	Ongoing
20/21-REC-C	It is recommended that a source apportionment study is completed as a component of the next odour modelling performed, to further understand the relationship between emission rates and the relative contribution of sources to aggregated off-site impacts.	Ongoing
20/21-REC-D	It is recommended that a summary is provided to NSW EPA at the earliest convenience that provides clarification on the respective odour controls implemented across the site.	Ongoing
<b>2019-20 Odour Audit Recommendations</b>		
2019-20-IOA-A	As identified at <b>Section 3.1</b> and <b>Section 3.6</b> , and as stated in the Biofilter Capacity and Condition Assessment report #23, the biofilters are not achieving the <i>de facto</i> 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing
<b>2018-19 Odour Audit Recommendations</b>		
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 <i>de facto</i> 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing
<b>2017-18 Odour Audit Recommendations</b>		
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 <i>de facto</i> 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing



## Appendix A – Director General’s Letter of Appointment



## Planning & Infrastructure

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

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

Ref: 10/06422-9

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

Dear Mr Studdert

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

#### Independent Environmental Audit – Schedule 4 Condition 4

The Department approves the proposed audit team, including Jon Panic from Edge, Gary Graham from Northstar and Matthew Verth from Resonate Acoustics. In undertaking the audit, Edge must ensure the audit:

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

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

#### Independent Odour Audit – Schedule 3 Condition 5

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

Finally, the Department requests that you:

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

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

Yours sincerely



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

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

### ***Declaration of Independence Form***

<b><i>Project Name:</i></b>	Shoalhaven Starches
<b><i>Consent Number:</i></b>	06_0228
<b><i>Description of Project</i></b>	Shoalhaven Starches Independent Odour Audit (2019-2020)
<b><i>Project Address</i></b>	160 Bolong Road, Bomaderry, NSW 2541
<b><i>Proponent</i></b>	Shoalhaven Starches Pty Ltd
<b><i>Title of Audit</i></b>	Shoalhaven Starches Independent Odour Audit (2019-2020)
<b><i>Date</i></b>	10 September 2021

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 that the 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)

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

## APPENDIX B – BIOFILTER PHOTOGRAPHS



Biofilter A (Shoalhaven Starches, photographed on 23/08/21)



Biofilter A (Shoalhaven Starches, photographed on 23/08/21)



## APPENDIX C – DDG BIOFILTER & CAPACITY & CONDITION ASSESSMENT REPORTS





**TO: JOHN STUDDERT**  
**COMPANY: MANILDRA GROUP, SHOALHAVEN STARCHES**  
**FROM: TERRY SCHULZ & MICHAEL ASSAL**  
**DATE: 29 APRIL 2021**  
**SUBJECT: DDG BIOFILTER PERFORMANCE AND CONDITION ASSESSMENT 24 – 2 FEBRUARY 2021**

### 1. Introduction

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

The assessments are currently carried out on a half-yearly basis. The following report covers the findings of Biofilter Assessment 24, undertaken on 2 February 2021 by TOU.

### 2. Biofilter Design – DDG Biofilters 1 & 2

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

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

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

### 3. Assessment Methodology

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

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

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

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

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

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

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

<b>Airflow:</b>	13.87 m/s, 14,120 m <sup>3</sup> /hr ( $\phi$ = 600 mm)
<b>Inlet air relative humidity:</b>	100%
<b>Inlet air temperature:</b>	46.1°C
<b>Inlet air pressure:</b>	+193 Pa

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

<b>Airflow:</b>	7.2 m/s, 7,330 m <sup>3</sup> /hr ( $\phi$ = 600 mm)
<b>Inlet air relative humidity:</b>	100%
<b>Inlet air temperature:</b>	43.9°C
<b>Inlet air pressure:</b>	+63 Pa (+60 Pa Cell 1, +66 Pa Cell 2)
<b>Biofilter outlet air humidity:</b>	saturated
<b>Biofilter surface air temperature:</b>	38.9°C (mean)
<b>Duct pressure in header manifold:</b>	+149 Pa
<b>Biofilter under-bed drain pressure:</b>	+18 Pa Cell 1, +37 Pa Cell 2

The new **Dryer #4 Duct** measurements yielded the following results in this assessment:

<b>Airflow:</b>	11.05 m/s, 2,810 m <sup>3</sup> /hr ( $\phi$ = 300 mm)
<b>Inlet air relative humidity:</b>	100%
<b>Inlet air temperature:</b>	34.0°C
<b>Inlet air pressure:</b>	+323 Pa

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

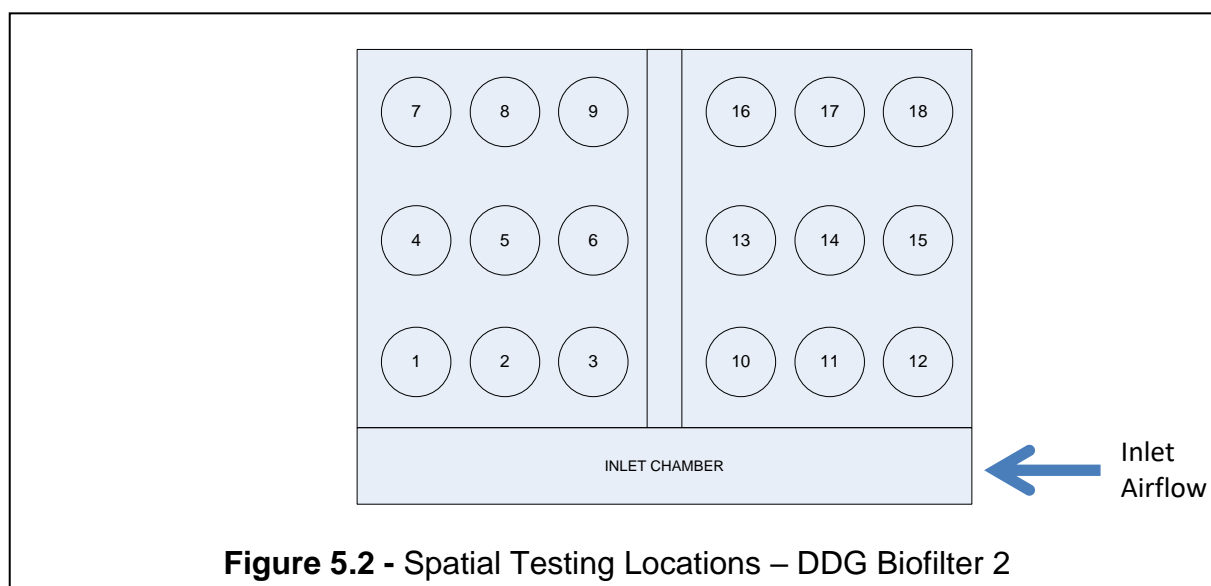
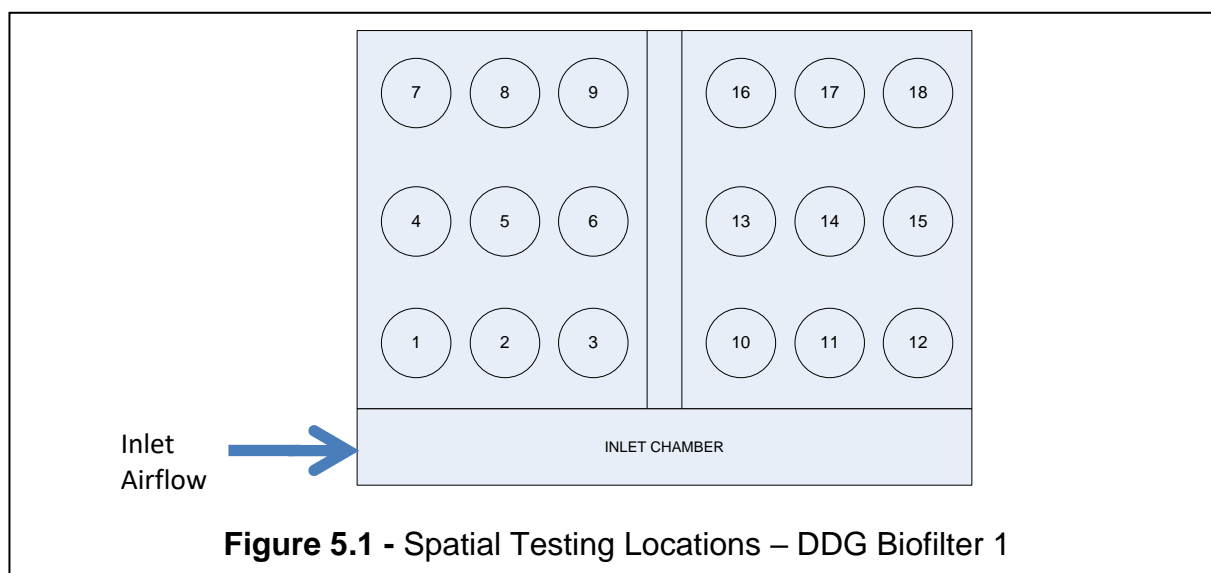
<b>Airflow:</b>	9,600 m <sup>3</sup> /hr
<b>Inlet air relative humidity:</b>	100%
<b>Inlet air temperature:</b>	44.9°C
<b>Inlet air pressure:</b>	+70 Pa
<b>Biofilter outlet air humidity:</b>	saturated
<b>Biofilter surface air temperature:</b>	40.6°C (mean)

**The combined total flow to the biofilters is 16,930 m<sup>3</sup>/hr**

The distribution of airflow to the two biofilters is relatively even. It is noted that the common inlet airflow marginally exceeds the design specification of 15,000 m<sup>3</sup>/hr.

## 5. Spatial Testing Results

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

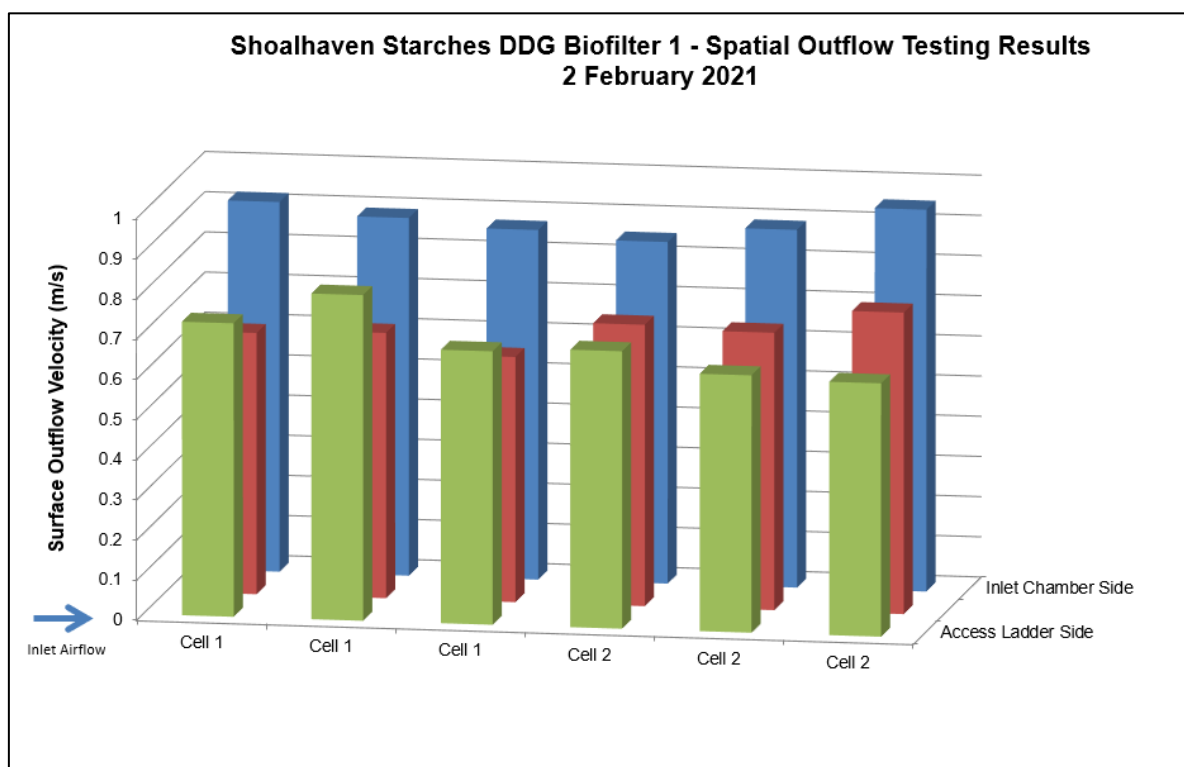


**Table 5.1 – Spatial airflow results: DDG Biofilter 1: 2 February 2021**

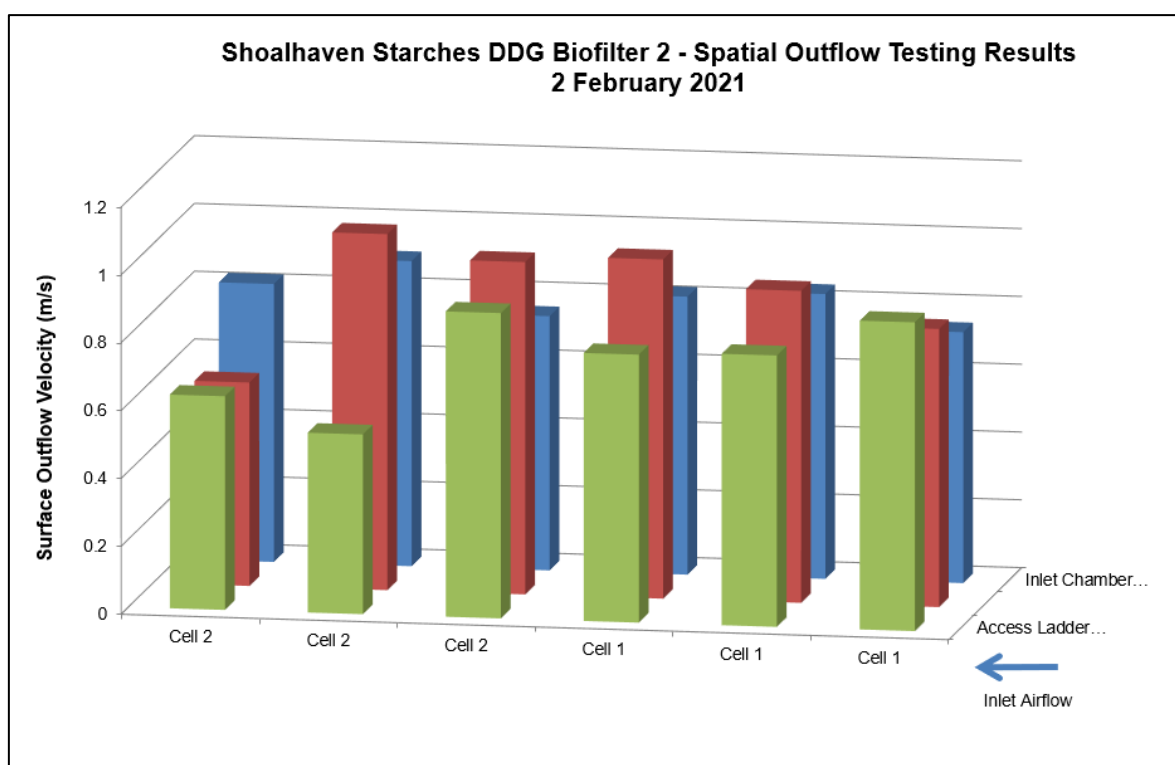
Biofilter Cell	Location ID	Outflow Velocity (m/s)	Mean Outlet Temperature (°C)
<b>Cell 1 (Northern Cell)</b>	Location 1	0.92	Refer to <b>Section 4</b>
	Location 2	0.89	
	Location 3	0.87	
	Location 4	0.65	
	Location 5	0.66	
	Location 6	0.61	
	Location 7	0.73	
	Location 8	0.81	
	Location 9	0.68	
<b>Cell 2 (Southern Cell)</b>	Location 10	0.85	
	Location 11	0.89	
	Location 12	0.95	
	Location 13	0.70	
	Location 14	0.69	
	Location 15	0.75	
	Location 16	0.69	
	Location 17	0.64	
	Location 18	0.63	

**Table 5.2 – Spatial airflow results: DDG Biofilter 2: 2 February 2021**

Biofilter Cell	Location ID	Outflow Velocity (m/s)	Mean Outlet Temperature (°C)
<b>Cell 1 (Southern Cell)</b>	Location 1	0.82	Refer to <b>Section 4</b>
	Location 2	0.90	
	Location 3	0.75	
	Location 4	0.60	
	Location 5	1.05	
	Location 6	0.98	
	Location 7	0.63	
	Location 8	0.53	
	Location 9	0.90	
<b>Cell 2 (Northern Cell)</b>	Location 10	0.82	
	Location 11	0.84	
	Location 12	0.74	
	Location 13	1.00	
	Location 14	0.92	
	Location 15	0.82	
	Location 16	0.79	
	Location 17	0.80	
	Location 18	0.91	



**Figure 5.3 – Biofilter 1: Spatial Outflow Testing Results on 2 February 2021**



**Figure 5.4 – Biofilter 2: Spatial Outflow Testing Results on 2 February 2021**

## 6. Odour Destruction Efficiency Results

As with previous assessments, odour samples were collected from the DDG biofilters' common inlet duct, and outlet samples from the surface of each cell from both Biofilters

1 & 2. A further sample was collected from the Dryer #4 duct. Each surface sample was a composite, prepared from three locations across the biofilter beds. One biofilter inlet sample was collected and tested on this occasion. The results of the odour testing of these samples are appended to this report, and are summarised as follows:

<b>Common Biofilter Inlet:</b>	35,700 ou (nutty, sour, oil)
<b>Dryer #4 Duct:</b>	35,700 ou (nutty, sour, oil)
<b>Flow Weighted Inlet to biofilters:</b>	35,700 ou
<b>Biofilter 2 Cell 2 Outlet – Southern Cell:</b>	4,100 ou (nutty, oil)
<b>Biofilter 2 Cell 1 Outlet – Northern Cell:</b>	4,870 ou (nutty, oil)
<b>Biofilter 1 Cell 2 Outlet – Southern Cell:</b>	2,900 ou (fermented, sour, oil)
<b>Biofilter 1 Cell 1 Outlet – Northern Cell:</b>	1,720 ou (fermented, sour, oil)
<b>Mean Result:</b>	3,160 ou
<b>Mean Odour Destruction Efficiency:</b>	91.2%

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

## **7. Trend Data Analyses**

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

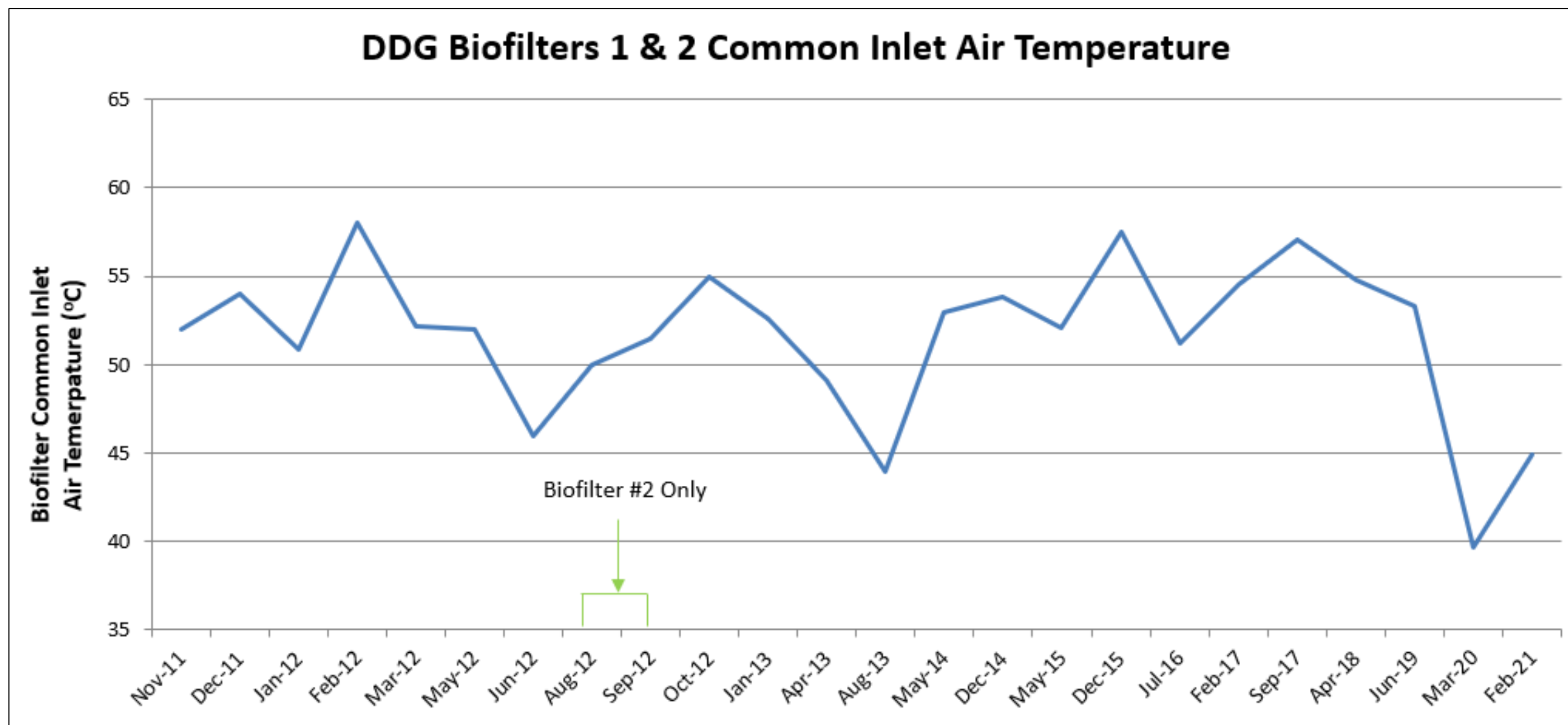
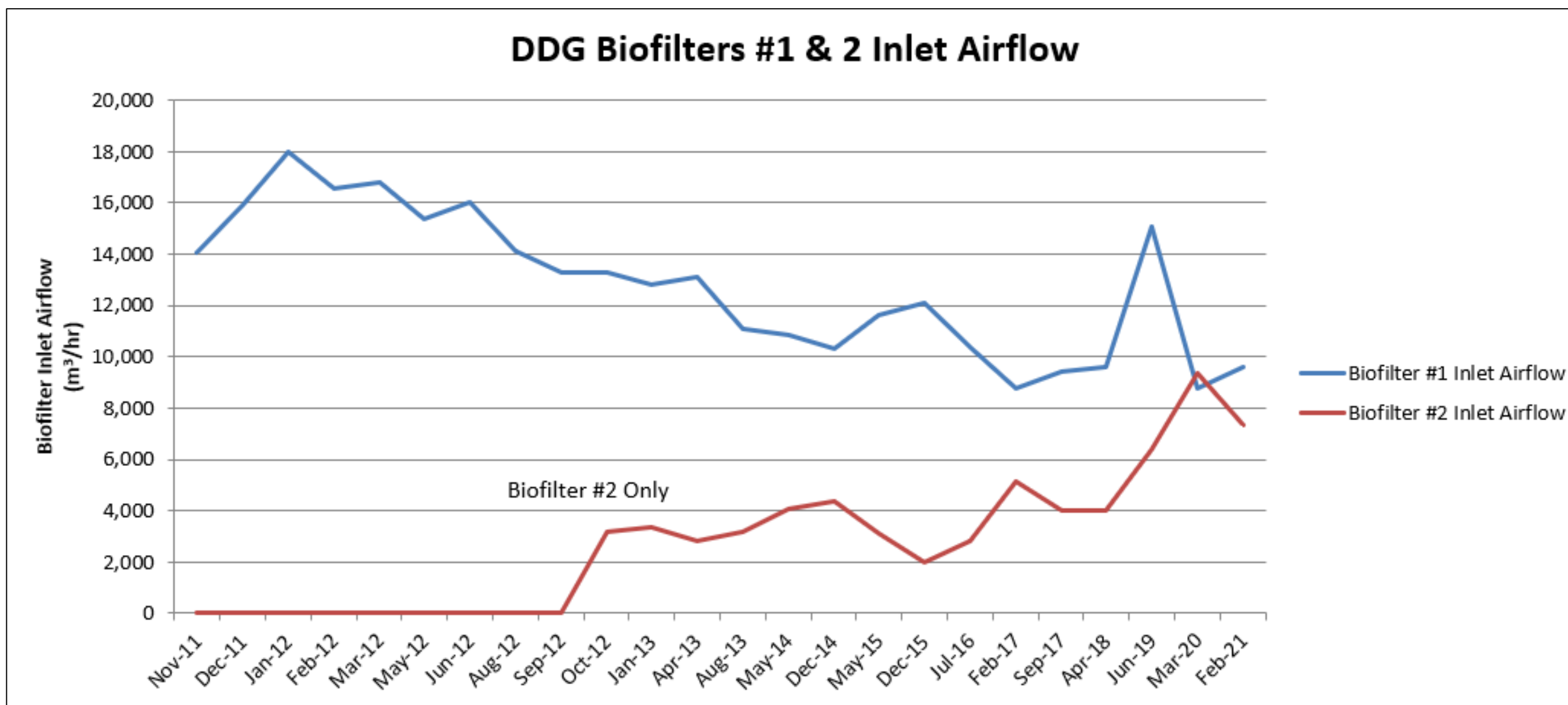


Figure 7.1 – DDG Biofilters 1 & 2 Common Inlet Air Temperature Monitoring



**Figure 7.2 – DDG Biofilters 1 & 2 Inlet Airflows**



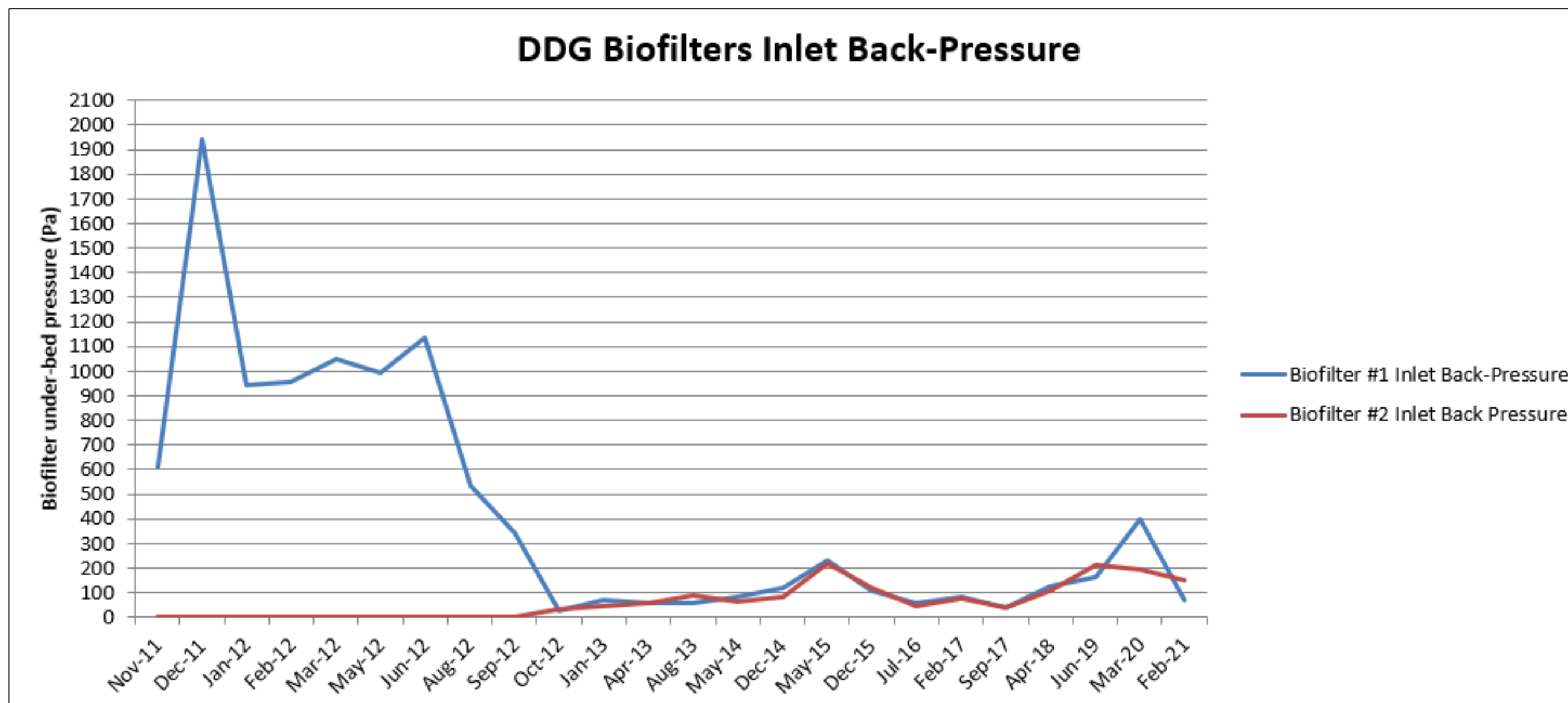


Figure 7.3 – DDG Biofilters 1 & 2 Inlet Back-Pressures

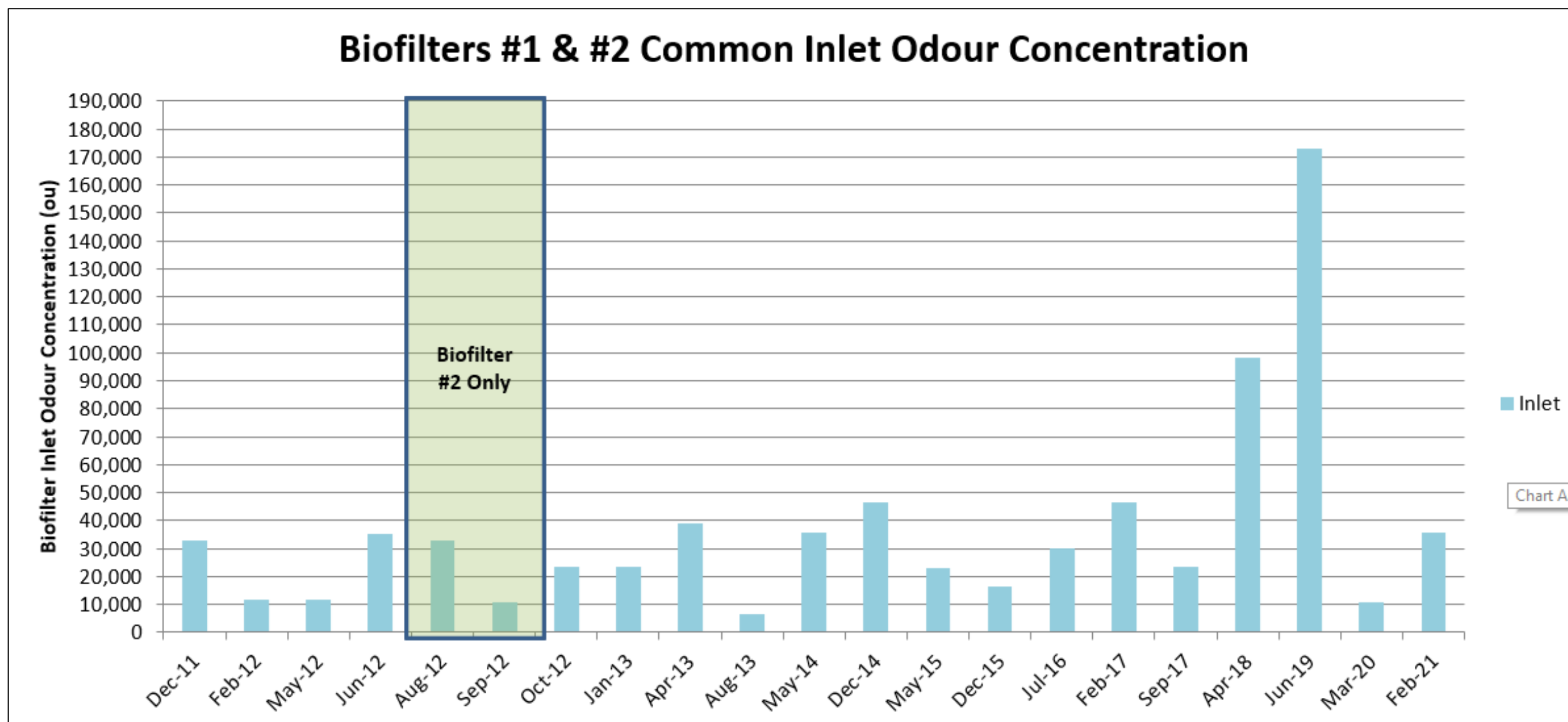


Figure 7.4 – DDG Biofilters 1 & 2 Common Odour Inlet Concentration

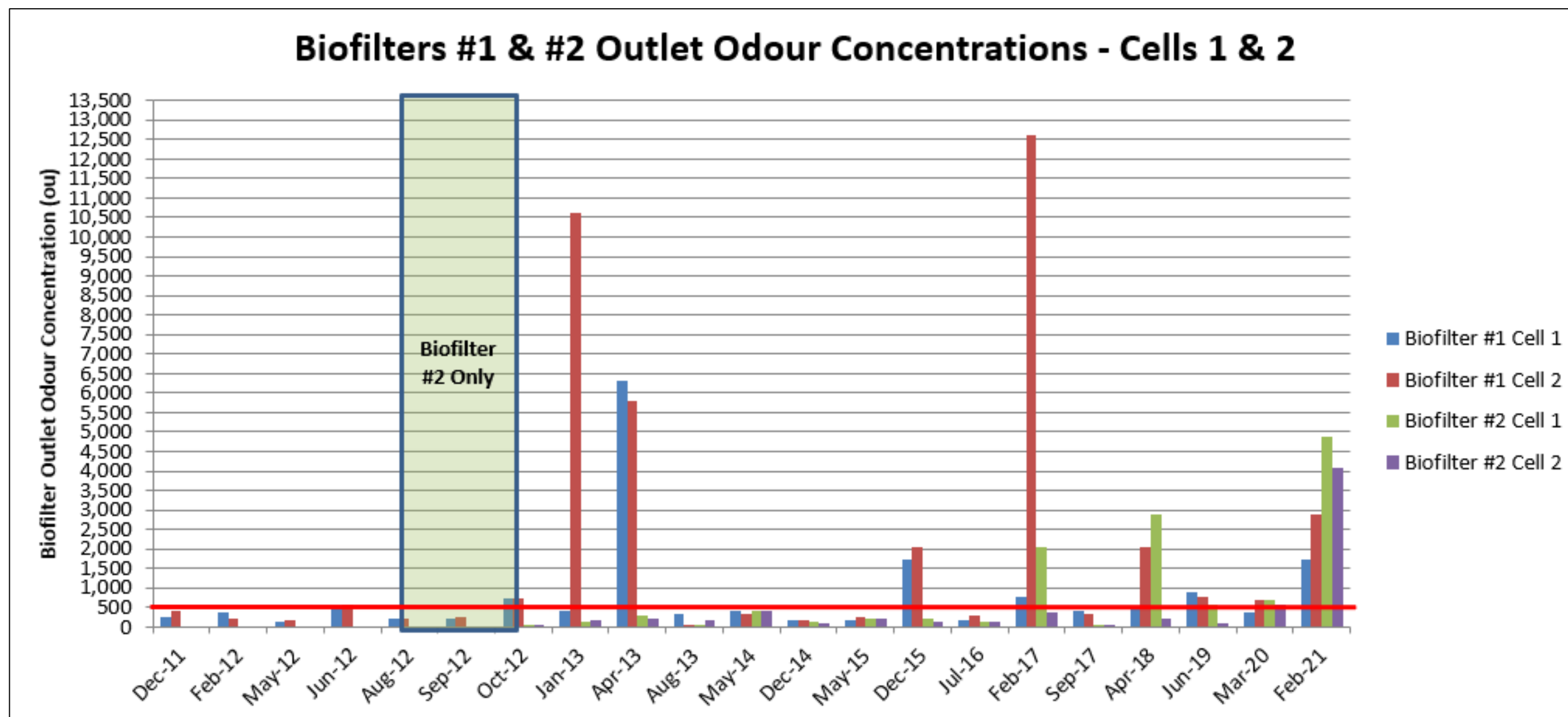


Figure 7.5 – DDG Biofilters 1 & 2 Odour Outlet Concentrations

## **8. Visual and Olfactory Assessment**

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

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

The odour emitted from the DDG biofilter system still contained residual inlet odour, although at a greatly reduced intensity. This odour was detectable within 20 metres of the biofilters but not beyond the plant boundary. This issue is discussed below.

It is understood that the medium age of Biofilter 1 is over 18 months old, with Biofilter 2 refurbished in late-October 2020.

## **9. Biofilter Drainage**

The drainage flows from the biofilter appeared normal.

## **10. Discussion and Recommendations**

The following comments are made based on the assessment results:

- The airflow to the biofilter system has maintained the historical airflow rate. The distribution of airflow between the two biofilters is still relatively even (43%/57%, now in favour of Biofilter 1) and within the historical range. This balance is expected and acceptable from both a performance and medium life perspective;
- The mean flow-weighted outlet odour concentration of 3,160 ou significantly exceeded the nominal 500 ou target concentration. The presence of residual DDG odour character in the treated samples indicates that full odour removal is not occurring. The fact that all four biofilter cells exceeded the target concentration suggests that the loading rate on the system may now be excessive for the current configuration, rather than a specific problem with one or more cells. Follow-up testing is desirable to confirm whether this effect is ongoing;
- Notwithstanding the above comment, the inlet odour concentration was typical of the pre-April 2018 levels and lower than the 2018 and 2019 results;
- The temperature of the inlet air has slightly decreased but lies below the historical mean for this parameter. This biofilter system has shown itself to be resilient to elevated and variable temperatures. These minor variations are likely due to changes in operating conditions, and are normal for this biofilter system;
- Biofilter back-pressures and spatial outflow distribution results are within the normal range and are acceptable; and

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

## **11. Concluding Remarks**

In summary, the reason for the decrease in odour removal performance for this biofilter system is unclear and may be a simple aberration. However, if follow-up testing confirms this level of performance the capacity of the biofilters may need to be increased and/or refurbished.

The next assessment is scheduled for **August 2021**. An earlier assessment is recommended.

The Odour Unit Pty Ltd

Signed by:



Terry Schulz B.Eng, CAQP  
Managing Director



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

## **Attachment:**

- Odour Concentration Laboratory Results: 2 February 2021

# THE ODOUR UNIT PTY LTD



THE ODOUR  
UNIT

Level 3 Suite 12  
56 Church Avenue  
MASCOT NSW 2020

Phone: +61 2 9209 4420  
Email: [info@odourunit.com.au](mailto:info@odourunit.com.au)  
Internet: [www.odourunit.com.au](http://www.odourunit.com.au)  
ABN: 53 091 163 061



Accreditation Number:  
14974

## Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	Manildra Group	Telephone	(02) 4423 8200
Contact	J. Studdert	Facsimile	(02) 4423 8331
Sampling Site	Bomaderry, NSW	Email	<a href="mailto:john.studdert@manildra.com.au">john.studdert@manildra.com.au</a>
Sampling Method	Drum & Pump	Sampling Team	TOU

Order details:

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

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – Part 3: 'Determination of odour concentration by dynamic olfactometry' (AS/NZS4323.3:2001). 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 $22^\circ\text{C} \pm 3^\circ\text{C}$ .
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT V01.
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the AS/NZS4323.3:2001. ODORMAT V01: $r = 0.280$ (October 2019) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the AS/NZS4323.3:2001. ODORMAT V01: $A = 0.076$ (October 2019) 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 measurements have been performed using standards for which the traceability to the national standard has been demonstrated. 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.

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

Date: Tuesday, 16 February 2021

Panel Roster Number: SYD20210203\_009

**A. Schulz**  
NSW Laboratory Coordinator

**Odour Sample Measurement Results**  
**Panel Roster Number: SYD20210203\_009**

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate (ou.m <sup>3</sup> /m <sup>2</sup> /s) (See Note:1)
Sample #1 -- Biofilter 1 Cell 1	SC21045	02.02.2021 1144 hrs	03.02.2021 1007 hrs	4	8	--	--	1,720	1,720	--
Sample #2 -- Biofilter 1 Cell 2	SC21046	02.02.2021 1148 hrs	03.02.2021 1036 hrs	4	8	--	--	2,900	2,900	--
Sample #3 -- Biofilter 2 Cell 1	SC21047	02.02.2021 1156 hrs	03.02.2021 1105 hrs	4	8	--	--	4,870	4,870	--
Sample #4 -- Biofilter 2 Cell 2	SC21048	02.02.2021 1201 hrs	03.02.2021 1134 hrs	4	8	--	--	4,100	4,100	--
Sample #5 -- Dryer Duct 4 (new)	SC21049	02.02.2021 1222 hrs	03.02.2021 1255 hrs	4	8	--	--	35,700	35,700	--
Sample #6 -- Biofilter Common Inlet	SC21050	02.02.2021 1219 hrs	03.02.2021 1328 hrs	4	8	--	--	35,700	35,700	--

**Samples Received in Laboratory** – From: TOU      Date: 03.02.2021      Time: 0900 hrs

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

1. The collection of Isolation Flux Hood (**IFH**) samples and the calculation of the Specific Odour Emission Rate (**SOER**).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd have performed the dilution of samples.

## 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/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20210203_009	51,400	$20 \leq \chi \leq 80$	861	60	Yes

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

SC21045 sour, fermented, oil  
 SC21046 sour, fermented, oil  
 SC21047 nutty, oil  
 SC21048 nutty, oil  
 SC21049 sour, nutty oil  
 SC21050 sour, nutty oil

Disclaimers

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

END OF DOCUMENT



## APPENDIX D – ANNUAL AND QUARTERLY ODOUR EMISSION SURVEYS



**Stephenson**

Environmental Management Australia

---

---

**EPL ODOUR EMISSION SURVEY QUARTER 1, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT No.: 7065/S25548/20**

**DATES OF SURVEY: 12, 14, 21 MAY AND 4 JUNE, 2020**

**DATE OF ISSUE: 21 JULY, 2020**

---



**Stephenson**

**Environmental Management Australia**

Peter W Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144  
Tel: (02) 9737 9991

E-Mail: [info@stephensonenv.com.au](mailto:info@stephensonenv.com.au)

---

**EPL ODOUR EMISSION SURVEY QUARTER 1, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT NO.: 7065/S25548/20**

**DATES OF SURVEY: 12, 14, 21 MAY AND 4 JUNE, 2020**

**DATE OF ISSUE: 21 JULY, 2020**

---

**P W STEPHENSON**

**J WEBER**

**M KIMBER**

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2</b>	<b>MONITORING REQUIREMENTS .....</b>	<b>4</b>
2.1	ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015) .....	4
2.1.1	CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS .....	4
2.1.2	CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS .....	5
<b>3</b>	<b>PRODUCTION CONDITIONS .....</b>	<b>7</b>
<b>4</b>	<b>ODOUR EMISSION TEST RESULTS .....</b>	<b>8</b>
<b>5</b>	<b>CONCLUSIONS .....</b>	<b>10</b>
<b>6</b>	<b>TEST METHODS .....</b>	<b>21</b>
6.1	ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY .....	21
6.1.1	ODOUR PANEL SELECTION .....	22
6.1.2	ODOUR TERMINOLOGY .....	22
6.2	EXHAUST GAS VELOCITY .....	22
6.3	EXHAUST GAS TEMPERATURE .....	23
6.4	OXYGEN (O <sub>2</sub> ) .....	23
6.5	MOISTURE .....	23
6.6	ACCURACY .....	23
<b>APPENDIX A – EMISSION TEST RESULTS .....</b>		<b>1</b>
<b>APPENDIX B – CERTIFICATES OF ANALYSIS .....</b>		<b>1</b>
<b>APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION .....</b>		<b>1</b>
<b>APPENDIX D – SAMPLE LOCATIONS .....</b>		<b>1</b>

## TABLE OF TABLES

TABLE 2-1	LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS .....	4
TABLE 2-2	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47) .....	5
TABLE 2-3	SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25) .....	5
TABLE 2-4	SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46) .....	5
TABLE 2-5	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45) .....	6
TABLE 4-1	EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, Q1, 2020-2021 .....	8
TABLE 4-2	EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, Q1, 2020-2021 .....	9
TABLE 6-1	ESTIMATION OF MEASUREMENT UNCERTAINTY .....	23

## TABLE OF FIGURES

FIGURE 5-1	ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS NO.1, 2, 3 & 4 (EPA 8,9,10,11) .....	11
FIGURE 5-2	ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13, 14) .....	12
FIGURE 5-3	ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47) .....	12
FIGURE 5-4	ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44) .....	14
FIGURE 5-5	ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16) .....	15
FIGURE 5-6	ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK (EPA 35) .....	16
FIGURE 5-7	ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42) .....	17
FIGURE 5-8	ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45) .....	18

FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41) .....	19
FIGURE 5-10 CONCENTRATION DDG PELLET PLANT STACK (EPA 46).....	20

### TABLE OF TABLES – APPENDICES

TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4 .....	II
TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5 .....	III
TABLE A-3 EMISSION TEST RESULTS – BOILERS NO. 5&6, 4 & 2.....	IV
TABLE A-4 EMISSION TEST RESULTS – FERMENTER 13 & CO <sub>2</sub> SCRUBBER OUTLET.....	V
TABLE A-5 EMISSION TEST RESULTS – DDG PELLET PLANT STACK & COMBINED INLET TO BIOFILTERS A & B ....	VI
TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS .....	VII
TABLE C-1 INSTRUMENT CALIBRATION DETAILS DAY 1 .....	II
TABLE C-2 INSTRUMENT CALIBRATION DETAILS DAY 2 .....	III

### TABLE OF FIGURES – APPENDICES

FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	II
FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION .....	III
FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC.....	IV
FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT .....	V
FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	VI
FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION .....	VII
FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	VIII
FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION .....	IX
FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	X
FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION .....	XI
FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	XII
FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION .....	XIII
FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	XIV
FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION .....	XV
FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC .....	XVI
FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION .....	XVII
FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC .....	XVIII
FIGURE D-18 FERMENTERS – SAMPLE LOCATION .....	XIX
FIGURE D-19 CO <sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC .....	XX
FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC .....	XXI
FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION .....	XXII
FIGURE D-22 BOILER NO. 4– SAMPLE LOCATION SCHEMATIC .....	XXIII
FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION.....	XXIV
FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC .....	XXV
FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC.....	XXVI
FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION .....	XXVII
FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION .....	XXVII
FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC.....	XXVIII
FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH.....	XXIX

## 1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Shoalhaven Starches Pty Limited to conduct an odour emission survey at their manufacturing complex in Bomaderry, New South Wales (NSW).

The objective of the survey is to comply with Condition M2.1 of the Environment Protection Licence (EPL) No. 883 issued by the Environment Protection Authority (EPA). The EPA is now part of the Office of Environment and Heritage (OEH).

Section 2 of this report outlines Conditions P1 and M2 which identify the potential point and diffuse odour sources and the sampling and analysis methods respectively required by the OEH. This survey monitored the quarterly odour concentrations as required in section M2.2 of EPL 883.

In addition, the Carbon Dioxide (CO<sub>2</sub>) Scrubber Inlet sampling point, which currently is not listed in EPL 883 and therefore does not have EPA Identification No., was also sampled.

The quarters are defined as below:

- Quarter 1 May to July inclusive
- Quarter 2 August to October inclusive
- Quarter 3 November to January inclusive
- Quarter 4 February to April inclusive

The Quarter 1, 2020-2021 odour test results are presented in this report. The tests were conducted on 12<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> May and 4<sup>th</sup> June, 2020.

## 2 MONITORING REQUIREMENTS

### 2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015)

#### 2.1.1 CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS

Table 2-1 identifies the point and diffuse sources as defined by the OEHL that relate to this survey as per most recent version of EPL No. 883 dated 20 June 2018.

**TABLE 2-1 LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS**

EPL ID. No.	Location	Odour Samples TM OM-7/8	Frequency as per M2.2 EPL 883
8	No. 1 Gluten Dryer	1	Quarterly
9	No. 2 Gluten/Starch Dryer*	1	Quarterly
10	No. 3 Gluten Dryer	1	Quarterly
11	No. 4 Gluten Dryer	1	Quarterly
12	No. 1 Starch Dryer	1	Quarterly
13	No. 3 Starch Dryer	1	Quarterly
14	No. 4 Starch Dryer	1	Quarterly
16	CO <sub>2</sub> Scrubber outlet	1	Quarterly
Not specified	CO <sub>2</sub> Scrubber inlet	1	--
19	Effluent Storage Dam 1	1	Yearly
20	Effluent Storage Dam 2	1	Yearly
21	Effluent Storage Dam 3	1	Yearly
23	Effluent Storage Dam 5	1	Yearly
24	Effluent Storage Dam 6	1	Yearly
25	Sulphur Oxidisation Pond	1	Yearly
35	Combined Stack Boilers No.5 & 6	1	Quarterly
39	Inlet Pipe to Biofilters A & B	1	Quarterly
39A	Inlet Pipe to Biofilters A & B	1	Quarterly
40	Outlet of Biofilter A	2	Quarterly
41	Outlet of Biofilter B	2	Quarterly
42	Boiler No.4	1	Quarterly
44	Fermenter	1	Quarterly
45	Boiler No.2	1	Quarterly
46	DDG Pellet Plant Stack	1	Quarterly
47	No. 5 Starch Dryer	1	Quarterly

## 2.1.2 CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS

Condition M2.1 states: *For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency specified in the opposite columns.*

Key to Tables 2.2 to 2.5:

%	=	percent
°C	=	degrees Celsius
g/g.mole	=	grams per gram mole
kg/m <sup>3</sup>	=	kilograms per cubic metre
m/s	=	metres per second
m <sup>3</sup> /s	=	cubic metres per second
mg/m <sup>3</sup>	=	milligrams per cubic metre
OM	=	Other Method
ou	=	odour units
TM	=	Test Method

**TABLE 2-2 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47)**

Pollutant	Units	Frequency	Approved Method
Dry Gas Density	kg/m <sup>3</sup>	Quarterly	TM-23
Flow	m <sup>3</sup> /s	Quarterly	TM-2
Moisture	%	Quarterly	TM-22
Molecular Weight of stack gases	g/g-mole	Quarterly	TM-23
Odour	ou	Quarterly	OM-7
Oxygen	%	Quarterly	TM-25
Temperature	°C	Quarterly	TM-2
Velocity	m/s	Quarterly	TM-2

**TABLE 2-3 SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Annual	OM-7

**TABLE 2-4 SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Quarterly	OM-7



**TABLE 2-5 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45)**

<b>Pollutant</b>	<b>Units</b>	<b>Frequency</b>	<b>Approved Method</b>
Cadmium	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Mercury	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Moisture	%	Quarterly	TM-22
Molecular weight of stack gases	g/g.mole	Quarterly	TM-23
Nitrogen Oxides	mg/m <sup>3</sup>	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m <sup>3</sup>	Annual	TM-4
Temperature	°C	Quarterly	TM-2
Total Solid Particles	mg/m <sup>3</sup>	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m <sup>3</sup>	Quarterly	TM-34
Volumetric Flowrate	m <sup>3</sup> /s	Quarterly	TM-2

### **3 PRODUCTION CONDITIONS**

Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.

## 4 ODOUR EMISSION TEST RESULTS

SEMA performed the sampling and the odour analysis was performed by Odour Research Laboratories Australia (ORLA). SEMA and ORLA are both NATA accredited (No.15043) facilities to ISO 17025 for this.

The NATA accredited ORLA Olfactometry Test Report 7065/ORLA/01 is presented in Appendix B. Exhaust gas flow and emission tests results from point sources are detailed in Tables A-1 to A-6, Appendix A. Appendix C details calibration of instruments used to take measurements. Appendix D shows sample locations.

Tables 4-1 and 4-2 summarise the odour emission concentrations for all point and diffuse sources respectively.

**TABLE 4-1 EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, Q1, 2020-2021**

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	14.05.2020	470
9	No.2 Gluten Dryer	04.06.2020	790
10	No.3 Gluten Dryer	14.05.2020	790
11	No.4 Gluten Dryer	04.06.2020	305
12	No.1 Starch Dryer	14.05.2020	330
13	No.3 Starch Dryer	12.05.2020	360
14	No.4 Starch Dryer	12.05.2020	330
16	Carbon Dioxide Scrubber Outlet	04.06.2020	8,000
--	Carbon Dioxide Scrubber Inlet	04.06.2020	8,700
35	Combined Stack No.5 & 6 Boilers	21.05.2020	1,000
42	Boiler No.4 Outlet	21.05.2020	1,400
44	Fermenter (No. 13)	04.06.2020	7,400
45	Boiler No.2 Outlet	04.06.2020	1,420
46	DDG Pellet Plant Stack	04.06.2020	4,400
47	No.5 Starch Dryer	12.05.2020	390

Key: ou = odour units

**TABLE 4-2 EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, Q1, 2020-2021**

EPA ID No.	Description	Date	Odour Concentration (ou)
39	Inlet to Biofilters A & B	12.05.2020	18,500
39A	Inlet to Biofilters A & B	12.05.2020	14,200
40	Outlet of Biofilter A (east)	12.05.2020	2,200
40	Outlet of Biofilter A (west)	12.05.2020	1,500
41	Outlet of Biofilter B (east)	12.05.2020	5,200
41	Outlet of Biofilter B (west)	12.05.2020	2,200

Key: ou = odour units

## 5 CONCLUSIONS

SEMA completed the odour sampling and analysis at Shoalhaven Starches manufacturing facility at Bomaderry for Quarter 1, 2020 - 2021.

Figure 5-1 presents graphical representations of odour concentrations recorded for Gluten Dryers No.1, 2, 3 and 4 since autumn 2005.

Figure 5-2 presents graphical representations of odour concentrations recorded for Starch Dryers No.1, 3 and 4 since autumn 2005.

Figure 5-3 graphically shows the Starch Dryer No. 5 emission concentrations since spring 2017.

Figure 5-4 graphically shows the Fermenter emission concentrations since summer 2007-2008.

Figure 5-5 illustrates odour emission concentrations from the Carbon Dioxide Scrubber since autumn 2013.

Figures 5-6 and 5-7 graphically show the Combined Boiler 5 and 6 stack and the Boiler No.4 stack emission concentrations since summer 2013-2014 respectively.

Figure 5-8 shows the Boiler 2 stack emission concentrations since winter 2019.

Figure 5-9 graphically shows the Bio-filter emission concentrations since autumn 2010.

Figure 5-10 graphically shows the DDG Pellet plant Stack emission concentrations since spring 2016.

FIGURE 5-1 ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS NO.1, 2, 3 & 4 (EPA 8,9,10,11)

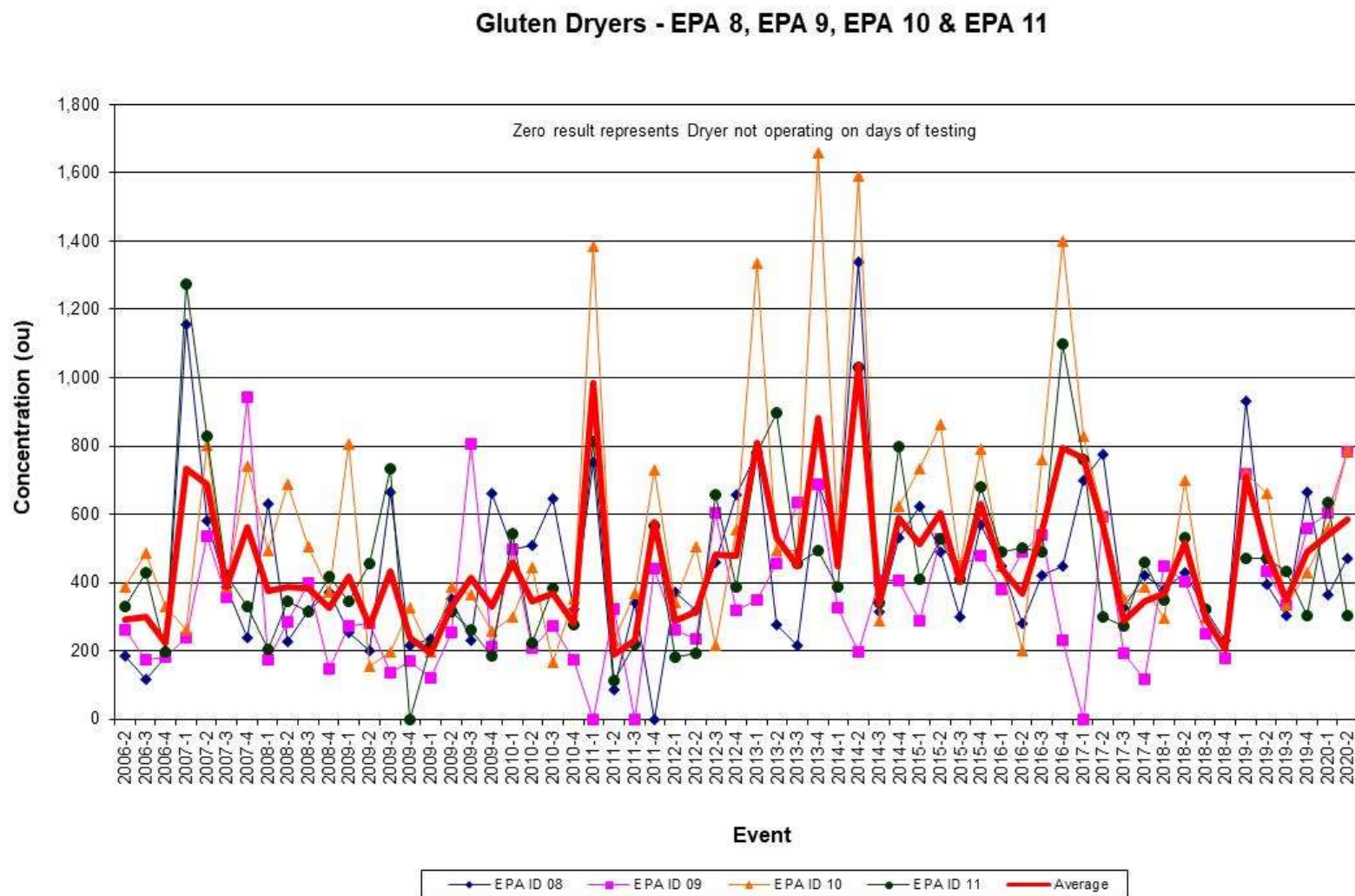


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13, 14)

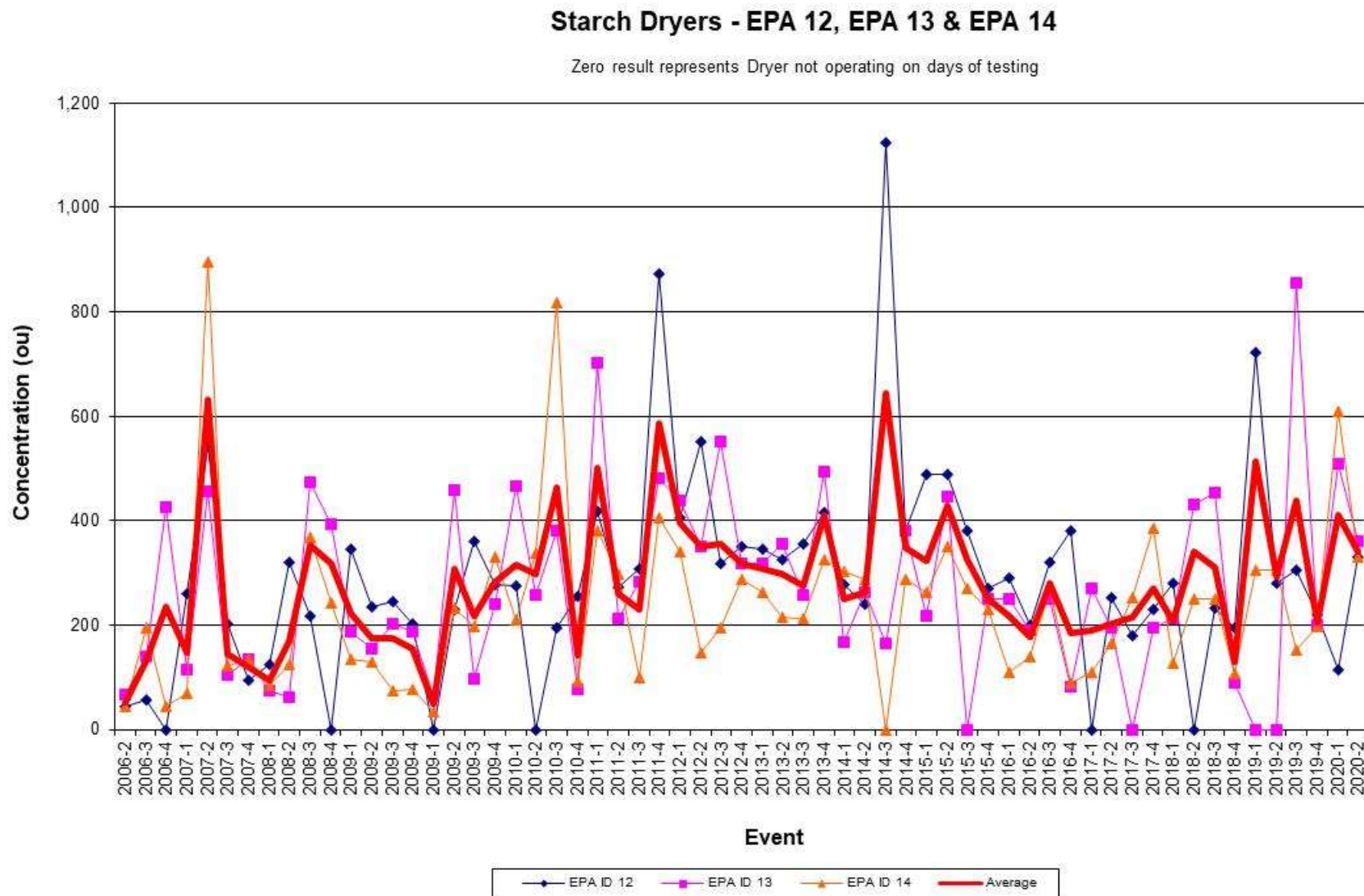
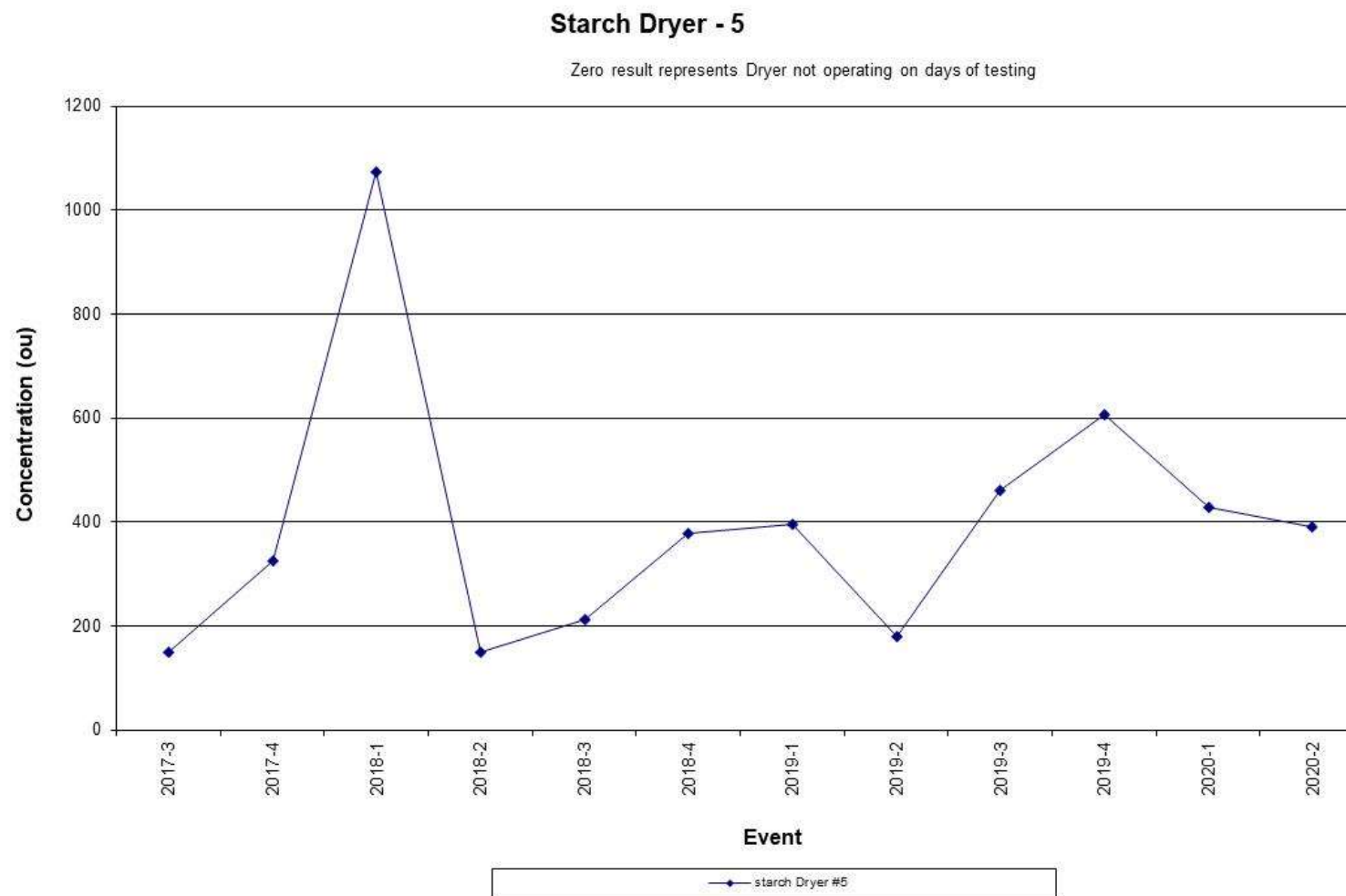


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47)





**FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44)**

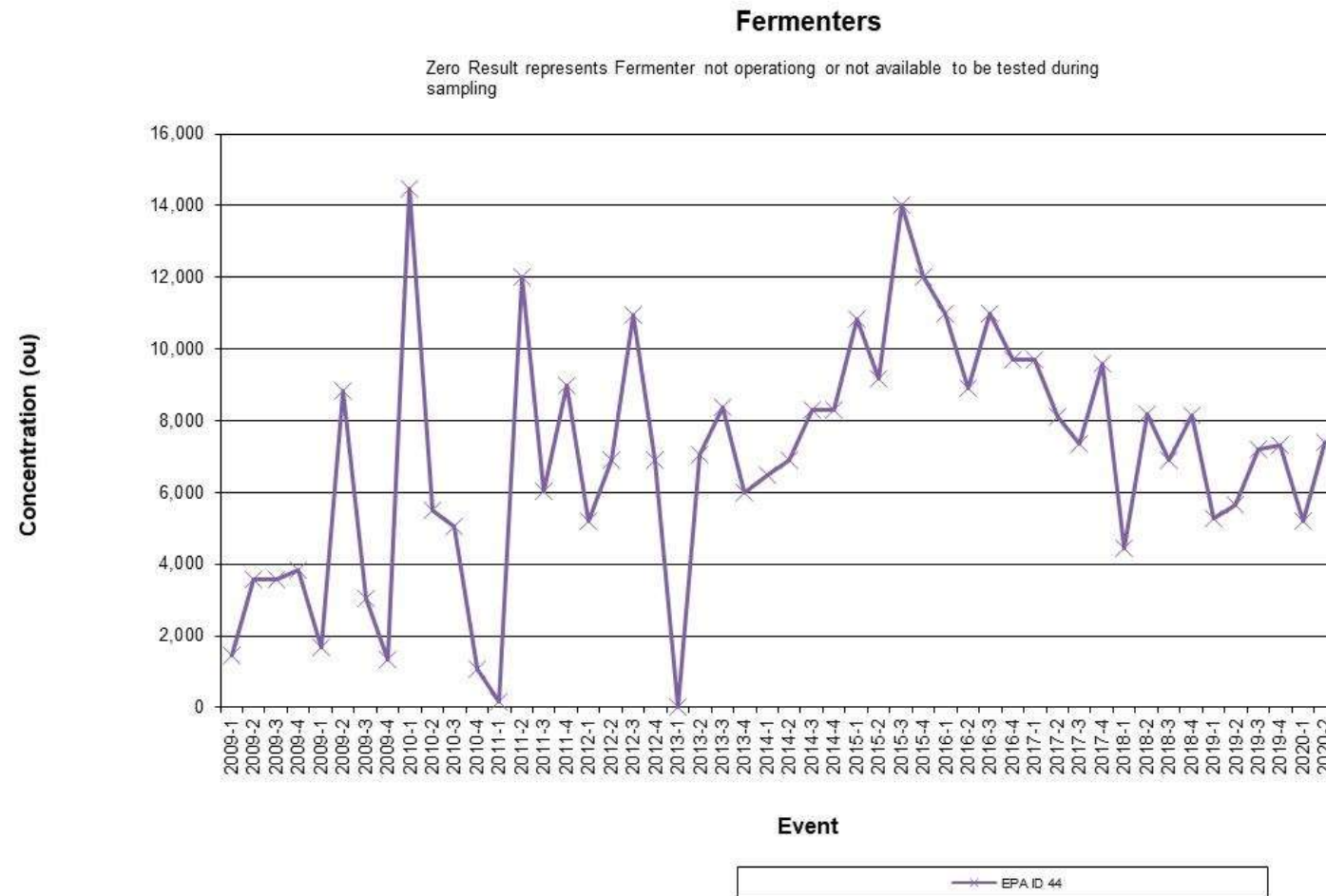


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16)

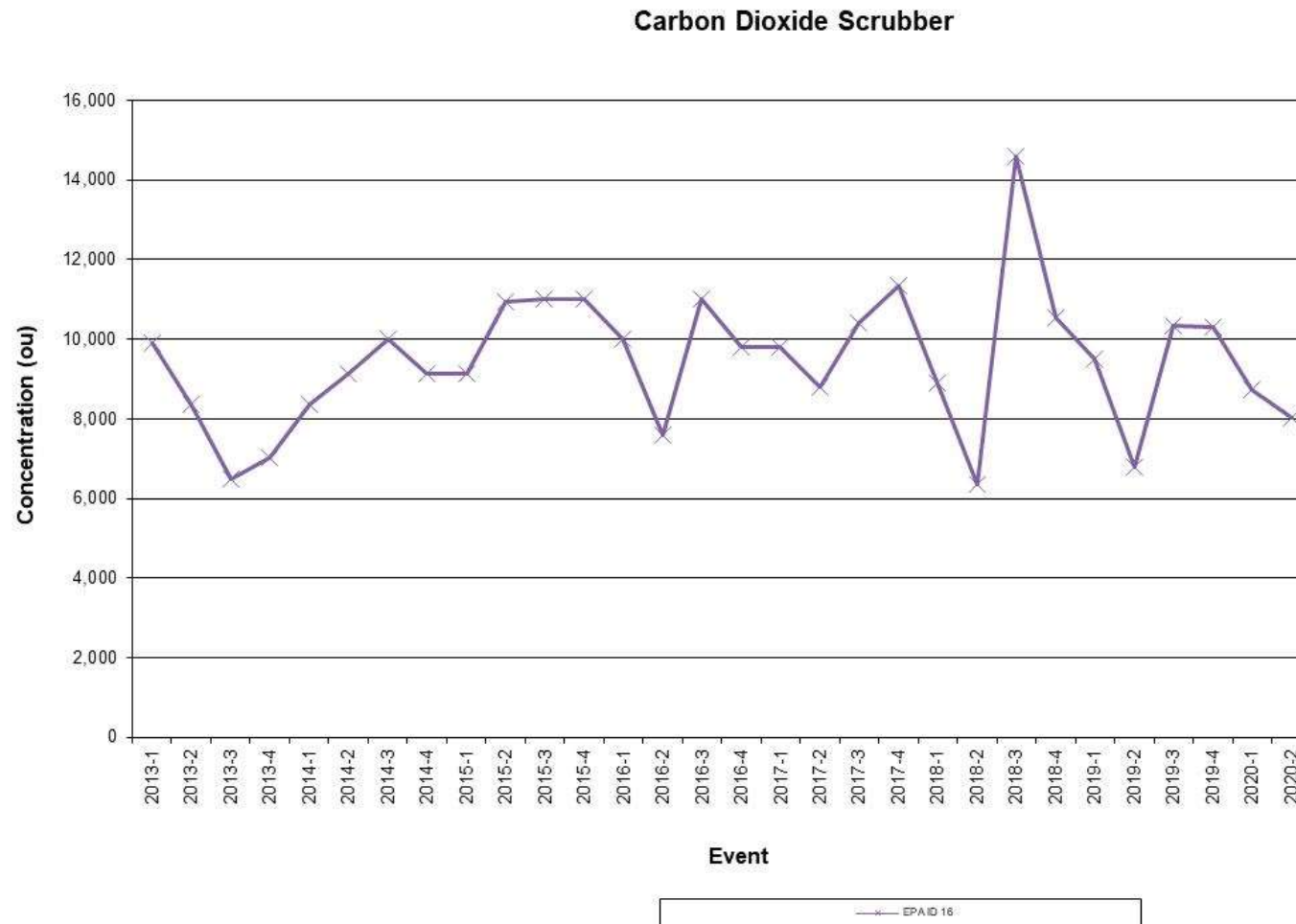
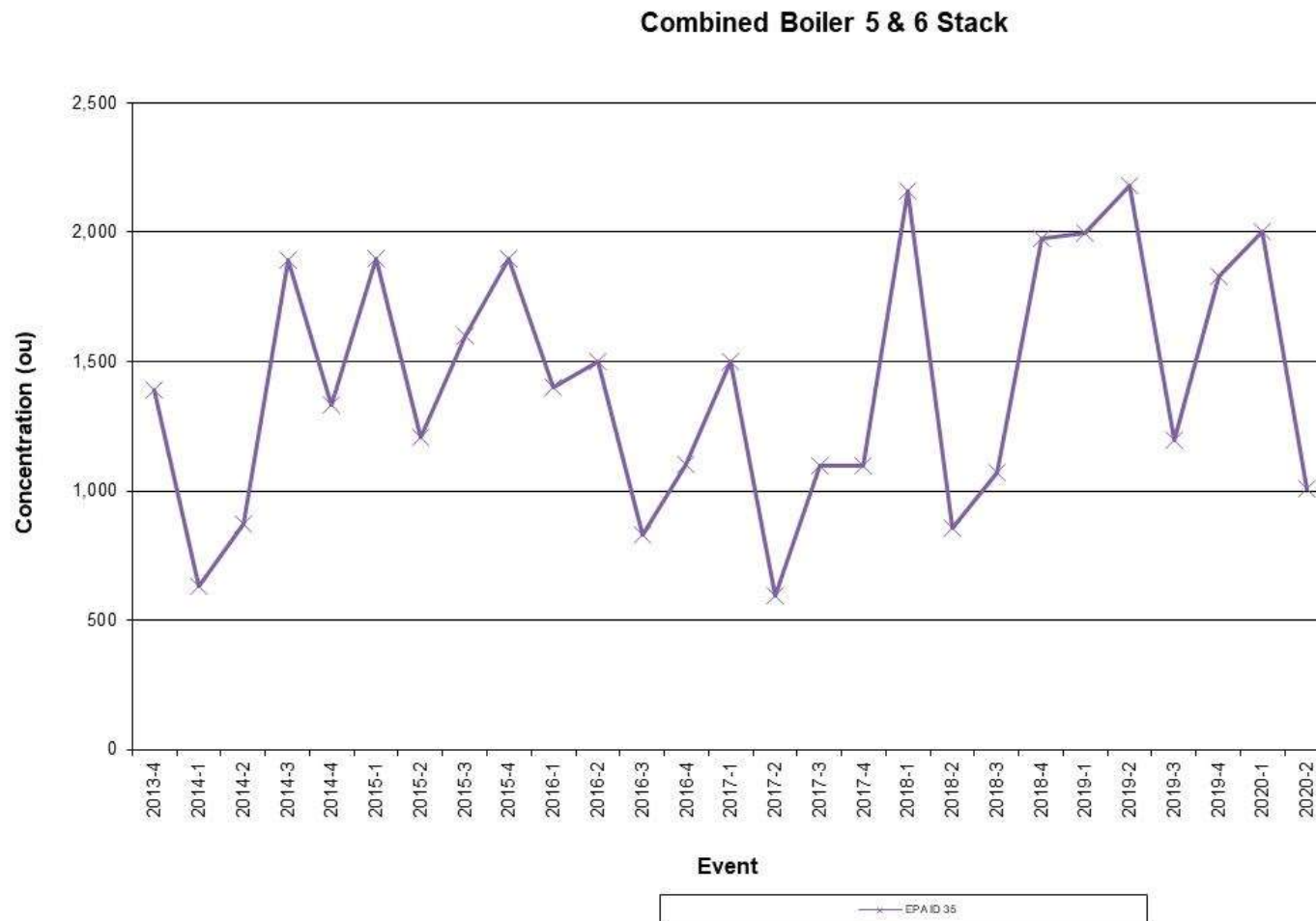


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK (EPA 35)



**FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42)**

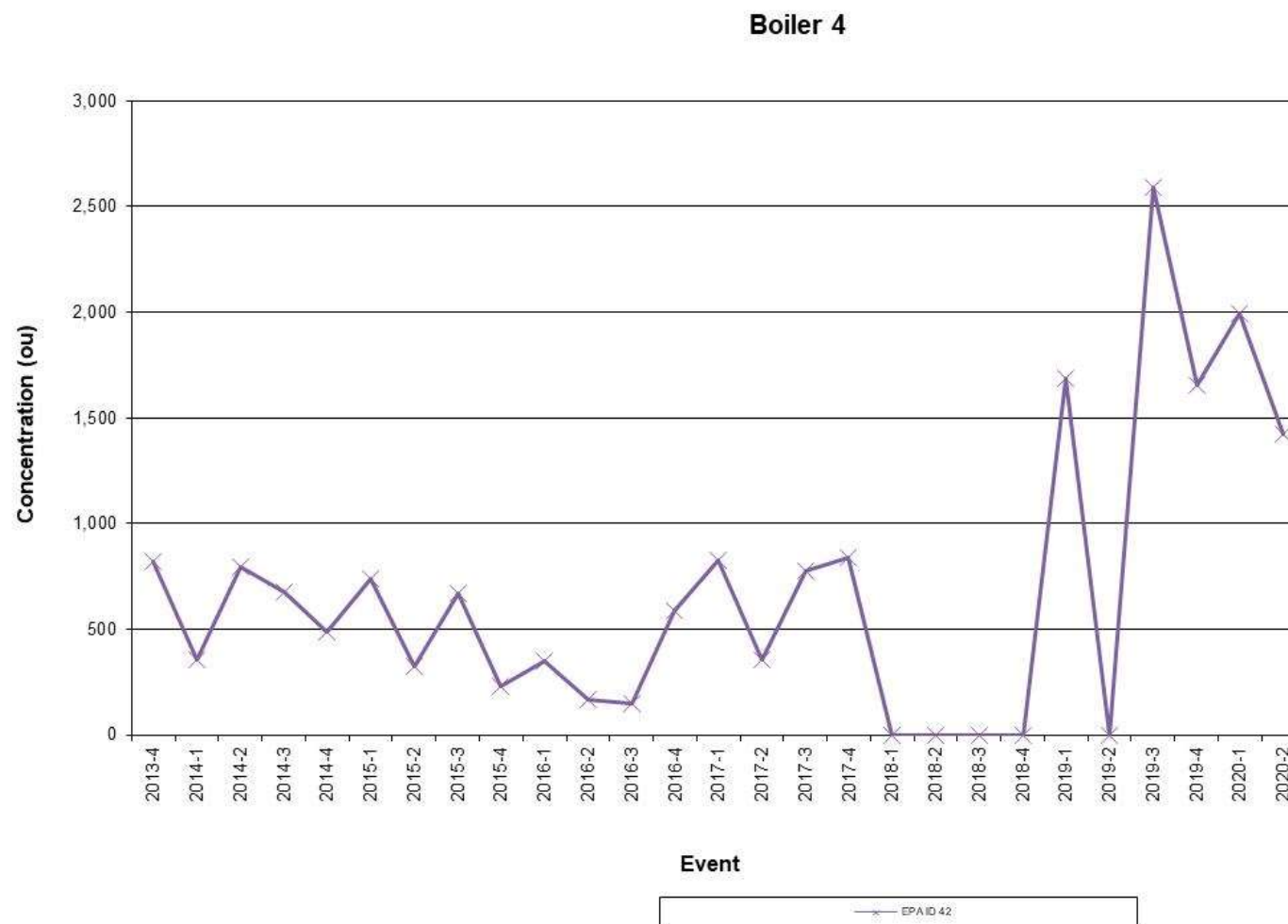


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45)

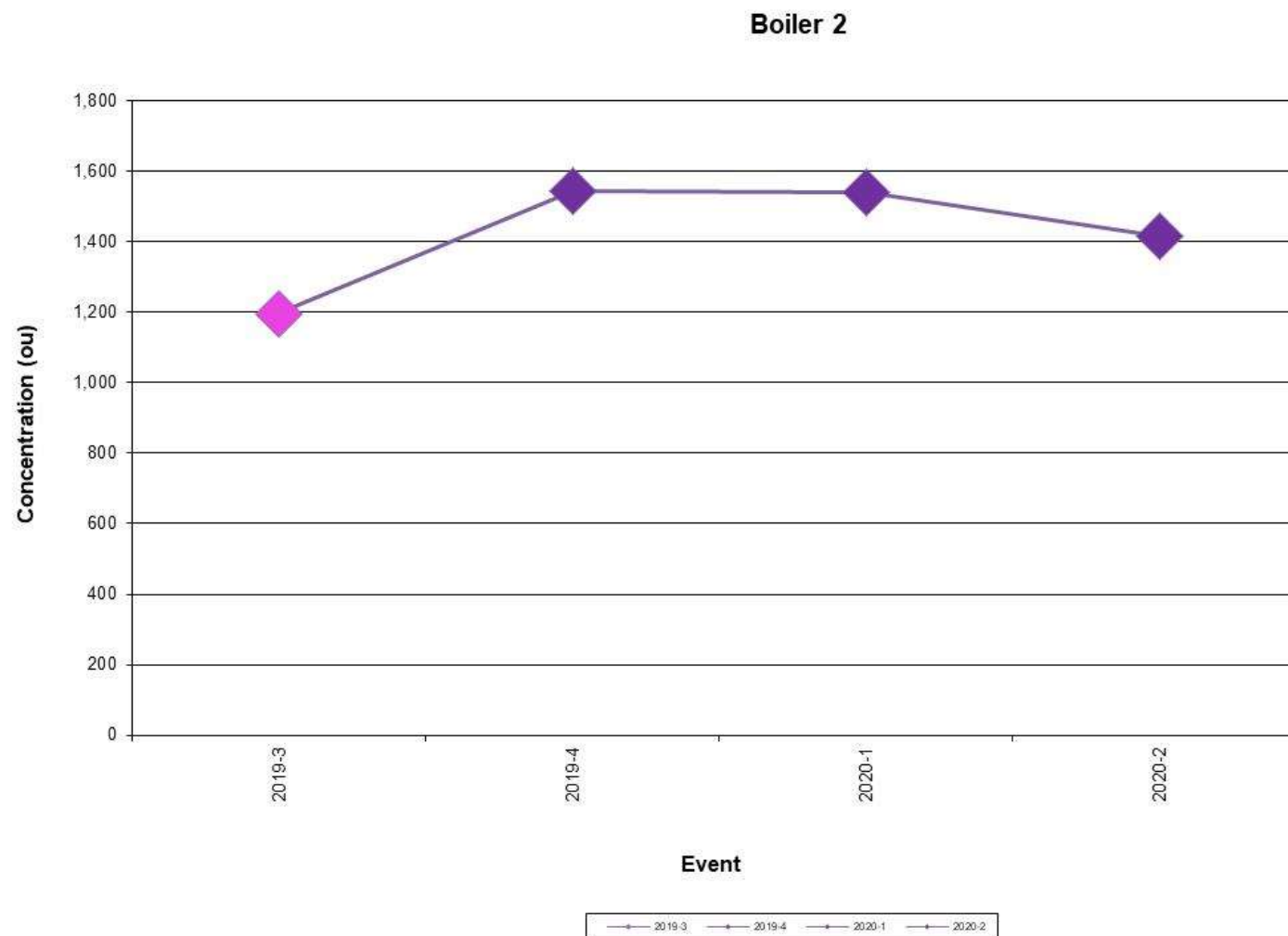


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41)

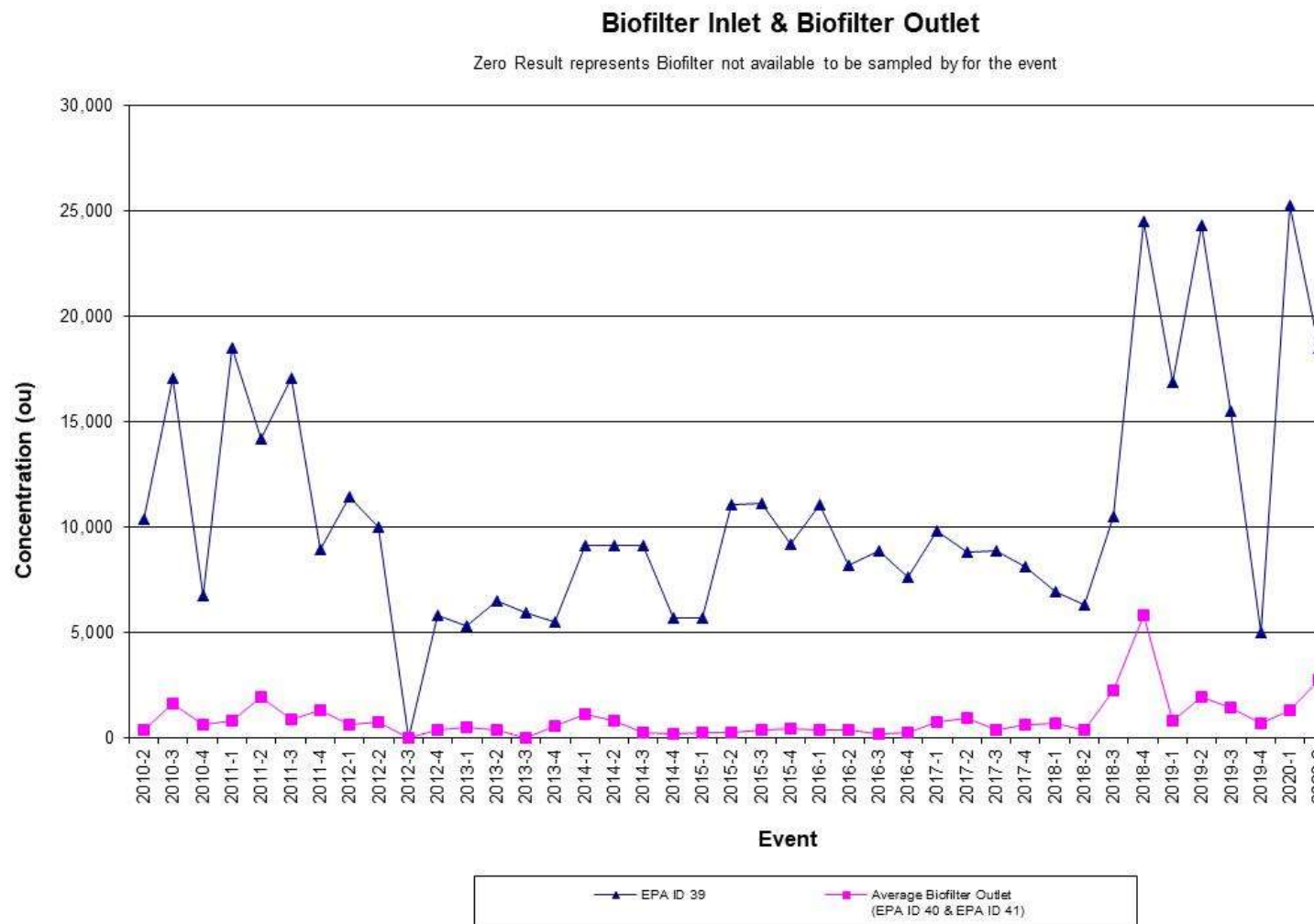
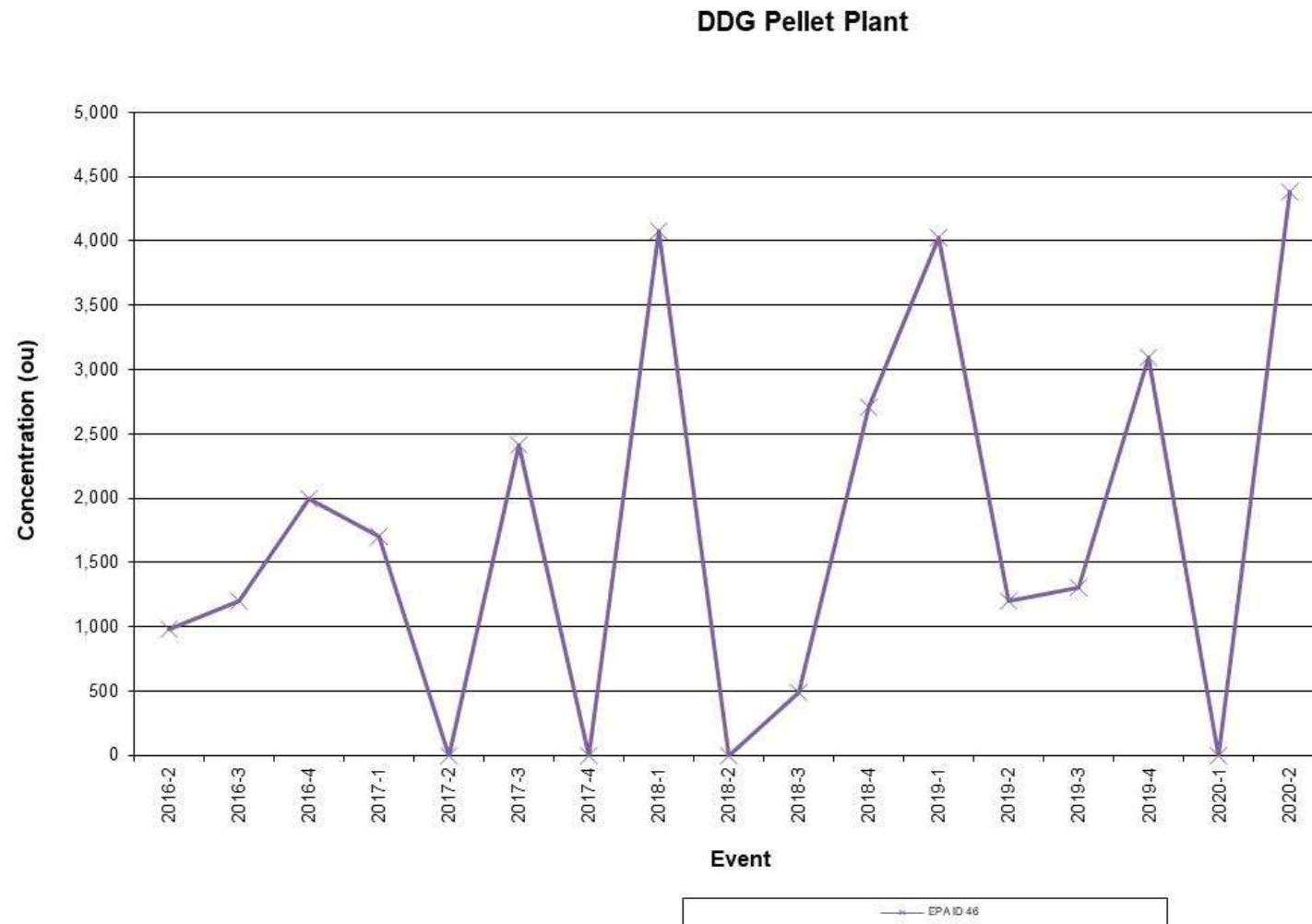


FIGURE 5-10 CONCENTRATION DDG PELLET PLANT STACK (EPA 46)



## 6 TEST METHODS

### 6.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

(AS 4323.3 & AS 4323.4 and OM-7 and OM-8)

Samples were collected in 30L Nalophane sampling bags which are enclosed in airtight plastic containers. Surface samples were collected utilising an equilibrium flux hood or witches hat flux hood.

Odorous gas for analysis was drawn through a Teflon (PTFE) sample probe. The gas then passes through a Teflon (PTFE) tube connected to the Nalophane sampling bag. The sampling pump is connected to the airtight plastic container to provide a sample gas flow-rate of approximately 0.5 – 1.5 litres per minute. After the required volume has been sampled, the pump is stopped and the bag sealed with a stainless steel valve. Two samples were collected from each site.

Using a triangular forced choice olfactometer, the Nalophane bag of odour sample was dynamically diluted to various concentrations with dry odour free air.

The diluted sample was then presented to a panel of screened panellists as one of these airflows. The panellists then recorded if they could detect any odour and from which flow. The other two flows were discharging odour free air.

The odour is always presented to the panellists in ascending concentration; that is, from lower to higher concentration. The panellists are required at each dilution level to give a response as to what they are smelling from the flows (forced choice methodology). The response options for the panellists are:

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows could be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows could be different from the other two flows and is able to: <ul style="list-style-type: none"><li>■ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from -10 to 10 and/or</li><li>■ Able to assign a character to the colour, as in 'it smells like ...'</li></ul> <p><i>Note: that the Recognise level concentration and Hedonic Tone and Odour descriptors are obtained with the diluted odour, panellists are not exposed to the full strength odour.</i></p>



The percentage panel response and dilution levels used were then entered into a computer programme to determine the 50% panel response. This dilution level corresponds to the odour concentration of the sample.

Sampling and dilution lines are constructed from teflon, stainless or glass to prevent contamination of the sample.

The sampling and the dilution procedures used were in accordance with OEH NSW Method OM-7 and OM-8, which are based on Standards Association of Australia, AS4323.3 and AS4323.4.

#### **6.1.1 ODOUR PANEL SELECTION**

Odour panellists must meet certain criteria to qualify as and remain panellists. Their average sensitivity to n-Butanol must be between 20 and 80 parts per billion (ppb) and their variability in response to n-Butanol must be within a certain range.

Panellists are screened against n-Butanol before every panel session to ensure they are in compliance.

Panellists should not suffer from respiratory complaints, nor should they eat or smoke or drink anything but water during the half hour preceding or during the test period and their person and clothing should be odour free and have not been exposed to an odorous environment before testing.

#### **6.1.2 ODOUR TERMINOLOGY**

The odour level is expressed in odour units and for mixed odours is analogous to concentration expressed in parts per billion. The odour detection level is defined as the ratio of *the volume that a sample of odorous gas would occupy when diluted to the threshold of detection of that odour to the volume of the sample*. In simpler terms, the ratio indicated the number of dilutions necessary to reduce the odour to its threshold of detection or odour detection threshold. This ratio is expressed in odour units or number of dilutions to detection threshold. For example, a value of 2,000 odour units would mean the volume of the initial sample of odorous gas would need to be diluted 2,000 times before the odour would just be detectable to the average human nose, that is, at the odour detection threshold.

### **6.2 EXHAUST GAS VELOCITY**

(OEH NSW TM-2 and USEPA Method 12)

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and digital manometer.

### 6.3 EXHAUST GAS TEMPERATURE

(OEH NSW TM- 2, 3 & 4 and USEPA Methods 2, 3 & 4)

The exhaust gas temperature was measured using a Digital thermometer (0-1200°C) connected to a chromel/alumel (K-type) thermocouple probe.

### 6.4 OXYGEN (O<sub>2</sub>)

(OEH NSW TM-24 and USEPA Method 3A)

O<sub>2</sub> was analysed by a Testo 350 analyser.

### 6.5 MOISTURE

(OEH NSW TM-22 and USEPA Method 4)

Moisture from the stack was determined in accordance with OEH NSW TM-22 and USEPA Method 4. In particular, M4 Section 2.2.1 which nominates a moisture approximation method used to enable calculation of isokinetic sampling rates and where isokinetic sampling is not required such as odour sampling.

### 6.6 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 6-1) uncertainties for various stack testing methods.

**TABLE 6-1 ESTIMATION OF MEASUREMENT UNCERTAINTY**

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Odour	AS4323.3, AS4323.4	3 times
Oxygen and Carbon Dioxide	TM-24, TM-25, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2A & 2C	5%

Key:

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

Sources: *Measurement Uncertainty - implications for the enforcement of emission limits* by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK

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

---

## APPENDIX A – EMISSION TEST RESULTS

### Glossary:

%	=	percent
°C	=	Degrees Celsius
am <sup>3</sup> /min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m <sup>3</sup> )	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am <sup>3</sup>	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m <sup>3</sup>	=	kilograms per cubic metre
kPa	=	kilo Pascals
m <sup>2</sup>	=	square metre
m/s	=	metre per second
m <sup>3</sup> /sec	=	cubic metre per second at 0°C and 1 atmosphere
mg	=	milligrams
mg/ m <sup>3</sup>	=	milligrams per cubic metre at 0°C and 1 atmosphere
O <sub>2</sub>	=	Oxygen

Abbreviations for names of SEMA staff who completed either Sampling or Analysis or QA Checking

PWS	=	Peter W Stephenson
JW	=	Jay Weber

**TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4**

Emission Test Results				
Project Number	7065			
Project Name	Shoalhaven Starches			
Test Location	EPA ID 8 Gluten Dryer 1	EPA ID 9 Gluten Dryer 2	EPA ID 10 Gluten Dryer 3	EPA ID 11 Gluten Dryer 4
Date	14-May-20	04-June-20	14-May-20	04-June-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	14:00	15:50	15:20	14:55
Flow Stop Time (hrs)	14:22	16:03	15:47	15:17
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	71.4	64	74.2	71.8
Stack Cross-Sectional area (m <sup>2</sup> )	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	13.9	17.4	10.9	17.1
Actual Gas Flow Volume (am <sup>3</sup> /min)	1,194	1,140	2,892	2,371
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	892	729	2,118	1,775
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	14.9	12.2	35.3	29.6
Total Stack Pressure (kPa)	102.6	93.4	101.4	102.3
Moisture Content (% by volume)	6.85	14.36	6.95	6.35
Molecular Weight Dry Stack Gas (g/gmole)	28.84	28.84	28.84	28.84
Dry Gas Density (kg/m <sup>3</sup> )	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.90	20.9	20.9
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5335	5347	5336	5346
SEMA Number	727937	727957	727938	727956
Sample Start Time (hrs)	14:12	15:57	15:37	15:07
Sample Finish Time (hrs)	14:22	16:03	15:47	15:17
Odour Concentration (As Received) (ou)	470	785	787	305
Odour Concentration (Final) (ou)	470	790	790	305
Normal MOER (As Received) (ou m <sup>3</sup> /s)	6,990	9,543	27,783	9,021
Normal MOER (Final) (ou m <sup>3</sup> /s)	7,000	9,500	27,800	9,000
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

**TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5**

Emission Test Results				
Project Number	7065			
Project Name	Shoalhaven Starches			
Test Location	EPA ID 12 Starch Dryer 1	EPA ID 13 Starch Dryer 3	EPA ID 14 Starch Dryer 4	EPA ID 47 Starch Dryer 5
Date	14-May-20	12-May-20	12-May-20	12-May-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:27	10:18	10:28	11:00
Flow Stop Time (hrs)	12:53	10:40	10:49	11:21
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	38.2	40.0	39.4	61.8
Stack Cross-Sectional area (m²)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	5.6	22.6	22.7	15.0
Actual Gas Flow Volume (am³/min)	754	1,358	1,361	4,073
Total Normal Gas Flow Volume (m³/min)	634	1,129	1,142	3,170
Total Normal Gas Flow Volume (m³/s)	10.6	18.8	19.0	52.8
Total Stack Pressure (kPa)	102.69	102.63	102.65	102.50
Moisture Content (% by volume)	5.44	5.88	5.27	5.68
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836	28.836	28.836
Dry Gas Density (kg/m³)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5334	5324	5325	5326
SEMA Number	727936	727927	727928	727929
Sample Start Time (hrs)	12:43	10:30	10:26	11:11
Sample Finish Time (hrs)	14:53	10:40	10:36	11:21
Odour Concentration (As Received) (ou)	333	360	330	390
Odour Concentration (Final) (ou)	330	360	330	390
Normal MOER (As Received) (ou m³/s)	3,521	6,777	6,281	20,604
Normal MOER (Final) (ou m³/s)	3,500	6,800	6,300	20,600
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

**TABLE A- 3 EMISSION TEST RESULTS – BOILERS NO. 5&6, 4 & 2**

<b>Emission Test Results</b>			
<b>Project Number</b>	<b>7065</b>		
<b>Project Name</b>	<b>Shoalhaven Starches</b>		
<b>Test Location</b>	<b>EPA ID 35 Boilers 5&amp;6</b>	<b>EPA ID 42 Boiler 4</b>	<b>EPA ID 45 Boiler 2</b>
<b>Date</b>	21-May-20	21-May-20	04-June-20
	Dry		
<b>Run</b>	1		
<b>Method</b>	TM-1, TM-2 & TM-22		
Flow Start Time (hrs)	12:31	11:44	11:19
Flow Stop Time (hrs)	12:53	12:06	11:41
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	130.8	152.4	170.8
Stack Cross-Sectional area (m²)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	14.9	14.3	9.3
Actual Gas Flow Volume (am³/min)	2,806.3	906.7	532.5
Total Normal Gas Flow Volume (m³/min)	1,798.6	550.1	316.2
Total Normal Gas Flow Volume (m³/s)	29.976	9.168	5.270
Total Stack Pressure (kPa)	101.06	101.22	102.22
Moisture Content (% by volume)	4.98	5.39	4.35
Molecular Weight Dry Stack Gas (g/gmole)	30.080	29.840	30.080
Dry Gas Density (kg/m³)	1.34	1.33	1.34
Oxygen (%)	8.4	10.0	8.4
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5339	5338	5342
SEMA Number	727940	727939	727952
Sample Start Time (hrs)	12:43	11:56	11:31
Sample Finish Time (hrs)	15:53	12:06	11:41
Odour Concentration (As Received) (ou)	1,009	1,421	1,417
<b>Odour Concentration (Final) (ou)</b>	<b>1,000</b>	<b>1,400</b>	<b>1,420</b>
Normal MOER (As Received) (ou m³/s)	30,246	13,028	7,467
Normal MOER (Final) (ou m³/s)	30,200	13,000	7,500
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

**TABLE A-4 EMISSION TEST RESULTS – FERMENTER 13 & CO<sub>2</sub> SCRUBBER OUTLET**

<b>Emission Test Results</b>		
<b>Project Number</b>	7065	7065
<b>Project Name</b>	Shoalhaven Starches	Shoalhaven Starches
<b>Test Location</b>	<b>EPA ID 44 Fermenter 13</b>	<b>EPA ID 16 CO<sub>2</sub> Scrubber outlet</b>
<b>Date</b>	04-June-20	04-June-20
	Dry	Dry
Run	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	12:39	12:40
Flow Stop Time (hrs)	13:01	13:02
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	31.5	27.4
Stack Cross-Sectional area (m <sup>2</sup> )	0.071	0.196
Average Stack Gas Velocity (m/s)	3.8	2.9
Actual Gas Flow Volume (am <sup>3</sup> /min)	16.1	34
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	14.0	30
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	0.233	0.507
Total Stack Pressure (kPa)	102.32	102.30
Moisture Content (% by volume)	3.91	3.23
Molecular Weight Dry Stack Gas (g/gmole)	29.620	31.204
Dry Gas Density (kg/m <sup>3</sup> )	1.32	1.39
Oxygen (%)	0.5	0.1
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5343	5344
SEMA Number	727953	727954
Sample Start Time (hrs)	12:51	12:52
Sample Finish Time (hrs)	13:01	13:02
Odour Concentration (As Received) (ou)	7,392	8,035
<b>Odour Concentration (Final) (ou)</b>	<b>7,400</b>	<b>8,000</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	1,723	4,077
Normal MOER (Final) (ou m <sup>3</sup> /s)	1,700	4,000
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

**TABLE A-5 EMISSION TEST RESULTS – DDG PELLET PLANT STACK & COMBINED INLET TO BIOFILTERS A & B**

<b>Emission Test Results</b>			
<b>Project Number</b>	7065	7065	7065
<b>Project Name</b>	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
<b>Test Location</b>	<b>EPA ID 46 DDG Pellet Plant Stack</b>	<b>EPA ID 39 Biofilter Inlet DDG Dryers 1, 2 &amp; 3</b>	<b>EPA ID 39A Biofilter Inlet DDG Dryer# 4</b>
<b>Date</b>	04-June-20	12-May-20	12-May-20
	Dry	Dry	Dry
Run	1	1	1
Method	TM-1, TM-2 & TM-22	TM-1, TM-2 & TM-22	TM-1, TM-2 & TM-22
Flow Start Time (hrs)	10:54	11:33	12:22
Flow Stop Time (hrs)	11:24	11:54	12:43
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	55.3	43.1	23.6
Stack Cross-Sectional area (m <sup>2</sup> )	1.674	0.283	0.049
Average Stack Gas Velocity (m/s)	14.7	15.1	11.3
Actual Gas Flow Volume (am <sup>3</sup> /min)	1,478.1	256	33
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	1,209.0	199	30
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	20.150	3.3	0.5
Total Stack Pressure (kPa)	102.12	98.09	103.02
Moisture Content (% by volume)	2.42	7.18	2.22
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836	28.836
Dry Gas Density (kg/m <sup>3</sup> )	1.29	1.287	1.287
Oxygen (%)	20.9	20.9	20.9
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5341	5327	5328
SEMA Number	727951	727930	727931
Sample Start Time (hrs)	11:11	11:44	12:33
Sample Finish Time (hrs)	11:24	11:54	12:43
Odour Concentration (As Received) (ou)	4,378	18,478	14,248
<b>Odour Concentration (Final) (ou)</b>	<b>4,400</b>	<b>18,500</b>	<b>14,200</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	88,216	61,249	7,239
Normal MOER (Final) (ou m <sup>3</sup> /s)	88,200	61,200	7,200
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS



**TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS**

<b>Emission Test Results</b>				
<b>Project Number</b>	7065	7065	7065	7065
<b>Project Name</b>	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
<b>Test Location</b>	<b>EPA ID 40 Biofilter A East</b>	<b>EPA ID 40 Biofilter A West</b>	<b>EPA ID 41 Biofilter B East</b>	<b>EPA ID 41 Biofilter B West</b>
<b>Date</b>	12-May-20	12-May-20	12-May-20	12-May-20
Run	1	1	1	1
Method	TM-2 & TM-22	TM-2 & TM-22	TM-2 & TM-22	TM-2 & TM-22
Sample & Flow Start Time (hrs)	13:08	13:36	13:09	13:37
Sample & Flow Stop Time (hrs)	13:18	13:46	13:19	13:47
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	37.7	37.4	40.5	39.0
<b>Proportion of Inlet air flow</b>	<b>24</b>	<b>22</b>	<b>29</b>	<b>25</b>
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5329	5330	5331	5332
SEMA Number	727932	727933	727934	727935
Odour Concentration (As Received) (ou)	2,175	1,549	5,200	2,188
<b>Odour Concentration (Final) (ou)</b>	<b>2,200</b>	<b>1,500</b>	<b>5,200</b>	<b>2,200</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	1,973	1,305	5,728	2,188
Normal MOER (Final) (ou m <sup>3</sup> /s)	2,000	1,300	5,700	2,100
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

---

## **APPENDIX B – CERTIFICATES OF ANALYSIS**



## Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144 Australia  
Tel: (02) 9737 9991  
E-Mail: pstephenson@orla.com.au

### Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

<b>Client</b>	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	Starch Dryers 1, 3, 4 & 5; Gluten Dryers 1, 2, 3 & 4; Boilers 2, 4 and 5&6; Biofilter A east & west outlets; Biofilter B east & west outlets; Biofilter inlets (DDG dryers #1, 2&3) & (DDG dryer #4); Fermenter; CO <sub>2</sub> Scrubber inlet & outlet, DDG Pellet Plant stack.
	Telephone:	02 4423 8254
<b>Project</b>	Email:	John.studdert@manildra.com.au
	ORLA Report Number:	7065/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5323 to 5347
<b>Order</b>	SEMA Sample number(s):	727927 to 727947
	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	12 May 2020
	Order number:	5123
<b>Report</b>	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
<b>Report</b>	Date of issue:	21 July 2020
	This report cannot be reproduced except in full.	

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing



ODOUR CONCENTRATION MEASUREMENTS RESULTS

7065/ORLA/01

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq X \leq 92,102$ ou. . If the measuring range was insufficient the odour samples will have been pre-diluted,
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between $\pm 3^{\circ}\text{C}$ .
Measuring Dates	The date of each measurement is specified with the results.
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.05$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $r = 0.0020$ (February 2020) Compliance - Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $A = 0.020$ (February 2020) Compliance - Yes
Lower Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 12 ou.
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored every session to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

21 July, 2020



Peter Stephenson  
Managing Director



## Odour Research Laboratories Australia

### Odour Olfactometry Results – 7065/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone *
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1</sup> *	(ou) <sup>2</sup> *	
Sample ID: Starch Dryer 3	727927	12/05/2020 10:30	5324	13/05/2020 10:55	4	8	Nil	360	360	Plastic, vinegar, malt, cereal, grain then musty/earthy, nutty & polyfills (-1) <sup>+</sup>
Sample ID: Starch Dryer 4	727928	12/05/2020 10:26	5325	13/05/2020 11:24	4	8	Nil	330	330	Hessian, malt, steamed vegetables, cereal, grain, sweet, dry soil (-1)
Sample ID: Starch Dryer 5	727929	12/05/2020 11:11	5326	13/05/2020 11:53	4	8	Nil	390	390	Plastic, vinyl, hessian, dank, malt, earth, mould, grain & sweet (-1) <sup>+</sup>
Sample ID: Biofilter In (DDG1-3)	727930	12/05/2020 11:44	5327	13/05/2020 12:24	4	8	Nil	18478	18500	Potato, citrus garlic, biscuit, sour, vegetables, earth, dank, sweet, gas, butterscotch, old cooking oil & caramel liqueur (-2) <sup>+</sup>
Sample ID: Biofilter inlet (DDG 4)	727931	12/05/2020 12:33	5328	13/05/2020 12:53	4	8	Nil	14248	14200	Dairy farm, barn, sour dough, biscuit, butterscotch, caramel liqueur, garlic, old cooking oil (-1) <sup>+</sup>
Sample ID: Biofilter A east outlet	727932	12/05/2020 13:08	5329	13/05/2020 13:55	4	8	Nil	2175	2200	Coffee, bitter, smoke, ashes, wheat, cooked vegetables, musty, wet cardboard, wood & ethanol (-2) <sup>+</sup>
Sample ID: Biofilter A west outlet	727933	12/05/2020 13:36	5330	13/05/2020 14:23	4	8	Nil	1549	1500	Earth, sweet, wood, potato in dirt, cooked potato, wet cardboard, wheat & burnt biscuit (-1) <sup>+</sup>



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7065/ORLA/01

Location	Sample			Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>1,2</sup>
	ID No.	Date/Time	ORLA No.					(ou) <sup>1</sup>	(ou) <sup>2</sup>	
Sample ID: Biofilter B east outlet	727934	12/05/2020 13:09	5331	13/05/2020 14:52	4	8	Nil	5200	5200	Wheat, onion, tomato, pumpkin, sour, sauerkraut, sweet potato, rotting hay, vegetable soup, sweet Yoplait (-2) <sup>1</sup>
Sample ID: Biofilter B west outlet	727935	12/05/2020 13:37	5332	13/05/2020 15:21	4	8	Nil	2188	2200	Yeast, vegemite, sour, feet odour salt, sauerkraut, rotting hay, Yoplait (-2) <sup>1</sup>
Sample ID: Starch Dryer 1	727936	14/05/2020 12:44	5334	15/05/2020 10:50	4	8	Nil	333	330	Wheat, musty, plastic, wood, sweet, hessian, (-1) <sup>1</sup>
Sample ID: Gluten Dryer 1	727937	14/05/2020 14:12	5335	15/05/2020 11:25	4	8	Nil	470	470	Plastic, grains, wheat, yeast, moss, pine, hessian, potato, grain, forest (-2) <sup>1</sup>
Sample ID: Gluten Dryer 3	727938	14/05/2020 15:37	5336	15/05/2020 11:54	4	8	Nil	787	790	Yeast, wood, wheat, hops, very slight sweet, mouse, mould, musty, grain, (-2) <sup>1</sup>
Sample ID: Boiler 4 (EPL 42)	727939	21/05/2020 11:56	5338	22/05/2020 10:45	4	8	Nil	1421	1400	Acetylene, disinfectant, acid, citrus, metallic, cloves, swampy, hessian, stale water, (-2) <sup>1</sup>
Sample ID: Boiler 5&6 (EPL 35)	727940	21/05/2020 12:43	5339	22/05/2020 11:14	4	8	Nil	1009	1000	Acetylene, plastic, paint, disinfectant, bleach, hydrochloric, chloride, ammonia, acid, swampy (-2) <sup>1</sup>





## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7065/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>1</sup> *
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1</sup> *	(ou) <sup>2</sup> *	
Sample ID: DDG Pellet Plant	727951	04/06/2020 11:11	5341	05/06/2020 10:53	4	8	Nil	4378	4400	Strong bitter tar at first & later swampy & musty, caramel, chocolate, coffee, grain, yeast, bread & barley (1)
Sample ID: Boiler 2 (EPL 45)	727952	04/06/2020 11:31	5342	05/06/2020 11:22	4	8	Nil	1417	1420	Resin, disinfectant, acetylene gas, acidic, wheat, swampy then yeast (-2) <sup>1</sup>
Sample ID: Fermenter #13	727953	04/06/2020 12:51	5343	05/06/2020 11:51	4	8	Nil	7392	7400	Tangy, vinegar, citrus, fruity, oil paint, paint, solvent, plastic, vinyl, faint yeast & sweet (1) <sup>1</sup>
Sample ID: CO2 scrub Outlet	727954	04/06/2020 12:52	5344	05/06/2020 12:21	4	8	Nil	8035	8000	Paint, oil paint, resin, solvent, vinegar, sharp, caramel liqueur, fruity, tangy citrus, yoghurt, acidofolis (-2) <sup>1</sup>
Sample ID: CO2 scrub Inlet	727955	04/06/2020 12:54	5345	05/06/2020 13:26	4	8	Nil	8735	8700	Vinegar, pen ink, sharp, varnish, paint, solvent, banana essence and caramel liqueur (-2) <sup>1</sup>
Sample ID: Gluten Dryer 4	727956	04/06/2020 15:07	5346	05/06/2020 13:55	4	8	Nil	305	305	Mushroom, mouldy, musty, grain, wheat, slight fruity, (-2) <sup>1</sup>
Sample ID: Gluten Dryer 2	727957	04/06/2020 15:57	5347	05/06/2020 14:24	4	8	Nil	785	790	Plastic then wheat, caramel liqueur, sweet grain, musty & dirty drain water (-1) <sup>1</sup>



## Odour Research Laboratories Australia

### Odour Panel Calibration Results - 7065/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) <sup>3</sup>	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) <sup>4</sup>
n-butanol	5323	13.05.2020	62.0	1236	50.2	Yes
n-butanol	5333	15.05.2020	62.0	1421	43.6	Yes
n-butanol	5337	22.05.2020	62.0	1195	51.9	Yes
n-butanol	5340	05.06.2020	62.0	1421		Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analysed by Odour Research Laboratories Australia at their Sydney Laboratory.

Notes from Odour Olfactometry Results:

<sup>1</sup> Sample Odour Concentration: as received in the bag

<sup>2</sup> Sample Odour Concentration: allowing for pre-dilution

<sup>3</sup> Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

<sup>4</sup> Target Range for reference gas n-butanol is  $20 \leq \chi \leq 80$  ppb and compliance with AS/NZ4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration.

Panelist Rolling Average:

13/05/2020: SR = 48.5, PR = 53.6, TL = 42.4, JW = 58.9

15/05/2020: SR = 48.5, PR = 53.6, TL = 41.0, JW = 57.4

22/05/2020: SR = 48.5, PR = 53.6, TL = 41.0, JW = 55.9

05/06/2020: SR = 48.5, PR = 55.4, TL = 41.0, JW = 52.5

^ denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panelist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

-----END OF TEST REPORT-----



---

## **APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION**

**TABLE C-1 INSTRUMENT CALIBRATION DETAILS DAY 1**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	07-May-20	07-Nov-20
769	Thermocouple	07-May-20	07-Nov-20
893	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
675	Personal Sampler	12-Mar-20	12-Mar-21
934	Personal Sampler	26-Aug-19	26-Aug-20
907	Gas Meter	05-May-20	05-May-21
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

**TABLE C-2 INSTRUMENT CALIBRATION DETAILS DAY 2**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	07-May-20	07-Nov-20
769	Thermocouple	07-May-20	07-Nov-20
893	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
675	Personal Sampler	12-Mar-20	12-Mar-21
934	Personal Sampler	26-Aug-19	26-Aug-20
907	Gas Meter	05-May-20	05-May-21
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

**TABLE C-3 INSTRUMENT CALIBRATION DETAILS DAY 3**

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	07-May-20	07-Nov-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
815	Digital Manometer	06-Dec-19	06-Dec-20
832	Personal Sampler	26-Feb-20	26-Feb-21
769	Thermocouple	07-May-20	07-Nov-20
768	Thermocouple	07-May-20	07-Nov-20
946	combustion analyzer	16-Mar-20	16-Sep-20
<b>Gas Mixtures used for Analyser Span Response</b>			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

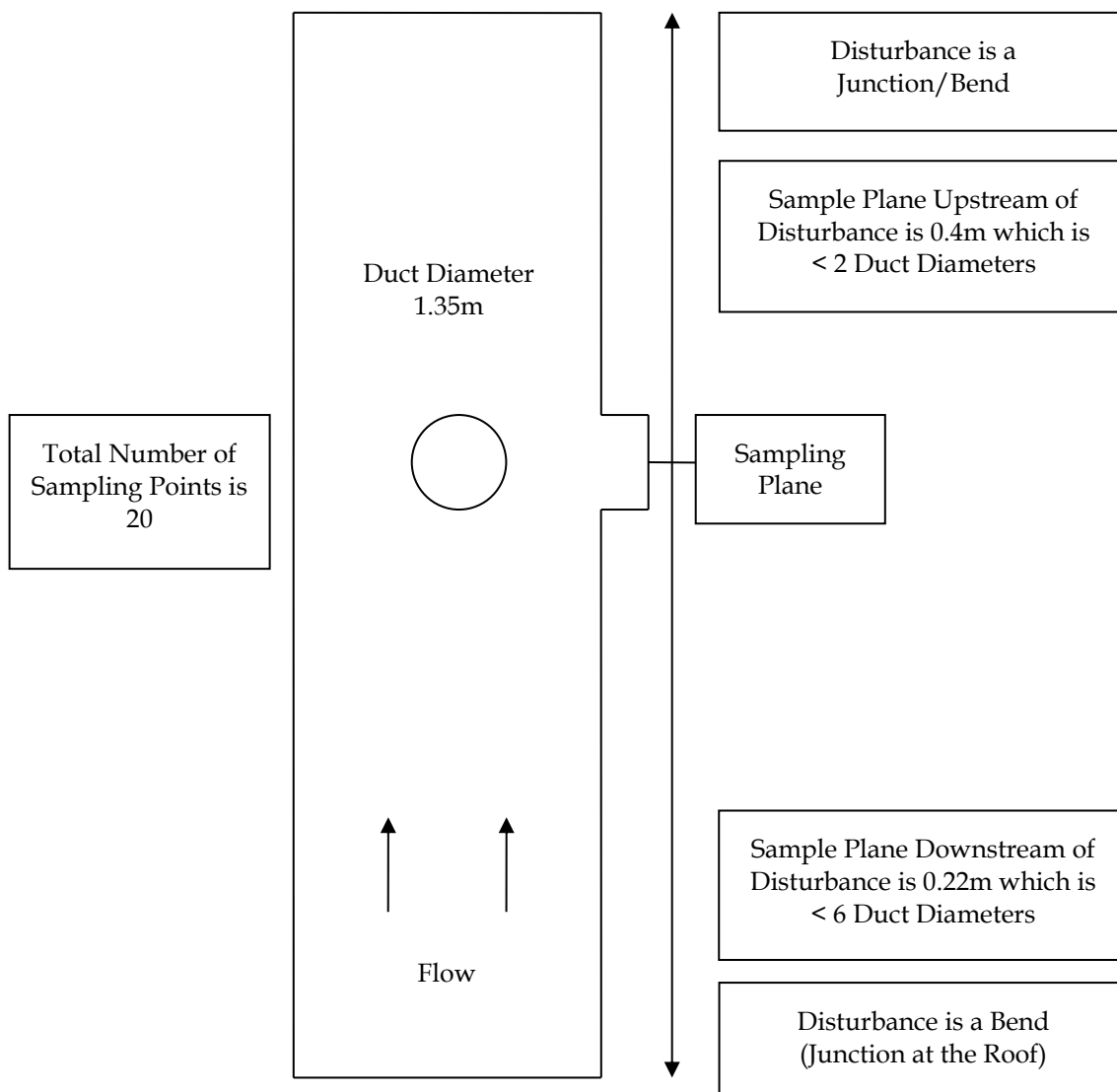
**TABLE C-4 INSTRUMENT CALIBRATION DETAILS DAY 4**

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	07-May-20	07-Nov-20
920	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
725	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
775	Thermocouple	07-May-20	07-Nov-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
753	Personal Sampler	12-Mar-20	12-Mar-21
946	combustion analyzer	16-Mar-20	16-Sep-20
<b>Gas Mixtures used for Analyser Span Response</b>			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

---

## **APPENDIX D – SAMPLE LOCATIONS**

**FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

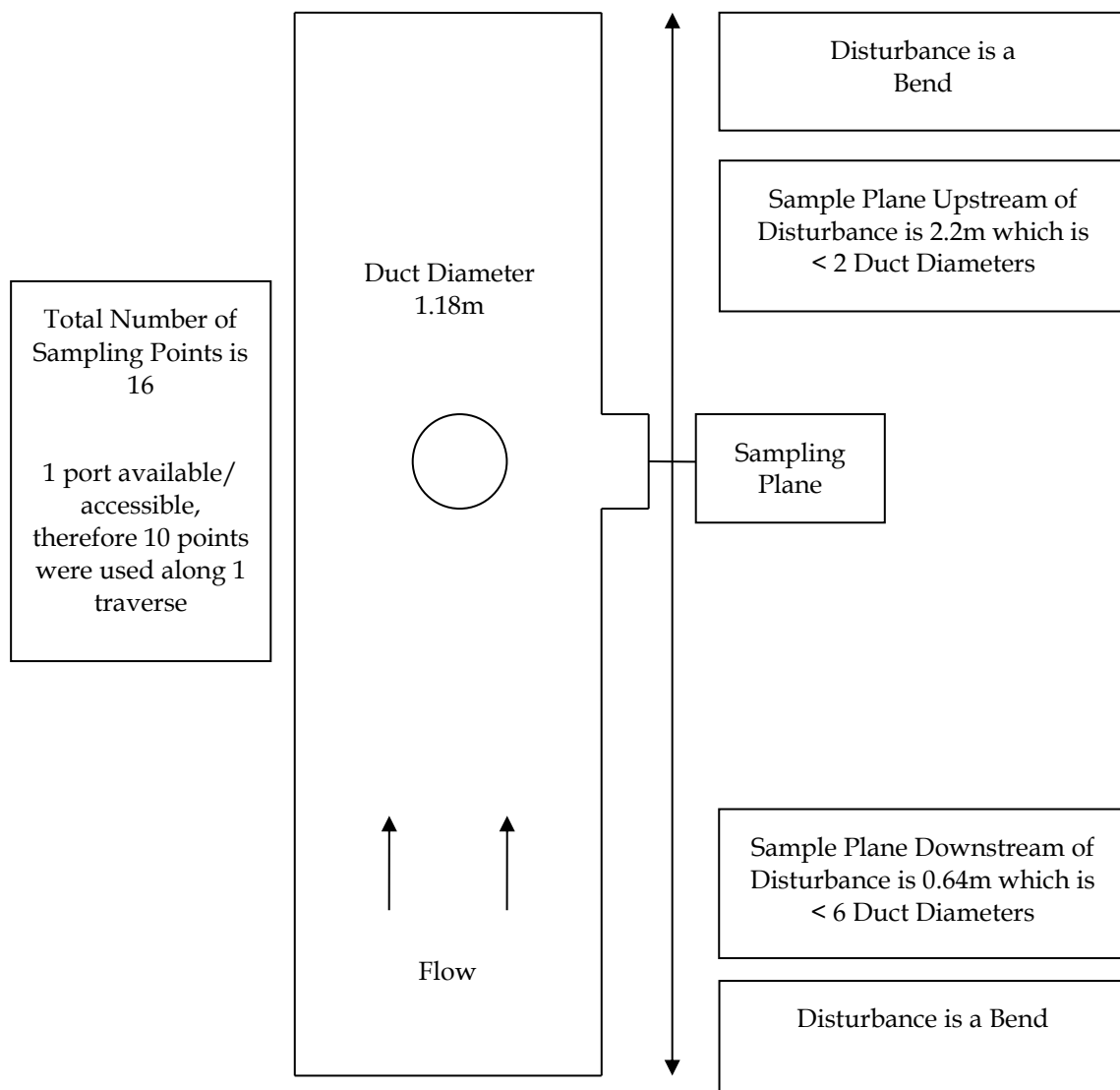
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

**FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION**





**FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC**



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

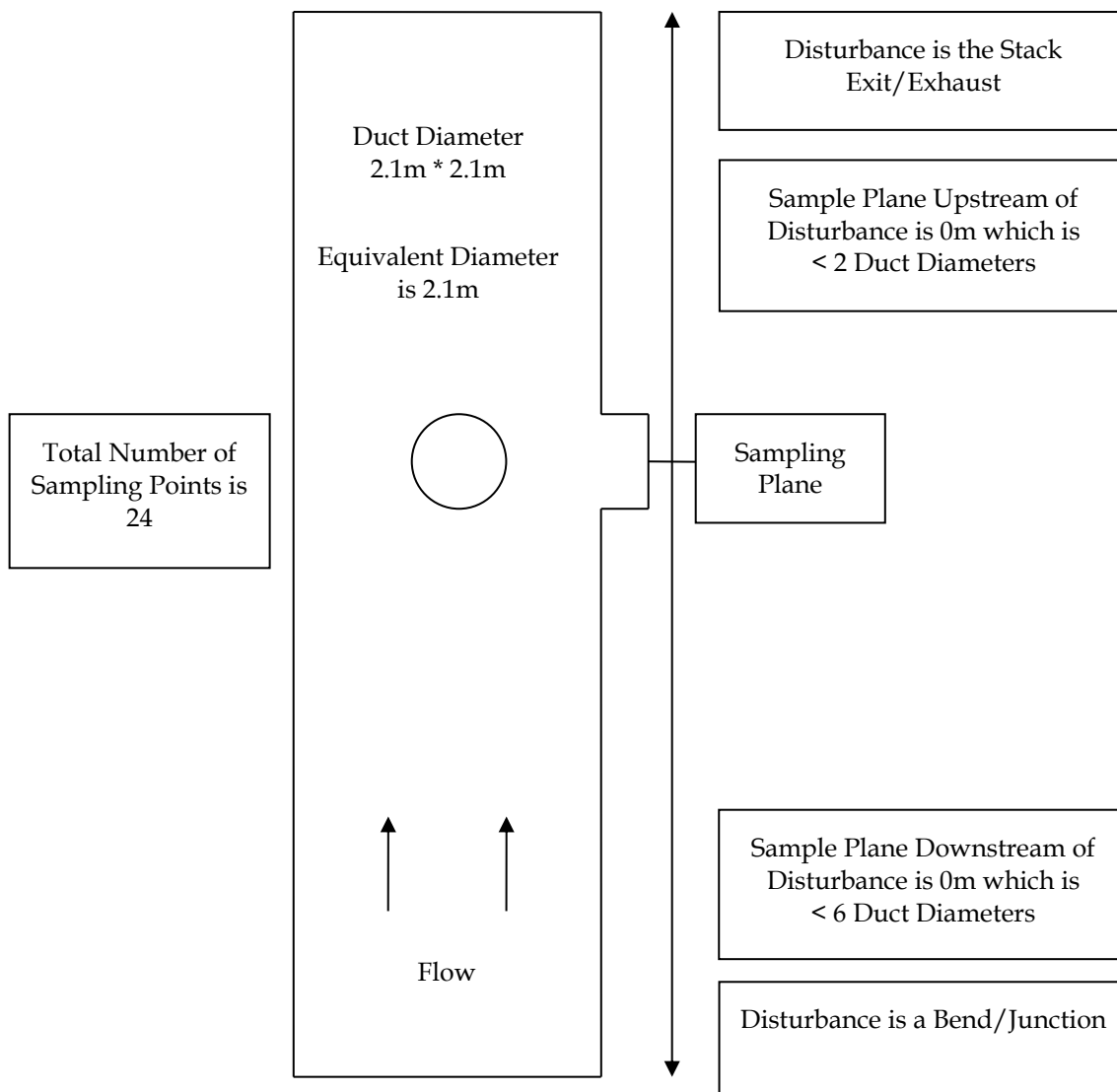
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The location of the interim exit sampling plane complies with AS4323.1 temperature and AS4323.3 odour criteria for sampling.

**FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT**



**FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

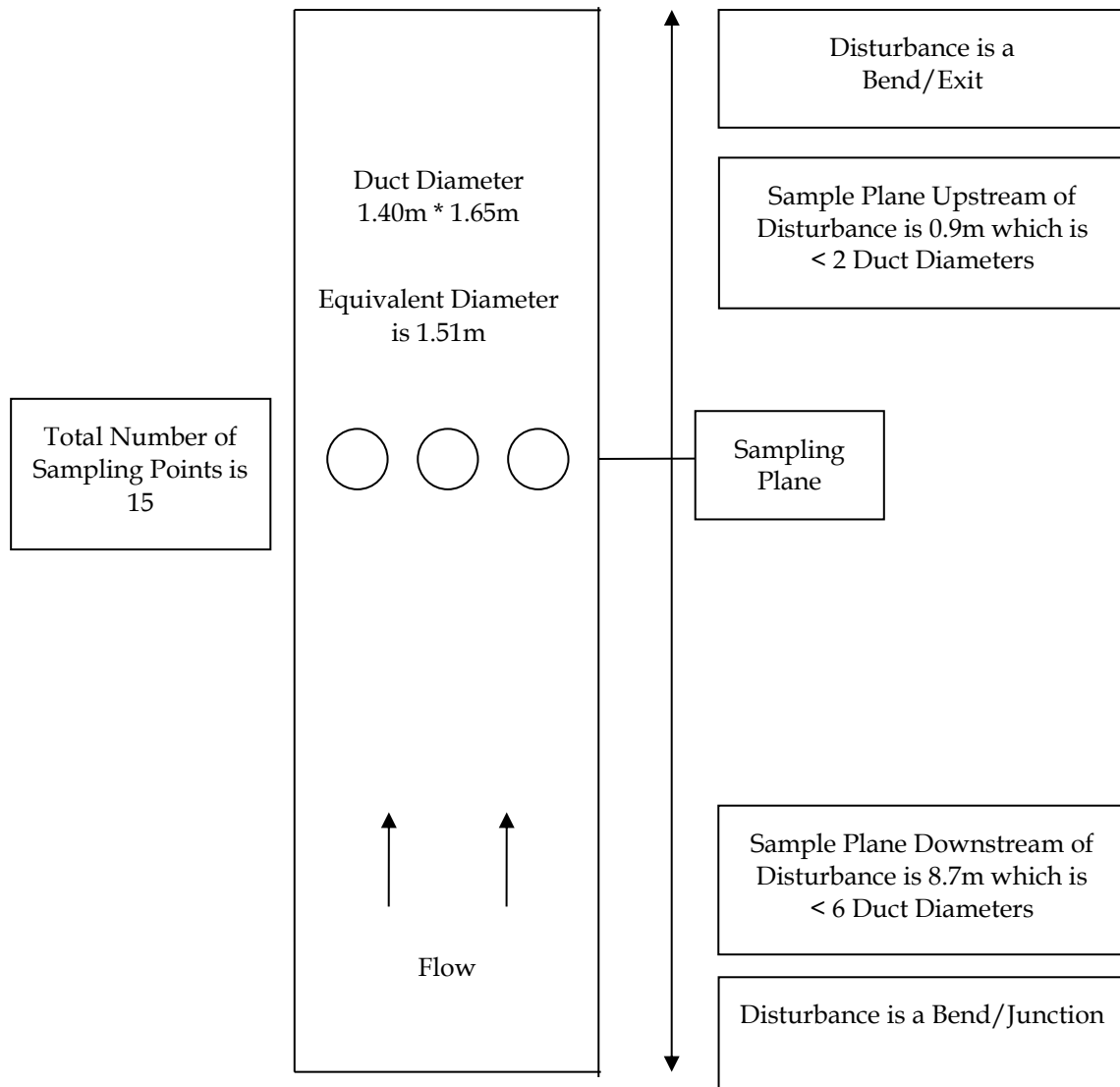
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of minimum velocity profile not meeting the minimum 3 metres per second (m/s) at every sampling point. Previous Minimum (0.8 m/s), Current Minimum (0 m/s).

**FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

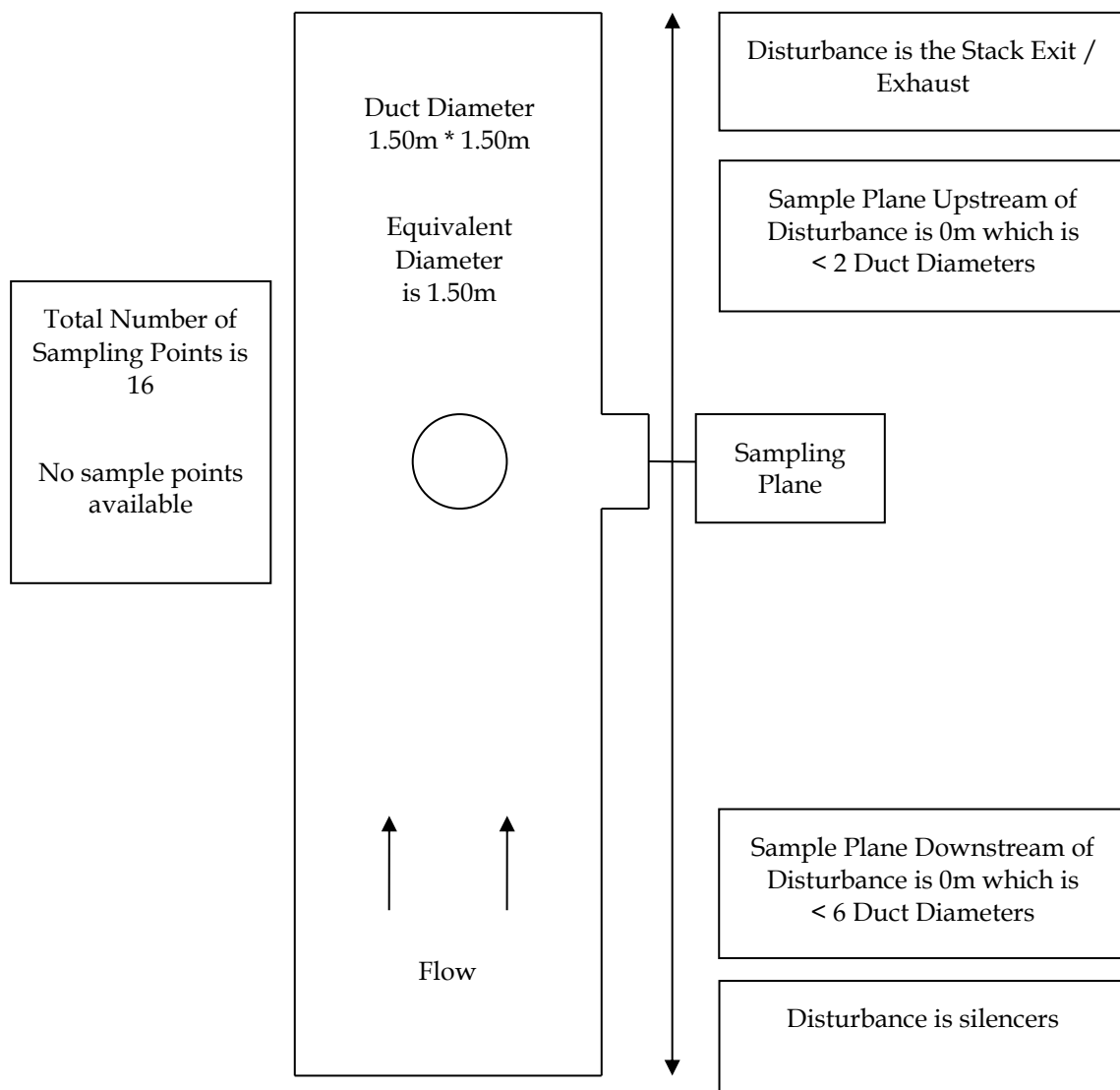
However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

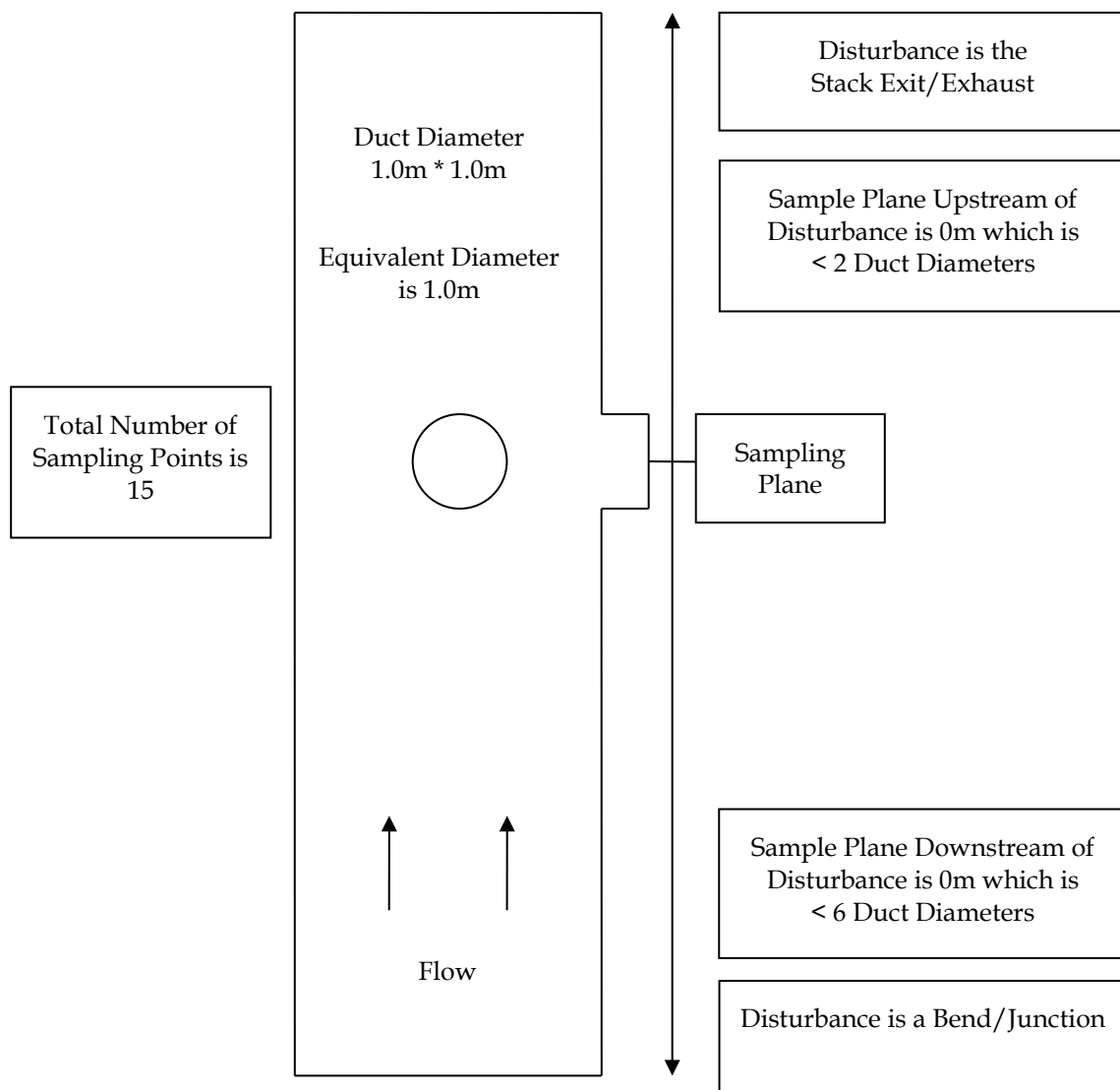
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

**FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION**





**FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

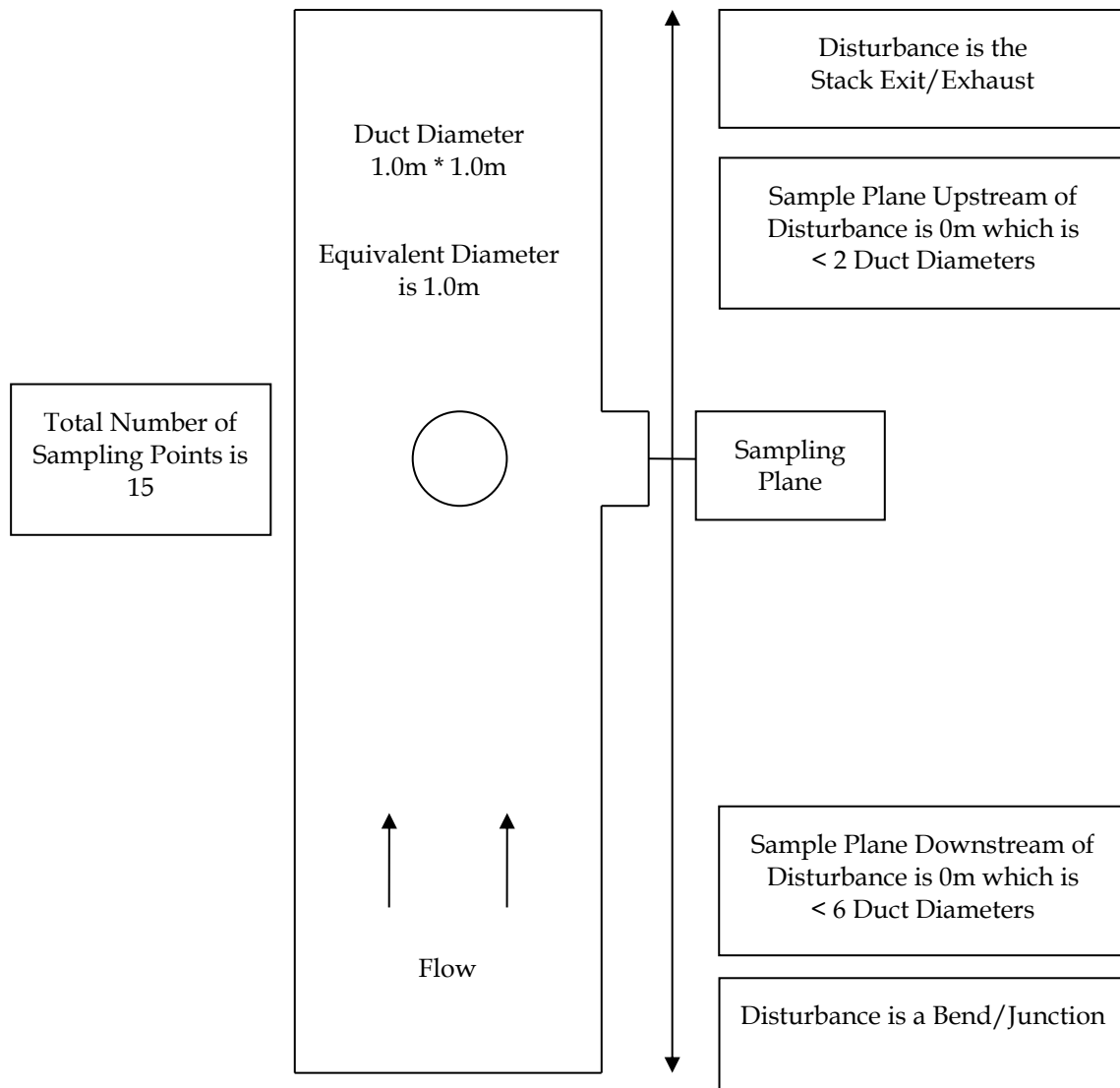
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

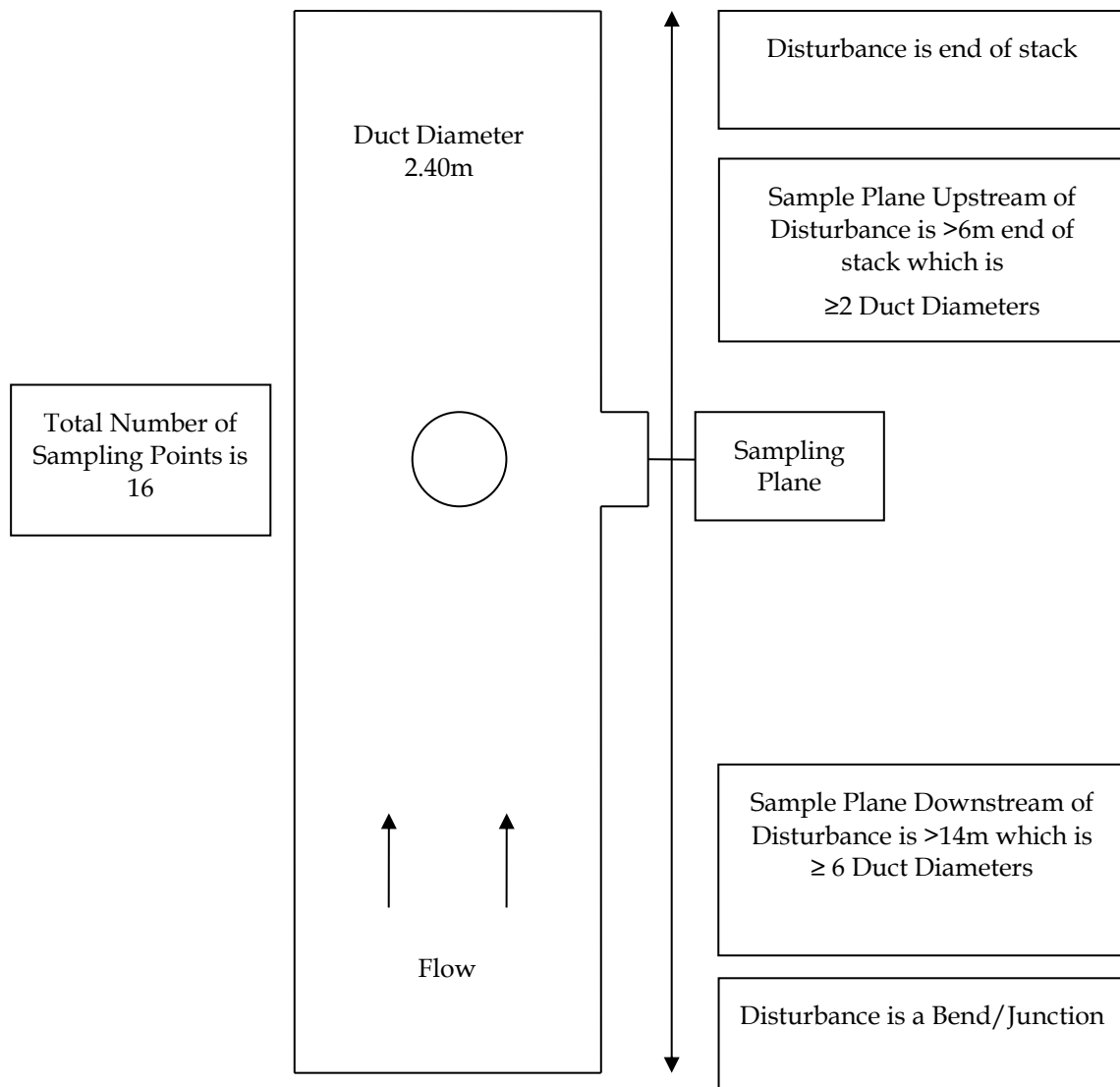
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC**



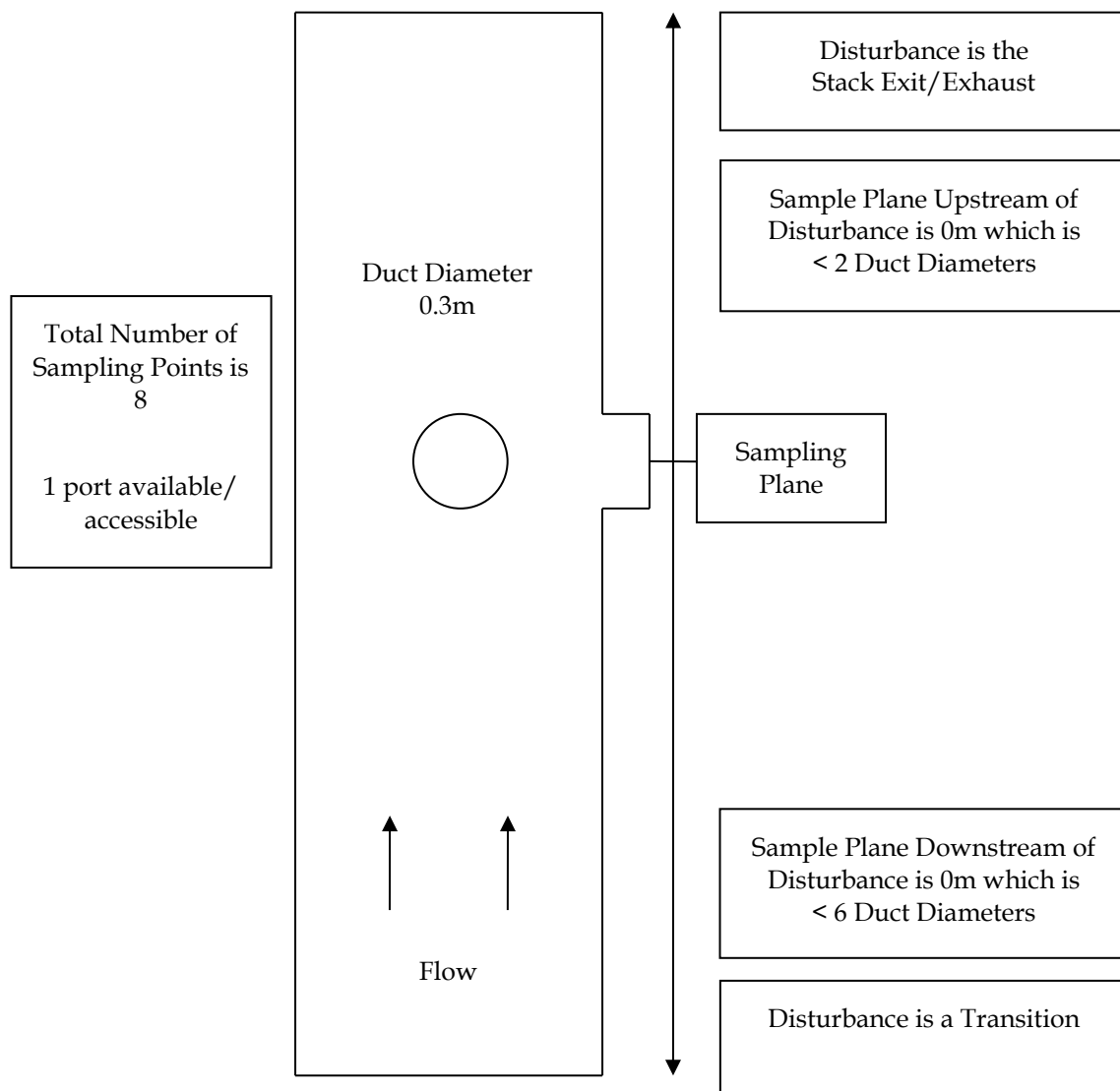
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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

**FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION**



**FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The sample location also does not meet the minimum number of access holes available.

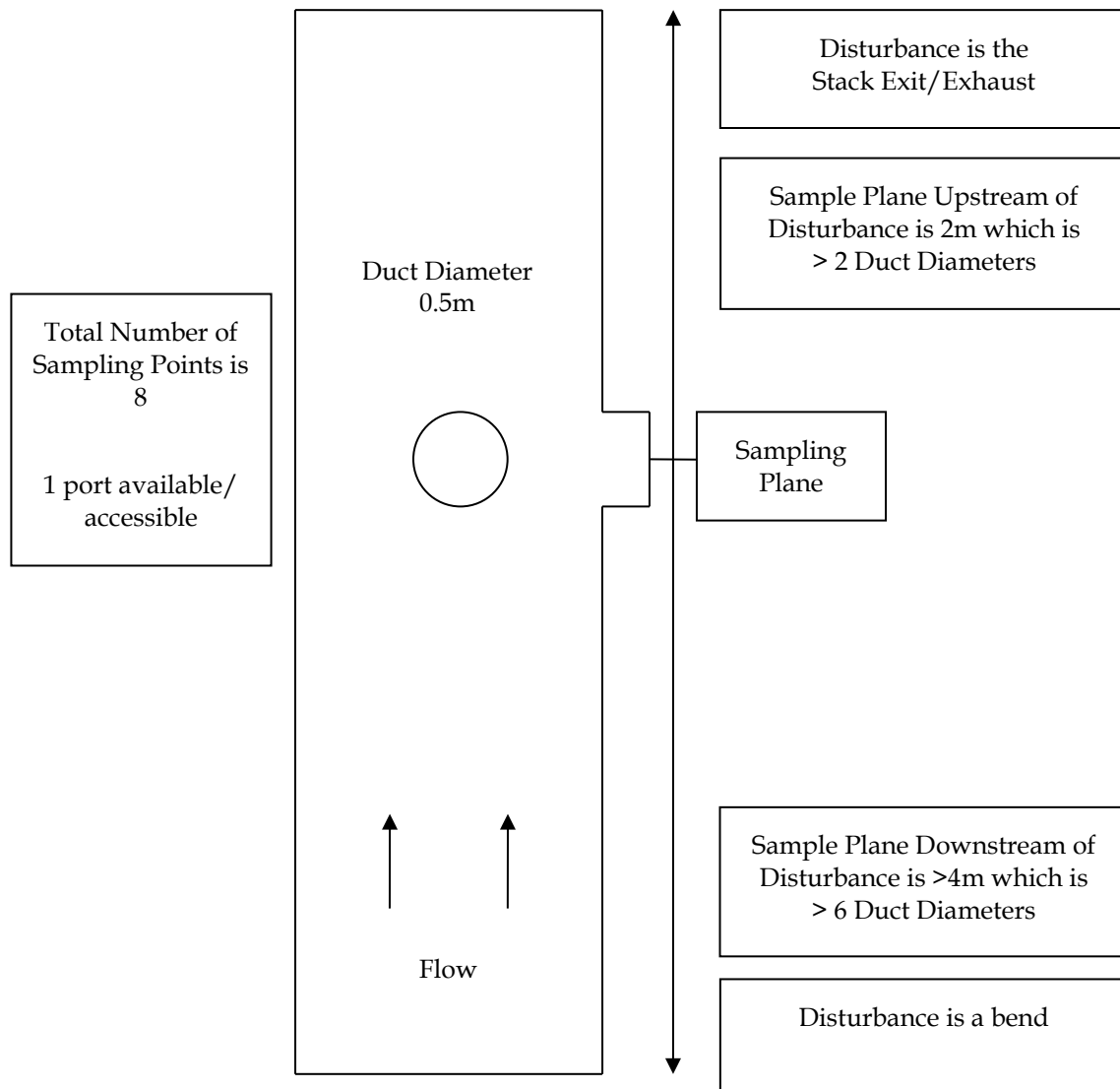
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of the velocity profile not meeting the minimum 3 metres per second (m/s) at any sampling point. Previous measurements were Average (0.9 m/s), maximum (1.1 m/s) and minimum (0.8 m/s) velocity profile. Current measurements are Average (1.7 m/s), maximum (3.5 m/s) and minimum (0 m/s) velocity profile.

**FIGURE D-18 FERMENTERS – SAMPLE LOCATION**





**FIGURE D-19 CO<sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC**

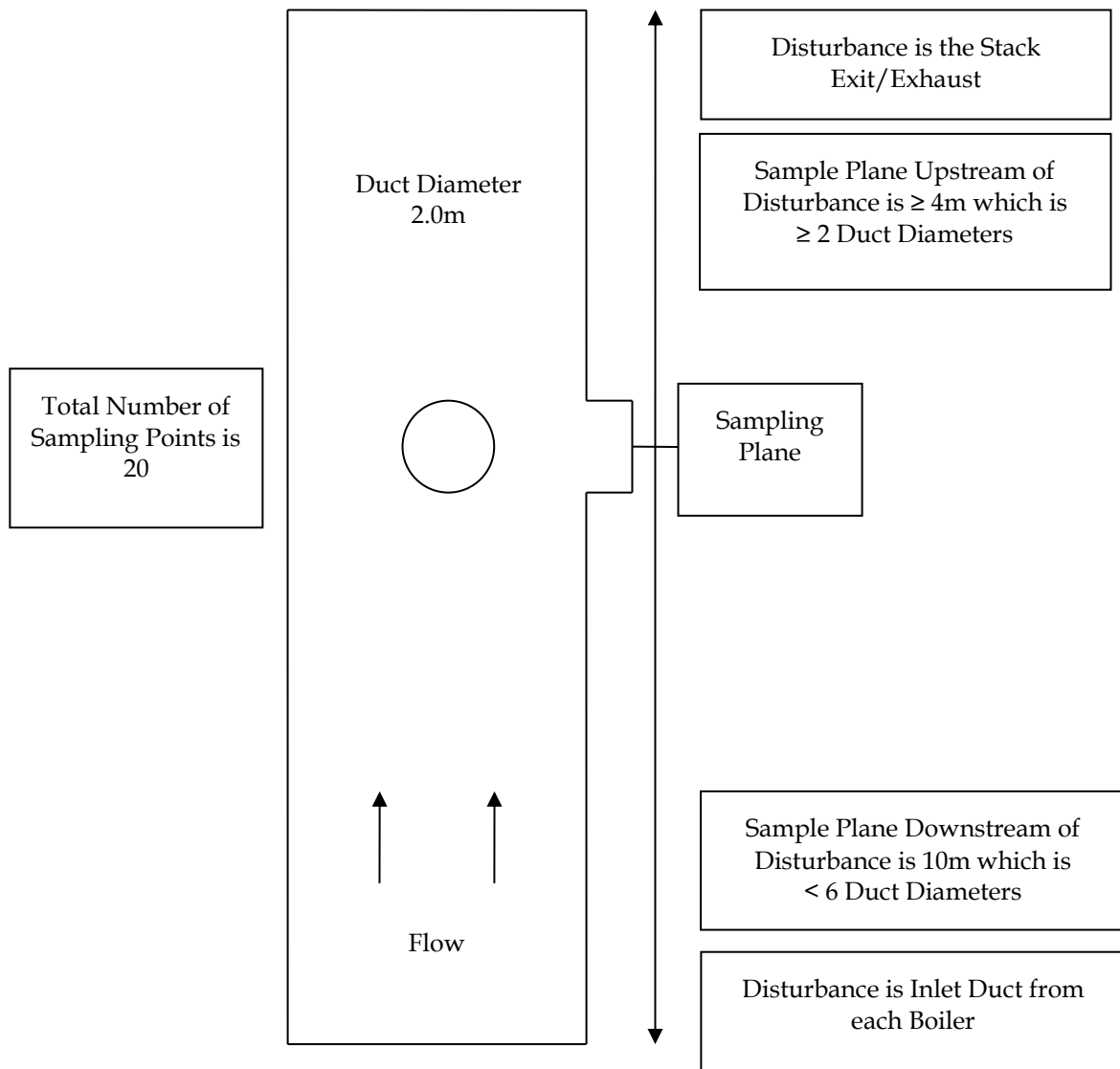


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

The sample location does not meet the minimum number of access holes available.

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

**FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC**



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

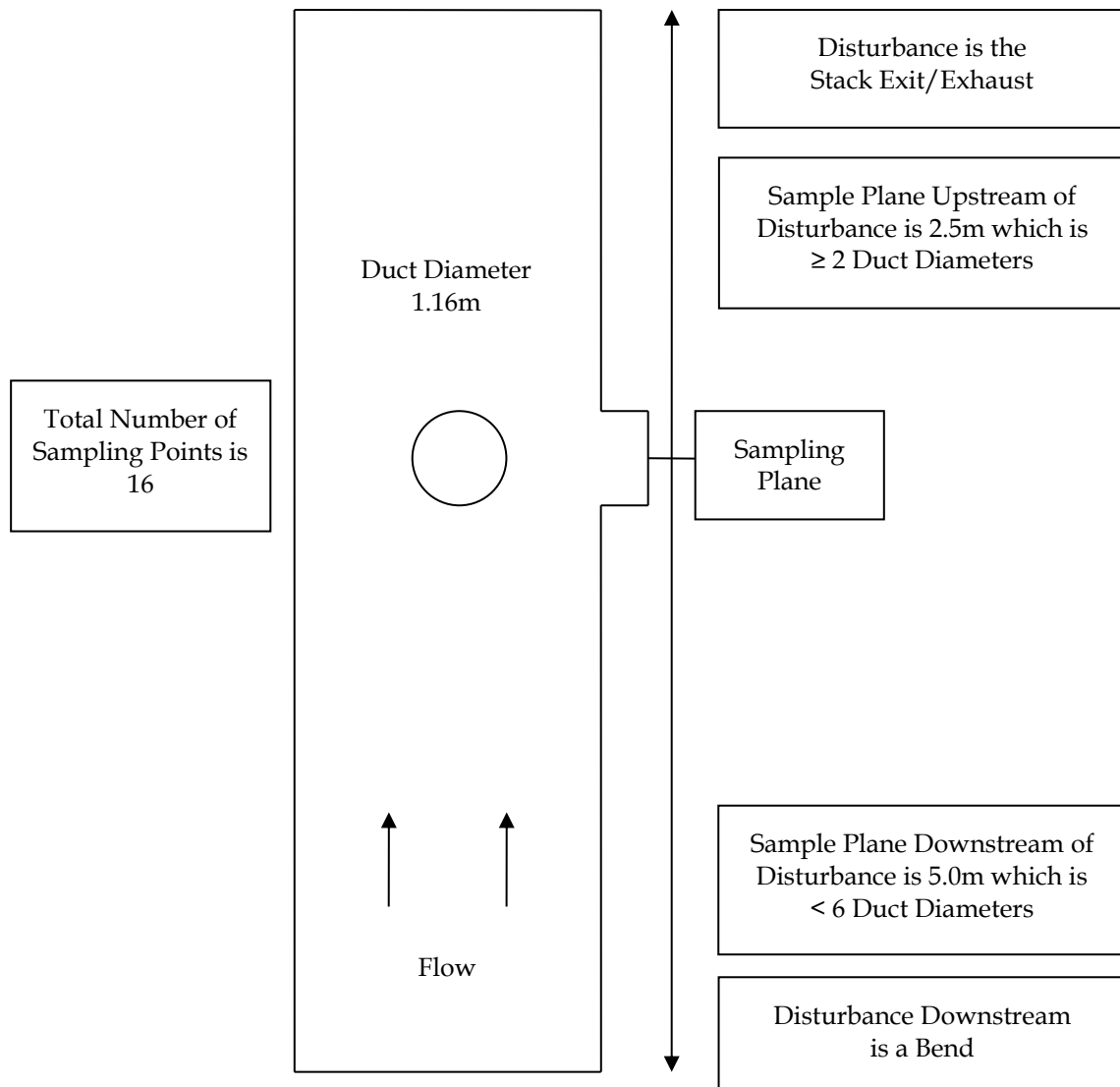
The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION**



**FIGURE D-22 BOILER NO. 4- SAMPLE LOCATION SCHEMATIC**



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

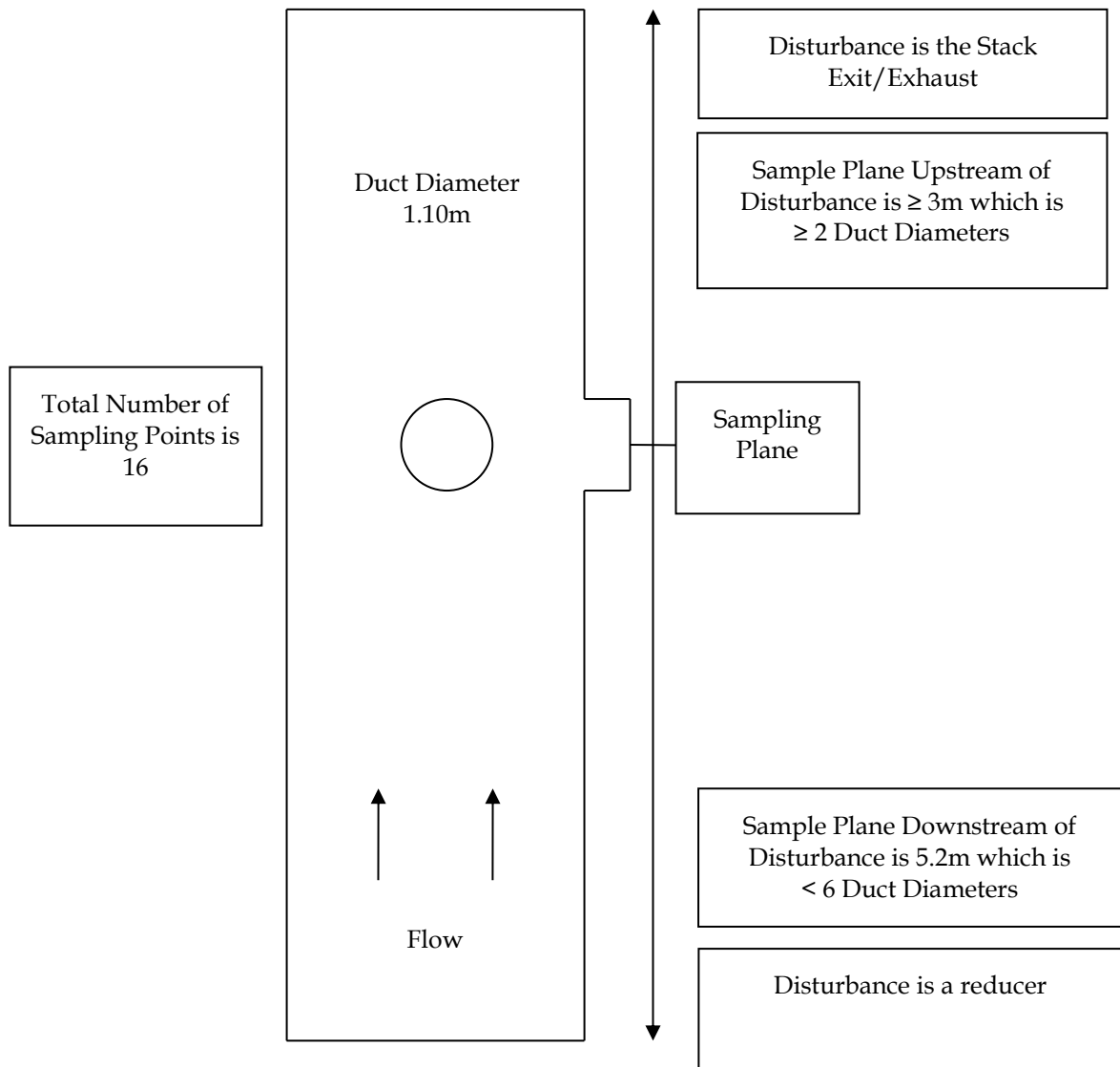
The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION**



**FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC**

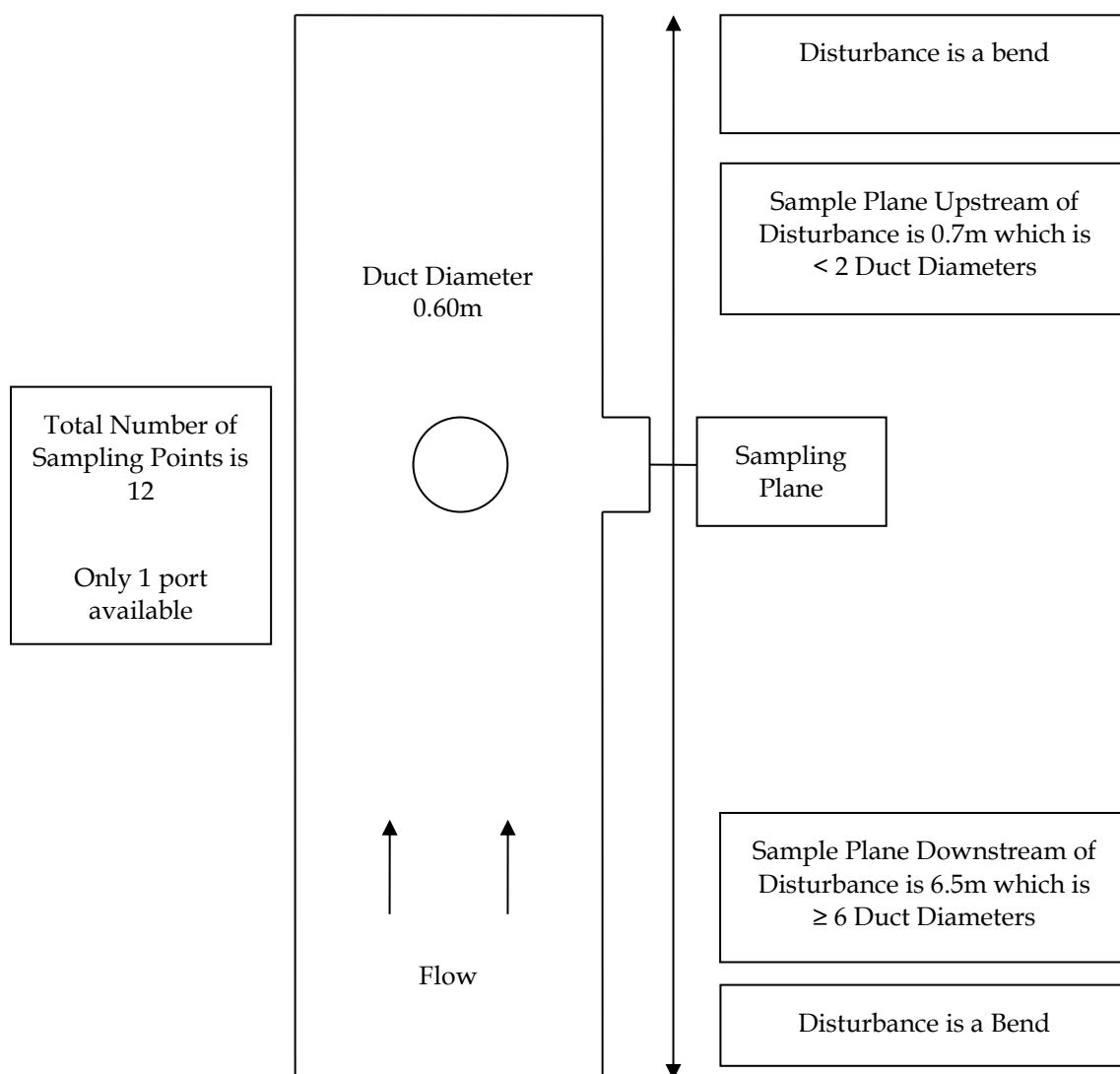


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

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

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

**FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC**



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

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

The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of velocity meeting the minimum velocity of 3m/s at every sampling point. Maximum = 5.2 m/s, Average = 2.4 m/s, Minimum = 1.0 m/s.



**FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION**

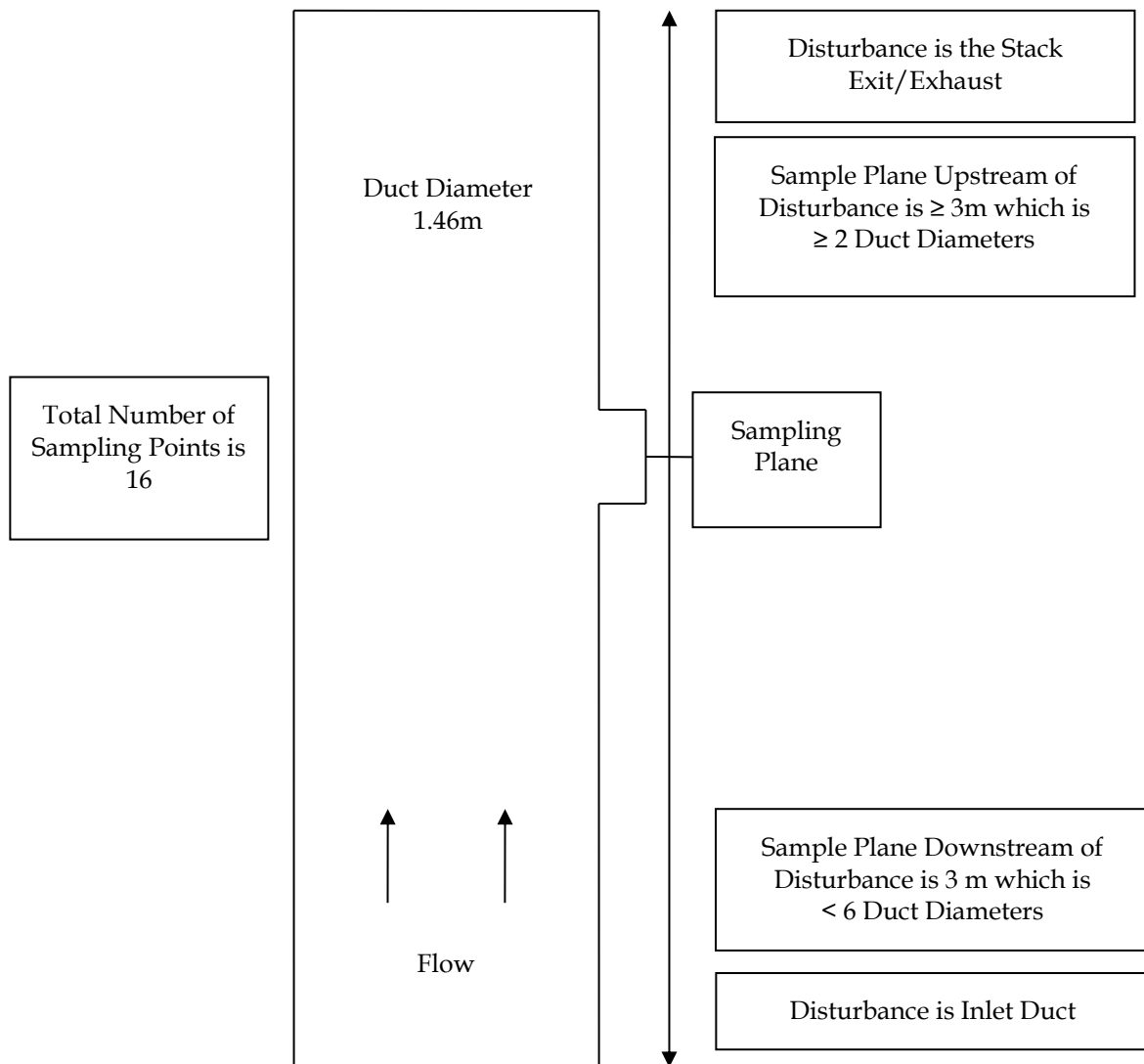


**FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION**





**FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC**



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

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

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

**FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH**





**Stephenson**

Environmental Management Australia

---

---

**EPL ODOUR EMISSION SURVEY QUARTER 2, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT No.: 7095/S25548A/20**

**DATES OF SURVEY: 5 & 12 AUGUST AND  
8 & 28 OCTOBER, 2020**

**DATE OF INTERIM REPORT ISSUE: 28 AUGUST, 2020**

**DATE OF FINAL REPORT ISSUE: 4 JANUARY, 2021**

---



**Stephenson**

**Environmental Management Australia**

Peter W Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144  
Tel: (02) 9737 9991

E-Mail: [info@stephensonenv.com.au](mailto:info@stephensonenv.com.au)

---

**EPL ODOUR EMISSION SURVEY QUARTER 2, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT NO.: 7095/S25548A/20**

**DATES OF SURVEY: 5 & 12 AUGUST AND  
8 & 28 OCTOBER, 2020**

**DATE OF INTERIM REPORT ISSUE: 28 AUGUST, 2020**

**DATE OF FINAL REPORT ISSUE: 4 JANUARY, 2021**

---

**P W STEPHENSON**

**J WEBER**

**M KIMBER**

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2</b>	<b>MONITORING REQUIREMENTS .....</b>	<b>4</b>
2.1	ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015) .....	4
2.1.1	CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS .....	4
2.1.2	CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS .....	5
<b>3</b>	<b>PRODUCTION CONDITIONS .....</b>	<b>7</b>
<b>4</b>	<b>ODOUR EMISSION TEST RESULTS .....</b>	<b>8</b>
<b>5</b>	<b>CONCLUSIONS .....</b>	<b>10</b>
<b>6</b>	<b>TEST METHODS .....</b>	<b>21</b>
6.1	ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY .....	21
6.1.1	ODOUR PANEL SELECTION .....	22
6.1.2	ODOUR TERMINOLOGY .....	22
6.2	EXHAUST GAS VELOCITY .....	22
6.3	EXHAUST GAS TEMPERATURE .....	23
6.4	OXYGEN (O <sub>2</sub> ) .....	23
6.5	MOISTURE .....	23
6.6	ACCURACY .....	23
<b>APPENDIX A – EMISSION TEST RESULTS .....</b>		<b>1</b>
<b>APPENDIX B – CERTIFICATES OF ANALYSIS .....</b>		<b>1</b>
<b>APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION .....</b>		<b>1</b>
<b>APPENDIX D – SAMPLE LOCATIONS .....</b>		<b>1</b>

## TABLE OF TABLES

TABLE 2-1	LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS .....	4
TABLE 2-2	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47) .....	5
TABLE 2-3	SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25) .....	5
TABLE 2-4	SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46) .....	5
TABLE 2-5	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45) .....	6
TABLE 4-1	MEASURED EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, QUARTER 2, 2020 .....	8
TABLE 4-2	MEASURED EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, QUARTER 2, 2020 .....	9
TABLE 6-1	ESTIMATION OF MEASUREMENT UNCERTAINTY .....	23

## TABLE OF FIGURES

FIGURE 5-1	ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS NO.1, 2, 3 & 4 (EPA 8, 9, 10 & 11) ..	11
FIGURE 5-2	ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13 & 14) .....	12
FIGURE 5-3	ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47) .....	12
FIGURE 5-4	ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44) .....	14
FIGURE 5-5	ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16) .....	15
FIGURE 5-6	ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35) .....	16
FIGURE 5-7	ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42) .....	17
FIGURE 5-8	ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45) .....	18

FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41) .....	19
FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46) .....	20

### TABLE OF TABLES – APPENDICES

TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4 .....	II
TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5 .....	III
TABLE A-3 EMISSION TEST RESULTS – BOILERS NO. 5&6, 4 & 2.....	IV
TABLE A-4 EMISSION TEST RESULTS – FERMENTER 13 & CO <sub>2</sub> SCRUBBER OUTLET.....	V
TABLE A-5 EMISSION TEST RESULTS – INLET TO BIOFILTERS, DDG EVAPORATORS 1, 2, 3 & 4.....	VI
TABLE A-6 EMISSION TEST RESULTS DDG PELLET PLANT.....	VII
TABLE A-7 EMISSION TEST RESULTS – BIOFILTER OUTLETS .....	VIII
TABLE C- 1 INSTRUMENT CALIBRATION DETAILS DAY 1 .....	II
TABLE C- 2 INSTRUMENT CALIBRATION DETAILS DAY 2.....	III
TABLE C- 3 INSTRUMENT CALIBRATION DETAILS DAY 3.....	IV
TABLE C-4 INSTRUMENT CALIBRATION DETAILS DAY 4 .....	V

### TABLE OF FIGURES – APPENDICES

FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	II
FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION .....	III
FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC.....	IV
FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT .....	V
FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	VI
FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION .....	VII
FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	VIII
FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION .....	IX
FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	X
FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION .....	XI
FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	XII
FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION .....	XIII
FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	XIV
FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION .....	XV
FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC .....	XVI
FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION .....	XVII
FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC .....	XVIII
FIGURE D-18 FERMENTERS – SAMPLE LOCATION .....	XIX
FIGURE D-19 CO <sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC .....	XX
FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC .....	XXI
FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION .....	XXII
FIGURE D-22 BOILER NO. 4– SAMPLE LOCATION SCHEMATIC .....	XXIII
FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION.....	XXIV
FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC .....	XXV
FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC.....	XXVI
FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION .....	XXVII
FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION .....	XXVII
FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC.....	XXVIII
FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH.....	XXIX

## 1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Shoalhaven Starches Pty Limited to conduct an odour emission survey at their manufacturing complex in Bomaderry, New South Wales (NSW).

The objective of the survey is to comply with Condition M2.1 of the Environment Protection Licence (EPL) No. 883 issued by the Environment Protection Authority (EPA). The EPA is now part of the Office of Environment and Heritage (OEH).

Section 2 of this report outlines Conditions P1 and M2 which identify the potential point and diffuse odour sources and the sampling and analysis methods respectively required by the OEH. This survey monitored the quarterly odour concentrations as required in section M2.2 of EPL 883.

In addition, the Carbon Dioxide (CO<sub>2</sub>) Scrubber Inlet sampling point, which currently is not listed in EPL 883 and therefore does not have an EPA Identification No., was also sampled.

The DDG Pellet Plant Stack sampling port was inaccessible so measurements were taken from the DDG Cooler Silo and DDG Pellet Cooler East stack. They have a partial contribution to EPA Identification No. 46.

The quarters are defined as below:

- Quarter 1 May to July inclusive
- Quarter 2 August to October inclusive
- Quarter 3 November to January inclusive
- Quarter 4 February to April inclusive

Quarter 2, 2020-2021 odour test results are presented in this report. These tests were conducted on the 5<sup>th</sup> and 12<sup>th</sup> August and the 8<sup>th</sup> and 28<sup>th</sup> October, 2020.

## 2 MONITORING REQUIREMENTS

### 2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015)

#### 2.1.1 CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS

Table 2-1 identifies the point and diffuse sources as defined by the OEHL that relate to this survey as per most recent version of EPL No. 883 dated 20 June 2018.

**TABLE 2-1 LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS**

EPL ID. No.	Location	Odour Samples TM OM-7/8	Frequency as per M2.2 EPL 883
8	No. 1 Gluten Dryer	1	Quarterly
9	No. 2 Gluten/Starch Dryer*	1	Quarterly
10	No. 3 Gluten Dryer	1	Quarterly
11	No. 4 Gluten Dryer	1	Quarterly
12	No. 1 Starch Dryer	1	Quarterly
13	No. 3 Starch Dryer	1	Quarterly
14	No. 4 Starch Dryer	1	Quarterly
16	CO <sub>2</sub> Scrubber outlet	1	Quarterly
Not specified	CO <sub>2</sub> Scrubber inlet	1	--
19	Effluent Storage Dam 1	1	Yearly
20	Effluent Storage Dam 2	1	Yearly
21	Effluent Storage Dam 3	1	Yearly
23	Effluent Storage Dam 5	1	Yearly
24	Effluent Storage Dam 6	1	Yearly
25	Sulphur Oxidisation Pond	1	Yearly
35	Combined Stack Boilers No.5 & 6	1	Quarterly
39	Inlet Pipe to Biofilters A & B (DDG Evaporators 1, 2 & 3)	1	Quarterly
39A	Inlet Pipe to Biofilters A & B (DDG Evaporator 4)	1	Quarterly
40	Outlet of Biofilter A	2	Quarterly
41	Outlet of Biofilter B	2	Quarterly
42	Boiler No.4	1	Quarterly
44	Fermenter	1	Quarterly
45	Boiler No.2	1	Quarterly
46	DDG Pellet Plant Stack	1	Quarterly
47	No. 5 Starch Dryer	1	Quarterly



## 2.1.2 CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS

Condition M2.1 states: *For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency specified in the opposite columns.*

Key to Tables 2.2 to 2.5:

%	=	percent
°C	=	degrees Celsius
g/g.mole	=	grams per gram mole
kg/m <sup>3</sup>	=	kilograms per cubic metre
m/s	=	metres per second
m <sup>3</sup> /s	=	cubic metres per second
mg/m <sup>3</sup>	=	milligrams per cubic metre
OM	=	Other Method
ou	=	odour units
TM	=	Test Method

**TABLE 2-2 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47)**

Pollutant	Units	Frequency	Approved Method
Dry Gas Density	kg/m <sup>3</sup>	Quarterly	TM-23
Flow	m <sup>3</sup> /s	Quarterly	TM-2
Moisture	%	Quarterly	TM-22
Molecular Weight of stack gases	g/g-mole	Quarterly	TM-23
Odour	ou	Quarterly	OM-7
Oxygen	%	Quarterly	TM-25
Temperature	°C	Quarterly	TM-2
Velocity	m/s	Quarterly	TM-2

**TABLE 2-3 SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Annual	OM-7

**TABLE 2-4 SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Quarterly	OM-7

**TABLE 2-5 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45)**

<b>Pollutant</b>	<b>Units</b>	<b>Frequency</b>	<b>Approved Method</b>
Cadmium	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Mercury	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Moisture	%	Quarterly	TM-22
Molecular weight of stack gases	g/g.mole	Quarterly	TM-23
Nitrogen Oxides	mg/m <sup>3</sup>	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m <sup>3</sup>	Annual	TM-4
Temperature	°C	Quarterly	TM-2
Total Solid Particles	mg/m <sup>3</sup>	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m <sup>3</sup>	Quarterly	TM-34
Volumetric Flowrate	m <sup>3</sup> /s	Quarterly	TM-2

### **3 PRODUCTION CONDITIONS**

Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.

One exception is that Gluten Dryer No.1 (EPA ID 8) has had a new silencer and supporting ductwork installed to replace the previous unit. However, the sampling ports have not been re-installed in this new ductwork. Therefore, access to the inside of the duct is no longer available. Thus, exhaust gas flow measurements were unable to be taken.

However, odour measurements were taken from the duct outlet to atmosphere. To enable calculation of the Mass Odour Emission Rate (MOER), exhaust gas flow measurements have been based on the most recent previous quarterly monitoring results; that is, Quarter 1, 2020 results.

Access to the DDG Pellet Plant Stack (EPA 46) was inaccessible, so measurements were taken from the DDG Pellet Cooler East and the DDG Pellet Silo, which have a partial contribution to EPA 46.

## 4 ODOUR EMISSION TEST RESULTS

SEMA performed the sampling and the odour analysis was performed by Odour Research Laboratories Australia (ORLA). SEMA and ORLA are both NATA accredited (No.15043) facilities to ISO 17025 for this.

The NATA accredited ORLA Olfactometry Test Reports 7095/ORLA/01 and 7095/ORLA/02 are presented in Appendix B.

Exhaust gas flow and emission tests results from measured sources are detailed in Tables A-1 to A-7, Appendix A.

Appendix C details calibration of instruments used to take measurements.

Appendix D shows sample locations.

Tables 4-1 summarise the odour emission concentrations for the point sources measured in Quarter 2, 2020.

**TABLE 4-1 MEASURED EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, QUARTER 2, 2020**

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	12.08.2020	660
9	No.2 Gluten Dryer	05.08.2020	430
10	No.3 Gluten Dryer	05.08.2020	850
11	No.4 Gluten Dryer	05.08.2020	720
12	No.1 Starch Dryer	05.08.2020	250
13	No.3 Starch Dryer	12.08.2020	400
14	No.4 Starch Dryer	12.08.2020	140
16	Carbon Dioxide Scrubber Outlet	05.08.2020	17,500
--	Carbon Dioxide Scrubber Inlet	05.08.2020	11,300
35	Combined Stack No.5 & 6 Boilers	12.08.2020	2,000
42	Boiler No.4 Outlet	12.08.2020	2,180
44	Fermenter (No. 13)	05.08.2020	10,300
45	Boiler No.2 Outlet	12.08.2020	1,100
47	No.5 Starch Dryer	12.08.2020	250
Part 46*	DDG Pellet Cooler East	28.10.2020	6200
Part 46*	DDG Pellet Silo	28.10.2020	8800

Key:

ou = odour units

-- = Not listed in EPL 883, no EPL ID number

Part 46\* = Partial contribution to EPA ID 46, as EPA ID 46 stack was inaccessible

**TABLE 4-2 MEASURED EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, QUARTER 2, 2020**

EPA ID No.	Description	Date	Odour Concentration (ou)
39	Inlet to Biofilters A & B DDG Evaporators 1, 2 & 3	8.10.2020	15,600
39A	Inlet to Biofilters A & B DDG Evaporators 4	8.10.2020	41,900
40	Outlet of Biofilter A (east)	8.10.2020	1,200
40	Outlet of Biofilter A (west)	8.10.2020	1,400
41	Outlet of Biofilter B (east)	8.10.2020	4,000
41	Outlet of Biofilter B (west)	8.10.2020	6,200

## 5 CONCLUSIONS

The comparative results of the odour sampling and analysis, over time, that have been undertaken by SEMA at Shoalhaven Starches manufacturing facility at Bomaderry are graphically presented in Figures 5-1 to 5-8.

Figure 5-1 presents graphical representations of odour concentrations recorded for Gluten Dryers No.1, 2, 3 and 4 since autumn 2005.

Figure 5-2 presents graphical representations of odour concentrations recorded for Starch Dryers No.1, 3 and 4 since autumn 2005.

Figure 5-3 graphically shows the Starch Dryer No. 5 emission concentrations since spring 2017.

Figure 5-4 graphically shows the Fermenter emission concentrations since summer 2007-2008.

Figure 5-5 illustrates odour emission concentrations from the Carbon Dioxide Scrubber since autumn 2013.

Figures 5-6 and 5-7 graphically show the Combined Boiler 5 and 6 stack and the Boiler No.4 stack emission concentrations since summer 2013-2014 respectively.

Figure 5-8 shows the Boiler 2 stack emission concentrations since winter 2019.

Figure 5-9 graphically shows the Bio-filter inlet and outlet emission concentrations since autumn 2010.

Figure 5-10 graphically shows the DDG Pellet plant stack emission concentrations since spring 2016.

FIGURE 5-1 ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS NO.1, 2, 3 & 4 (EPA 8, 9, 10 & 11)

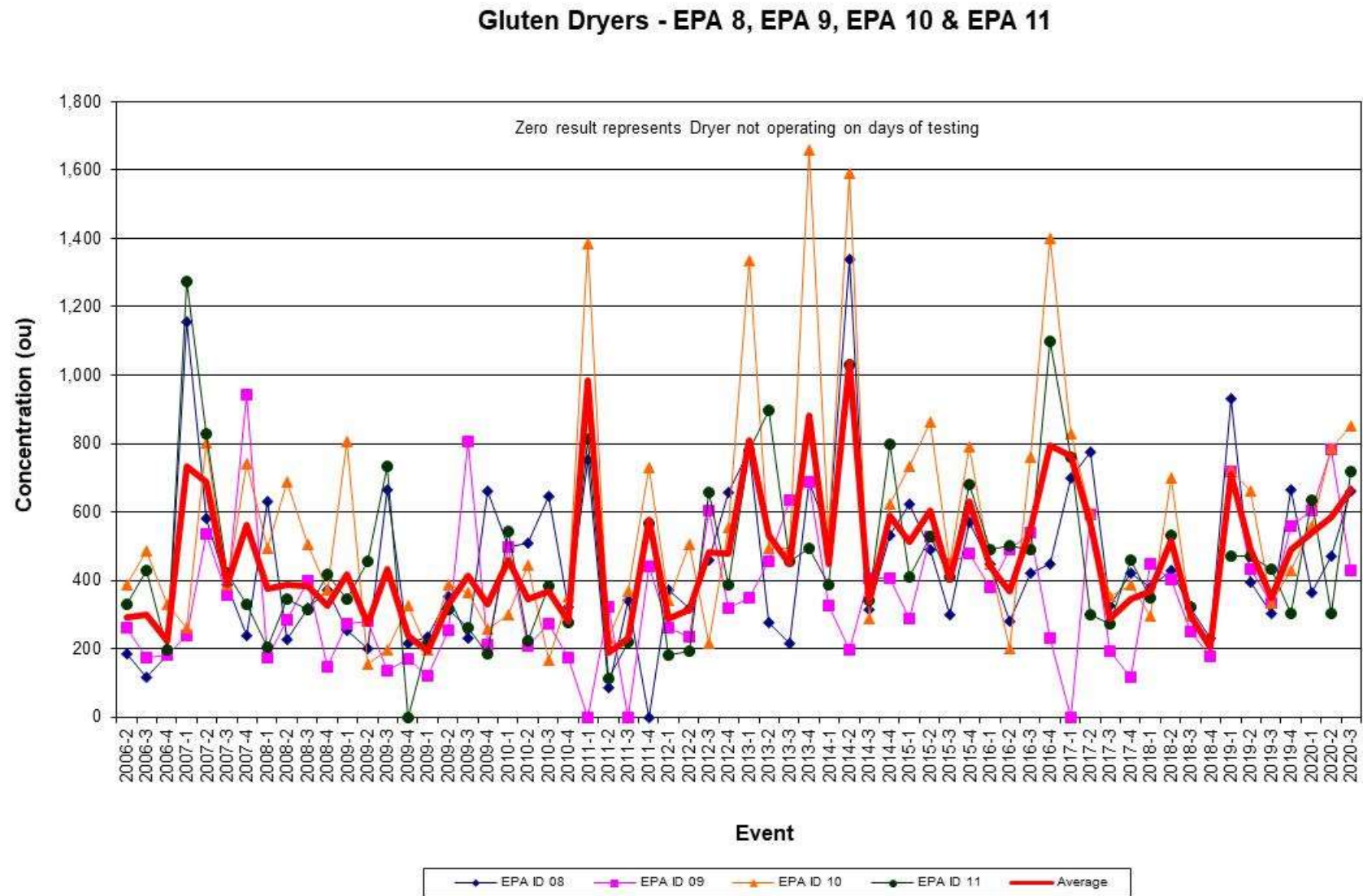


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13 & 14)

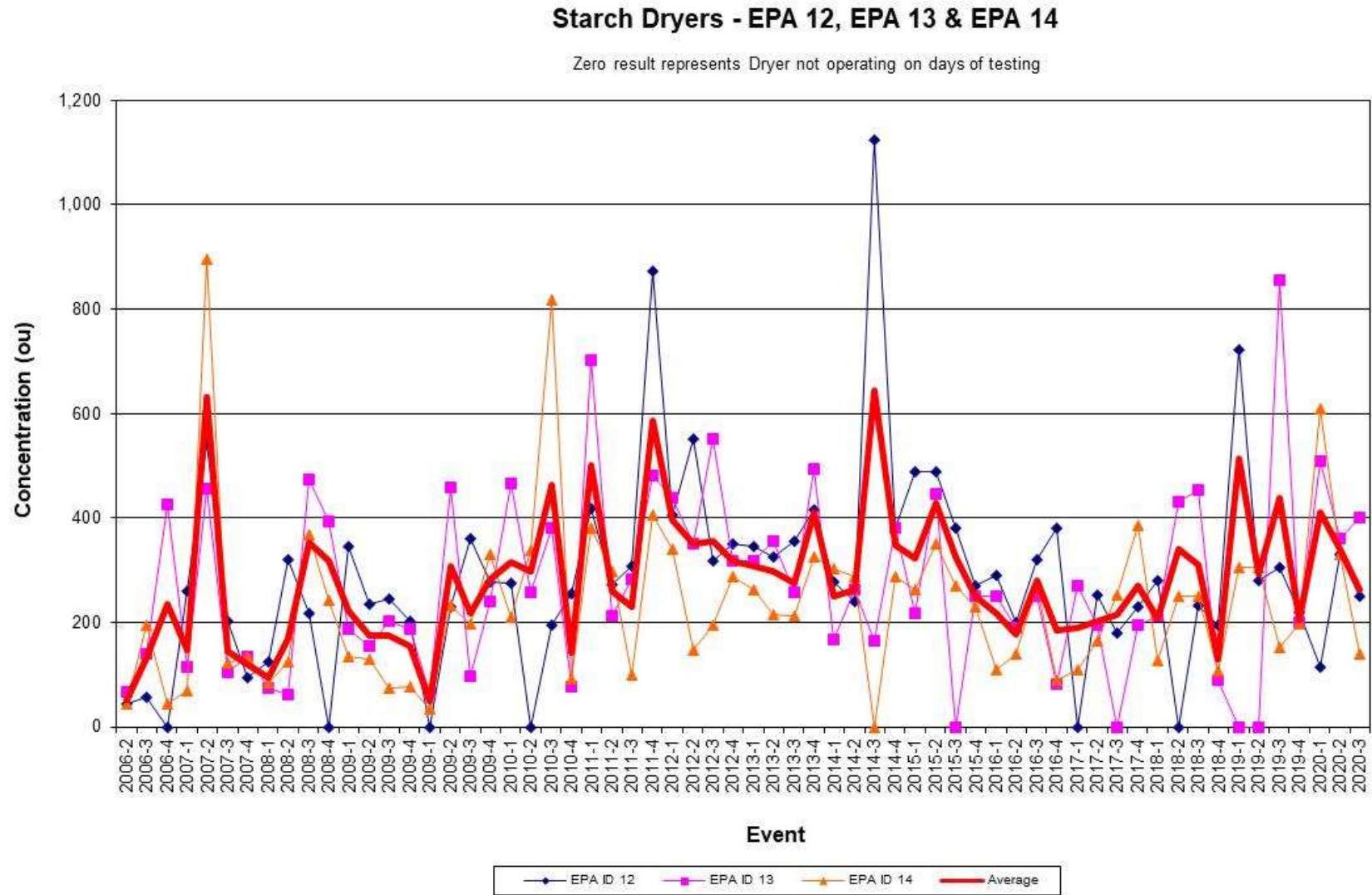
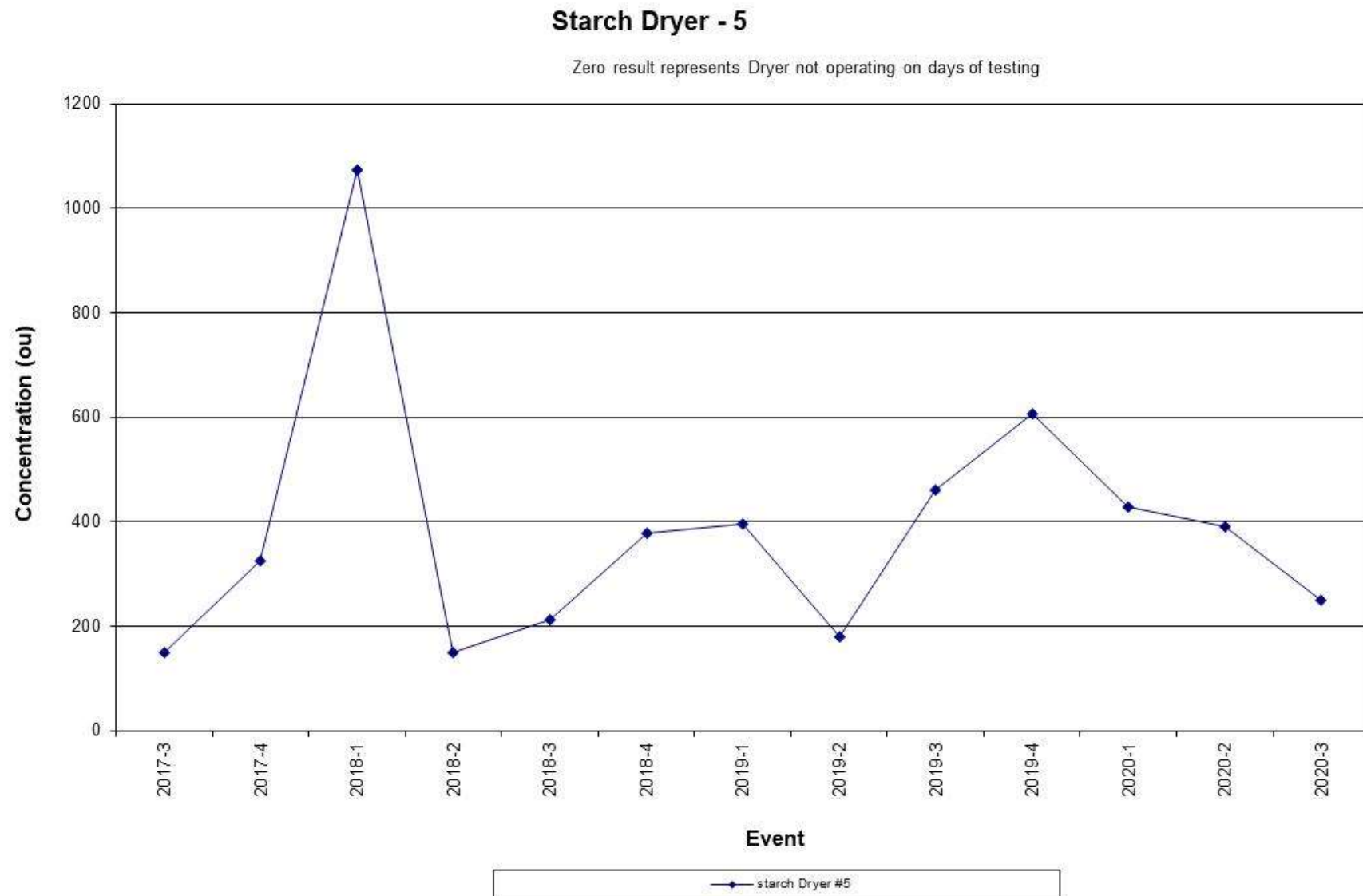




FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47)



**FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44)**

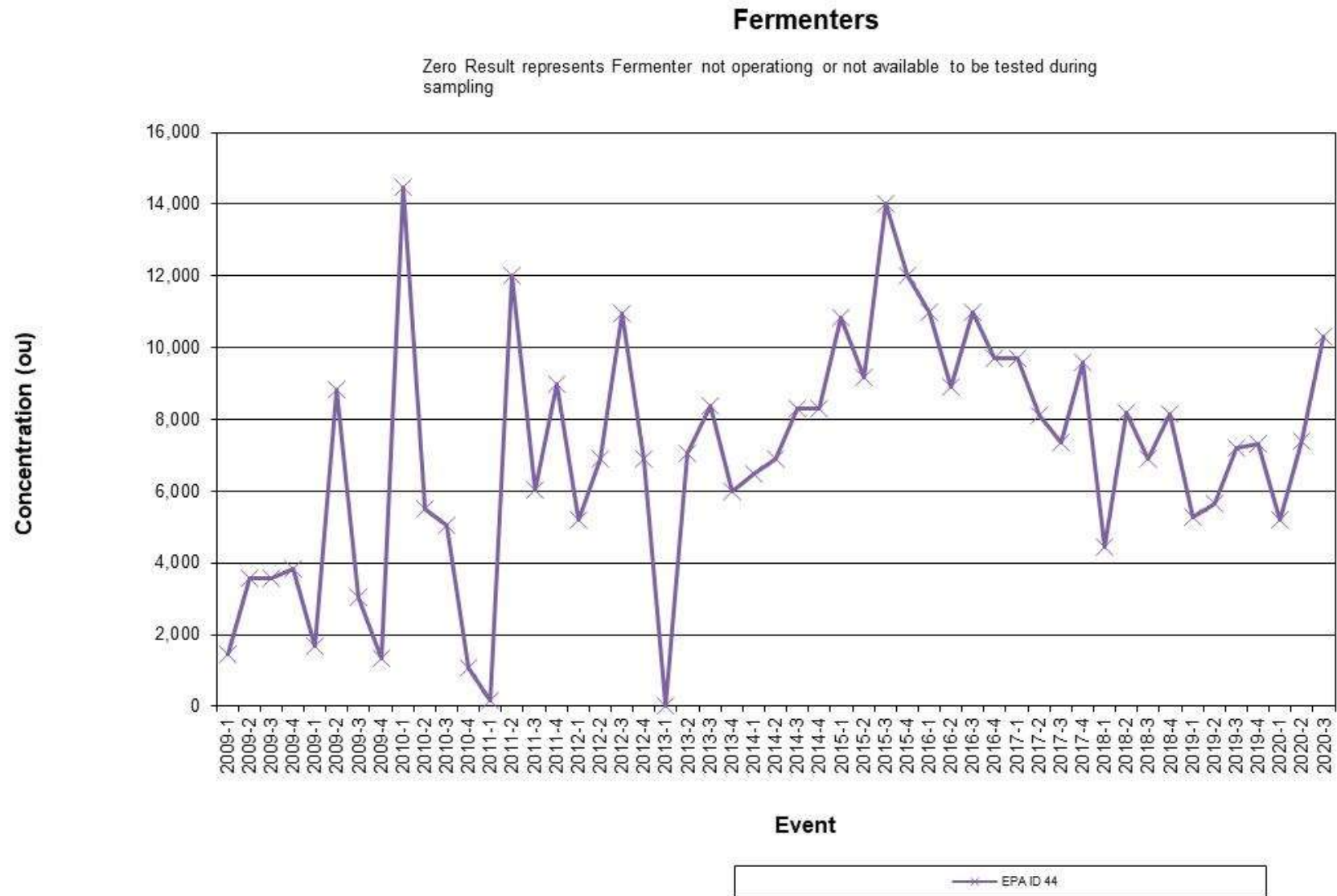
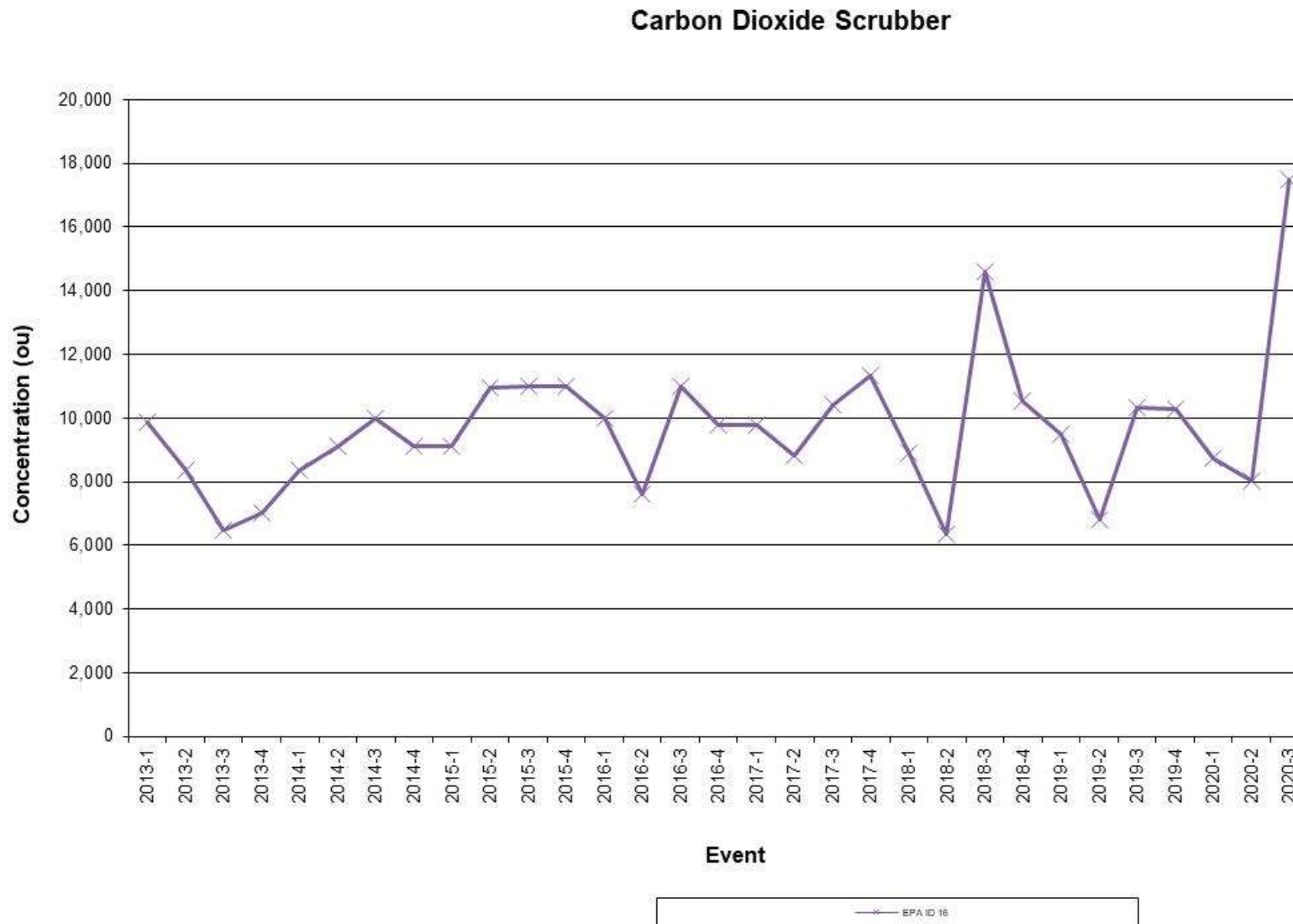


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16)



**FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35)**

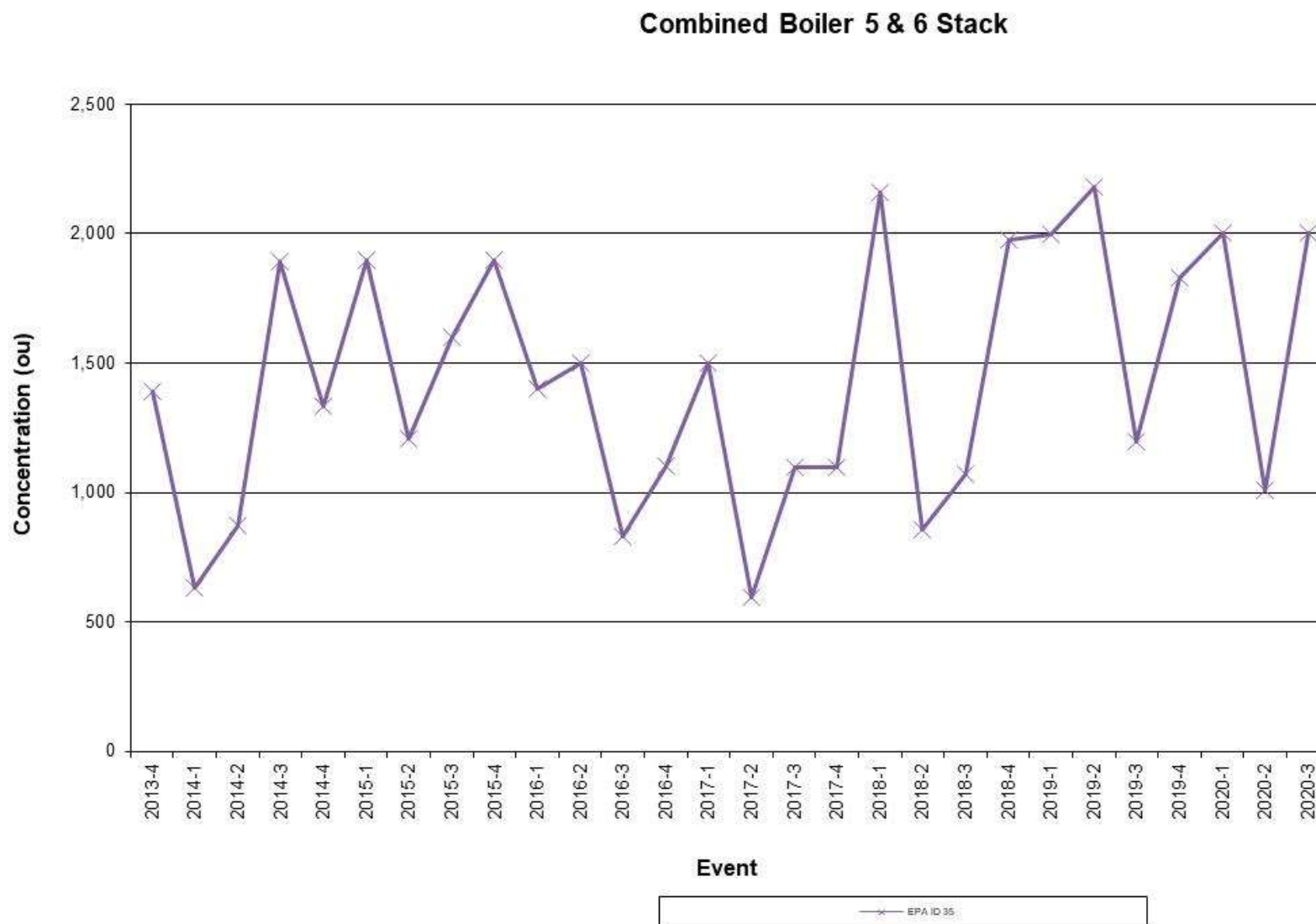


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42)

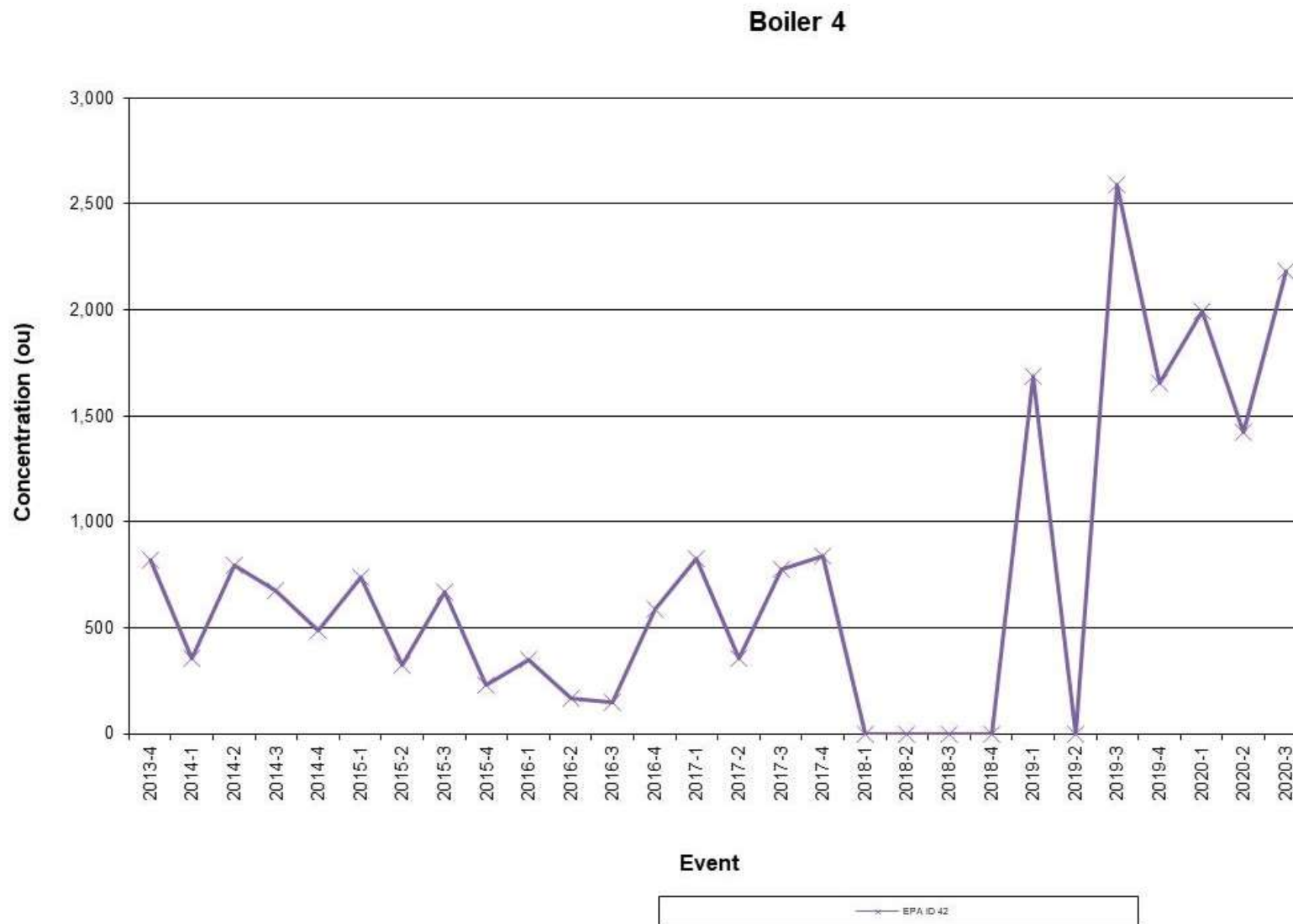


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45)

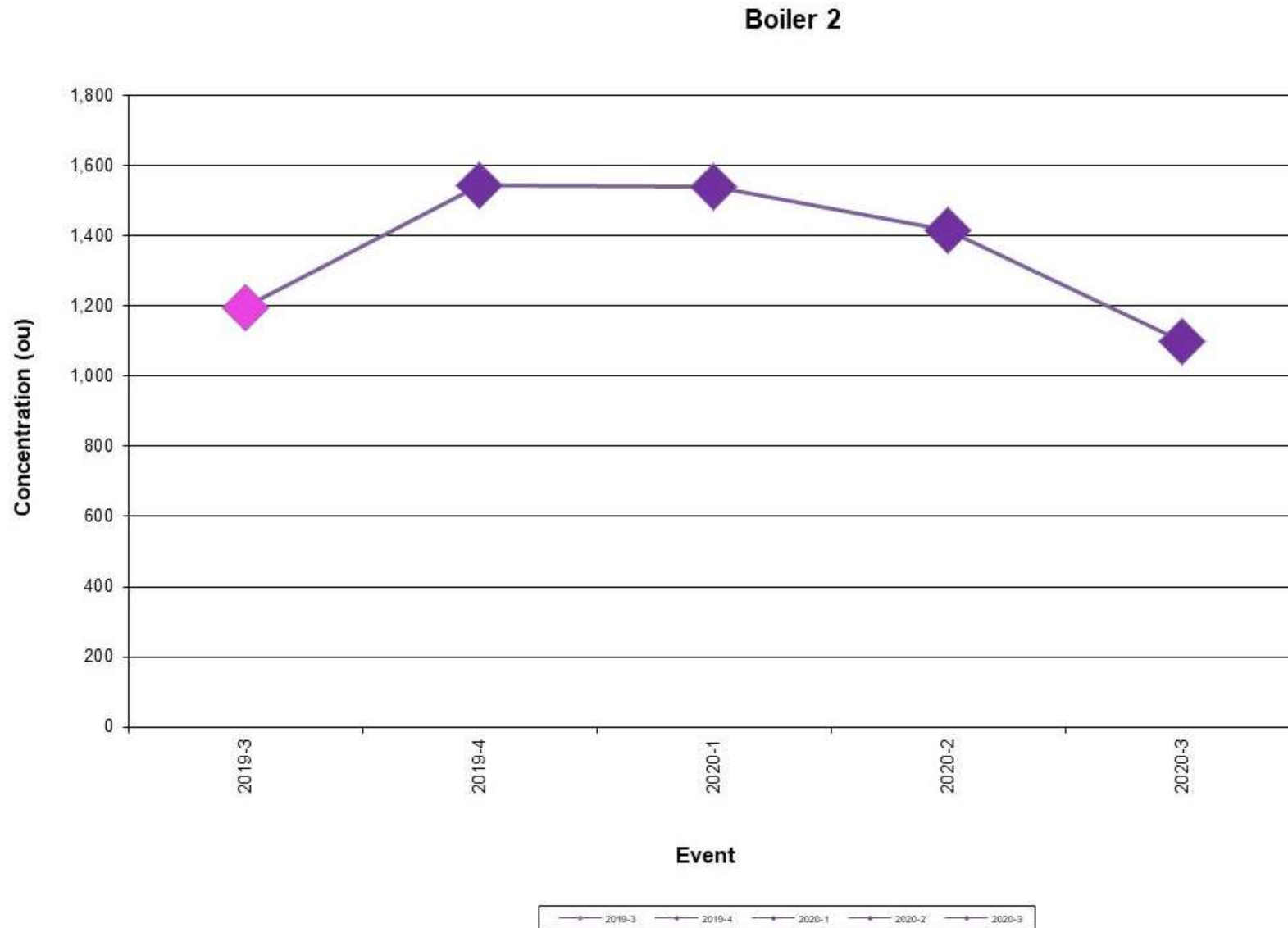


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41)

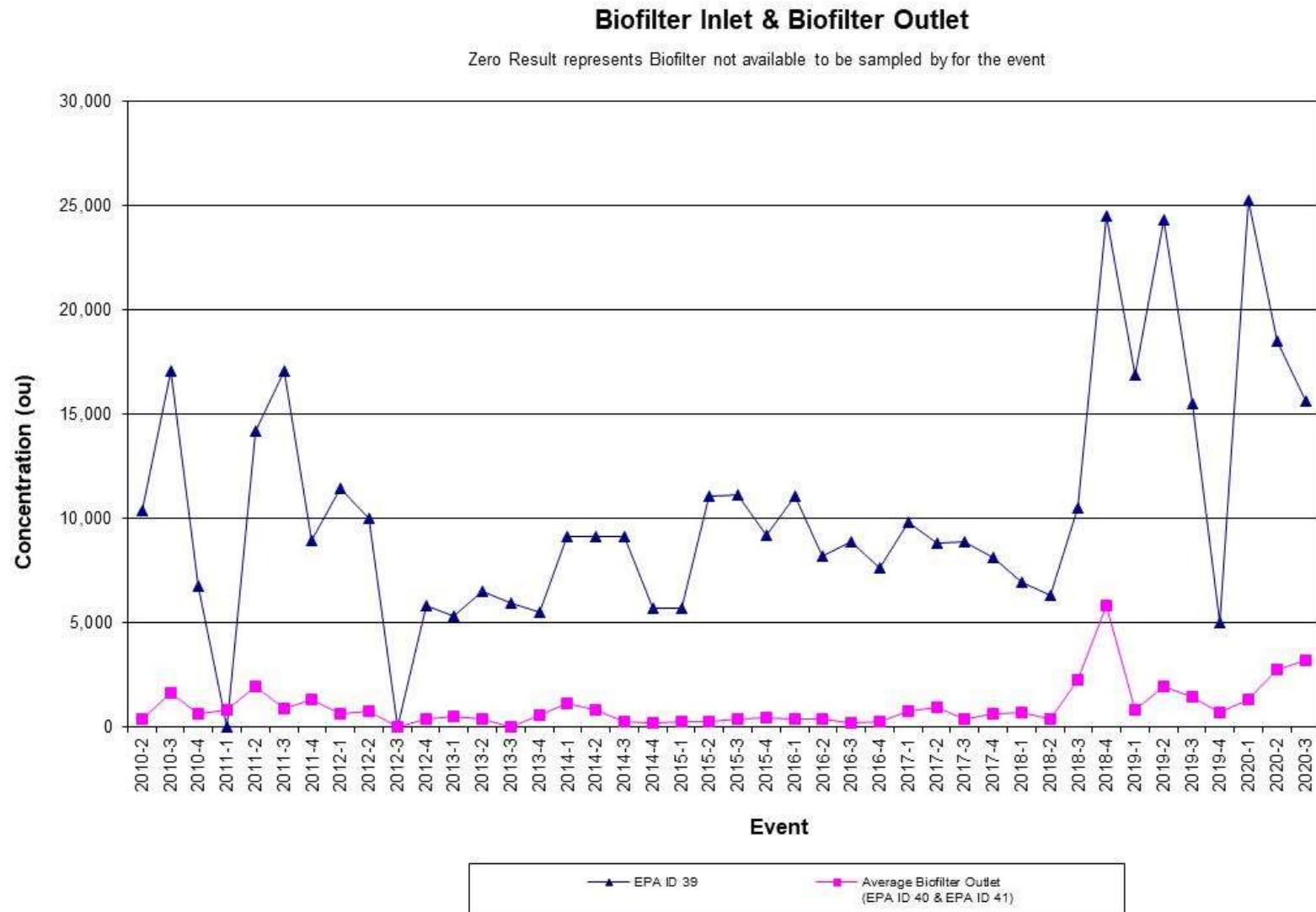
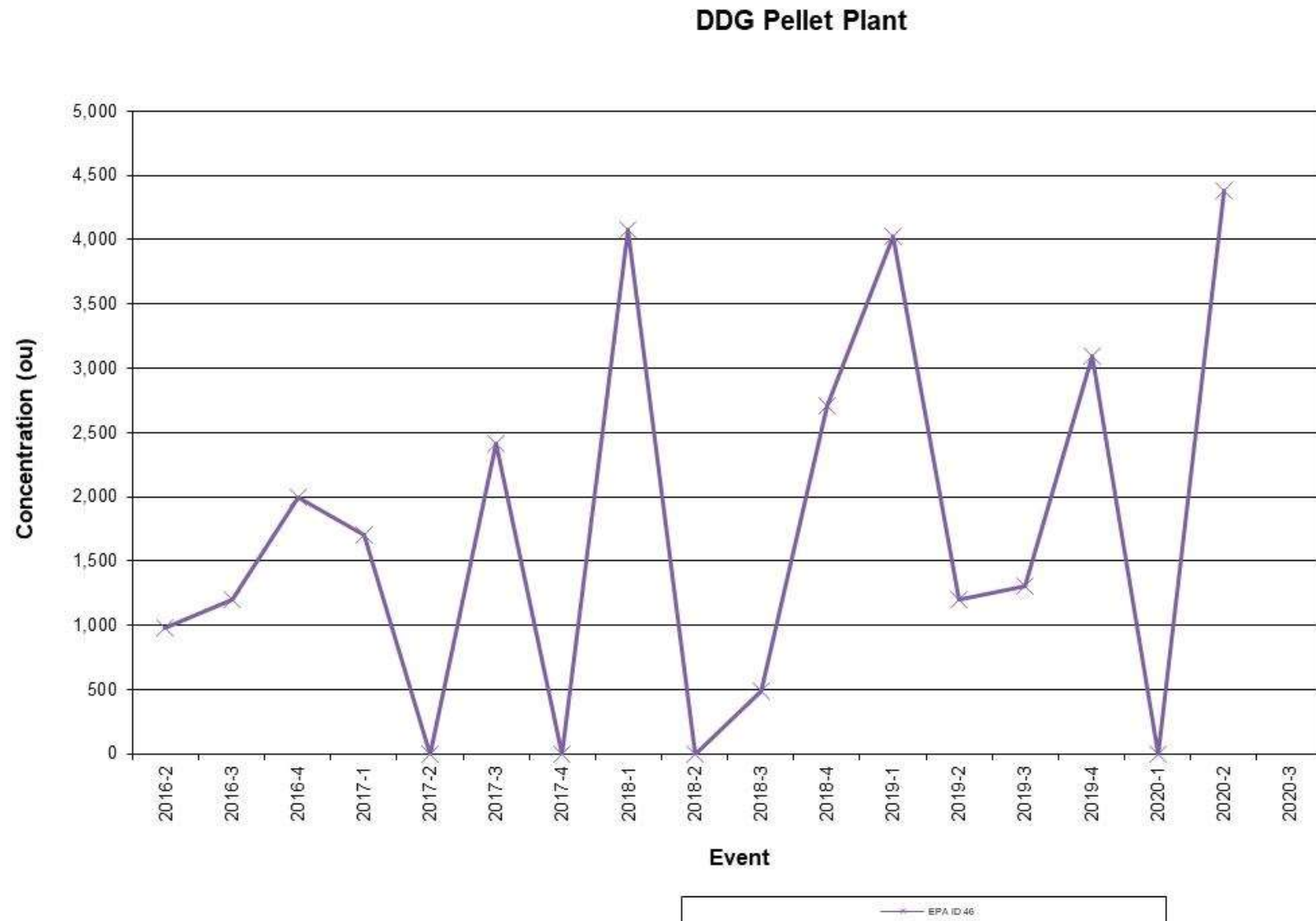


FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46)





## 6 TEST METHODS

### 6.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

(AS 4323.3 & AS 4323.4 and OM-7 and OM-8)

Samples were collected in 30L Nalophane sampling bags which are enclosed in airtight plastic containers. Surface samples were collected utilising an equilibrium flux hood or witches hat flux hood.

Odorous gas for analysis was drawn through a Teflon (PTFE) sample probe. The gas then passes through a Teflon (PTFE) tube connected to the Nalophane sampling bag. The sampling pump is connected to the airtight plastic container to provide a sample gas flow-rate of approximately 0.5 – 1.5 litres per minute. After the required volume has been sampled, the pump is stopped and the bag sealed with a stainless steel valve. Two samples were collected from each site.

Using a triangular forced choice olfactometer, the Nalophane bag of odour sample was dynamically diluted to various concentrations with dry odour free air.

The diluted sample was then presented to a panel of screened panellists as one of these airflows. The panellists then recorded if they could detect any odour and from which flow. The other two flows were discharging odour free air.

The odour is always presented to the panellists in ascending concentration; that is, from lower to higher concentration. The panellists are required at each dilution level to give a response as to what they are smelling from the flows (forced choice methodology). The response options for the panellists are:

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows could be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows could be different from the other two flows and is able to: <ul style="list-style-type: none"><li>■ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from -10 to 10 and/or</li><li>■ Able to assign a character to the colour, as in 'it smells like ...'</li></ul> <p><i>Note: that the Recognise level concentration and Hedonic Tone and Odour descriptors are obtained with the diluted odour, panellists are not exposed to the full strength odour.</i></p>

The percentage panel response and dilution levels used were then entered into a computer programme to determine the 50% panel response. This dilution level corresponds to the odour concentration of the sample.

Sampling and dilution lines are constructed from teflon, stainless or glass to prevent contamination of the sample.

The sampling and the dilution procedures used were in accordance with OEH NSW Method OM-7 and OM-8, which are based on Standards Association of Australia, AS4323.3 and AS4323.4.

#### **6.1.1 ODOUR PANEL SELECTION**

Odour panellists must meet certain criteria to qualify as and remain panellists. Their average sensitivity to n-Butanol must be between 20 and 80 parts per billion (ppb) and their variability in response to n-Butanol must be within a certain range.

Panellists are screened against n-Butanol before every panel session to ensure they are in compliance.

Panellists should not suffer from respiratory complaints, nor should they eat or smoke or drink anything but water during the half hour preceding or during the test period and their person and clothing should be odour free and have not been exposed to an odorous environment before testing.

#### **6.1.2 ODOUR TERMINOLOGY**

The odour level is expressed in odour units and for mixed odours is analogous to concentration expressed in parts per billion. The odour detection level is defined as the ratio of *the volume that a sample of odorous gas would occupy when diluted to the threshold of detection of that odour to the volume of the sample*. In simpler terms, the ratio indicated the number of dilutions necessary to reduce the odour to its threshold of detection or odour detection threshold. This ratio is expressed in odour units or number of dilutions to detection threshold. For example, a value of 2,000 odour units would mean the volume of the initial sample of odorous gas would need to be diluted 2,000 times before the odour would just be detectable to the average human nose, that is, at the odour detection threshold.

### **6.2 EXHAUST GAS VELOCITY**

*(OEH NSW TM-2 and USEPA Method 12)*

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and digital manometer.

### 6.3 EXHAUST GAS TEMPERATURE

(OEH NSW TM- 2, 3 & 4 and USEPA Methods 2, 3 & 4)

The exhaust gas temperature was measured using a Digital thermometer (0-1200°C) connected to a chromel/alumel (K-type) thermocouple probe.

### 6.4 OXYGEN (O<sub>2</sub>)

(OEH NSW TM-24 and USEPA Method 3A)

O<sub>2</sub> was analysed by a Testo 350 analyser.

### 6.5 MOISTURE

(OEH NSW TM-22 and USEPA Method 4)

Moisture from the stack was determined in accordance with OEH NSW TM-22 and USEPA Method 4. In particular, M4 Section 2.2.1 which nominates a moisture approximation method used to enable calculation of isokinetic sampling rates and where isokinetic sampling is not required such as odour sampling.

### 6.6 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 6-1) uncertainties for various stack testing methods.

**TABLE 6-1 ESTIMATION OF MEASUREMENT UNCERTAINTY**

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Odour	AS4323.3, AS4323.4	3 times
Oxygen and Carbon Dioxide	TM-24, TM-25, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2A & 2C	5%

Key:

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

Sources: *Measurement Uncertainty - implications for the enforcement of emission limits* by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK

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

---

## APPENDIX A – EMISSION TEST RESULTS

### Glossary:

%	=	percent
°C	=	degrees celsius
am <sup>3</sup> /min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m <sup>3</sup> )	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am <sup>3</sup>	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m <sup>3</sup>	=	kilograms per cubic metre
kPa	=	kilo Pascals
m <sup>2</sup>	=	square metre
m/s	=	metre per second
m <sup>3</sup> /sec	=	cubic metre per second at 0°C and 1 atmosphere
mg	=	milligrams
mg/ m <sup>3</sup>	=	milligrams per cubic metre at 0°C and 1 atmosphere
O <sub>2</sub>	=	oxygen

Abbreviations for names of SEMA staff who completed either Sampling or Analysis or QA Checking

PWS	=	Peter W Stephenson
JW	=	Jay Weber

**TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4**

<b>Emission Test Results</b>				
<b>Project Number</b>	<b>7095</b>			
<b>Project Name</b>	<b>Shoalhaven Starches</b>			
<b>Test Location</b>	<b>EPA ID 8 Gluten Dryer 1*</b>	<b>EPA ID 9 Gluten Dryer 2</b>	<b>EPA ID 10 Gluten Dryer 3</b>	<b>EPA ID 11 Gluten Dryer 4</b>
<b>Date</b>	05-Aug-20	05-Aug-20	05-Aug-20	05-Aug-20
	Dry			
<b>Run</b>	1			
<b>Method</b>	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:07	10:30	12:00	11:32
Flow Stop Time (hrs)	12:24	10:40	12:21	11:53
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	71.4	63	70.1	73.5
Stack Cross-Sectional area (m <sup>2</sup> )	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	14.0	18.1	11.6	16.0
Actual Gas Flow Volume (am <sup>3</sup> /min)	1,201	1,190	3,080	2,222
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	887	837	2,253	1,651
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	14.8	14.0	37.6	27.5
Total Stack Pressure (kPa)	101.4	92.1	101.4	101.1
Moisture Content (% by volume)	6.9	4.8	8.1	5.5
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m <sup>3</sup> )	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.90	20.9	20.9
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5417	5407	5408	5409
SEMA Number	728041	728032	728033	728034
Sample Start Time (hrs)	12:14	10:35	12:11	11:43
Sample Finish Time (hrs)	12:24	10:40	12:21	11:53
Odour Concentration (As Received) (ou)	660	430	850	720
<b>Odour Concentration (Final) (ou)</b>	<b>660</b>	<b>430</b>	<b>850</b>	<b>720</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	9,800	6,000	32,000	20,000
Normal MOER (Final) (ou m <sup>3</sup> /s)	9,800	6,000	32,000	20,000
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit	No Limit	No Limit
Sample storage period prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

\* Re. Gluten Dryer No.1 (EPA ID 8), odour measurements were taken. However, new silencer and ductwork no longer enable access to the duct. Thus, flow measurements were unable to be taken. To enable calculation of the MOER, flow measurements have been based on previous Quarter 1, 2020 results.

**TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5**

Emission Test Results				
Project Number	7095			
Project Name	Shoalhaven Starches			
Test Location	EPA ID 12 Starch Dryer 1	EPA ID 13 Starch Dryer 3	EPA ID 14 Starch Dryer 4	EPA ID 47 Starch Dryer 5
Date	05-Aug-20	12-Aug-20	12-Aug-20	12-Aug-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	11:10	11:21	11:22	10:29
Flow Stop Time (hrs)	11:31	11:43	11:43	10:30
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	36.1	34.2	36.8	67.3
Stack Cross-Sectional area (m²)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	6.8	20.0	21.2	15.3
Actual Gas Flow Volume (am³/min)	920	1,200	1,273	4,156
Total Normal Gas Flow Volume (m³/min)	773	1,018	1,064	3,173
Total Normal Gas Flow Volume (m³/s)	12.9	17.0	17.7	52.9
Total Stack Pressure (kPa)	101.05	101.44	101.42	101.42
Moisture Content (% by volume)	4.6	4.6	5.3	5.0
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m³)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5406	5415	5416	5413A
SEMA Number	728031	728039	728040	728038
Sample Start Time (hrs)	11:21	11:33	11:33	10:40
Sample Finish Time (hrs)	11:31	11:43	11:43	10:50
Odour Concentration (As Received) (ou)	250	400	140	250
Odour Concentration (Final) (ou)	250	400	140	250
Normal MOER (As Received) (ou m³/s)	3,200	6,800	2,500	13,000
Normal MOER (Final) (ou m³/s)	3,200	6,800	2,500	13,000
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

**TABLE A- 3 EMISSION TEST RESULTS – BOILERS NO. 5&6, 4 & 2**

<b>Emission Test Results</b>			
<b>Project Number</b>	<b>7095</b>		
<b>Project Name</b>	<b>Shoalhaven Starches</b>		
<b>Test Location</b>	<b>EPA ID 35 Boilers 5&amp;6</b>	<b>EPA ID 42 Boiler 4</b>	<b>EPA ID 45 Boiler 2</b>
<b>Date</b>	12-Aug-20	12-Aug-20	12-Aug-20
	Dry		
<b>Run</b>	1		
<b>Method</b>	TM-1, TM-2 & TM-22		
Flow Start Time (hrs)	12:32	13:12	13:58
Flow Stop Time (hrs)	12:53	13:32	14:20
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	139.5	164.6	216.0
Stack Cross-Sectional area (m²)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	16.7	18.8	10.4
Actual Gas Flow Volume (am³/min)	3,143.1	1,194.9	592.4
Total Normal Gas Flow Volume (m³/min)	1,978.0	708.3	316.9
Total Normal Gas Flow Volume (m³/s)	32.966	11.805	5.282
Total Stack Pressure (kPa)	101.36	101.64	101.52
Moisture Content (% by volume)	5.0	5.3	4.4
Molecular Weight Dry Stack Gas (g/gmole)	30.1	29.8	30.080
Dry Gas Density (kg/m³)	1.34	1.33	1.34
Oxygen (%)	8.4	10.0	8.4
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5418	5419	5420
SEMA Number	728042	728043	728044
Sample Start Time (hrs)	12:43	13:22	14:10
Sample Finish Time (hrs)	12:53	13:32	14:20
Odour Concentration (As Received) (ou)	2,000	2,180	1,100
<b>Odour Concentration (Final) (ou)</b>	<b>2,000</b>	<b>2,180</b>	<b>1,100</b>
Normal MOER (As Received) (ou m³/s)	66,000	26,000	5,800
Normal MOER (Final) (ou m³/s)	66,000	26,000	5,800
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days	2 days
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

**TABLE A-4 EMISSION TEST RESULTS – FERMENTER 13 & CO<sub>2</sub> SCRUBBER OUTLET**

Emission Test Results		
Project Number	7095	
Project Name	Shoalhaven Starches	
Test Location	EPA ID 44 Fermenter 13	EPA ID 16 CO <sub>2</sub> Scrubber outlet
Date	05-Aug-20	05-Aug-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	12:54	13:04
Flow Stop Time (hrs)	13:15	13:25
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	29.7	22.4
Stack Cross-Sectional area (m <sup>2</sup> )	0.071	0.196
Average Stack Gas Velocity (m/s)	3.1	9.3
Actual Gas Flow Volume (am <sup>3</sup> /min)	13.1	110
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	11.4	99
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	0.190	1.645
Total Stack Pressure (kPa)	101.11	101.07
Moisture Content (% by volume)	3.30	2.56
Molecular Weight Dry Stack Gas (g/gmole)	29.6	31.2
Dry Gas Density (kg/m <sup>3</sup> )	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	Odour	Odour
Method	AS4323.3	AS4323.3
ORLA Number	5410	5412
SEMA Number	728035	728037
Sample Start Time (hrs)	13:05	13:15
Sample Finish Time (hrs)	13:15	13:25
Odour Concentration (As Received) (ou)	10,300	17,500
<b>Odour Concentration (Final) (ou)</b>	<b>10,300</b>	<b>17,500</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	2,000	28,800
Normal MOER (Final) (ou m <sup>3</sup> /s)	2,000	28,800
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS



**TABLE A- 5 EMISSION TEST RESULTS – INLET TO BIOFILTERS, DDG EVAPORATORS 1, 2, 3 & 4**

<b>Emission Test Results</b>		
<b>Project Number</b>	7095	
<b>Project Name</b>	Shoalhaven Starches	
<b>Test Location</b>	<b>EPA ID 39 Biofilter Inlet DDG Evaporators 1, 2 &amp; 3</b>	<b>EPA ID 39A Biofilter Inlet DDG Evaporator 4</b>
<b>Date</b>	8-Oct-20	8-Oct-20
	Dry	
<b>Run</b>	1	
<b>Method</b>	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	12:18	12:22
Flow Stop Time (hrs)	12:46	12:43
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	39.8	31.1
Stack Cross-Sectional area (m²)	0.283	0.049
Average Stack Gas Velocity (m/s)	14.3	7.5
Actual Gas Flow Volume (am³/min)	243	22
Total Normal Gas Flow Volume (m³/min)	189	19
Total Normal Gas Flow Volume (m³/s)	3.1	0.3
Total Stack Pressure (kPa)	96.25	101.06
Moisture Content (% by volume)	6.23	4.12
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m³)	1.287	1.287
Oxygen (%)	20.9	20.9
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5434	5435
SEMA Number	728098	728099
Sample Start Time (hrs)	12:32	13:09
Sample Finish Time (hrs)	12:46	13:19
Odour Concentration (As Received) (ou)	15,600	41,900
<b>Odour Concentration (Final) (ou)</b>	<b>15,600</b>	<b>41,900</b>
Normal MOER (As Received) (ou m³/s)	49,100	13,200
Normal MOER (Final) (ou m³/s)	49,100	13,200
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

**TABLE A- 6 EMISSION TEST RESULTS DDG PELLET PLANT**

<b>Emission Test Results</b>		
<b>Project Number</b>	<b>7095</b>	
<b>Project Name</b>	<b>Shoalhaven Starches</b>	
<b>Test Location</b>	<b>Part EPA ID 46* DDG Pellet Cooler East Stack</b>	<b>Part EPA ID 46* DDG Pellet Silo</b>
<b>Date</b>	28-Oct-20	28-Oct-20
	Dry	
<b>Run</b>	1	
<b>Method</b>	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	16:25	15:54
Flow Stop Time (hrs)	16:48	16:06
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	69.0	56.0
Stack Cross-Sectional area (m²)	0.665	0.126
Average Stack Gas Velocity (m/s)	14	12
Actual Gas Flow Volume (am³/min)	571	87
Total Normal Gas Flow Volume (m³/min)	434	70
Total Normal Gas Flow Volume (m³/s)	7.2	1.2
Total Stack Pressure (kPa)	99.70	102.11
Moisture Content (% by volume)	3.21	3.57
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m³)	1.29	1.29
Oxygen (%)	20.9	20.9
<b>Analysis</b>	<b>Odour</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>	<b>AS4323.3</b>
ORLA Number	5438	5437
SEMA Number	728112	728111
Sample Start Time (hrs)	16:38	16:08
Sample Finish Time (hrs)	16:48	16:18
Odour Concentration (As Received) (ou)	8,800	6,200
<b>Odour Concentration (Final) (ou)</b>	<b>8,800</b>	<b>6,200</b>
Normal MOER (As Received) (ou m³/s)	63,600	7,300
Normal MOER (Final) (ou m³/s)	63,600	7,300
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit
Sample Storage Period prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

Key:

Part 46\* = partial contribution to EPA ID 46 stack which was not accessible

**TABLE A- 7 EMISSION TEST RESULTS – BIOFILTER OUTLETS**

<b>Emission Test Results</b>				
<b>Project Number</b>	<b>7095</b>			
<b>Project Name</b>	<b>Shoalhaven Starches</b>			
<b>Test Location</b>	<b>EPA ID 40 Biofilter A East</b>	<b>EPA ID 40 Biofilter A West</b>	<b>EPA ID 41 Biofilter B East</b>	<b>EPA ID 41 Biofilter B West</b>
<b>Date</b>	8-Oct-20	8-Oct-20	8-Oct-20	8-Oct-20
<b>Run</b>	<b>1</b>			
<b>Method</b>	<b>TM-2 &amp; TM-22</b>			
Sample & Flow Start Time (hrs)	13:10	13:41	13:06	13:32
Sample & Flow Stop Time (hrs)	13:20	13:51	13:16	13:43
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	37.6	38.4	30.6	27.8
<b>Proportion of Inlet air flow (%)</b>	<b>26</b>	<b>25</b>	<b>26</b>	<b>23</b>
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	728094	728096	728095	728097
SEMA Number	5430	5432	5431	5433
Odour Concentration (As Received) (ou)	1,200	1,400	4,000	6,200
<b>Odour Concentration (Final) (ou)</b>	<b>1,200</b>	<b>1,400</b>	<b>4,000</b>	<b>6,200</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	1,100	1,200	3,700	4,900
Normal MOER (Final) (ou m <sup>3</sup> /s)	1,100	1,200	3,700	4,900
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

---

## **APPENDIX B – CERTIFICATES OF ANALYSIS**



## Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)

ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144 Australia  
Tel: (02) 9737 9991  
E-Mail: pstephenson@orla.com.au

### Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

<b>Client</b>	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Starch Dryers 1, 3, 4 and 5
		Gluten Dryers 1, 2, 3 and 4
		Fermenter 13
		CO <sub>2</sub> Scrubber inlet and outlet
<b>Project</b>	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	ORLA Report Number:	7095/ORLA/01
	Project Manager:	Margot Kimber
<b>Order</b>	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5405 - 5420
	SEMA Sample number(s):	728031 - 728044
	Analysis Requested:	Odour Analysis
<b>Report</b>	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	31 July 2020
	Order number:	5147
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
<b>Report</b>	Date of issue:	14 August 2020

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing



ODOUR CONCENTRATION MEASUREMENTS RESULTS

7095/ORLA/01

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq X \leq 92,102$ ou. . If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between $\pm 3^{\circ}\text{C}$ .
Measuring Dates	The date of each measurement is specified with the results.
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.05$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $r = 0.0020$ (February 2020) Compliance - Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $A = 0.020$ (February 2020) Compliance - Yes
Lower Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 12 ou.
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored every session to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

14 August, 2020



Peter Stephenson  
Managing Director



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7095/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>*,**</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Starch Dryer 1	728031	05.08.20 11:21	5406	06.08.20 10:50	4	8	Nil	250	250	Hessian, earthy, floral mould, flour, musty, yeasty-then plastic, paint (-1) <sup>*</sup>
Sample ID: Gluten Dryer 2	728032	05.08.20 10:35	5407	06.08.20 11:19	4	8	Nil	430	430	Musty, dirty feet, wheat, plastic, paint, hessian, bag of dirty potatoes, earthy, grains (-2) <sup>*</sup>
Sample ID: Gluten Dryer 3	728033	05.08.20 12:11	5408	06.08.20 11:49	4	8	Nil	850	850	Dirty feet, hessian, wet cardboard, fried vegetables, first sharp/sour vomit – then musty, wheat, plastic (-2) <sup>*</sup>
Sample ID: Gluten Dryer 4	728034	05.08.20 11:43	5409	06.08.20 12:18	4	8	Nil	720	720	Musty, hessian, earthy, wheat, plastic, dirty feet, metallic drain water (-2) <sup>*</sup>
Sample ID: Fermenter #13	728035	05.08.20 13:05	5410	06.08.20 12:47	4	8	Nil	10300	10300	Flowery, sweet, perfume, vinegar, ink, alcohol, caramel liqueur, fruit yoghurt (-1) <sup>*</sup>
Sample ID: CO2 scrubber Inlet	728036	05.08.20 13:16	5411	06.08.20 14:10	4	8	Nil	11300	11300	Ethanol, sickly sweet, alcohol, sweet vinegar, ink, caramel liqueur, syrup, mango yoghurt (0) <sup>*</sup>
Sample ID: CO2 scrubber Outlet	728037	05.08.20 13:15	5412	06.08.20 14:39	4	8	Nil	17500	17500	Perfume, citrus, sweet vinegar, ink, alcohol, caramel liqueur, syrup, fruit, sour – but not sharp (-2) <sup>*</sup>



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7095/ORLA/01

Sample				Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>1*</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Starch Dryer 5	728038	12.08.20 10:40	5413	13.08.20 10:46	4	8	Nil	250	250	Dirty feet, gas, musty, hessian, grain, wheat, fermentation (hops?), firstly earth & garbage/septic then plastic (-2)
Sample ID: Starch Dryer 3	728039	12.08.20 11:33	5415	13.08.20 11:14	4	8	Nil	400	400	Yeasty, sweet, organic, hessian, wheat, grains, slight soapy, later plastic artificial fruit (0)
Sample ID: Starch Dryer 4	728040	12.08.20 11:33	5416	13.08.20 11:43	4	8	Nil	140	140	Starch, musty, sweet, plastic toys, slight chlorine, dank pipe water (metallic), hessian, wheat, compost, dirty & earthy at end (-1)
Sample ID: Gluten Dryer 1	728041	12.08.20 12:14	5417	13.08.20 12:12	4	8	Nil	660	660	Dirty feet, musty, rotting stone fruit, corn, garlic, potato, earth, vinyl, wood (-2)
Sample ID: Boiler 5&6	728042	12.08.20 12:43	5418	13.08.20 12:42	4	8	Nil	2000	2000	Damp, musty, car exhaust, sweet coal/steam train exhaust, septic, earth, wood, grain, plastic (-2)
Sample ID: Boiler 4	728043	12.08.20 13:24	5419	13.08.20 13:10	4	8	Nil	2180	2180	Car exhaust fumes, coke-not coal, slightly metallic, musty, acid, sweet, slight mild & sweet vinegar, plastic (-1)
Sample ID: Boiler 2	728044	12.08.20 14:10	5420	13.08.20 13:39	4	8	Nil	1100	1100	Exhaust fumes, coke, musty, sulfur, solvent, plastic, sweet mild vinegar (-1)





## Odour Research Laboratories Australia

### Odour Panel Calibration Results - 7095/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) <sup>3</sup>	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) <sup>4</sup>
n-butanol	5405	06.08.20	62.0	1413	43.9	Yes
n-butanol	5414	13.08.20	62.0	1679	36.9	Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analysed by Odour Research Laboratories Australia at their Sydney Laboratory.

Notes from Odour Olfactometry Results:

<sup>1</sup> Sample Odour Concentration: as received in the bag

<sup>2</sup> Sample Odour Concentration: allowing for pre-dilution

<sup>3</sup> Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

<sup>4</sup> Target Range for reference gas n-butanol is  $20 \leq \chi \leq 80$  ppb and compliance with AS/NZS4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration.

Panelist Rolling Average:

06/08/2020: SR =46.9, PR = 61.3, TL = 32.2, JW= 42.4

13/08/2020: SR =46.9, PR = 61.3, TL = 31.1, JW= 42.4

^ denotes the Average Hedonic Toner: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panellist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

-----END OF TEST REPORT-----



## Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)

ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144 Australia  
Tel: (02) 9737 9991  
E-Mail: pstephenson@orla.com.au

### Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

<b>Client</b>	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Biofilter Outlets A & B East, Biofilter Outlets A & B West, Biofilter Inlet from DDG Evaporators 1, 2, 3 & 4, DDG Pellet Silo and DDG Pellet Cooler East Stack
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
<b>Project</b>	ORLA Report Number:	7095/ORLA/02
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5429 - 5438
	SEMA Sample number(s):	728094 - 728099 and 728111 - 728112
<b>Order</b>	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	8-Oct-2020
	Order number:	5167
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
<b>Report</b>	Date of issue:	04 January, 2021

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing



ODOUR CONCENTRATION MEASUREMENTS RESULTS

7095/ORLA/02

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq X \leq 92,102$ ou. . If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between $\pm 3^{\circ}\text{C}$ .
Measuring Dates	The date of each measurement is specified with the results.
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.05$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $r = 0.0020$ (February 2020) Compliance - Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $A = 0.020$ (February 2020) Compliance - Yes
Lower Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 12 ou.
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored every session to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

04 January, 2021



Peter Stephenson  
Managing Director



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7095/ORLA/02

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour concentration		Odour Character & Hedonic Tone <sup>1*</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Bio outlet A East	728094	08.10.20 13:10	5430	09.10.20 09:54	4	8	Nil	1200	1200	Manure, caffeine, sour, fertiliser, bitter, mould, earth, yeast, cocoa, coffee (-3) <sup>+</sup>
Sample ID: Bio outlet B East	728095	08.10.20 13:06	5431	09.10.20 10:24	4	8	Nil	4000	4000	Vegemite, slight sewer, earth, grain, hessian, sweet, cocoa, fruit yoghurt, sour vegetables, chocolate (-2) <sup>+</sup>
Sample ID: Bio outlet A West	728096	08.10.20 13:41	5432	09.10.20 10:53	4	8	Nil	1400	1400	Manure, fertiliser, smoky, burnt, earth, sulfur, grain, vegemite, swamp, cocoa (-2) <sup>+</sup>
Sample ID: Bio outlet B West	728097	08.10.20 13:32	5433	09.10.20 11:22	4	8	Nil	6200	6200	Sour, sour vegetable soup, hessian, mould, peat, cocoa, chocolate, sweet (-1) <sup>+</sup>
Sample ID: Bio inlet DDG Evaporators 1,2 & 3	728098	08.10.20 12:32	5434	09.10.20 12:55	4	8	Nil	15600	15600	Hessian, vegemite, grain, cocoa, sweet, dusty vacuum cleaner, plastic (-1) <sup>+</sup>
Sample ID: Bio inlet DDG Evaporator 4	728099	08.10.20 13:09	5435	09.10.20 13:27	4	8	Nil	42000	42000	Almond oil, sickly oil, cooking potatoes, tar, molasses, grain, sweet, chocolate, caramel liqueur (-3) <sup>+</sup>
Sample ID: DDG Pellet Silo	728111	28.10.20 16:08	5437	29.10.20 17:22	4	8	Nil	6200	6200	Malt, milkshake, wheat, cereal, slight yoghurt odour, old cooking oil, bitter (+1) <sup>+</sup>
Sample ID: DDG Pellet Cooler East	728112	28.10.20 16:38	5438	29.10.20 17:50	4	8	Nil	8800	8800	Sweet, sugar, malt, milkshake, cereal, wheat, dirty (+1) <sup>+</sup>



## Odour Research Laboratories Australia

### Odour Panel Calibration Results - 7095/ORLA/02

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) <sup>3</sup>	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) <sup>4</sup>
n-butanol	5429	09.10.20	62.0	1413	43.8	Yes
n-butanol	5436	29.10.20	62.0	1421	43.6	Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analysed by Odour Research Laboratories Australia at their Sydney Laboratory.

Notes from Odour Olfactometry Results:

<sup>1</sup> Sample Odour Concentration: as received in the bag

<sup>2</sup> Sample Odour Concentration: allowing for pre-dilution

<sup>3</sup> Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

<sup>4</sup> Target Range for reference gas n-butanol is  $20 \leq \chi \leq 80$  ppb and compliance with AS/NZS4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration.

Panelist Rolling Average:

09/10/2020: SR = 48.5, PR = 57.3, TL = 32.2, JW = 45.3

29/10/2020: SR = 46.9, PR = 61.3, TL = 31.1, PRP = 39.5

^ denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panelist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

-----END OF TEST REPORT-----

---

## **APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION**

**TABLE C- 1 INSTRUMENT CALIBRATION DETAILS DAY 1**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	07-May-20	07-Nov-20
775	Thermocouple	07-May-20	07-Nov-20
893	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

**TABLE C- 2 INSTRUMENT CALIBRATION DETAILS DAY 2**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	07-May-20	07-Nov-20
920	Thermocouple	07-May-20	07-Nov-20
769	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21



**TABLE C- 3 INSTRUMENT CALIBRATION DETAILS DAY 3**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	07-May-20	07-Nov-20
919	Thermocouple	07-May-20	07-Nov-20
775	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	02-Sep-20	02-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
<b>Gas Mixtures used for Analyser Span Response</b>			
<b>Conc.</b>	<b>Mixture</b>	<b>Cylinder No.</b>	<b>Expiry Date</b>
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

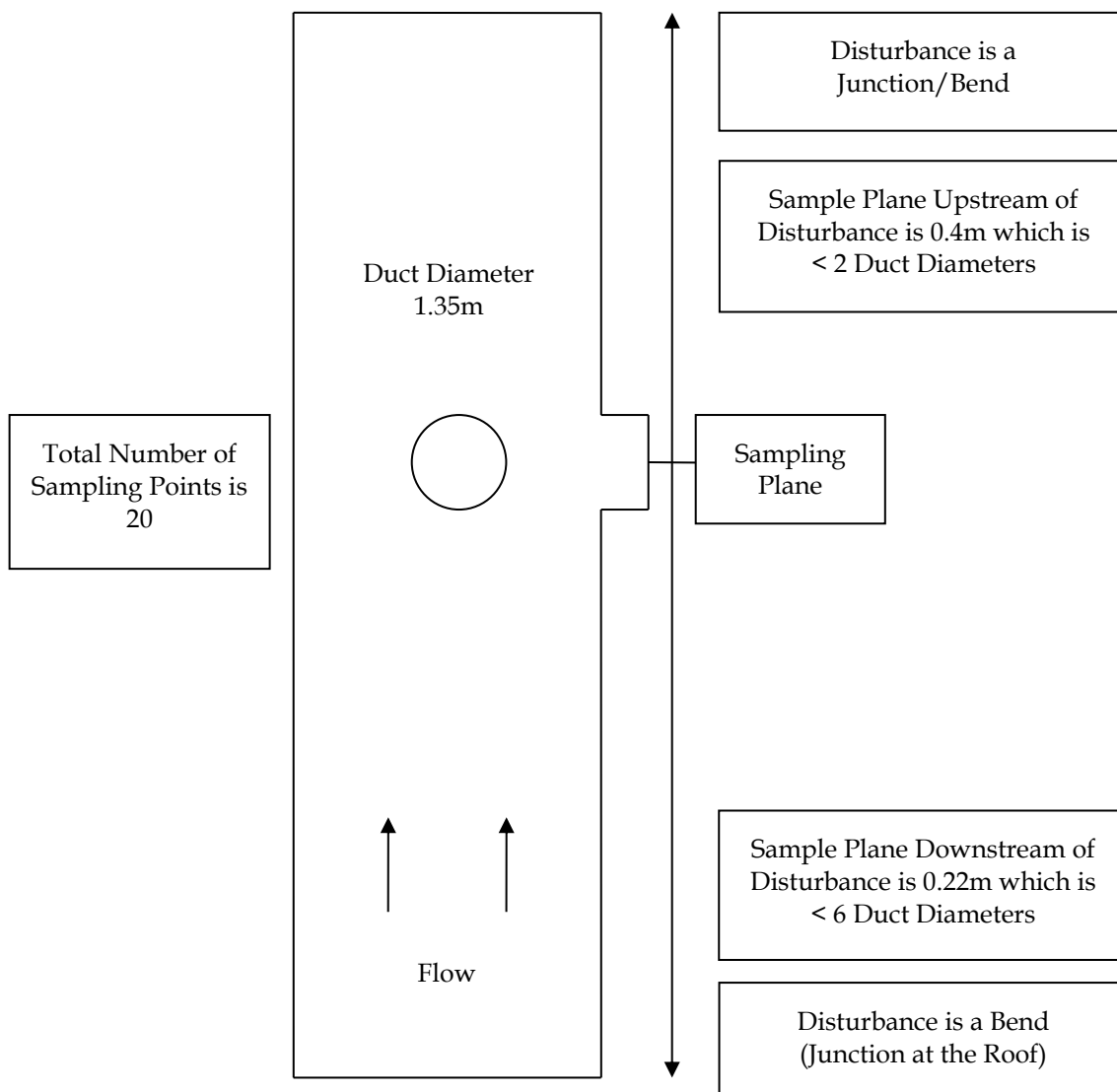
**TABLE C-4 INSTRUMENT CALIBRATION DETAILS DAY 4**

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	06-Dec-19	06-Dec-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	02-Sep-20	02-Mar-21
676	Personal Sampler	26-Feb-20	26-Feb-21
613	Barometer	05-Dec-19	05-Dec-20
<b>Gas Mixtures used for Analyser Span Response</b>			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

---

## **APPENDIX D – SAMPLE LOCATIONS**

**FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

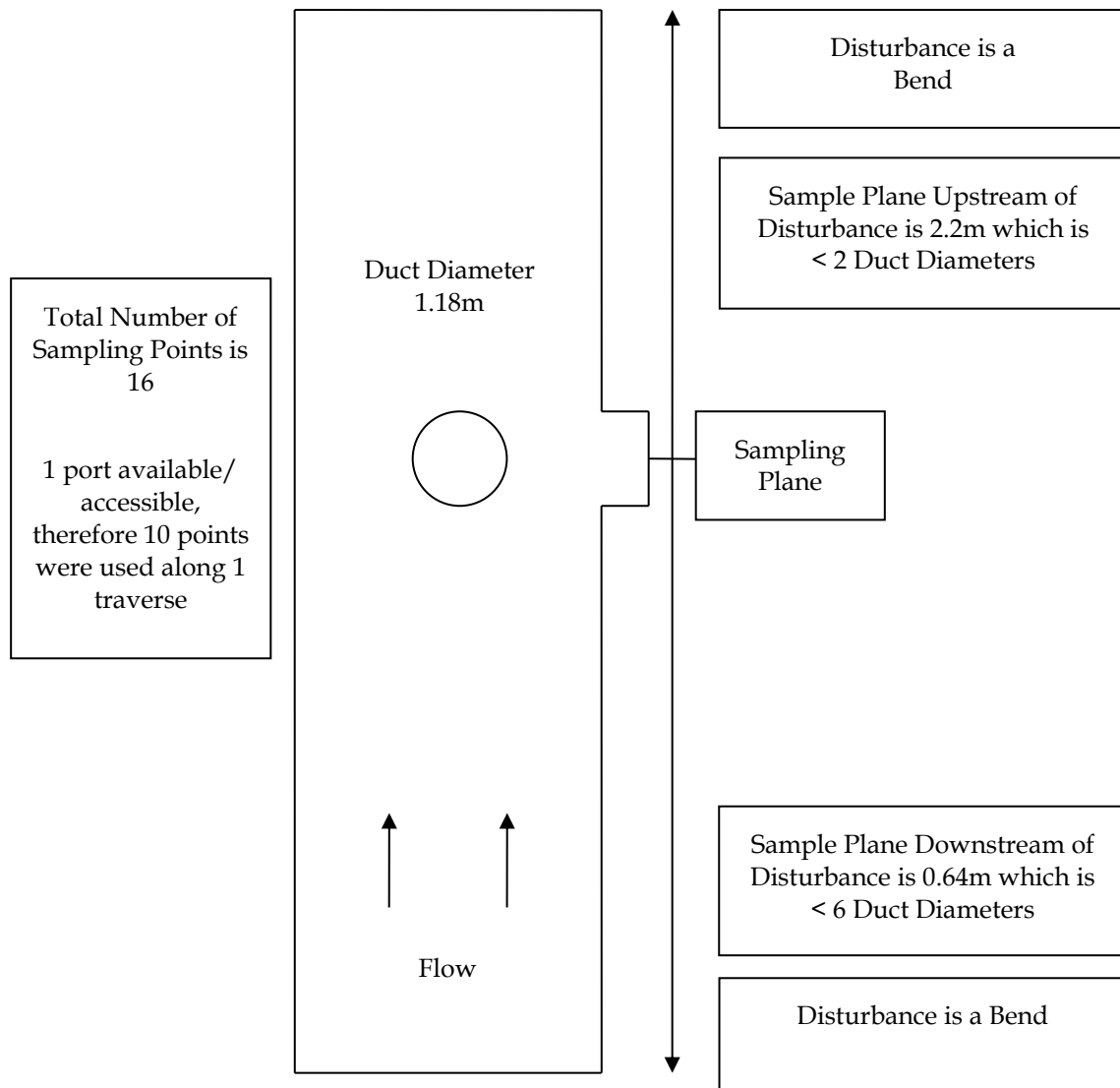
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION**



**FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC**



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

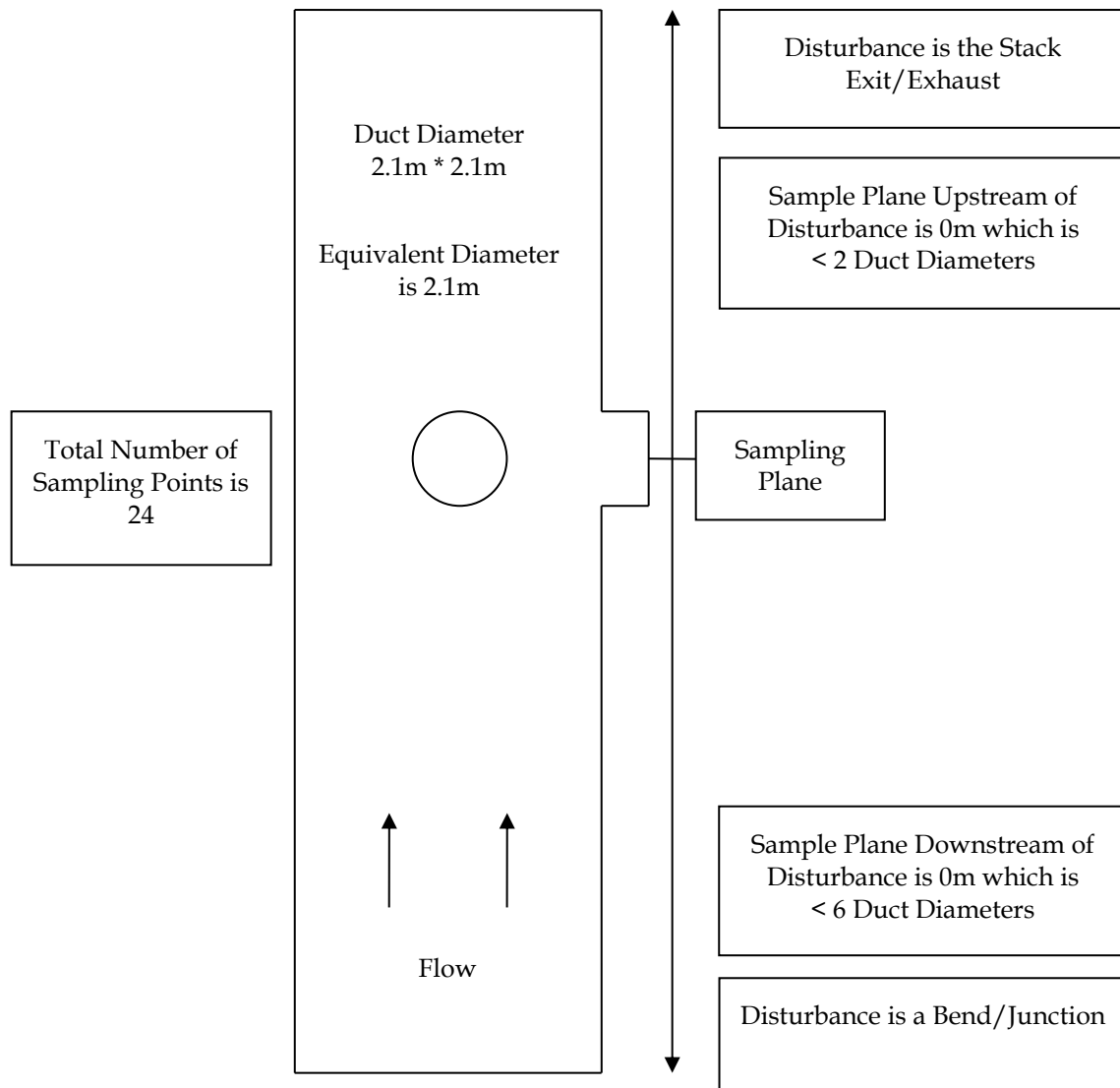
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The location of the interim exit sampling plane complies with AS4323.1 temperature and AS4323.3 odour criteria for sampling.

**FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT**



**FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

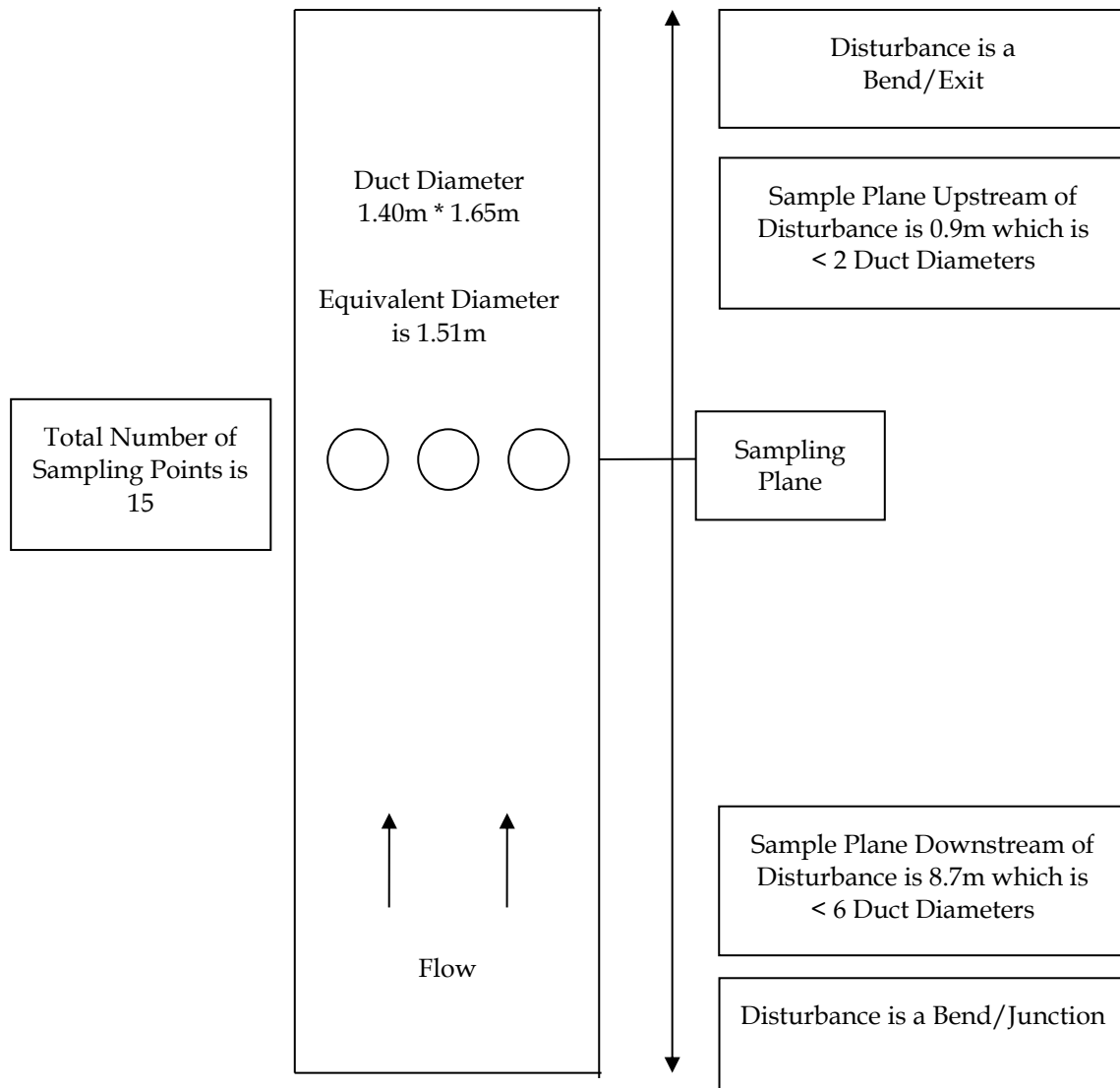
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of minimum velocity profile not meeting the minimum 3 metres per second (m/s) at every sampling point. Previous Minimum (0.8 m/s), Current Minimum (0 m/s).



**FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

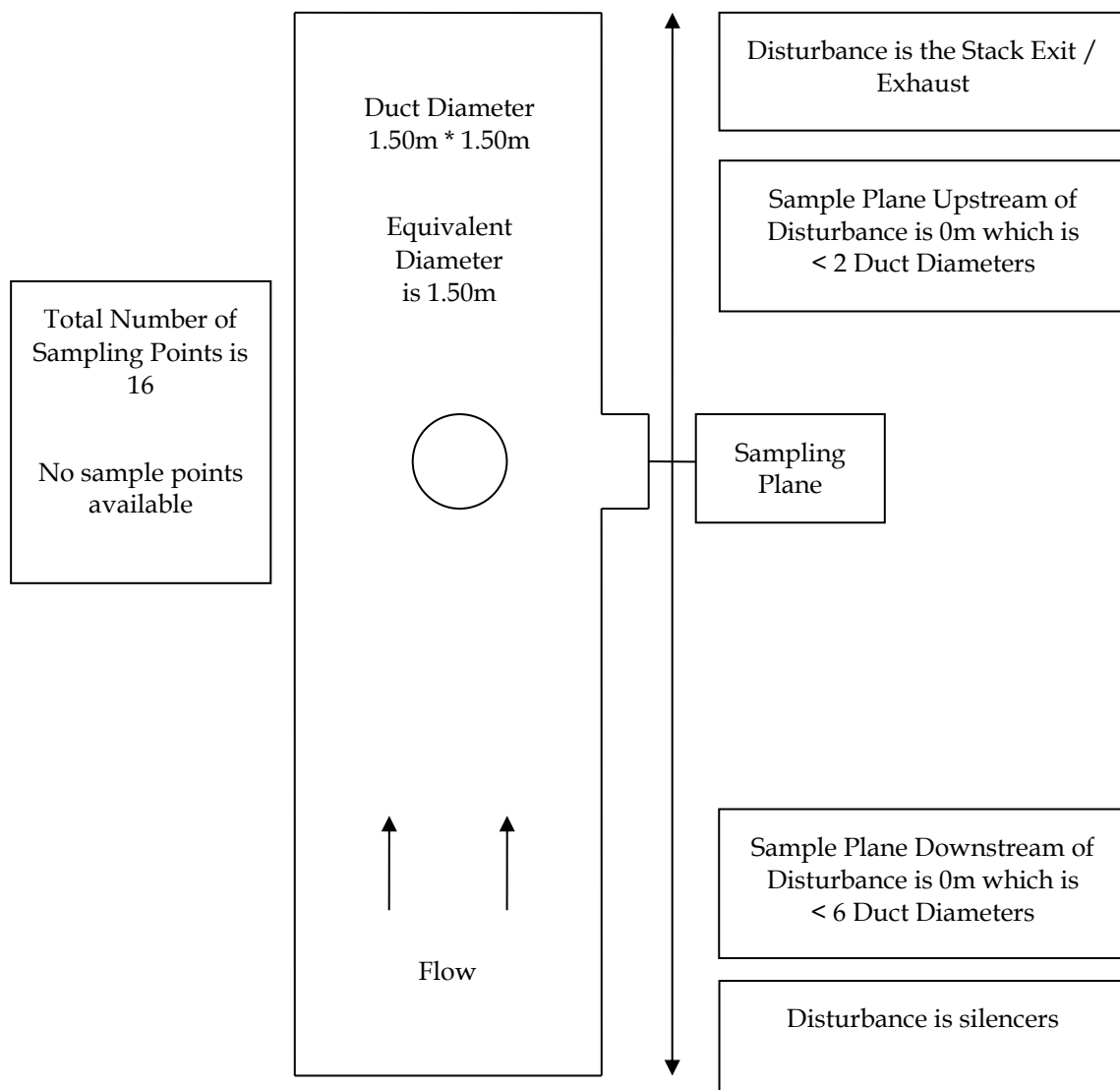
However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

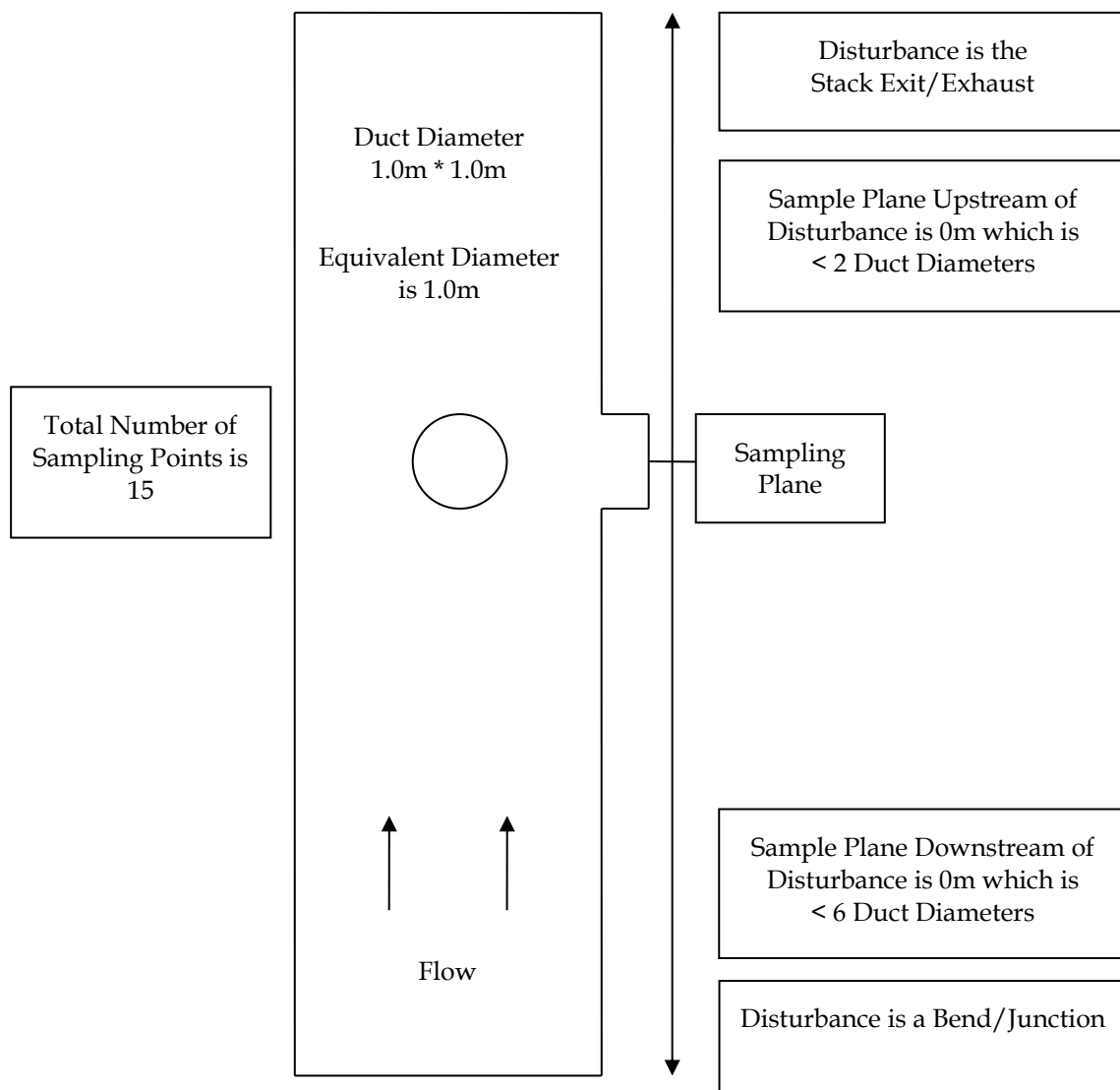
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION**



**FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

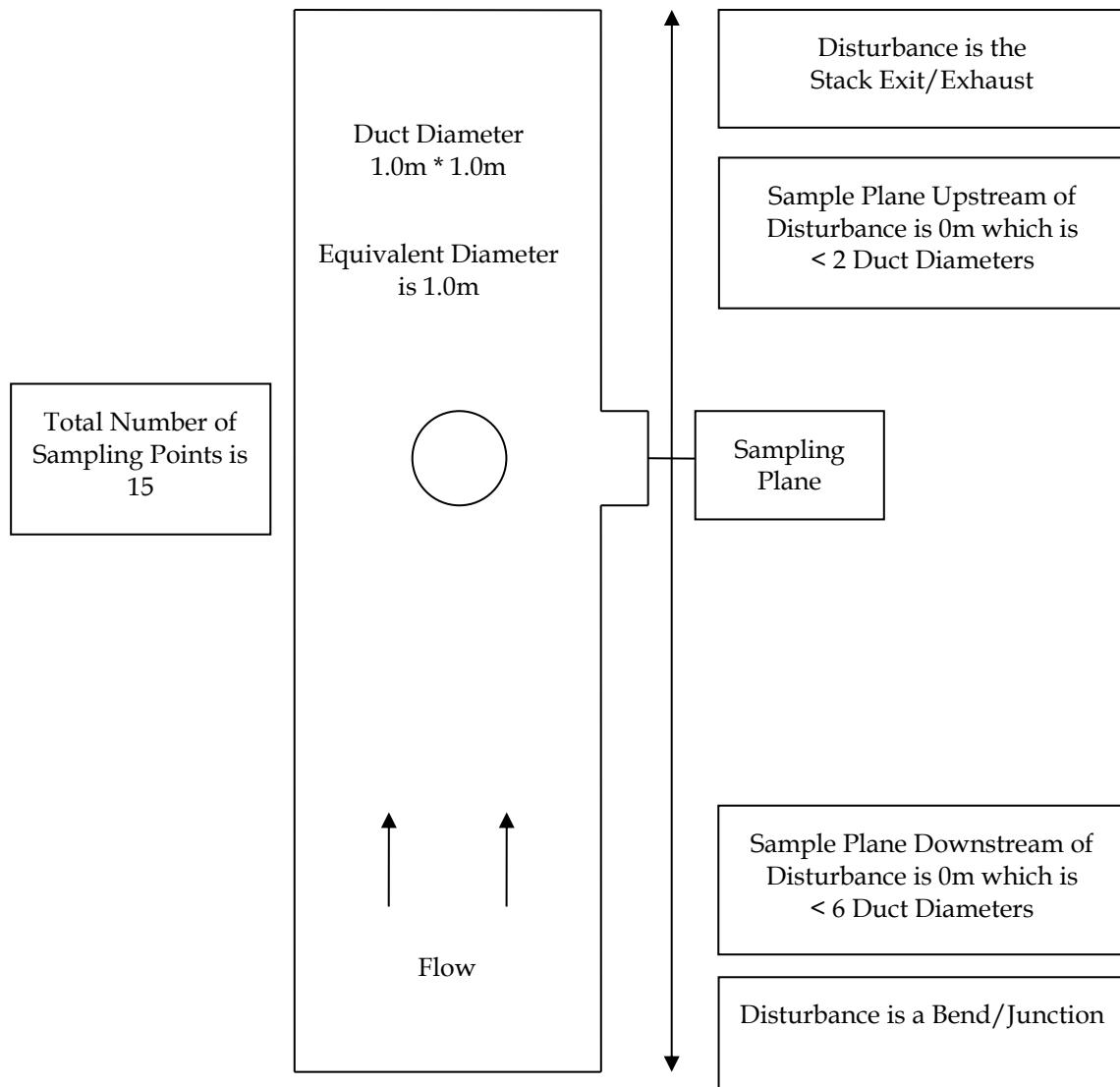
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

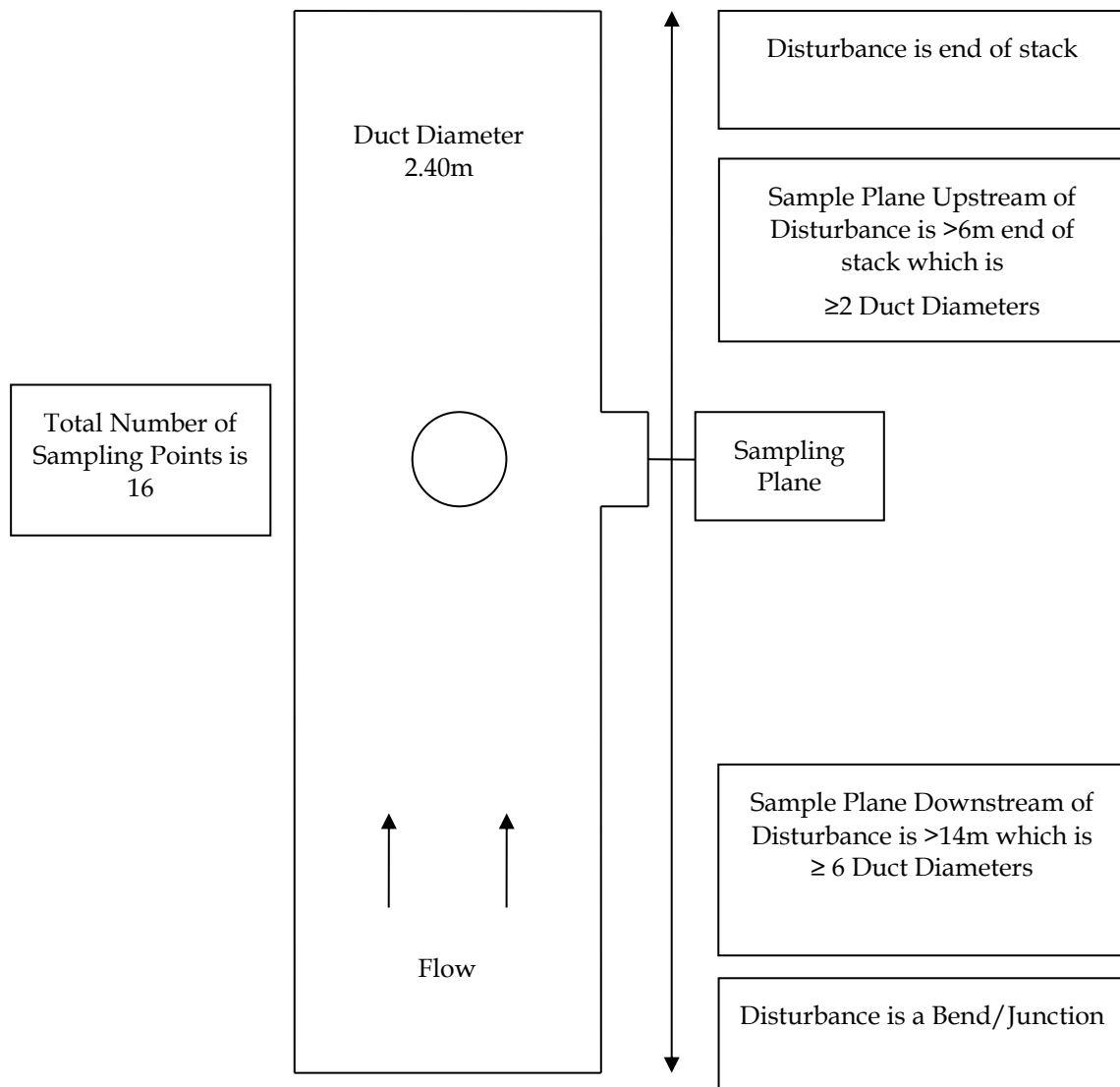
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.



**FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC**



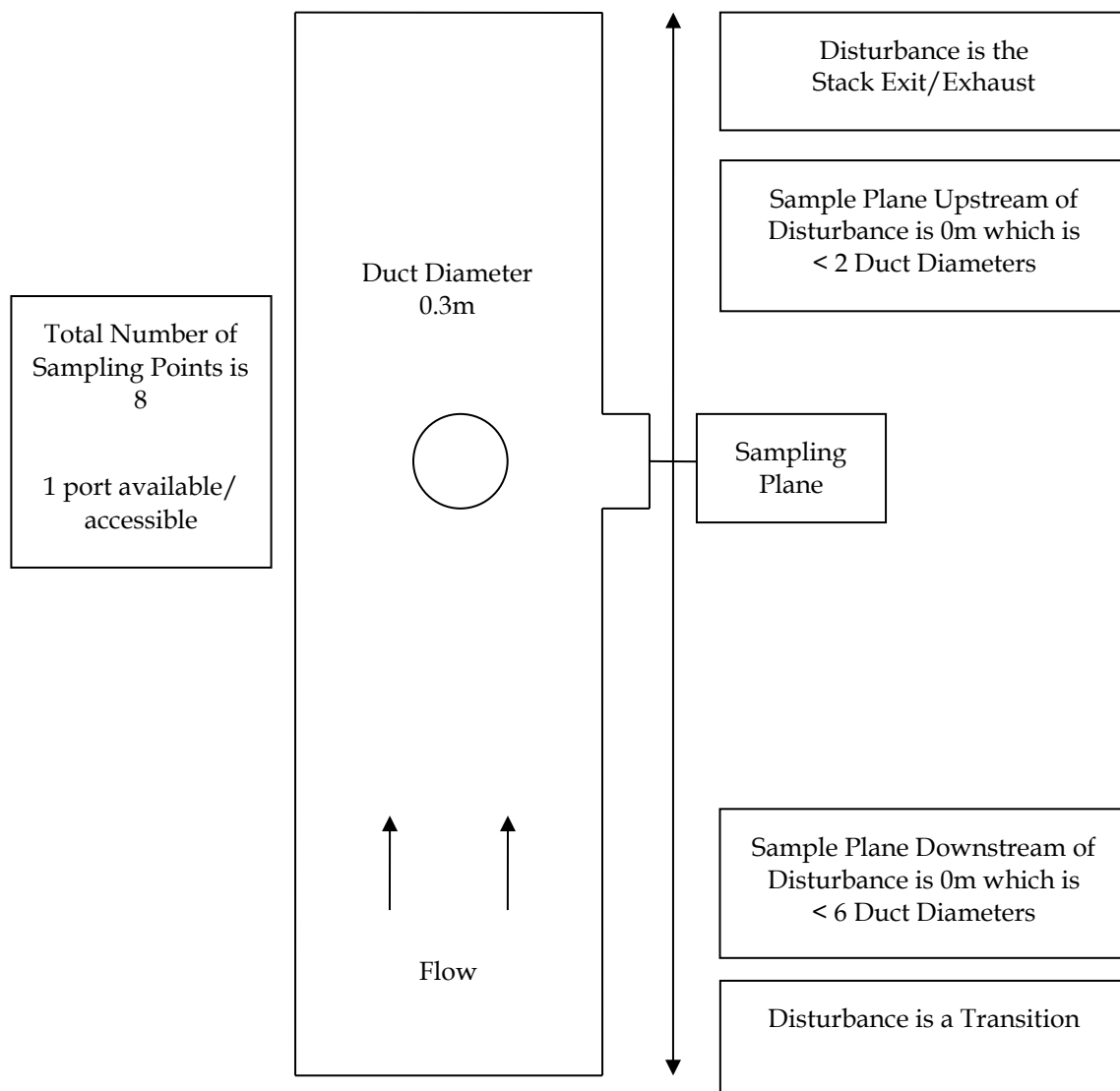
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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

**FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION**



**FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

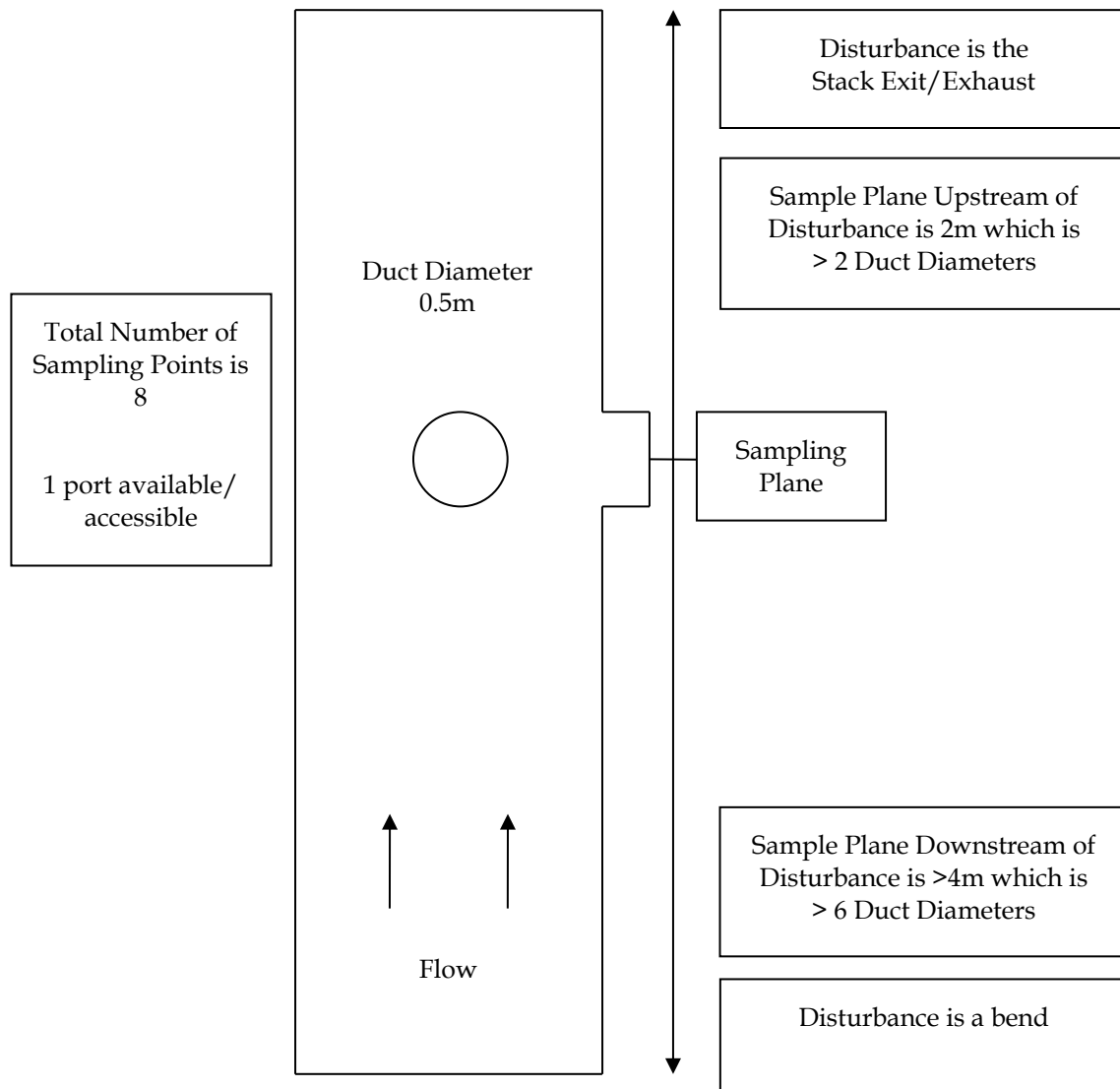
The sample location also does not meet the minimum number of access holes available.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of the velocity profile not meeting the minimum 3 metres per second (m/s) at any sampling point. Previous measurements were Average (0.9 m/s), maximum (1.1 m/s) and minimum (0.8 m/s) velocity profile. Current measurements are Average (1.7 m/s), maximum (3.5 m/s) and minimum (0 m/s) velocity profile.

**FIGURE D-18 FERMENTERS – SAMPLE LOCATION**



**FIGURE D-19 CO<sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC**

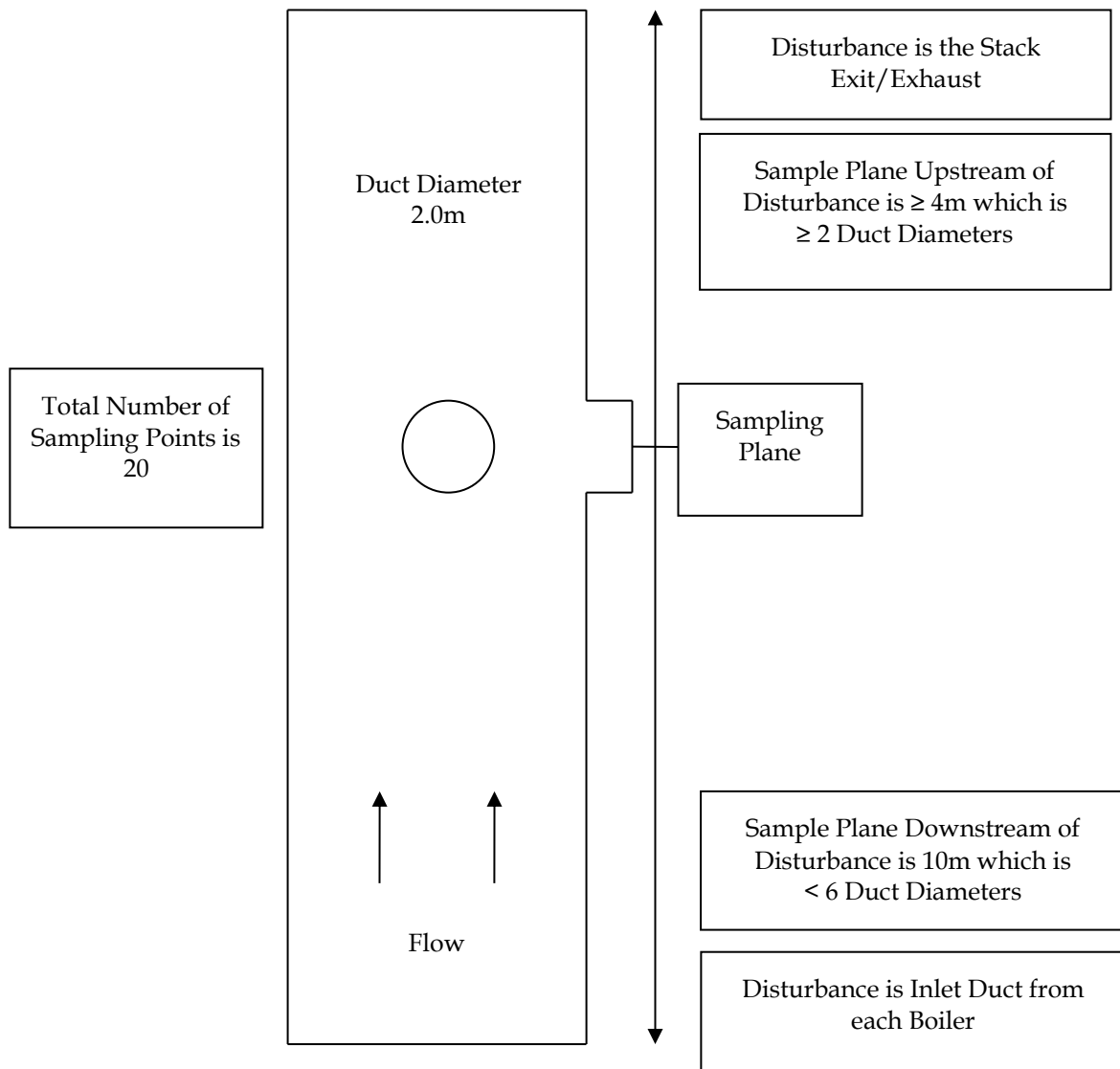


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

The sample location does not meet the minimum number of access holes available.

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

**FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC**



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

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

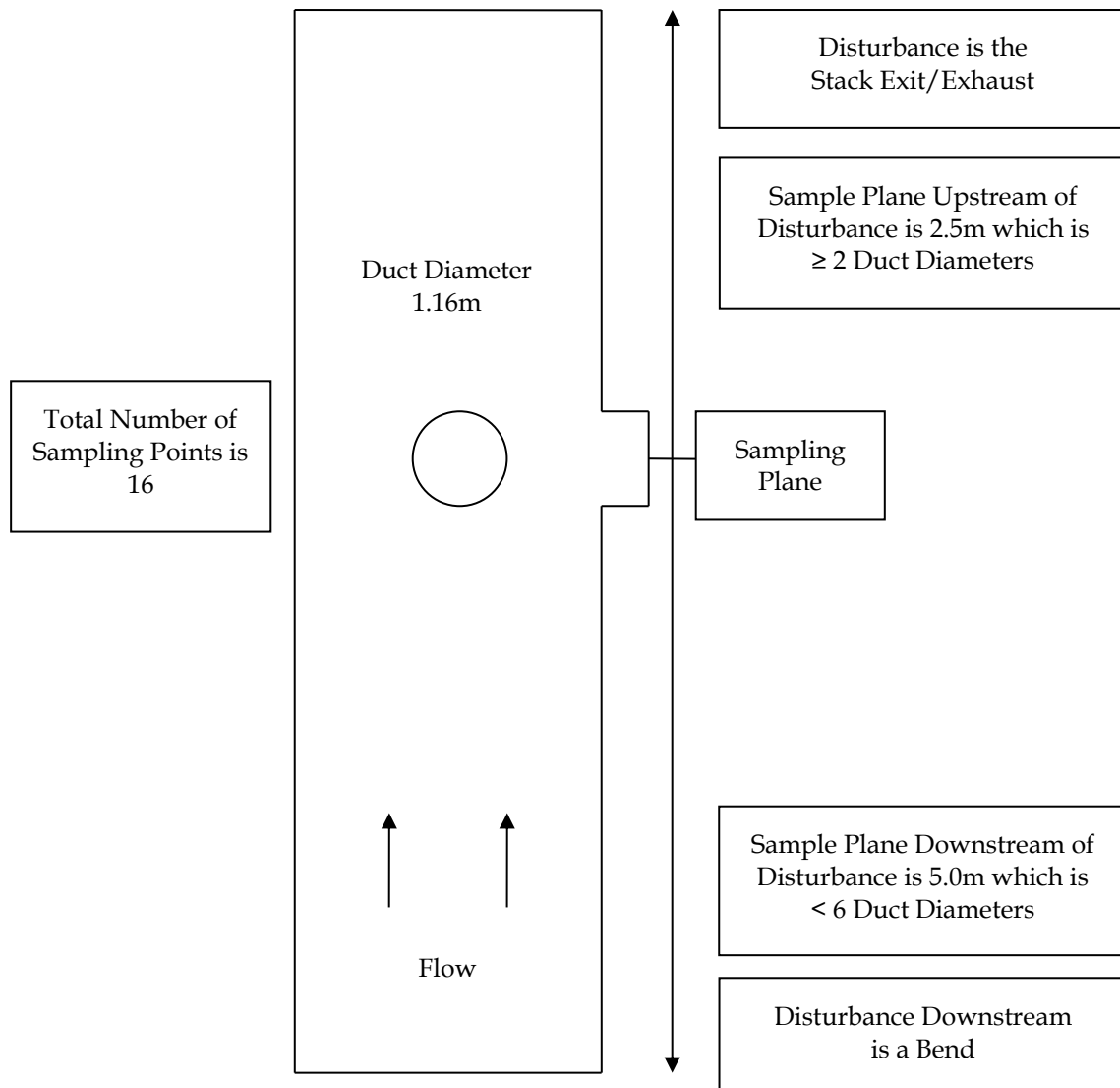
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

**FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION**





**FIGURE D-22 BOILER NO. 4- SAMPLE LOCATION SCHEMATIC**



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

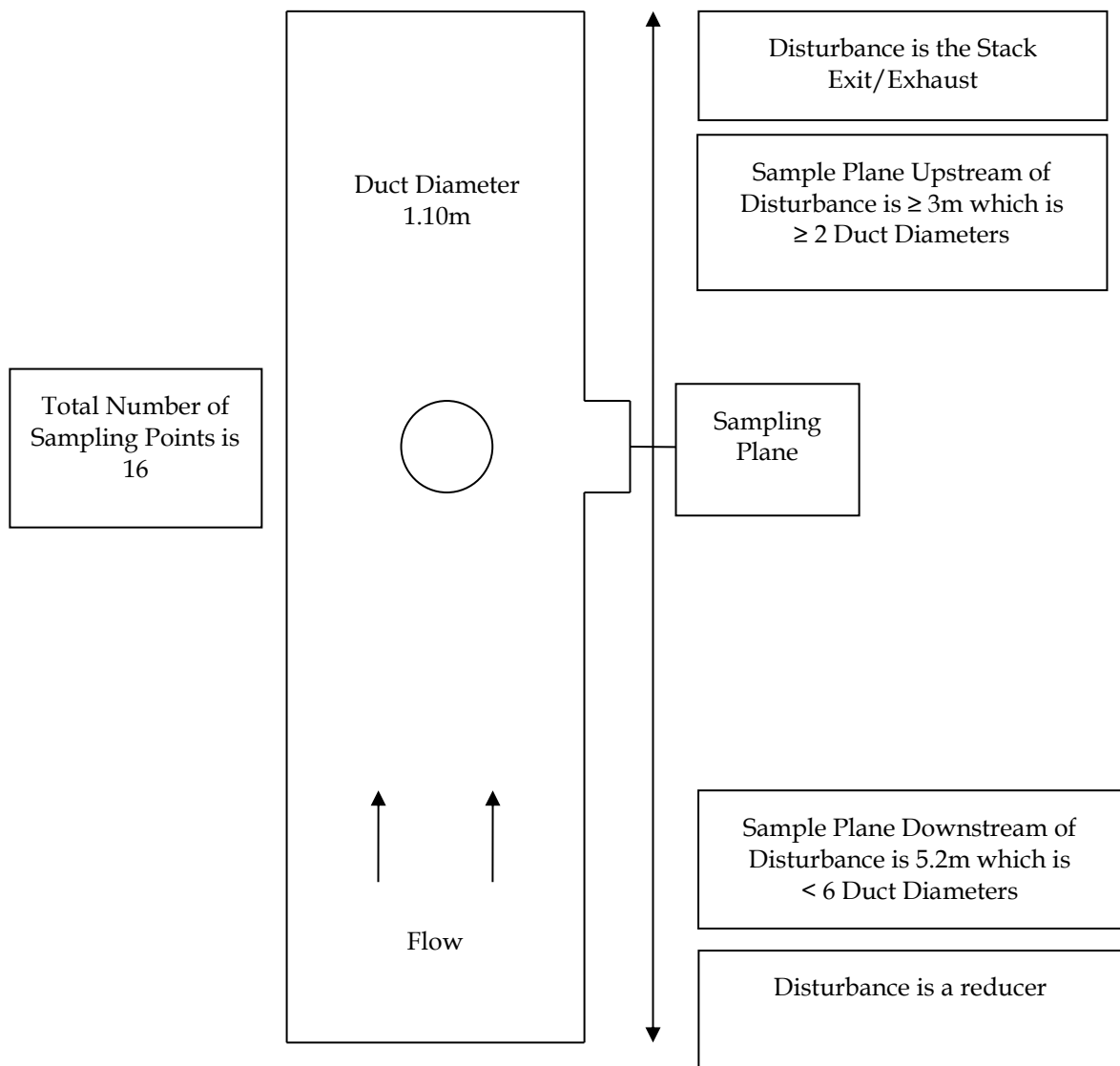
The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION**



**FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC**

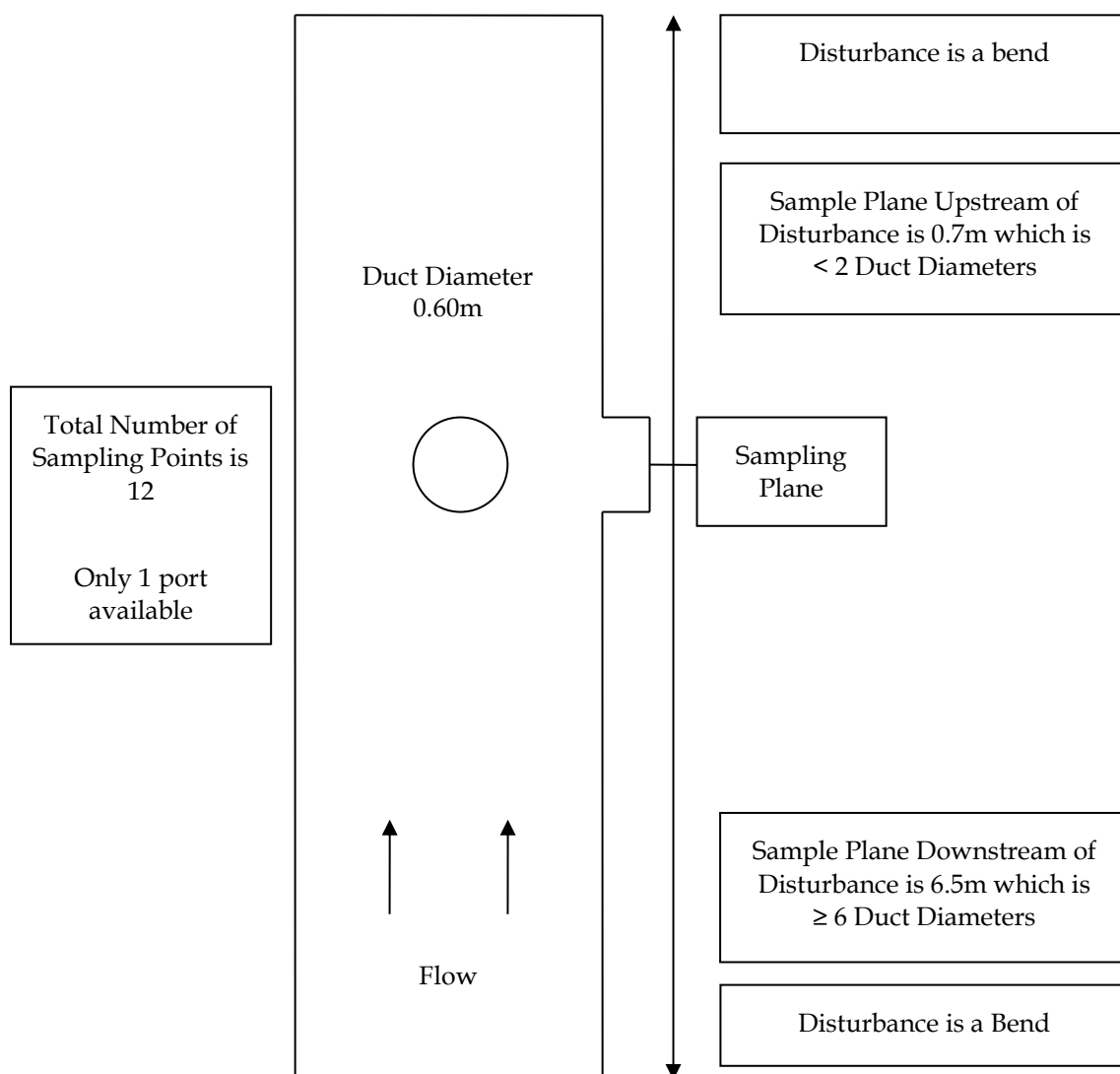


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

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

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

**FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC**



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

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

The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of velocity meeting the minimum velocity of 3m/s at every sampling point. Maximum = 5.2 m/s, Average = 2.4 m/s, Minimum = 1.0 m/s.

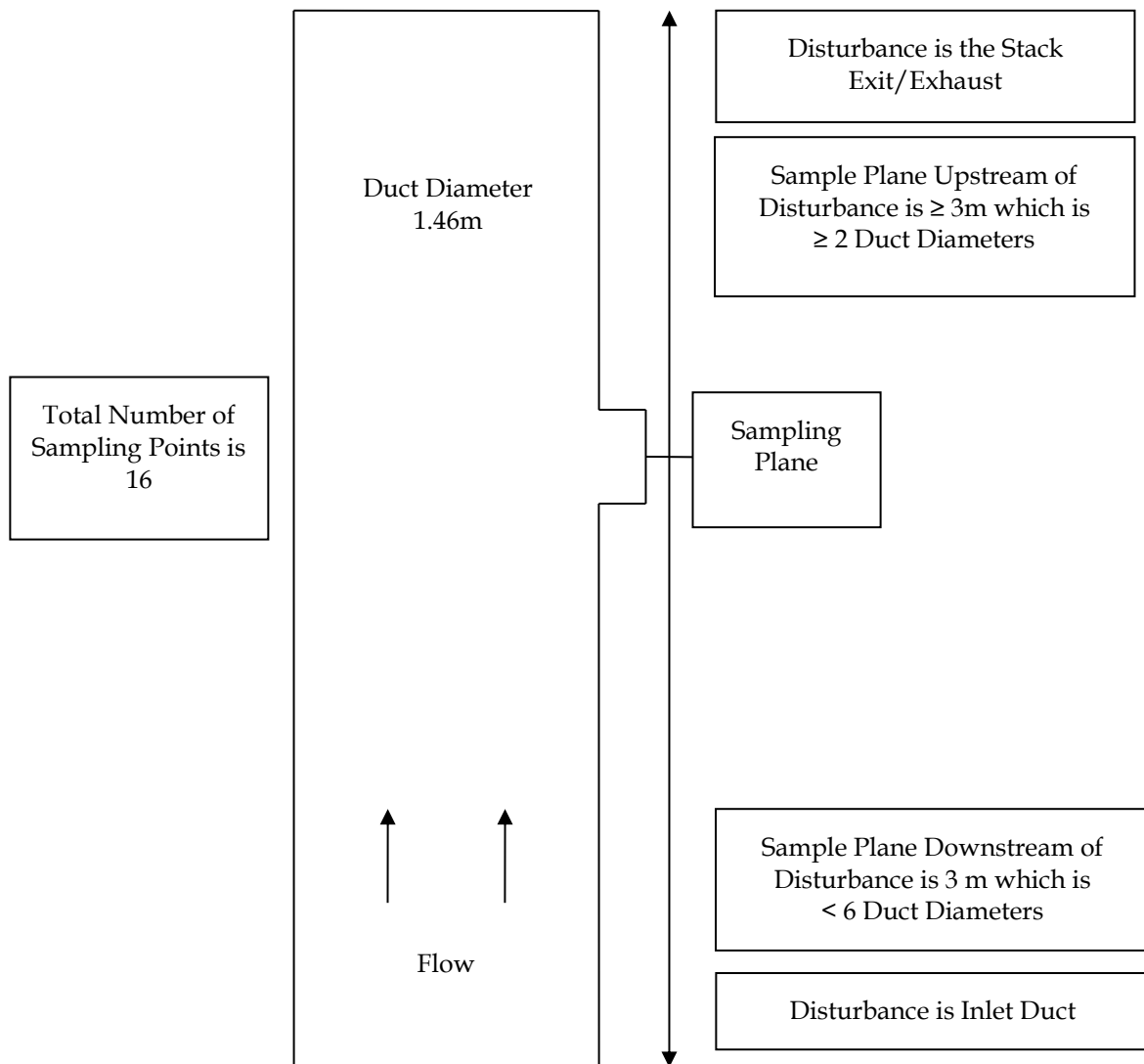
**FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION**



**FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION**



**FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC**



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

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

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



**FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH**





**Stephenson**

Environmental Management Australia

---

---

**EPL ODOUR EMISSION SURVEY ANNUAL & QUARTER 3, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT No.: 7116/S25548B/20**

**DATES OF SURVEY: 18 & 24 NOVEMBER, AND 7 DECEMBER 2020**

**DATE OF REPORT ISSUE: 21 DECEMBER, 2020**

---





**Stephenson**

**Environmental Management Australia**

Peter W Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)  
ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144  
Tel: (02) 9737 9991

E-Mail: [info@stephensonenv.com.au](mailto:info@stephensonenv.com.au)

---

**EPL ODOUR EMISSION SURVEY ANNUAL & QUARTER 3, 2020-2021**

**SHOALHAVEN STARCHES PTY LTD**

**BOMADERRY, NSW**

**PROJECT NO.: 7116/S25548B/20**

**DATES OF SURVEY: 18 & 24 NOVEMBER, AND 7 DECEMBER 2020**

**DATE OF REPORT ISSUE: 21 DECEMBER, 2020**

---

**P W STEPHENSON**

**J WEBER**

**M KIMBER**

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>4</b>
<b>2</b>	<b>MONITORING REQUIREMENTS .....</b>	<b>5</b>
2.1	ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015) .....	5
2.1.1	CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS .....	5
2.1.2	CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS .....	6
<b>3</b>	<b>PRODUCTION CONDITIONS .....</b>	<b>8</b>
<b>4</b>	<b>ODOUR EMISSION TEST RESULTS .....</b>	<b>9</b>
<b>5</b>	<b>CONCLUSIONS .....</b>	<b>11</b>
<b>6</b>	<b>TEST METHODS .....</b>	<b>27</b>
6.1	ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY .....	27
6.1.1	ODOUR PANEL SELECTION .....	28
6.1.2	ODOUR TERMINOLOGY .....	28
6.2	EXHAUST GAS VELOCITY .....	28
6.3	EXHAUST GAS TEMPERATURE .....	29
6.4	OXYGEN (O <sub>2</sub> ) .....	29
6.5	MOISTURE .....	29
6.6	ACCURACY .....	29
<b>APPENDIX A – EMISSION TEST RESULTS .....</b>		<b>1</b>
<b>APPENDIX B – CERTIFICATES OF ANALYSIS .....</b>		<b>1</b>
<b>APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION .....</b>		<b>1</b>
<b>APPENDIX D – SAMPLE LOCATIONS .....</b>		<b>1</b>

## TABLE OF TABLES

TABLE 2-1	LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS .....	5
TABLE 2-2	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47) .....	6
TABLE 2-3	SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25) .....	6
TABLE 2-4	SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46) .....	6
TABLE 2-5	SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45) .....	7
TABLE 4-1	MEASURED EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, QUARTER 3, 2020 .....	9
TABLE 4-2	MEASURED EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, ANNUAL & Q3, 2020 ..	10
TABLE 6-1	ESTIMATION OF MEASUREMENT UNCERTAINTY .....	29

## TABLE OF FIGURES

FIGURE 5-1	ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS No.1, 2, 3 & 4 (EPA 8, 9, 10 & 11) ..	12
FIGURE 5-2	ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS No.1, 3 & 4 (EPA 12, 13 & 14) .....	13
FIGURE 5-3	ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47) .....	14
FIGURE 5-4	ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44) .....	15
FIGURE 5-5	ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16) .....	16
FIGURE 5-6	ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35) .....	17
FIGURE 5-7	ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42) .....	18
FIGURE 5-8	ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45) .....	19

FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41) .....	20
FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46) .....	21
FIGURE 5-11 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 1 .....	22
FIGURE 5-12 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 3 .....	23
FIGURE 5-13 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 5 .....	24
FIGURE 5-14 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 6 .....	25
FIGURE 5-15 ODOUR EMISSION CONCENTRATIONS, SULPHUR OXIDATION POND .....	26

## TABLE OF TABLES – APPENDICES

TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4 .....	II
TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5 .....	III
TABLE A-3 EMISSION TEST RESULTS – BOILERS NO. 5&6, 4 & 2.....	IV
TABLE A-4 EMISSION TEST RESULTS – FERMENTER 16 & CO <sub>2</sub> SCRUBBER OUTLET.....	V
TABLE A- 5 EMISSION TEST RESULTS –INLET TO BIOFILTERS, DDG DRYERS 1,2,3 & 4.....	VI
TABLE A- 6 EMISSION TEST RESULTS DDG PELLET PLANT.....	VII
TABLE A- 7 EMISSION TEST RESULTS – BIOFILTER OUTLETS .....	VIII
TABLE C- 1 INSTRUMENT CALIBRATION DETAILS DAY 1 .....	II
TABLE C- 2 INSTRUMENT CALIBRATION DETAILS DAY 2.....	III
TABLE C- 3 INSTRUMENT CALIBRATION DETAILS DAY 3.....	IV

## TABLE OF FIGURES – APPENDICES

FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	II
FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION .....	III
FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC.....	IV
FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT .....	V
FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	VI
FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION .....	VII
FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	VIII
FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION .....	IX
FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC .....	X
FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION .....	XI
FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC .....	XII
FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION .....	XIII
FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC .....	XIV
FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION .....	XV
FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC .....	XVI
FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION .....	XVII
FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC .....	XVIII
FIGURE D-18 FERMENTERS – SAMPLE LOCATION .....	XIX
FIGURE D-19 CO <sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC .....	XX
FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC .....	XXI
FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION .....	XXII
FIGURE D-22 BOILER NO. 4– SAMPLE LOCATION SCHEMATIC .....	XXIII
FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION.....	XXIV
FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC .....	XXV
FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC.....	XXVI
FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION .....	XXVII

FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION .....	XXVII
FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC.....	XXVIII
FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH.....	XXIX

## 1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Shoalhaven Starches Pty Limited to conduct an odour emission survey at their manufacturing complex in Bomaderry, New South Wales (NSW).

The objective of the survey is to comply with Condition M2.1 of the Environment Protection Licence (EPL) No. 883 issued by the Environment Protection Authority (EPA). The EPA is now part of the Office of Environment and Heritage (OEH).

Section 2 of this report outlines Conditions P1 and M2 which identify the potential point and diffuse odour sources and the sampling and analysis methods respectively required by the OEH. This survey monitored the quarterly and annual odour concentrations as required in section M2.2 of EPL 883.

In addition, the Carbon Dioxide (CO<sub>2</sub>) Scrubber Inlet sampling point, which currently is not listed in EPL 883 and therefore does not have EPA Identification No., was also sampled.

The quarters are defined as below:

- Quarter 1 May to July inclusive
- Quarter 2 August to October inclusive
- Quarter 3 November to January inclusive
- Quarter 4 February to April inclusive

The annual and Quarter 3, 2020-2021 odour test results are presented in this report. These tests were conducted on the 18<sup>th</sup> and 24<sup>th</sup> November, and the 7<sup>th</sup> December 2020.

## 2 MONITORING REQUIREMENTS

### 2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015)

#### 2.1.1 CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS

Table 2-1 identifies the point and diffuse sources as defined by the OEH that relate to this survey as per most recent version of EPL No. 883 dated 20 June 2018.

**TABLE 2-1 LOCATION OF ODOUR MONITORING/DISCHARGE POINTS AND AREAS**

EPL ID. No.	Location	Odour Samples TM OM-7/8	Frequency as per M2.2 EPL 883
8	No. 1 Gluten Dryer	1	Quarterly
9	No. 2 Gluten/Starch Dryer*	1	Quarterly
10	No. 3 Gluten Dryer	1	Quarterly
11	No. 4 Gluten Dryer	1	Quarterly
12	No. 1 Starch Dryer	1	Quarterly
13	No. 3 Starch Dryer	1	Quarterly
14	No. 4 Starch Dryer	1	Quarterly
16	CO <sub>2</sub> Scrubber outlet	1	Quarterly
Not specified	CO <sub>2</sub> Scrubber inlet	1	--
19	Effluent Storage Dam 1	1	Yearly
20	Effluent Storage Dam 2	1	Yearly
21	Effluent Storage Dam 3	1	Yearly
23	Effluent Storage Dam 5	1	Yearly
24	Effluent Storage Dam 6	1	Yearly
25	Sulphur Oxidisation Pond	1	Yearly
35	Combined Stack Boilers No.5 & 6	1	Quarterly
39	Inlet Pipe to Biofilters A & B (DDG Evap #1,2&3)	1	Quarterly
39A	Inlet Pipe to Biofilters A & B (DDG Evap #4)	1	Quarterly
40	Outlet of Biofilter A	2	Quarterly
41	Outlet of Biofilter B	2	Quarterly
42	Boiler No.4	1	Quarterly
44	Fermenter	1	Quarterly
45	Boiler No.2	1	Quarterly
46	DDG Pellet Plant Stack	1	Quarterly
47	No. 5 Starch Dryer	1	Quarterly

## 2.1.2 CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS

Condition M2.1 states: *For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency specified in the opposite columns.*

Key to Tables 2.2 to 2.5:

%	=	percent
°C	=	degrees Celsius
g/g.mole	=	grams per gram mole
kg/m <sup>3</sup>	=	kilograms per cubic metre
m/s	=	metres per second
m <sup>3</sup> /s	=	cubic metres per second
mg/m <sup>3</sup>	=	milligrams per cubic metre
OM	=	Other Method
ou	=	odour units
TM	=	Test Method

**TABLE 2-2 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8, 9, 10, 11, 12, 13, 14, 16 & 47)**

Pollutant	Units	Frequency	Approved Method
Dry Gas Density	kg/m <sup>3</sup>	Quarterly	TM-23
Flow	m <sup>3</sup> /s	Quarterly	TM-2
Moisture	%	Quarterly	TM-22
Molecular Weight of stack gases	g/g-mole	Quarterly	TM-23
Odour	ou	Quarterly	OM-7
Oxygen	%	Quarterly	TM-25
Temperature	°C	Quarterly	TM-2
Velocity	m/s	Quarterly	TM-2

**TABLE 2-3 SAMPLING AND ANALYSIS OF DIFFUSE SOURCES (POINTS 19, 20, 21 & 23, 24 & 25)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Annual	OM-7

**TABLE 2-4 SAMPLING AND ANALYSIS OF SOURCES (POINTS 39, 40, 41, 44 & 46)**

Pollutant	Units	Frequency	Approved Method
Odour	ou	Quarterly	OM-7

**TABLE 2-5 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 35, 42 & 45)**

<b>Pollutant</b>	<b>Units</b>	<b>Frequency</b>	<b>Approved Method</b>
Cadmium	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Mercury	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Moisture	%	Quarterly	TM-22
Molecular weight of stack gases	g/g.mole	Quarterly	TM-23
Nitrogen Oxides	mg/m <sup>3</sup>	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m <sup>3</sup>	Annual	TM-4
Temperature	°C	Quarterly	TM-2
Total Solid Particles	mg/m <sup>3</sup>	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m <sup>3</sup>	Quarterly	TM-12, TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m <sup>3</sup>	Quarterly	TM-34
Volumetric Flowrate	m <sup>3</sup> /s	Quarterly	TM-2



### **3 PRODUCTION CONDITIONS**

Shoalhaven Starches personnel considered the factory and the ethanol distillery were operating under typical conditions on the days of testing.

One exception is that Gluten Dryer No.1 (EPA ID 8) has had a new silencer and supporting ductwork installed to replace the previous unit. However, the sampling ports have not been re-installed in this new ductwork. Therefore, access to the inside of the duct is no longer available. Thus, exhaust gas flow measurements were unable to be taken.

However, odour measurements were taken from the duct outlet to atmosphere. To enable calculation of the Mass Odour Emission Rate (MOER), exhaust gas flow measurements have been based on the most recent previous quarterly monitoring results; that is, Quarter 1, 2020 results.

## 4 ODOUR EMISSION TEST RESULTS

SEMA performed the sampling, and the odour analysis was performed by Odour Research Laboratories Australia (ORLA). SEMA and ORLA are both NATA accredited (No.15043) facilities to ISO 17025 for this.

The NATA accredited ORLA Olfactometry Test Report 7116/ORLA is presented in Appendix B.

Exhaust gas flow and emission tests results from measured sources are detailed in Tables A-1 to A-7, Appendix A.

Appendix C details calibration of instruments used to take measurements.

Appendix D shows sample locations.

Tables 4-1 summarises the odour emission concentrations for the point sources measured in Quarter 3, 2020. Table 4-2 summarises the odour emission concentrations of the diffuse sources.

**TABLE 4-1 MEASURED EMISSION CONCENTRATION TEST RESULTS POINT SOURCES, QUARTER 3, 2020**

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	18/11/2020	470
9	No.2 Gluten Dryer	18/11/2020	250
10	No.3 Gluten Dryer	18/11/2020	300
11	No.4 Gluten Dryer	18/11/2020	360
12	No.1 Starch Dryer	18/11/2020	470
13	No.3 Starch Dryer	18/11/2020	120
14	No.4 Starch Dryer	18/11/2020	110
16	Carbon Dioxide Scrubber Outlet	18/11/2020	8,000
--	Carbon Dioxide Scrubber Inlet	18/11/2020	10,600
35	Combined Stack No.5 & 6 Boilers	24/11/2020	2,200
42	Boiler No.4 Stack	24/11/2020	1,700
44	Fermenter (No. 16)	24/11/2020	7,500
45	Boiler No.2 Stack	24/11/2020	1,200
46	DDG Pellet Plant Stack	24/11/2020	2,300
47	No.5 Starch Dryer	24/11/2020	390

Key: ou = odour units

**TABLE 4-2 MEASURED EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, ANNUAL & Q3, 2020**

<b>EPA ID No.</b>	<b>Description</b>	<b>Date</b>	<b>Odour Concentration (ou)</b>
39	Inlet to Biofilters A & B	24/11/2020	9,500
39A	Inlet to Biofilters A & B	24/11/2020	70,400
40	Outlet of Biofilter A (east)	24/11/2020	1,200
40	Outlet of Biofilter A (west)	24/11/2020	2,000
41	Outlet of Biofilter B (east)	24/11/2020	1,680
41	Outlet of Biofilter B (west)	24/11/2020	1,830
19	Effluent Storage Dam 1	7/12/2020	360
20	Effluent Storage Dam 2	Unsafe for sampling	---
21	Effluent Storage Dam 3	7/12/2020	280
23	Effluent Storage Dam 5	7/12/2020	63
24	Effluent Storage Dam 6	7/12/2020	38
25	Sulphur Oxidation Pond	7/12/2020	63

Key: ou = odour units

## 5 CONCLUSIONS

The comparative results of the odour sampling and analysis, over time, that have been undertaken by SEMA at Shoalhaven Starches manufacturing facility at Bomaderry are graphically presented in Figures 5-1 to 5-16.

Figure 5-1 presents graphical representations of odour concentrations recorded for Gluten Dryers No.1, 2, 3 and 4 since autumn 2005.

Figure 5-2 presents graphical representations of odour concentrations recorded for Starch Dryers No.1, 3 and 4 since autumn 2005.

Figure 5-3 graphically shows the Starch Dryer No. 5 emission concentrations since spring 2017.

Figure 5-4 graphically shows the Fermenter emission concentrations since summer 2007-2008.

Figure 5-5 illustrates odour emission concentrations from the Carbon Dioxide Scrubber since autumn 2013.

Figures 5-6 and 5-7 graphically show the Combined Boiler 5 and 6 stack and the Boiler No.4 stack emission concentrations since summer 2013-2014 respectively.

Figure 5-8 shows the Boiler 2 stack emission concentrations since winter 2019.

Figure 5-9 graphically shows the Bio-filter inlet (EPA ID#39) and outlet emission concentrations since autumn 2010.

Figure 5-10 graphically shows the DDG Pellet plant Stack emission concentrations since spring 2016.

Figures 5-11 to 5-15 show the Effluent Ponds 1, 3, 5 and 6 odour emission concentrations since summer 2003-2004.

Figure 5-16 shows Sulphur Oxidation Pond odour emission concentrations since winter 2010.

FIGURE 5-1 ODOUR EMISSION CONCENTRATIONS, GLUTEN DRYERS NO.1, 2, 3 & 4 (EPA 8, 9, 10 & 11)

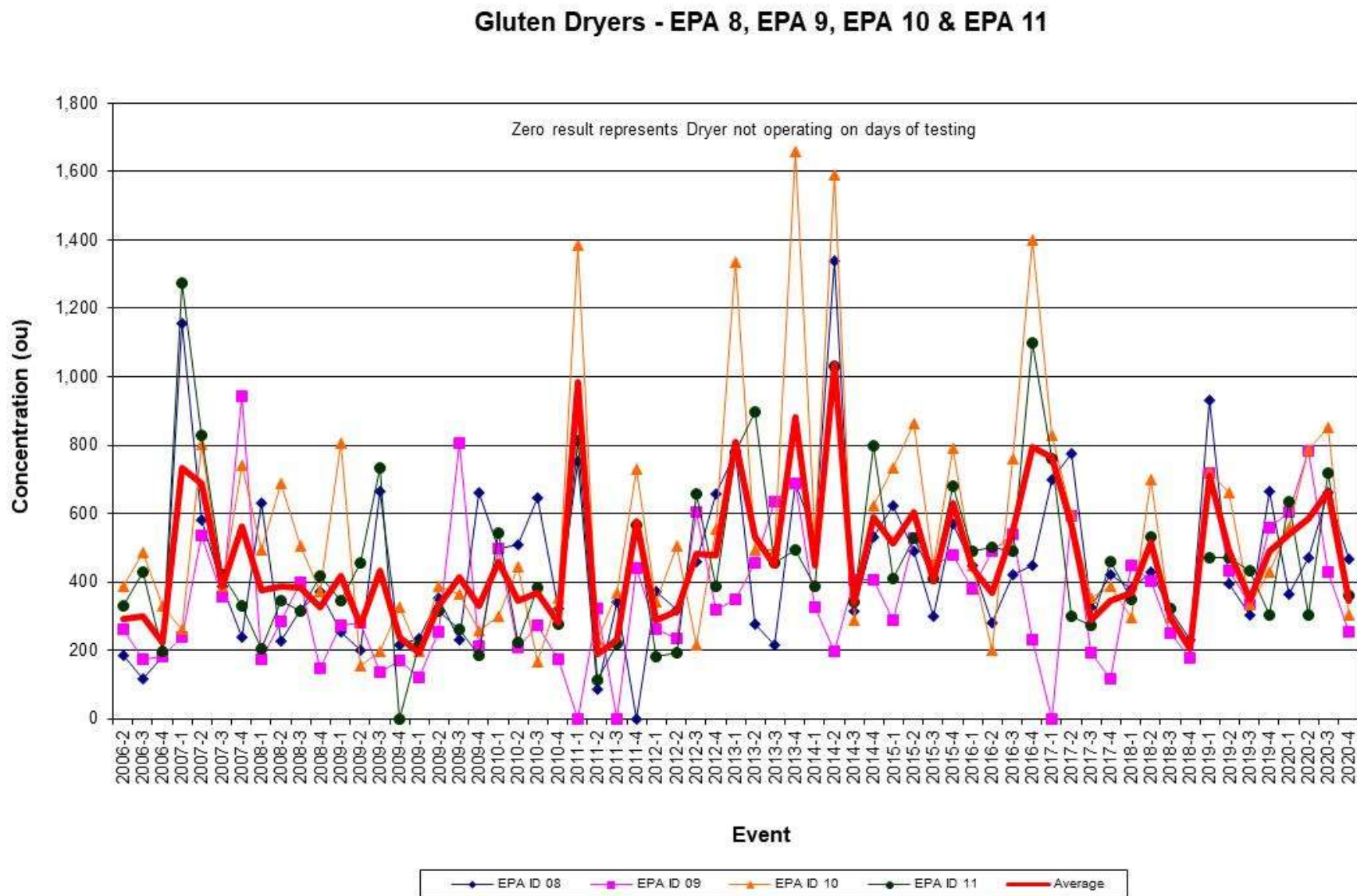


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS No.1, 3 & 4 (EPA 12, 13 & 14)

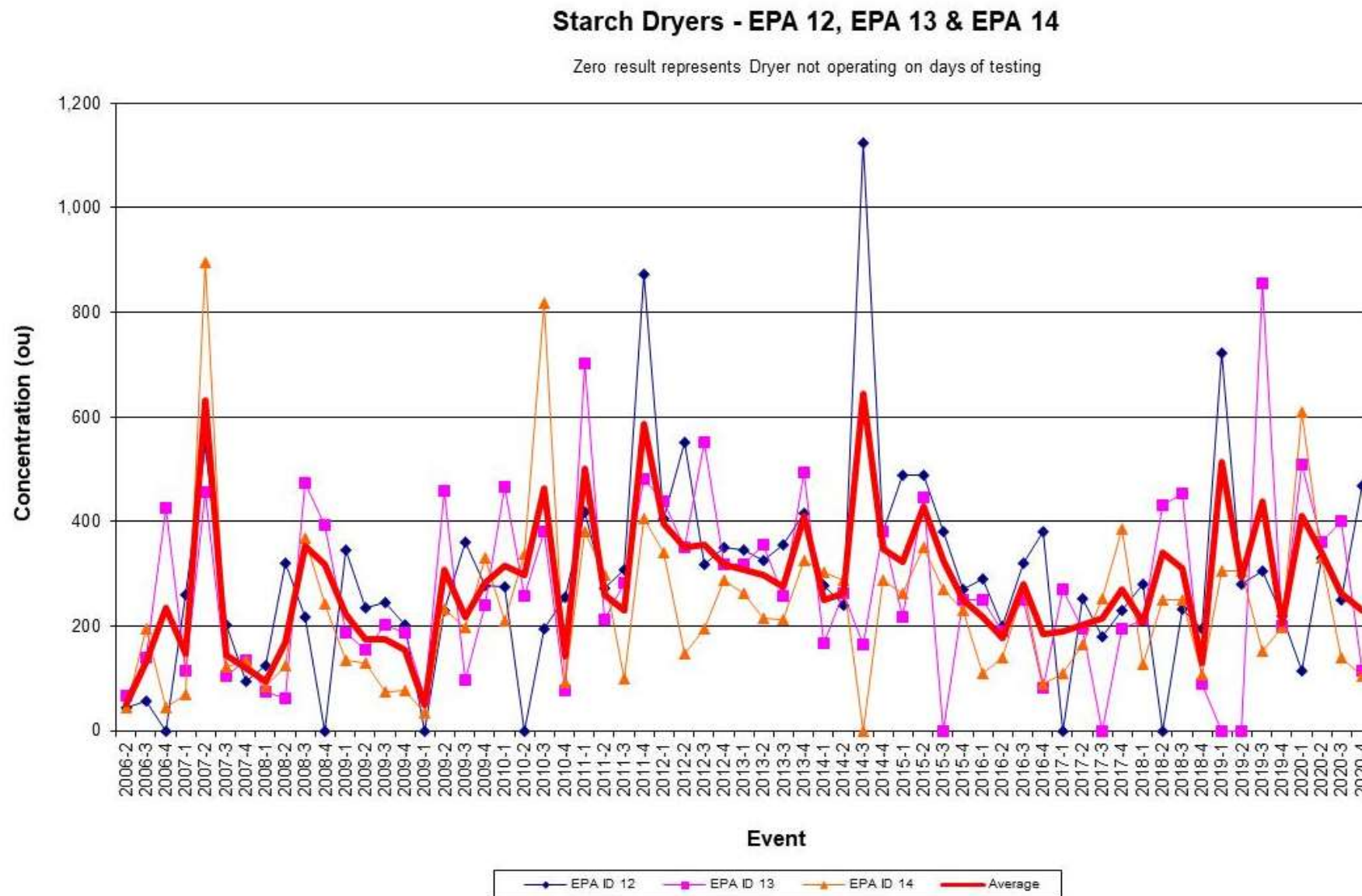
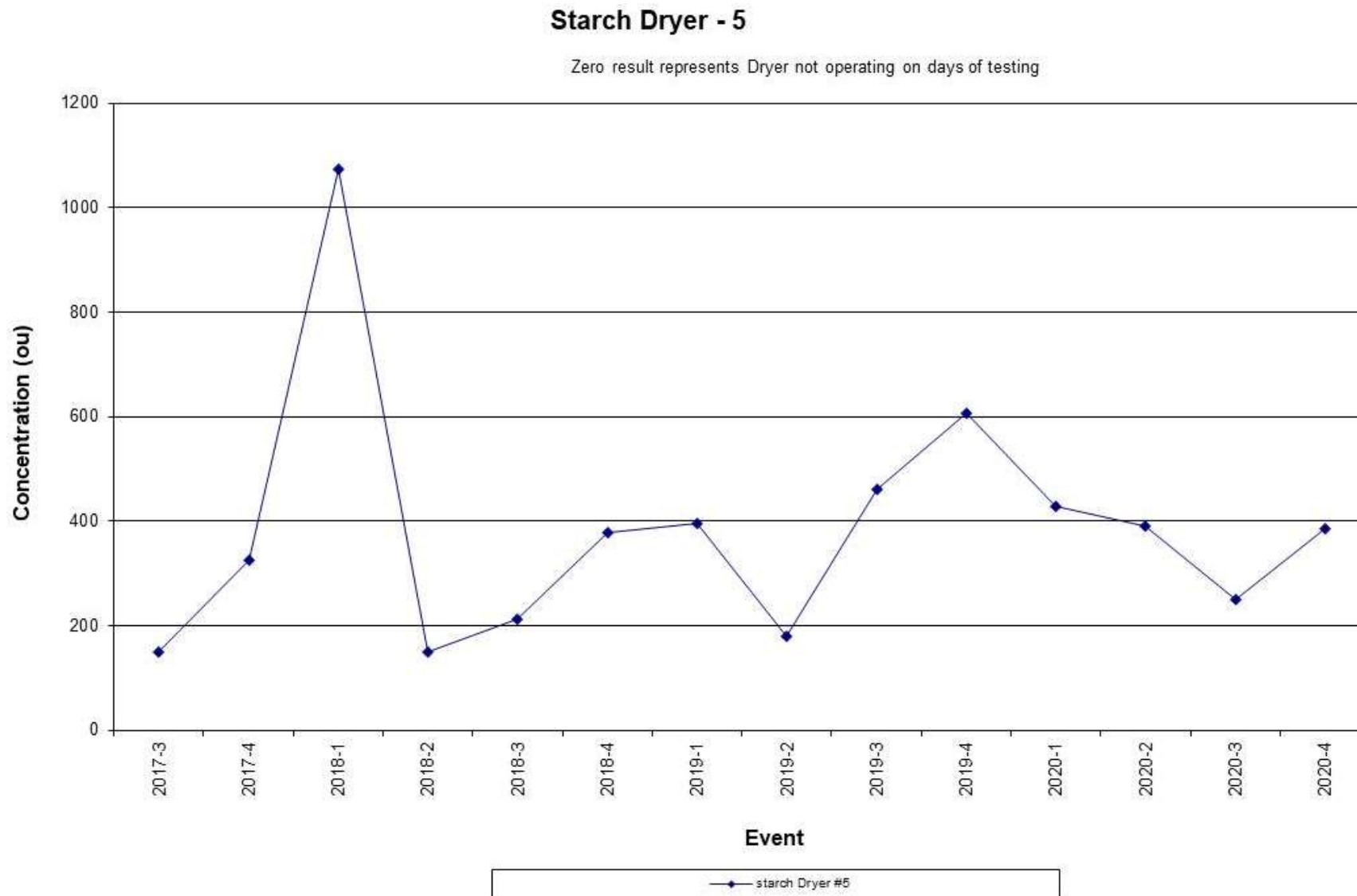
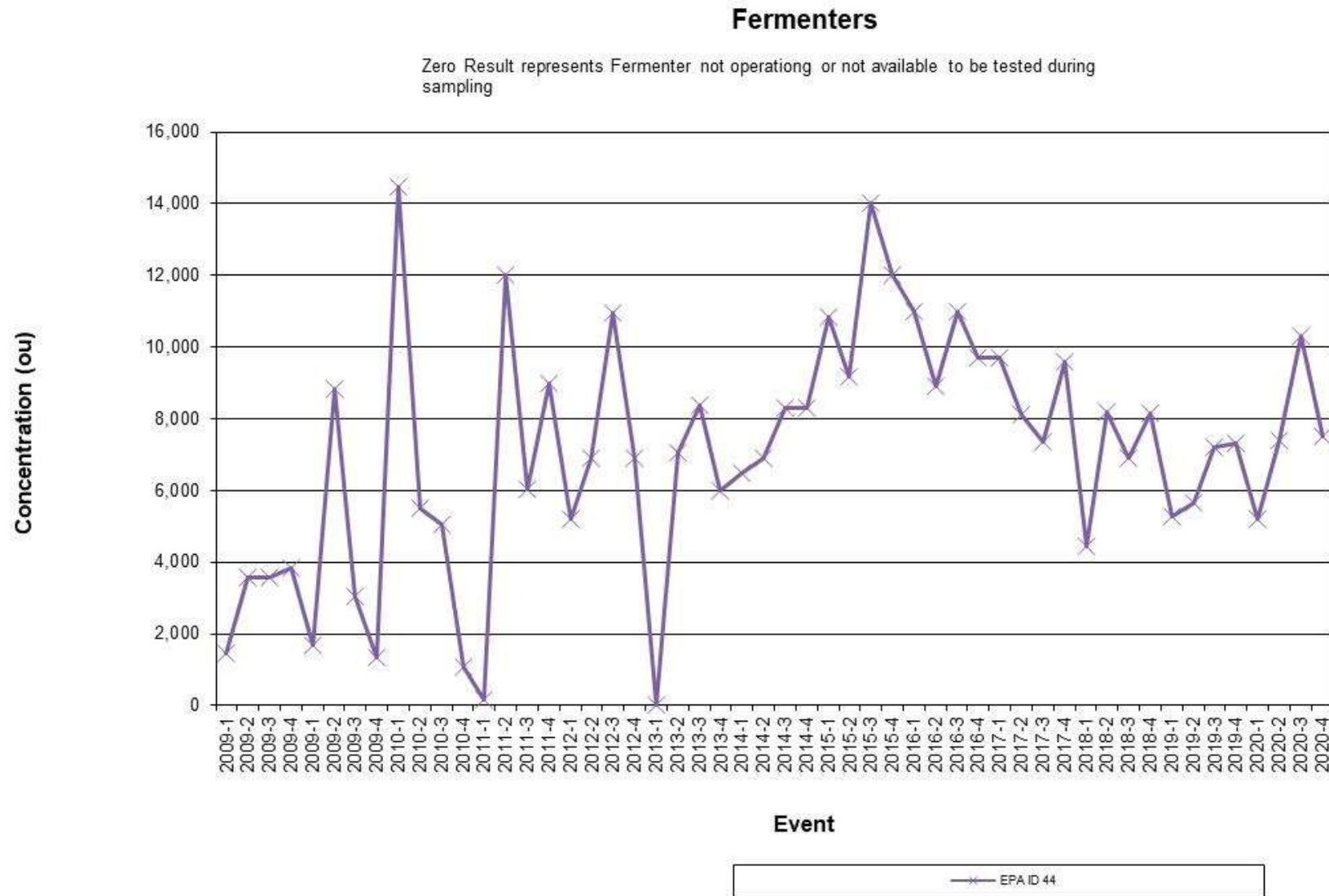


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47)



**FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44)**





**FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16)**

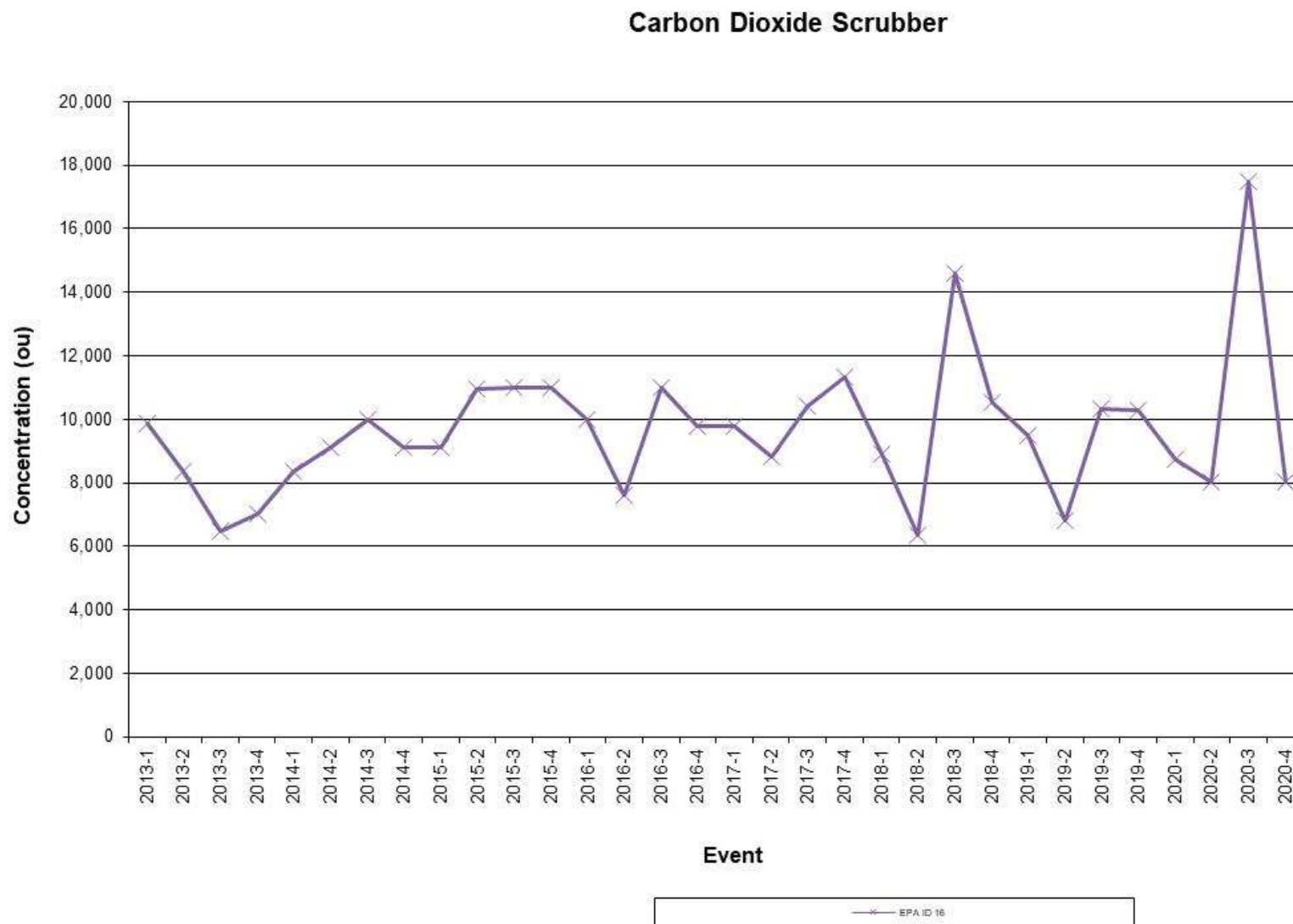
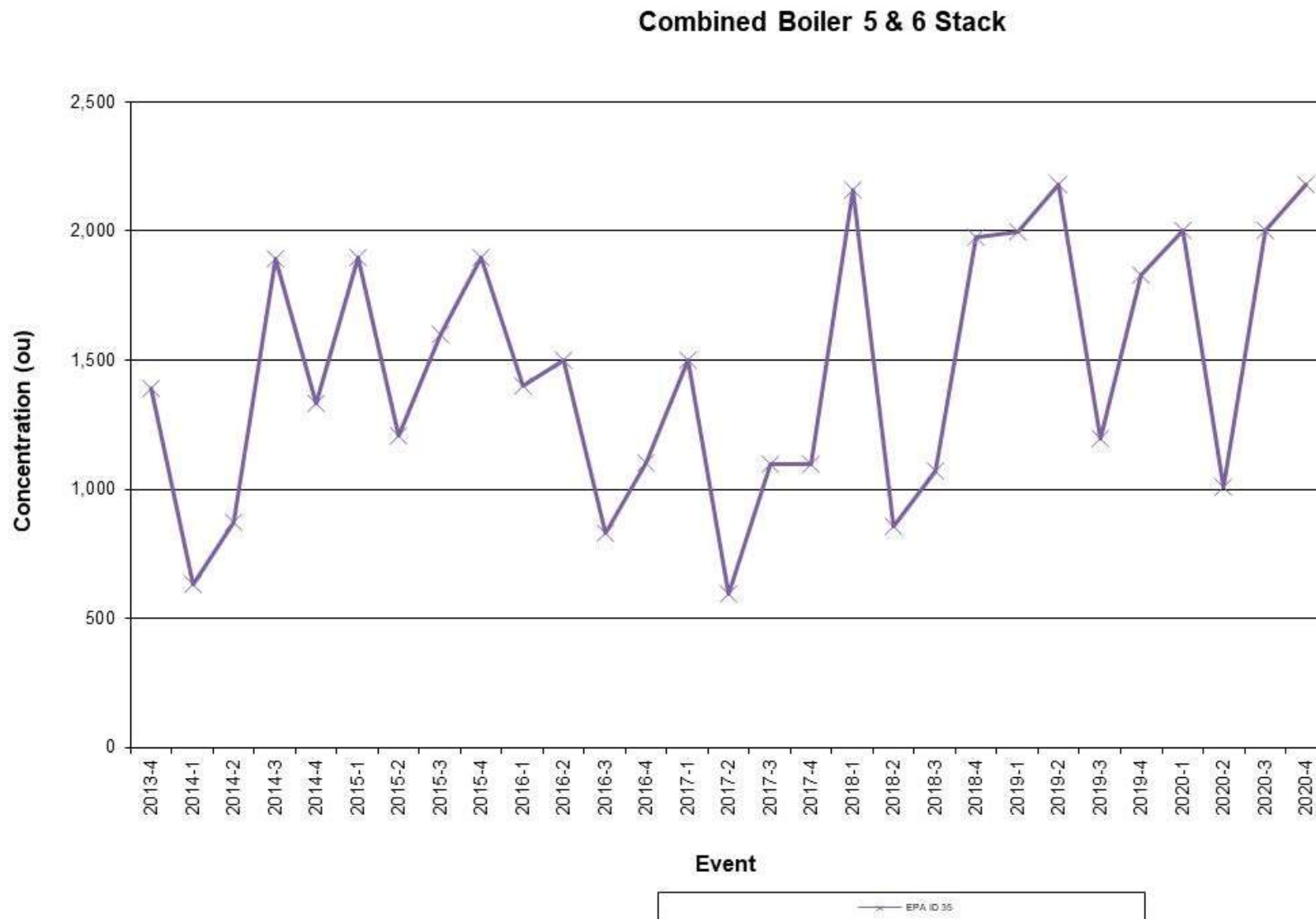


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35)



**FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42)**

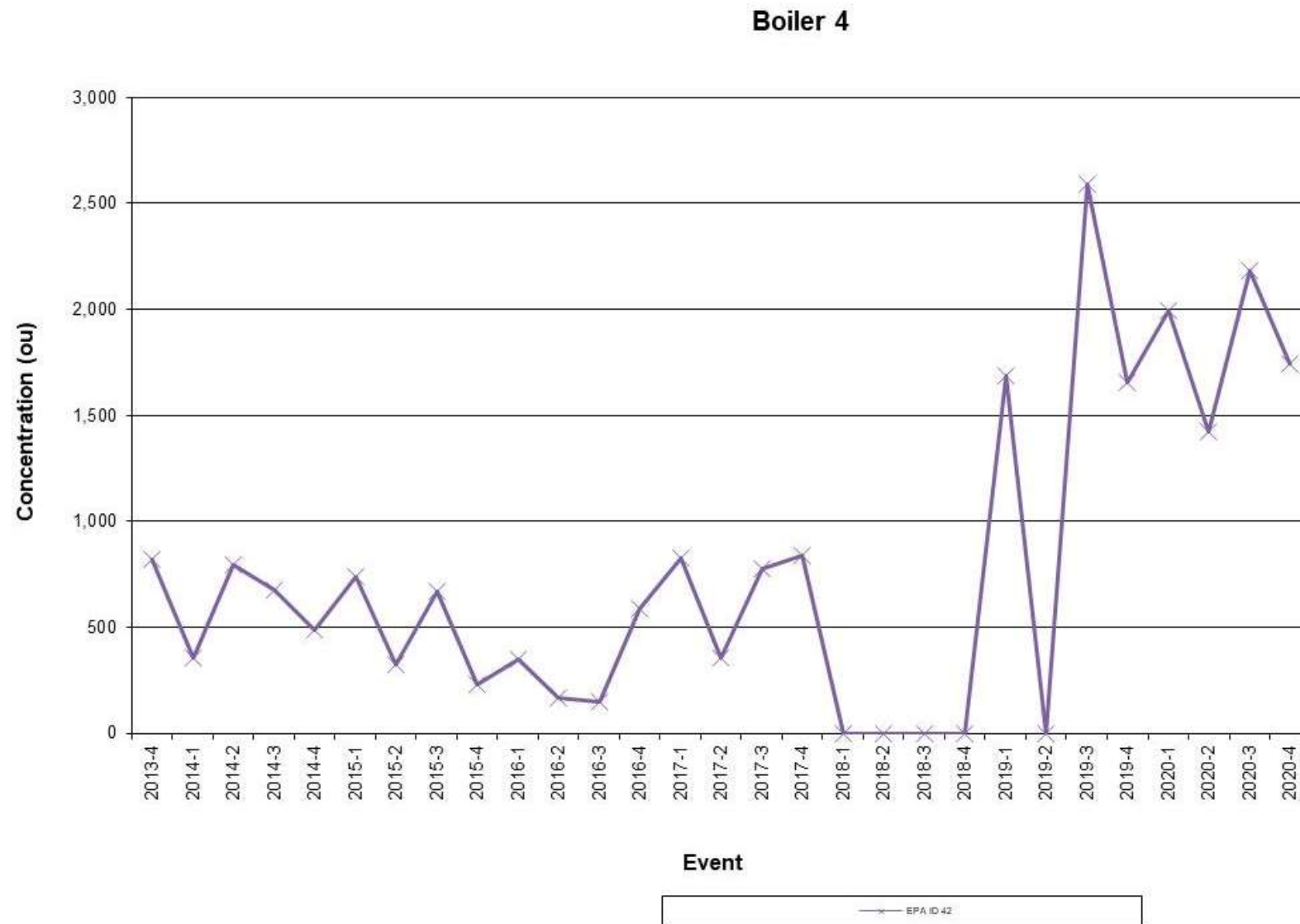


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45)

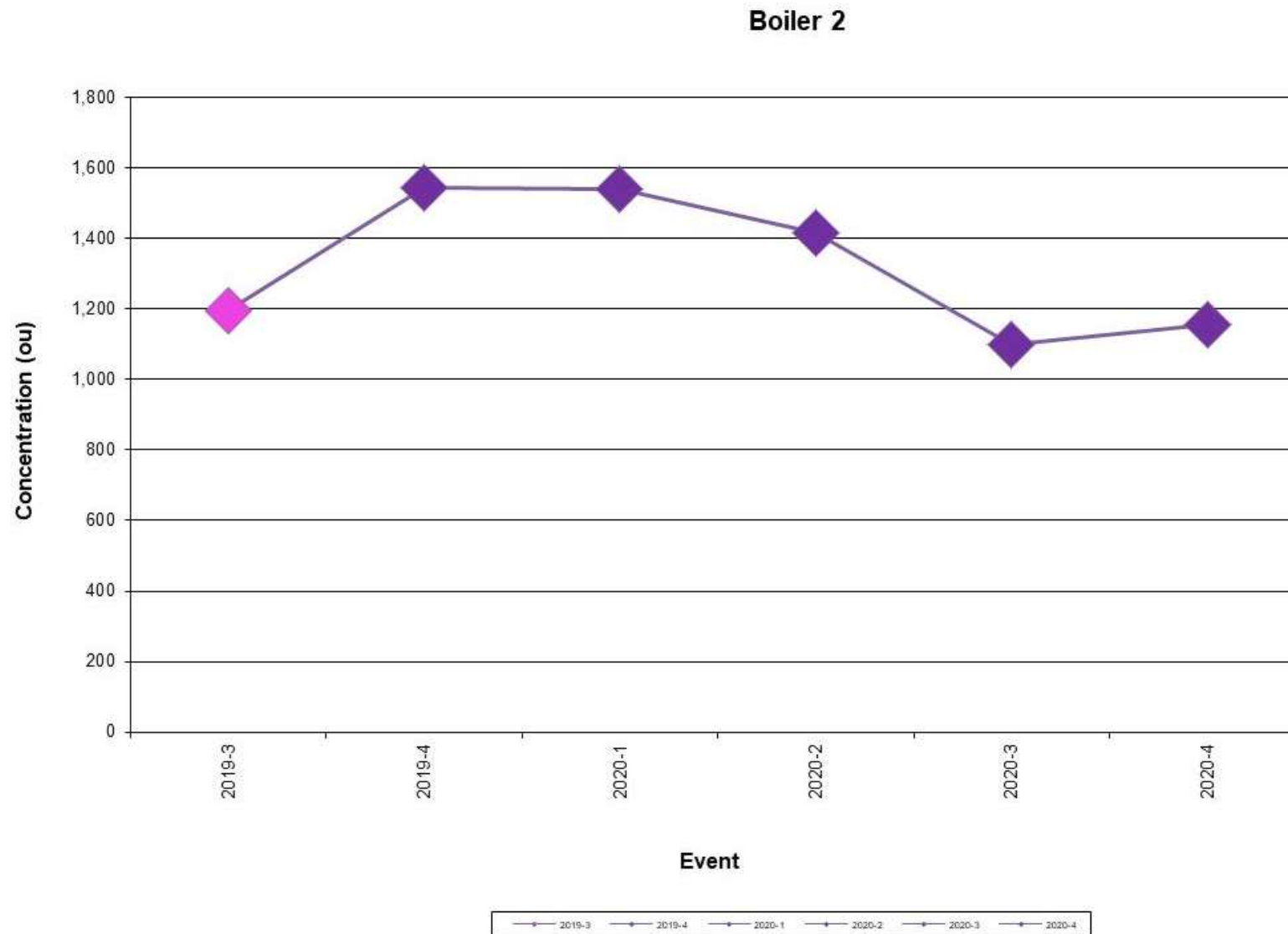


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41)

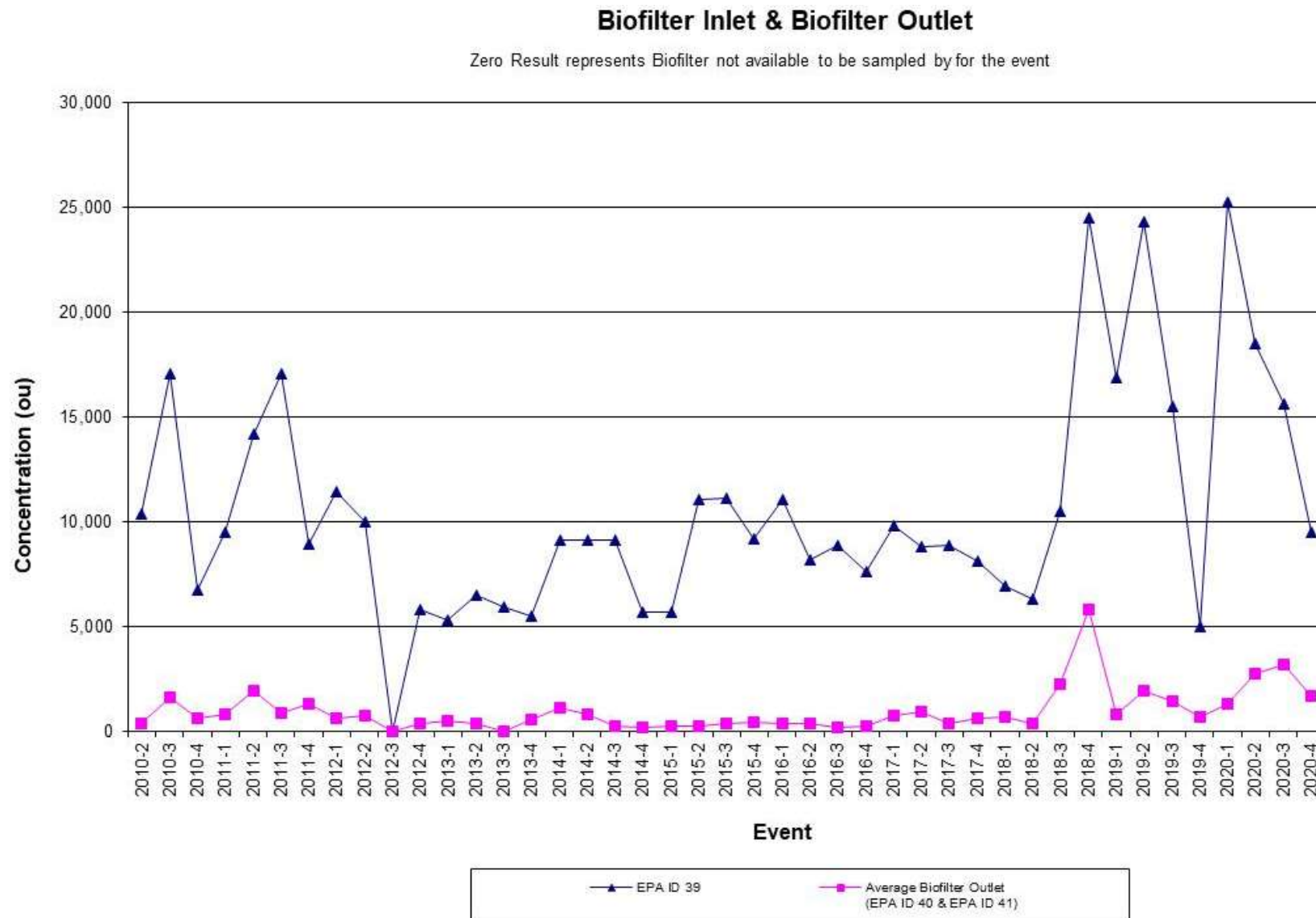
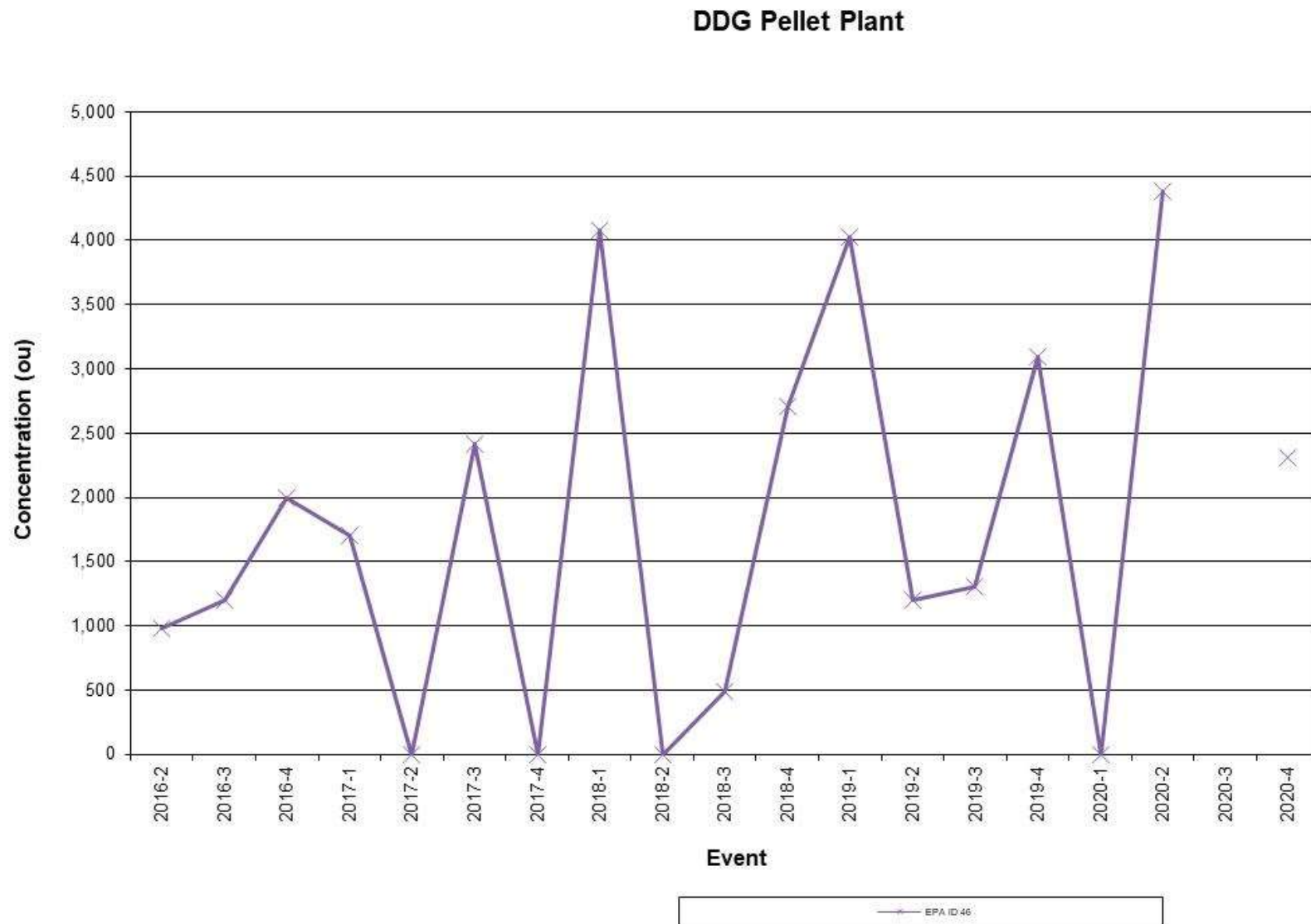


FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46)



**FIGURE 5-11 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 1**

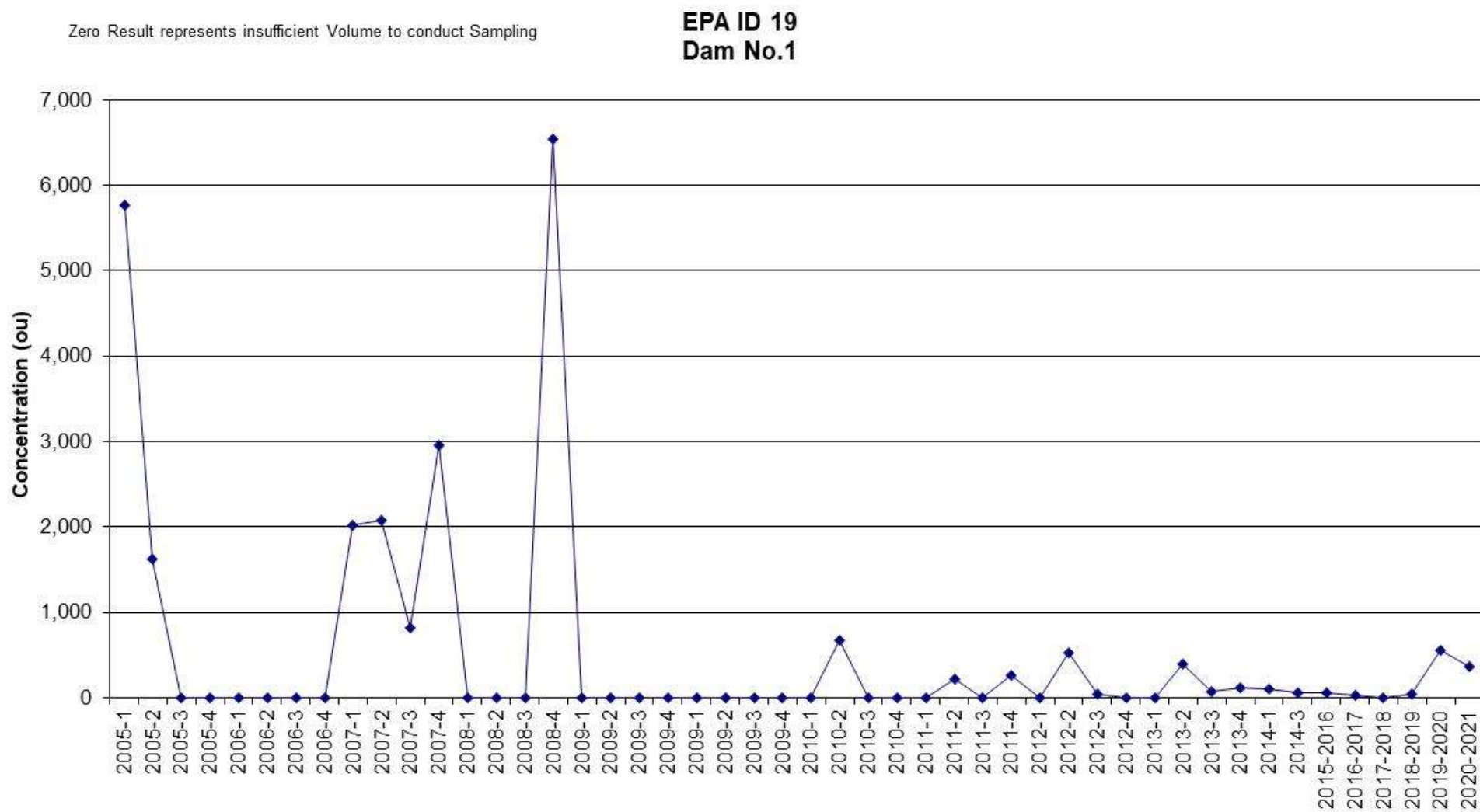
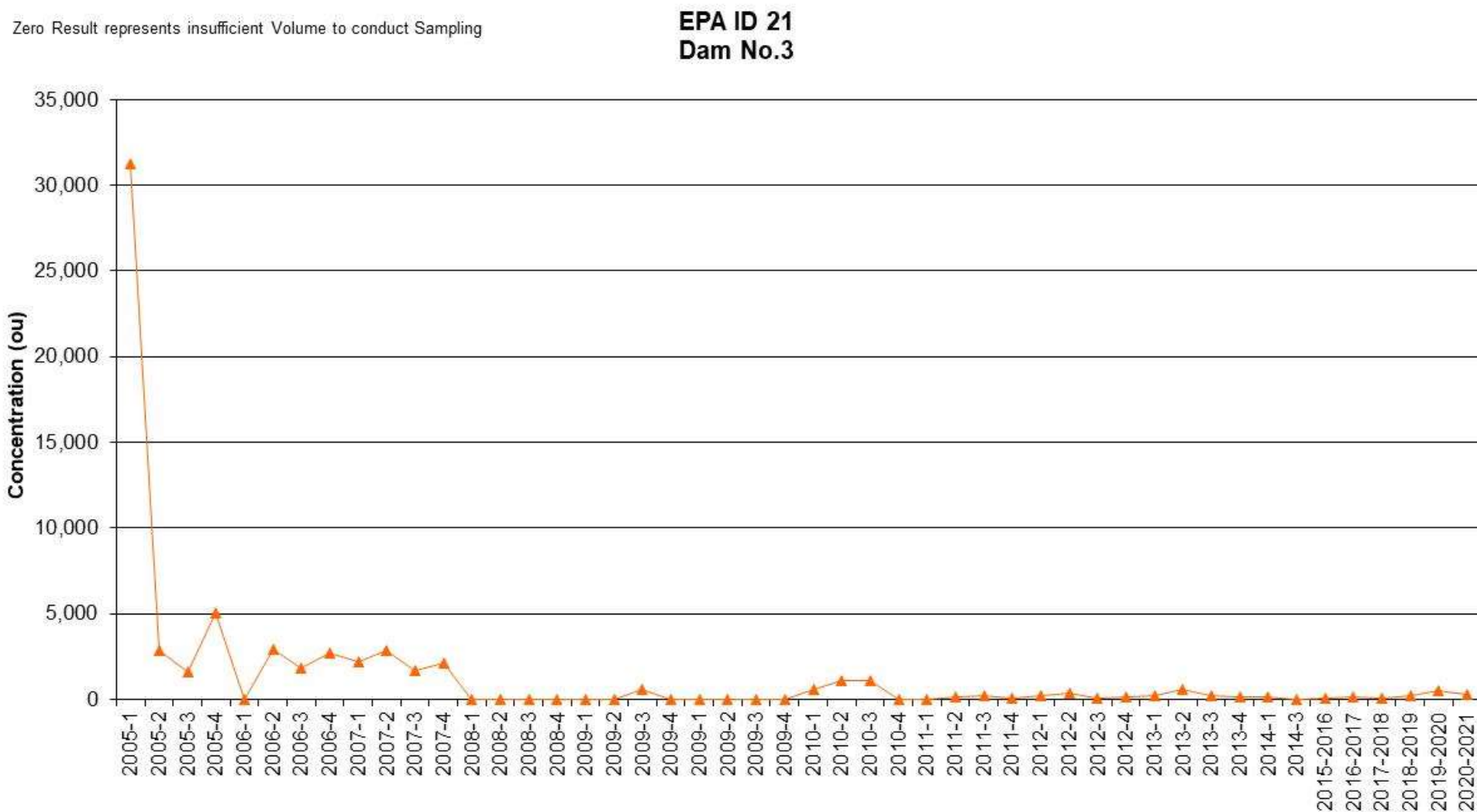
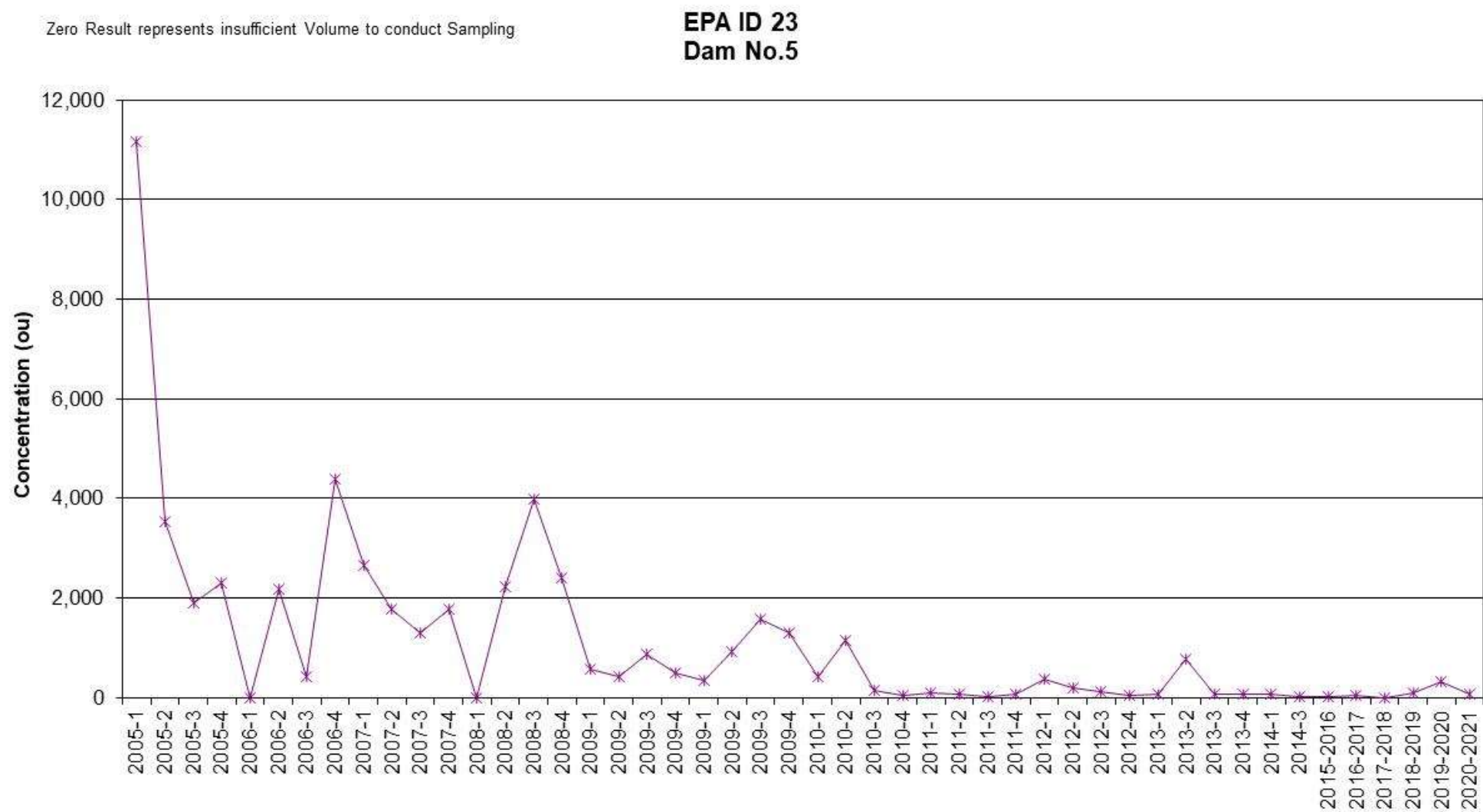


FIGURE 5-12 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 3





**FIGURE 5-13 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 5**



**FIGURE 5-14 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 6**

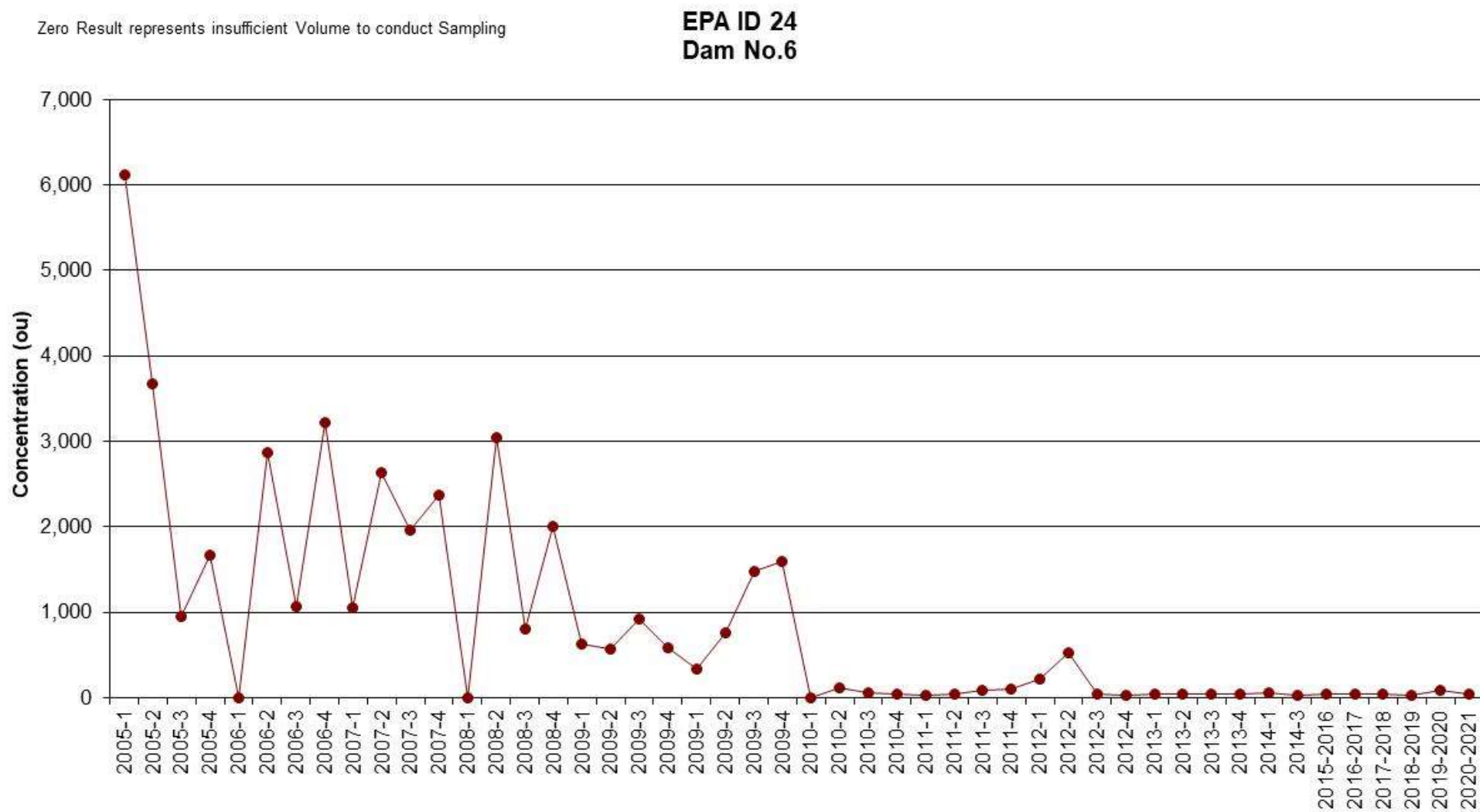
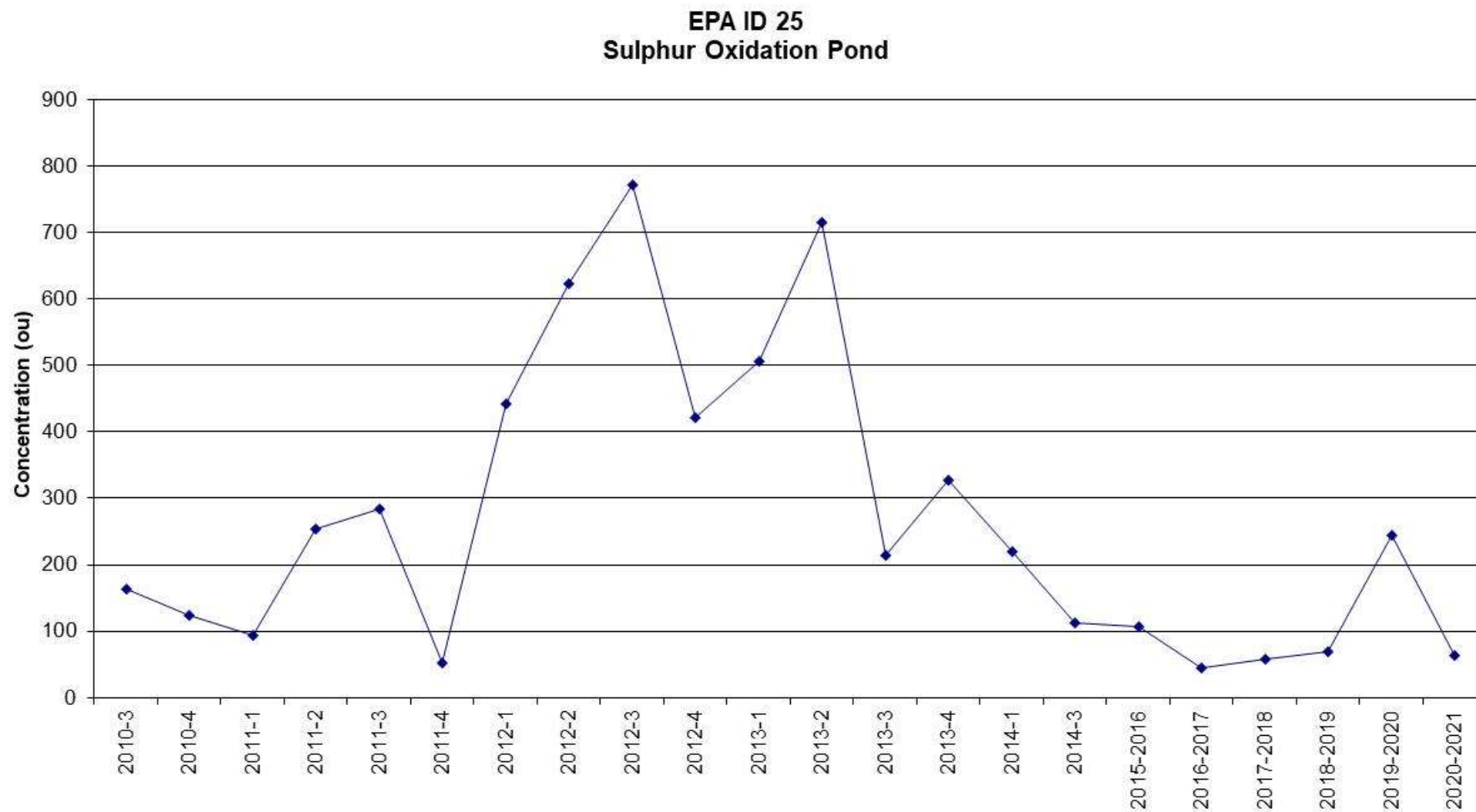


FIGURE 5-15 ODOUR EMISSION CONCENTRATIONS, SULPHUR OXIDATION POND



## 6 TEST METHODS

### 6.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

(AS 4323.3 & AS 4323.4 and OM-7 and OM-8)

Samples were collected in 30L Nalophane sampling bags which are enclosed in airtight plastic containers. Surface samples were collected utilising an equilibrium flux hood or witches hat flux hood.

Odorous gas for analysis was drawn through a Teflon (PTFE) sample probe. The gas then passes through a Teflon (PTFE) tube connected to the Nalophane sampling bag. The sampling pump is connected to the airtight plastic container to provide a sample gas flow-rate of approximately 0.5 – 1.5 litres per minute. After the required volume has been sampled, the pump is stopped and the bag sealed with a stainless steel valve. Two samples were collected from each site.

Using a triangular forced choice olfactometer, the Nalophane bag of odour sample was dynamically diluted to various concentrations with dry odour free air.

The diluted sample was then presented to a panel of screened panellists as one of these airflows. The panellists then recorded if they could detect any odour and from which flow. The other two flows were discharging odour free air.

The odour is always presented to the panellists in ascending concentration; that is, from lower to higher concentration. The panellists are required at each dilution level to give a response as to what they are smelling from the flows (forced choice methodology). The response options for the panellists are:

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows could be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows could be different from the other two flows and is able to: <ul style="list-style-type: none"><li>■ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from -10 to 10 and/or</li><li>■ Able to assign a character to the colour, as in 'it smells like ...'</li></ul> <p><i>Note: that the Recognise level concentration and Hedonic Tone and Odour descriptors are obtained with the diluted odour, panellists are not exposed to the full strength odour.</i></p>

The percentage panel response and dilution levels used were then entered into a computer programme to determine the 50% panel response. This dilution level corresponds to the odour concentration of the sample.

Sampling and dilution lines are constructed from teflon, stainless or glass to prevent contamination of the sample.

The sampling and the dilution procedures used were in accordance with OEH NSW Method OM-7 and OM-8, which are based on Standards Association of Australia, AS4323.3 and AS4323.4.

#### **6.1.1 ODOUR PANEL SELECTION**

Odour panellists must meet certain criteria to qualify as and remain panellists. Their average sensitivity to n-Butanol must be between 20 and 80 parts per billion (ppb) and their variability in response to n-Butanol must be within a certain range.

Panellists are screened against n-Butanol before every panel session to ensure they are in compliance.

Panellists should not suffer from respiratory complaints, nor should they eat or smoke or drink anything but water during the half hour preceding or during the test period and their person and clothing should be odour free and have not been exposed to an odorous environment before testing.

#### **6.1.2 ODOUR TERMINOLOGY**

The odour level is expressed in odour units and for mixed odours is analogous to concentration expressed in parts per billion. The odour detection level is defined as the ratio of *the volume that a sample of odorous gas would occupy when diluted to the threshold of detection of that odour to the volume of the sample*. In simpler terms, the ratio indicated the number of dilutions necessary to reduce the odour to its threshold of detection or odour detection threshold. This ratio is expressed in odour units or number of dilutions to detection threshold. For example, a value of 2,000 odour units would mean the volume of the initial sample of odorous gas would need to be diluted 2,000 times before the odour would just be detectable to the average human nose, that is, at the odour detection threshold.

### **6.2 EXHAUST GAS VELOCITY**

*(OEH NSW TM-2 and USEPA Method 12)*

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and digital manometer.

### 6.3 EXHAUST GAS TEMPERATURE

(OEH NSW TM- 2, 3 & 4 and USEPA Methods 2, 3 & 4)

The exhaust gas temperature was measured using a Digital thermometer (0-1200°C) connected to a chromel/alumel (K-type) thermocouple probe.

### 6.4 OXYGEN (O<sub>2</sub>)

(OEH NSW TM-24 and USEPA Method 3A)

O<sub>2</sub> was analysed by a Testo 350 analyser.

### 6.5 MOISTURE

(OEH NSW TM-22 and USEPA Method 4)

Moisture from the stack was determined in accordance with OEH NSW TM-22 and USEPA Method 4. In particular, M4 Section 2.2.1 which nominates a moisture approximation method used to enable calculation of isokinetic sampling rates and where isokinetic sampling is not required such as odour sampling.

### 6.6 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 6-1) uncertainties for various stack testing methods.

**TABLE 6-1 ESTIMATION OF MEASUREMENT UNCERTAINTY**

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Odour	AS4323.3, AS4323.4	3 times
Oxygen and Carbon Dioxide	TM-24, TM-25, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2A & 2C	5%

Key:

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

Sources: *Measurement Uncertainty - implications for the enforcement of emission limits* by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK

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

---

## APPENDIX A – EMISSION TEST RESULTS

### Glossary:

%	=	percent
°C	=	Degrees Celsius
am <sup>3</sup> /min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m <sup>3</sup> )	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am <sup>3</sup>	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m <sup>3</sup>	=	kilograms per cubic metre
kPa	=	kilo Pascals
m <sup>2</sup>	=	square metre
m/s	=	metre per second
m <sup>3</sup> /sec	=	cubic metre per second at 0°C and 1 atmosphere
mg	=	milligrams
mg/ m <sup>3</sup>	=	milligrams per cubic metre at 0°C and 1 atmosphere
O <sub>2</sub>	=	Oxygen

Abbreviations for names of SEMA staff who completed either Sampling or Analysis or QA Checking

PWS	=	Peter W Stephenson
JW	=	Jay Weber

**TABLE A-1 EMISSION TEST RESULTS – GLUTEN DRYERS NO. 1, 2, 3 & 4**

Emission Test Results				
Project Number	7116			
Project Name	Shoalhaven Starches			
Test Location	EPA ID 8 Gluten Dryer 1*	EPA ID 9 Gluten Dryer 2	EPA ID 10 Gluten Dryer 3	EPA ID 11 Gluten Dryer 4
Date	18-Nov-20	18-Nov-20	18-Nov-20	18-Nov-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:07	13:48	14:46	14:26
Flow Stop Time (hrs)	12:24	14:06	15:57	14:48
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	65.3	63.0	73.5	74.3
Stack Cross-Sectional area (m <sup>2</sup> )	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	13.7	17.0	11.5	15.7
Actual Gas Flow Volume (am <sup>3</sup> /min)	1,179	1,114	3,040	2,173
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	915	794	2,293	1,633
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	15.2	13.2	38.2	27.2
Total Stack Pressure (kPa)	102.5	93.4	102.8	102.5
Moisture Content (% by volume)	5.01	4.77	5.69	5.57
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m <sup>3</sup> )	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5446	5447	5448	5449
SEMA Number	728138	728139	728140	728141
Sample Start Time (hrs)	12:58	13:53	14:57	14:38
Sample Finish Time (hrs)	13:08	14:06	15:07	14:48
Odour Concentration (As Received) (ou)	468	254	302	359
Odour Concentration (Final) (ou)	470	250	300	360
Normal MOER (As Received) (ou m <sup>3</sup> /s)	7,136	3,362	11,540	9,768
Normal MOER (Final) (ou m <sup>3</sup> /s)	7,136	3,362	11,540	9,768
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

\* Re. Gluten Dryer No.1 (EPA ID 8), odour measurements were taken. However, new silencer and ductwork no longer enable access to the duct. Thus, flow measurements were unable to be taken. To enable calculation of the MOER, flow measurements have been based on previous Quarter 1, 2020 results.



**TABLE A-2 EMISSION TEST RESULTS – STARCH DRYERS NO.1, 3, 4 & 5**

Emission Test Results				
Project Number	7116			
Project Name	Shoalhaven Starches			
Test Location	EPA ID 12 Starch Dryer 1	EPA ID 13 Starch Dryer 3	EPA ID 14 Starch Dryer 4	EPA ID 47 Starch Dryer 5
Date	18-Nov-20	18-Nov-20	18-Nov-20	24-Nov-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:47	15:26	15:25	13:19
Flow Stop Time (hrs)	13:09	15:48	16:47	13:40
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	41.4	40.1	39.5	64.4
Stack Cross-Sectional area (m²)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	7.3	20.2	21.0	14.9
Actual Gas Flow Volume (am³/min)	980	1,214	1,258	4,047
Total Normal Gas Flow Volume (m³/min)	812	1,004	1,046	3,020
Total Normal Gas Flow Volume (m³/s)	13.5	16.7	17.4	50.3
Total Stack Pressure (kPa)	102.47	102.53	102.54	101.11
Moisture Content (% by volume)	5.75	6.22	5.99	7.61
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m³)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5445	5450	5451	5457
SEMA Number	728137	728142	728143	728148
Sample Start Time (hrs)	12:59	15:38	16:37	13:30
Sample Finish Time (hrs)	13:09	15:48	16:47	13:40
Odour Concentration (As Received) (ou)	470	116	106	386
<b>Odour Concentration (Final) (ou)</b>	<b>470</b>	<b>120</b>	<b>110</b>	<b>390</b>
Normal MOER (As Received) (ou m³/s)	6,358	1,942	1,848	19,428
Normal MOER (Final) (ou m³/s)	6,358	1,942	1,848	19,428
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

**TABLE A-3 EMISSION TEST RESULTS – BOILERS NO. 5 & 6, 4 & 2**

Emission Test Results			
Project Number	7116		
Project Name	Shoalhaven Starches		
Test Location	EPA ID 35 Boilers 5&6	EPA ID 42 Boiler 4	EPA ID 45 Boiler 2
Date	24-Nov-20	24-Nov-20	24-Nov-20
	Dry		
Run	1		
Method	TM-1, TM-2 & TM-22		
Flow Start Time (hrs)	11:38	10:43	10:00
Flow Stop Time (hrs)	12:00	11:05	10:20
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	135.2	164.6	214.0
Stack Cross-Sectional area (m²)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	16.5	18.7	8.3
Actual Gas Flow Volume (am³/min)	3,117.3	1,187.5	475.9
Total Normal Gas Flow Volume (m³/min)	1,973.7	702.2	254.5
Total Normal Gas Flow Volume (m³/s)	32.895	11.704	4.242
Total Stack Pressure (kPa)	101.11	101.23	101.23
Moisture Content (% by volume)	5.15	5.15	4.54
Molecular Weight Dry Stack Gas (g/gmole)	30.080	29.840	30.080
Dry Gas Density (kg/m³)	1.34	1.33	1.34
Oxygen (%)	8.4	10.0	8.4
Analysis	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5455	5454	5453
SEMA Number	728146	728145	728144
Sample Start Time (hrs)	11:50	10:55	10:10
Sample Finish Time (hrs)	12:00	11:05	10:20
Odour Concentration (As Received) (ou)	2,181	1,742	1,156
<b>Odour Concentration (Final) (ou)</b>	<b>2,200</b>	<b>1,700</b>	<b>1,200</b>
Normal MOER (As Received) (ou m³/s)	71,745	20,388	4,904
Normal MOER (Final) (ou m³/s)	71,745	20,388	4,904
Mass Odour Emission Rate Limit (ou m³/s)	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

**TABLE A-4 EMISSION TEST RESULTS – FERMENTER 16 & CO<sub>2</sub> SCRUBBER OUTLET**

Emission Test Results		
Project Number	7116	
Project Name	Shoalhaven Starches	
Test Location	EPA ID 44 Fermenter 16	EPA ID 16 CO <sub>2</sub> Scrubber outlet
Date	18-Nov-20	18-Nov-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	10:36	11:02
Flow Stop Time (hrs)	10:57	11:22
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	32.2	28.4
Stack Cross-Sectional area (m <sup>2</sup> )	0.071	0.196
Average Stack Gas Velocity (m/s)	6.1	7.6
Actual Gas Flow Volume (am <sup>3</sup> /min)	25.7	90
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	22.4	79
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	0.373	1.320
Total Stack Pressure (kPa)	102.51	102.51
Moisture Content (% by volume)	3.80	3.45
Molecular Weight Dry Stack Gas (g/gmole)	29.620	31.204
Dry Gas Density (kg/m <sup>3</sup> )	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	Odour	Odour
Method	AS4323.3	AS4323.3
ORLA Number	5442	5443
SEMA Number	728134	728135
Sample Start Time (hrs)	10:47	11:12
Sample Finish Time (hrs)	10:57	11:22
Odour Concentration (As Received) (ou)	7,516	8,035
<b>Odour Concentration (Final) (ou)</b>	<b>7,500</b>	<b>8,000</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	2,804	10,609
Normal MOER (Final) (ou m <sup>3</sup> /s)	2,804	10,609
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

**TABLE A-5 EMISSION TEST RESULTS – INLET TO BIOFILTERS, DDG DRYERS 1, 2, 3 & 4**

Emission Test Results		
Project Number	7116	
Project Name	Shoalhaven Starches	
Test Location	EPA ID 39 Biofilter Inlet DDG Dryers 1, 2 & 3	EPA ID 39A Biofilter Inlet DDG Dryer 4
Date	24-Nov-20	24-Nov-20
	Dry	Dry
Run	1	1
Method	TM-1, TM-2 & TM-22	TM-1, TM-2 & TM-22
Flow Start Time (hrs)	14:50	14:50
Flow Stop Time (hrs)	14:50	15:12
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	41.8	30.1
Stack Cross-Sectional area (m <sup>2</sup> )	0.283	0.049
Average Stack Gas Velocity (m/s)	13.6	8.5
Actual Gas Flow Volume (am <sup>3</sup> /min)	231	25
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	178	22
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	3.0	0.4
Total Stack Pressure (kPa)	96.42	101.39
Moisture Content (% by volume)	6.90	3.93
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m <sup>3</sup> )	1.287	1.287
Oxygen (%)	20.9	20.9
Analysis	Odour	Odour
Method	AS4323.3	AS4323.3
ORLA Number	5462	5463
SEMA Number	728153	728154
Sample Start Time (hrs)	14:16	15:02
Sample Finish Time (hrs)	14:26	15:12
Odour Concentration (As Received) (ou)	9,495	70,388
<b>Odour Concentration (Final) (ou)</b>	<b>9,500</b>	<b>70,400</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	28,146	25,522
Normal MOER (Final) (ou m <sup>3</sup> /s)	28,146	25,522
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit	No Limit
Sample Storage prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

**TABLE A-6 EMISSION TEST RESULTS DDG PELLET PLANT**

<b>Emission Test Results</b>	
<b>Project Number</b>	<b>7116</b>
<b>Project Name</b>	<b>Shoalhaven Starches</b>
<b>Test Location</b>	<b>EPA ID 46 DDG Pellet Plant Stack</b>
<b>Date</b>	24-Nov-20
	Dry
Run	1
Method	TM-1, TM-2 & TM-22
Flow Start Time (hrs)	11:24
Flow Stop Time (hrs)	11:47
Inlet/Exhaust	Exhaust
Stack Temperature (°C)	45.0
Stack Cross-Sectional area (m <sup>2</sup> )	1.674
Average Stack Gas Velocity (m/s)	12.5
Actual Gas Flow Volume (am <sup>3</sup> /min)	1,255.6
Total Normal Gas Flow Volume (m <sup>3</sup> /min)	1,051.8
Total Normal Gas Flow Volume (m <sup>3</sup> /s)	17.530
Total Stack Pressure (kPa)	101.07
Moisture Content (% by volume)	2.20
Molecular Weight Dry Stack Gas (g/gmole)	28.836
Dry Gas Density (kg/m <sup>3</sup> )	1.29
Oxygen (%)	20.9
<b>Analysis</b>	<b>Odour</b>
<b>Method</b>	<b>AS4323.3</b>
ORLA Number	5456
SEMA Number	728147
Sample Start Time (hrs)	11:24
Sample Finish Time (hrs)	11:47
Odour Concentration (As Received) (ou)	2,307
<b>Odour Concentration (Final) (ou)</b>	<b>2,300</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	40,442
Normal MOER (Final) (ou m <sup>3</sup> /s)	40,442
Mass Odour Emission Rate Limit (ou m <sup>3</sup> /s)	No Limit
Sample Storage prior to disposal	2 days
Calculations entered by	JW
Calculations checked by	PWS

**TABLE A- 7 EMISSION TEST RESULTS – BIOFILTER OUTLETS**

<b>Emission Test Results</b>				
<b>Project Number</b>	7116			
<b>Project Name</b>	Shoalhaven Starches			
<b>Test Location</b>	<b>EPL ID 40 Biofilter A East</b>	<b>EPL ID 40 Biofilter A West</b>	<b>EPL ID 41 Biofilter B East</b>	<b>EPL ID 41 Biofilter B West</b>
<b>Date</b>	24-Nov-20	24-Nov-20	24-Nov-20	24-Nov-20
	Dry	Dry	Dry	Dry
<b>Run</b>	1	1	1	1
<b>Method</b>	TM-2 & TM-22			
Sample Start Time (hrs)	15:37	16:32	15:32	16:15
Sample Stop Time (hrs)	15:47	16:42	15:42	16:25
<b>Inlet/Exhaust</b>	Exhaust			
Stack Temperature (°C)	39.1	37.8	39.5	36.4
<b>Proportion of Inlet air flow</b>	<b>0.26</b>	<b>0.24</b>	<b>0.24</b>	<b>0.26</b>
Calculated from inlet flow Actual Gas Flow Volume (am <sup>3</sup> /min)	65.4	62.2	62.2	66.8
Calculated from inlet flow Total Normal Gas Flow Volume (m <sup>3</sup> /min)	50.90	48.36	48.36	52.0
<b>Analysis</b>	Odour			
<b>Method</b>	AS4323.3			
ORLA Number	5458	5460	5459	5461
SEMA Number	728149	728151	728150	728152
Sample Start Time (hrs)	15:37	16:32	15:32	16:15
Sample Stop Time (hrs)	15:47	16:42	15:42	16:25
Odour Concentration (As Received) (ou)	1,242	1,679	2,004	1,830
<b>Odour Concentration (Final) (ou)</b>	<b>1,200</b>	<b>1,680</b>	<b>2,000</b>	<b>1,830</b>
Normal MOER (As Received) (ou m <sup>3</sup> /s)	1054	1353	1615	1586
Normal MOER (Final) (ou m <sup>3</sup> /s)	1054	1353	1615	1586
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

---

## **APPENDIX B – CERTIFICATES OF ANALYSIS**



## Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd  
ACN 002 600 526 (Incorporated in NSW)

ABN 75 002 600 526

52A Hampstead Road  
Auburn NSW 2144 Australia

Tel: (02) 9737 9991

E-Mail: [pstephenson@orla.com.au](mailto:pstephenson@orla.com.au)

### Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

<b>Client</b>	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	Ponds 1, 3, 5 & 6, SO Basin Pond, Starch Dryers 1, 3, 4 & 5, Gluten Dryers 1, 2, 3 & 4, Boiler 2, Boiler 4, Boilers 5&6, Biofilter A outlets, Biofilter B outlets, Biofilter inlet from DDG Evaporators No. 1, 2, 3, & 4, CO <sub>2</sub> Scrubber inlet & outlet, Fermenter 16, DDG Pellet Plant stack
	Telephone:	02 4423 8254
	Email:	<a href="mailto:John.studdert@manildra.com.au">John.studdert@manildra.com.au</a>
<b>Project</b>	ORLA Report Number:	7116/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5441 to 5469
	SEMA Sample number(s):	728134 to 728159
<b>Order</b>	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	18 November 2020
	Order number:	5175
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
<b>Report</b>	Date of issue:	18 December 2020

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing





ODOUR CONCENTRATION MEASUREMENTS RESULTS

7116/ORLA/01

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq \chi \leq 92,102$ ou. . If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between $\pm 3^{\circ}\text{C}$ .
Measuring Dates	The date of each measurement is specified with the results.
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.05$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $r = 0.0020$ (February 2020) Compliance - Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $A = 0.020$ (February 2020) Compliance - Yes
Lower Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 12 ou.
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored every session to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

18 December, 2020



Peter Stephenson  
Managing Director



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7116/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>*,*</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Fermenter No.16	728134	18/11/2020 10:50	5442	19/11/2020 10:55	4	8	Nil	7500	7500	Strawberry Yoplait, oily, vinegar, sharp, alcohol, sweet, veggie oil, glue, gas, ink pen (-1) <sup>*</sup>
Sample ID: CO <sub>2</sub> scrubber outlet	728135	18/11/2020 11:12	5443	19/11/2020 11:26	4	8	Nil	8000	8000	Vinegar, sharp, sweet, glue, oily, veggie oil, strawberry, slight decay, decomposing fruit, alcohol (-1)
Sample ID: CO <sub>2</sub> scrubber inlet	728136	18/11/2020 11:14	5444	19/11/2020 11:54	4	8	Nil	10600	10600	Fruity, faint strawberry, oily, sweet, sharp, alcohol, veggie oil, vinegar (-1)
Sample ID: Starch Dryer 1	728137	18/11/2020 12:59	5445	19/11/2020 12:25	4	8	Nil	470	470	Swampy, woody, earth, weet-bix, yeast, fresh bread, starchy, banana, vinegar (-0) <sup>*</sup>
Sample ID: Gluten Dryer 1	728138	18/11/2020 12:58	5446	19/11/2020 13:40	4	8	Nil	470	470	Earth, natural gas, wheat, grain, fresh bread, starchy vegetables, yoghurt (0) <sup>*</sup>
Sample ID: Gluten Dryer 2	728139	18/11/2020 13:53	5447	19/11/2020 14:09	4	8	Nil	250	250	Fermenting yoghurt, Yoplait, banana, fresh bread, plastic, vacuum cleaner dust (-1) <sup>*</sup>
Sample ID: Gluten Dryer 3	728140	18/11/2020 14:57	5448	19/11/2020 15:07	4	8	Nil	300	300	Plastic, yeast, slight sour, strawberry, yoghurt, cereal, plastic taste, fast food potato and gravy (0) <sup>*</sup>



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7116/ORLA/01

Sample				Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>1,2</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1</sup>	(ou) <sup>2</sup>	
Sample ID: Gluten Dryer 4	728141	18/11/2020 14:38	5449	19/11/2020 14:38	4	8	Nil	360	360	Nestle Quik, caramel, vanilla, earth, chocolate, slight coffee, cocoa (2) <sup>1</sup>
Sample ID: Starch Dryer 3	728142	18/11/2020 15:38	5450	19/11/2020 15:38	4	8	Nil	120	120	Musty, dust, earth, mushroom, gas, peat, cereal, hops (-1) <sup>1</sup>
Sample ID: Starch Dryer 4	728143	18/11/2020 16:37	5451	19/11/2020 15:41	4	8	Nil	110	110	Hops, cereal, earth, peat, plastic, musty, potato (-1) <sup>1</sup>
Sample ID: Boiler 2	728144	24/11/2020 10:10	5453	25/11/2020 10:55	4	8	Nil	1200	1200	Acid, chalk, ammonia, earthy, moss exhaust, household gas, swamp gas, dirty, mould, dusty, fireplace heater, (-2) <sup>1</sup>
Sample ID: Boiler 4	728145	24/11/2020 10:55	5454	25/11/2020 11:25	4	8	Nil	1700	1700	Acid, lime, citrus, gas, burnt jet fuel, swamp gas, earth, mushroom, chlorine, bleach (-1) <sup>1</sup>
Sample ID: Boiler 5&6	728146	24/11/2020 11:50	5455	25/11/2020 11:54	4	8	Nil	2200	2200	Chlorine, acid, oil, burnt kerosene or jet fuel exhaust gas, swampy, natural gas (-2) <sup>1</sup>
Sample ID: DDG Pellet	728147	24/11/2020 11:37	5456	25/11/2020 12:24	4	8	Nil	2300	2300	Yeast, baking bread, herbs, powdered cheese, vegemite, bitter (1) <sup>1</sup>



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7116/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>1*</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Starch Dryer 5	728148	24/11/2020 13:30	5457	25/11/2020 13:55	4	8	Nil	390	390	Wet towel, musty, mould, mushroom, yeast, baking bread, dirty socks, coal, oil, plastic, paint (-1) <sup>1*</sup>
Sample ID: Biofilter A East outlet	728149	24/11/2020 13:37	5458	25/11/2020 14:25	4	8	Nil	1200	1200	Smelly sandshoes, smelly socks, garbage, septic, dirt, soil, plastic paint, vinegar, sour, tannin from decayed vegetable matter and mangroves (-3) <sup>1*</sup>
Sample ID: Biofilter B East outlet	728150	24/11/2020 15:32	5459	25/11/2020 14:53	4	8	Nil	2000	2000	Garbage, smelly socks, sewerage, methylated spirits, rotten vegetables, faeces, decomposed matter, tyres (-3) <sup>1*</sup>
Sample ID: Biofilter A West outlet	728151	24/11/2020 16:32	5460	25/11/2020 15:22	4	8	Nil	1680	1680	Decomposing starch, garbage, yeast, rotten vegetables, faeces, coal, tar, roadworks (-3) <sup>1*</sup>
Sample ID: Biofilter B West outlet	728152	24/11/2020 16:15	5461	25/11/2020 15:51	4	8	Nil	1830	1830	Decomposing vegetation, ammonia, faeces, garbage, stinky socks, rubber, coal, tar (-3) <sup>1*</sup>
Sample ID: Bio inlet DDG Evap. 1,2,3	728153	24/11/2020 14:16	5462	25/11/2020 17:23	4	8	Nil	9500	9500	Cocoa, chocolate, coffee, cereal, wheat, green wheat, corn bread, squishy rubber toys (1) <sup>1*</sup>



## Odour Research Laboratories Australia

### Odour Olfactometry Results - 7116/ORLA/01

Sample				Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone <sup>*,*</sup>
Location	ID No.	Date/Time	ORLA No.					(ou) <sup>1*</sup>	(ou) <sup>2*</sup>	
Sample ID: Bio inlet DDG Evap. 4	728154	24/11/2020 15:02	5463	25/11/2020 17:27	4	8	Nil	70400	70400	Compost, wheat, plastic playdough (-2) <sup>†</sup>
Sample ID: Pond 1	728155	07/12/2020 15:00	5465	08/12/2020 10:25	4	8	Nil	360	360	Earthy, mushrooms, yoghurt, yeast, vegemite, dirty, floral, creek, chicken salt, 2-minute noodles, slight motor oil (-1) <sup>†</sup>
Sample ID: Pond 3	728156	07/12/2020 16:13	5466	08/12/2020 11:13	4	8	Nil	280	280	Earthy, grass, mushrooms, corn, very faint sharp musty odour, styrofoam, 2-minute noodles, plastic (-1) <sup>†</sup>
Sample ID: Pond 5	728157	07/12/2020 17:38	5467	08/12/2020 11:49	4	8	Nil	63	63	Grain, tobacco leaf, earthy, coffee, mushroom, powered beef stock, decomposing logs, wood, wet forest, air from rubber tube, slight plastic (-2) <sup>†</sup>
Sample ID: Pond 6	728158	07/12/2020 18:19	5468	08/12/2020 12:22	4	8	Nil	38	38	Dry grass, reeds, dirt, decaying wet wood, earthy, mushrooms, bark, drain water with unperfumed soap (-2) <sup>†</sup>
Sample ID: SO Basin	728159	07/12/2020 20:00	5469	08/12/2020 14:17	4	8	Nil	63	63	Musty, stale, sports shoes, vinegar, peppermint, sweet dried tobacco, menthol cigarettes, dirt, pen ink (1) <sup>†</sup>





## Odour Research Laboratories Australia

### Odour Panel Calibration Results - 7116/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) <sup>3</sup>	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) <sup>4</sup>
n-butanol	5441	19/11/2020	62.0	1236	50.2	Yes
n-butanol	5452	25/11/2020	62.0	1264	49.1	Yes
n-butanol	5464	08/12/2020	62.0	1269	48.9	Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analysed by Odour Research Laboratories Australia at their Sydney Laboratory.

#### Notes from Odour Olfactometry Results:

<sup>1</sup> Sample Odour Concentration: as received in the bag

<sup>2</sup> Sample Odour Concentration: allowing for pre-dilution

<sup>3</sup> Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

<sup>4</sup> Target Range for reference gas n-butanol is  $20 \leq \chi \leq 80$  ppb and compliance with AS/NZS4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration.

#### Panelist Rolling Average:

19/11/2020: SR = 46.9, PR = 61.3, MB = 54.1, JW = 42.4

25/11/2020: SR = 46.9, PR = 59.3, TL = 31.1, JW = 43.8, MB = 52.4

08/12/2020: SR = 48.5, PR = 57.3, TL = 31.1, JW = 45.3, MB = 51.8

<sup>^</sup> denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panelist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

-----END OF TEST REPORT-----

---

## **APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION**

**TABLE C- 1 INSTRUMENT CALIBRATION DETAILS DAY 1**

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	13-Nov-20	13-Nov-21
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	02-Sep-20	02-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	16-Nov-20	16-Nov-21
<b>Gas Mixtures used for Analyser Span Response</b>			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21



**TABLE C- 2 INSTRUMENT CALIBRATION DETAILS DAY 2**

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	13-Nov-20	13-Nov-21
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	02-Sep-20	02-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	16-Nov-20	16-Nov-21
<b>Gas Mixtures used for Analyser Span Response</b>			
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

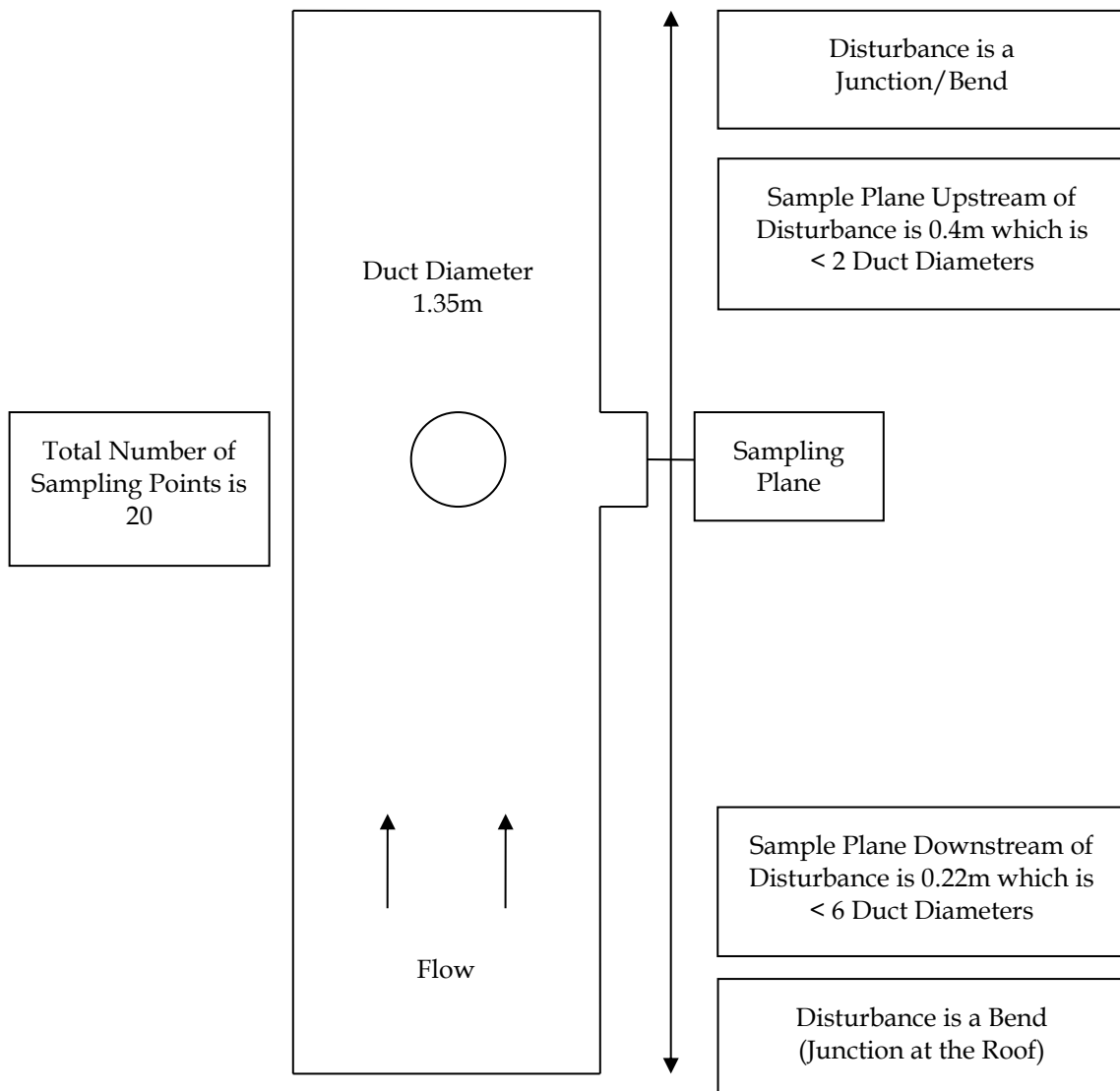
**TABLE C- 3 INSTRUMENT CALIBRATION DETAILS DAY 3**

<b>SEMA Asset No.</b>	<b>Equipment Description</b>	<b>Date Last Calibrated</b>	<b>Calibration Due Date</b>
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
605	Thermocouple	19-Oct-20	19-Apr-21
607	Thermocouple	19-Oct-20	19-Apr-21
753	Personal Sampler	12-Mar-20	12-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
613	Barometer	16-Nov-20	16-Nov-21

---

## **APPENDIX D – SAMPLE LOCATIONS**

**FIGURE D-1 GLUTEN DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

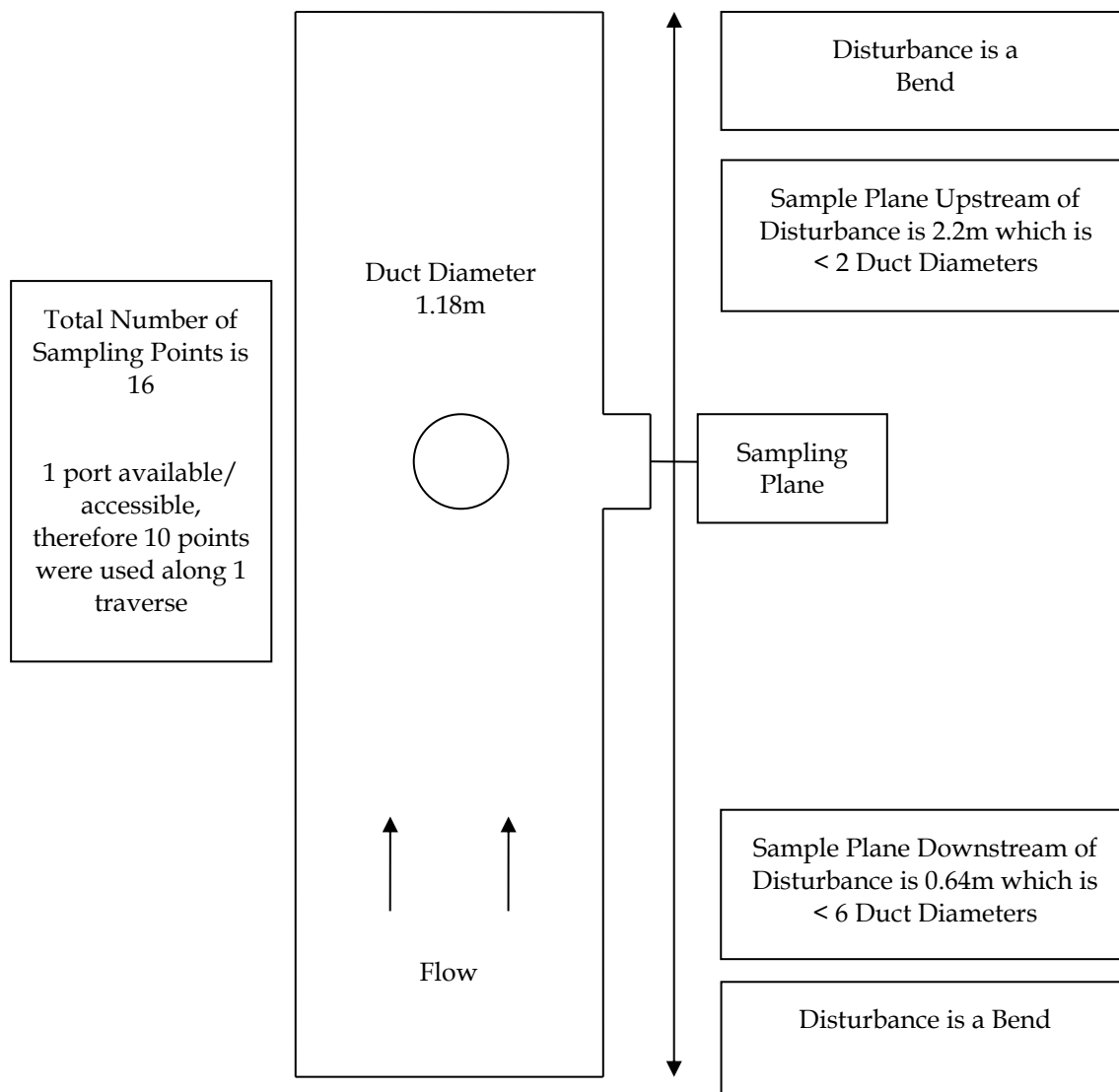
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The location of the sampling plane would most likely comply with AS4323.1 temperature, velocity and gas flow profile criteria for sampling; once the sampling ports are replaced in the new duct work.

**FIGURE D-2 GLUTEN DRYER NO. 1 – SAMPLE LOCATION**



**FIGURE D-3 GLUTEN DRYER NO. 2 –SAMPLE LOCATION SCHEMATIC**



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

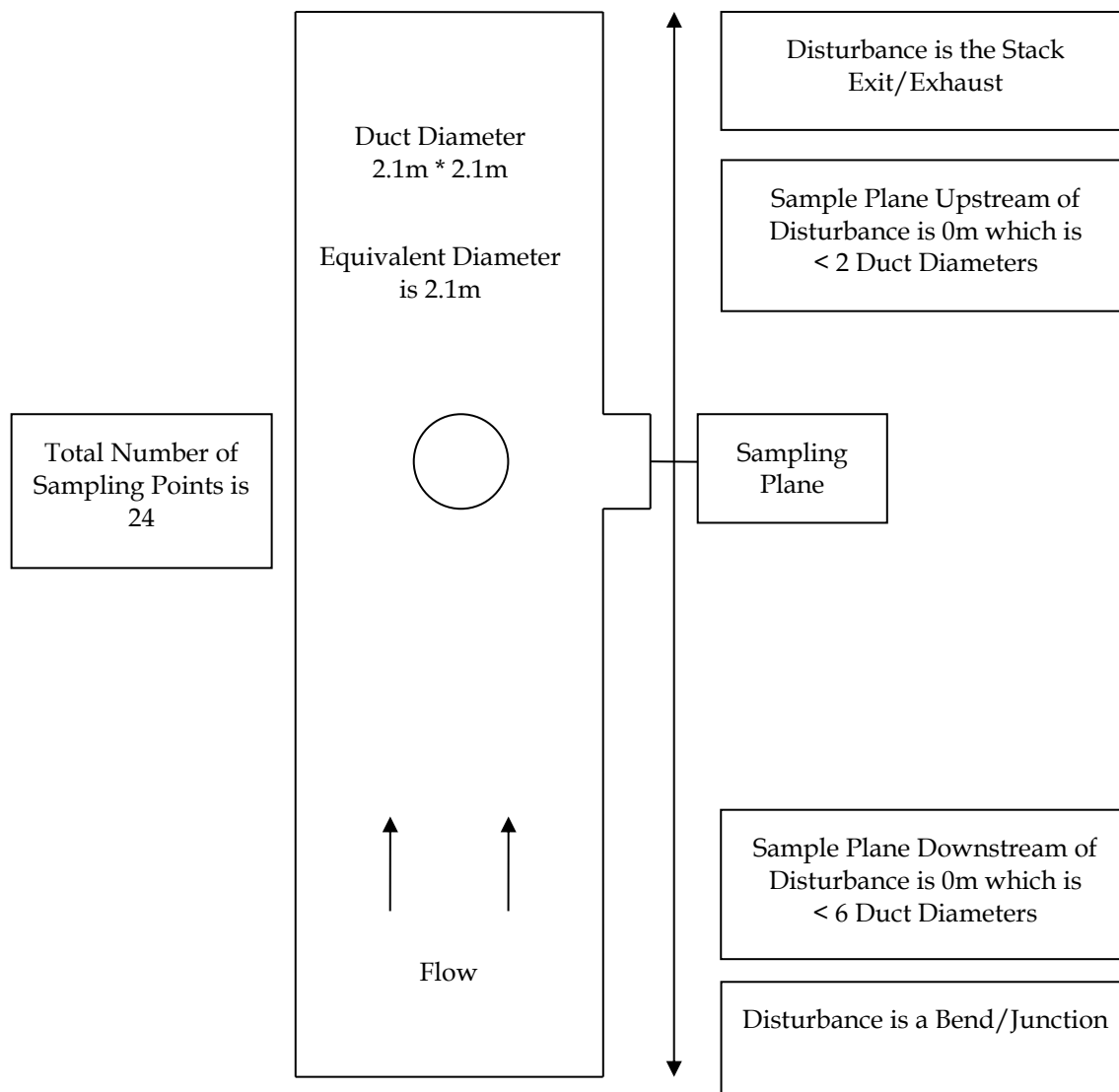
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

The location of the interim exit sampling plane complies with AS4323.1 temperature and AS4323.3 odour criteria for sampling.

**FIGURE D-4 GLUTEN DRYER NO. 2 – ODOUR SAMPLE LOCATION AT DUCT EXIT**



**FIGURE D-5 GLUTEN DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

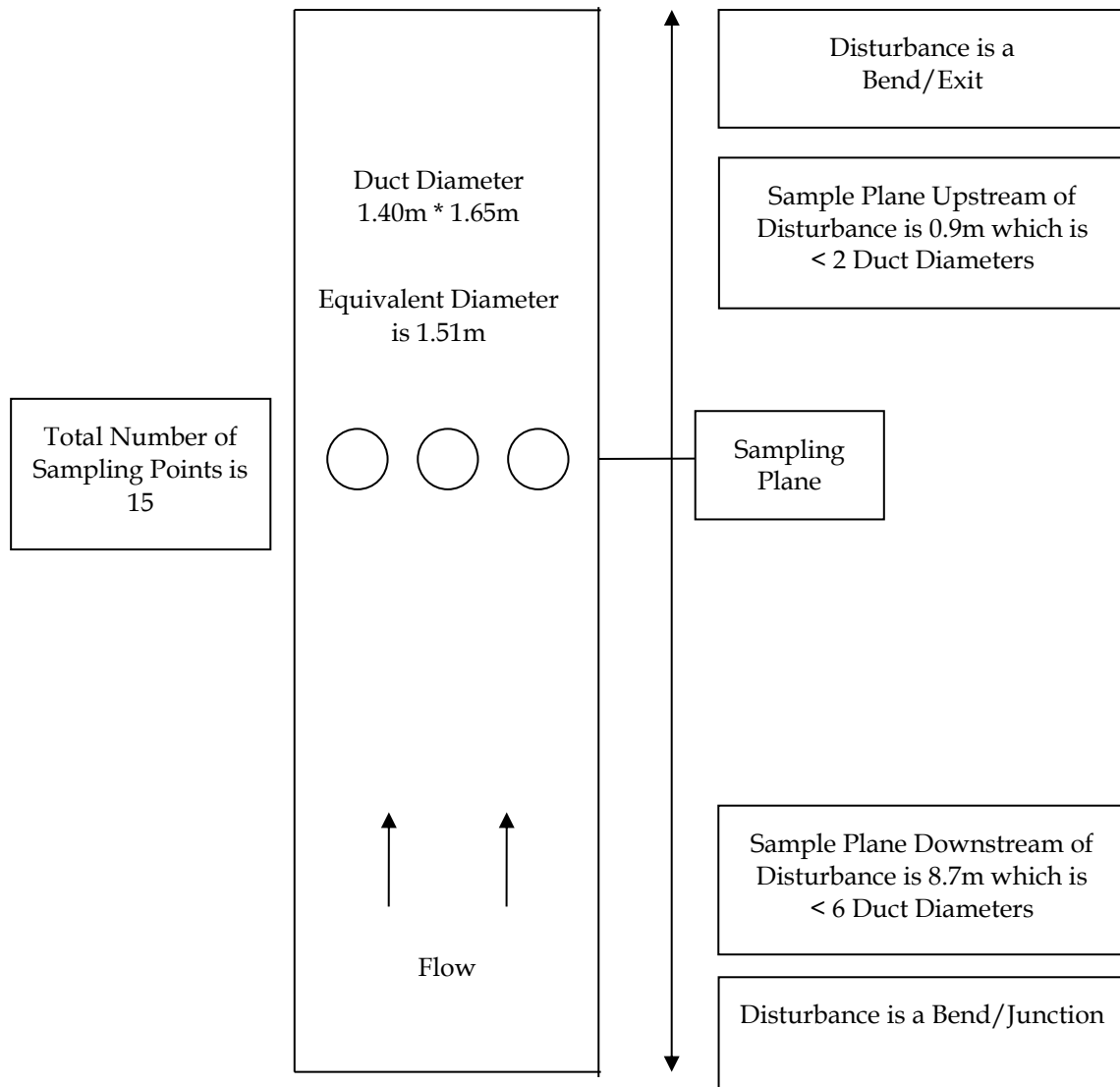
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of minimum velocity profile not meeting the minimum 3 metres per second (m/s) at every sampling point. Previous Minimum (0.8 m/s), Current Minimum (0 m/s).



**FIGURE D-6 GLUTEN DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-7 GLUTEN DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

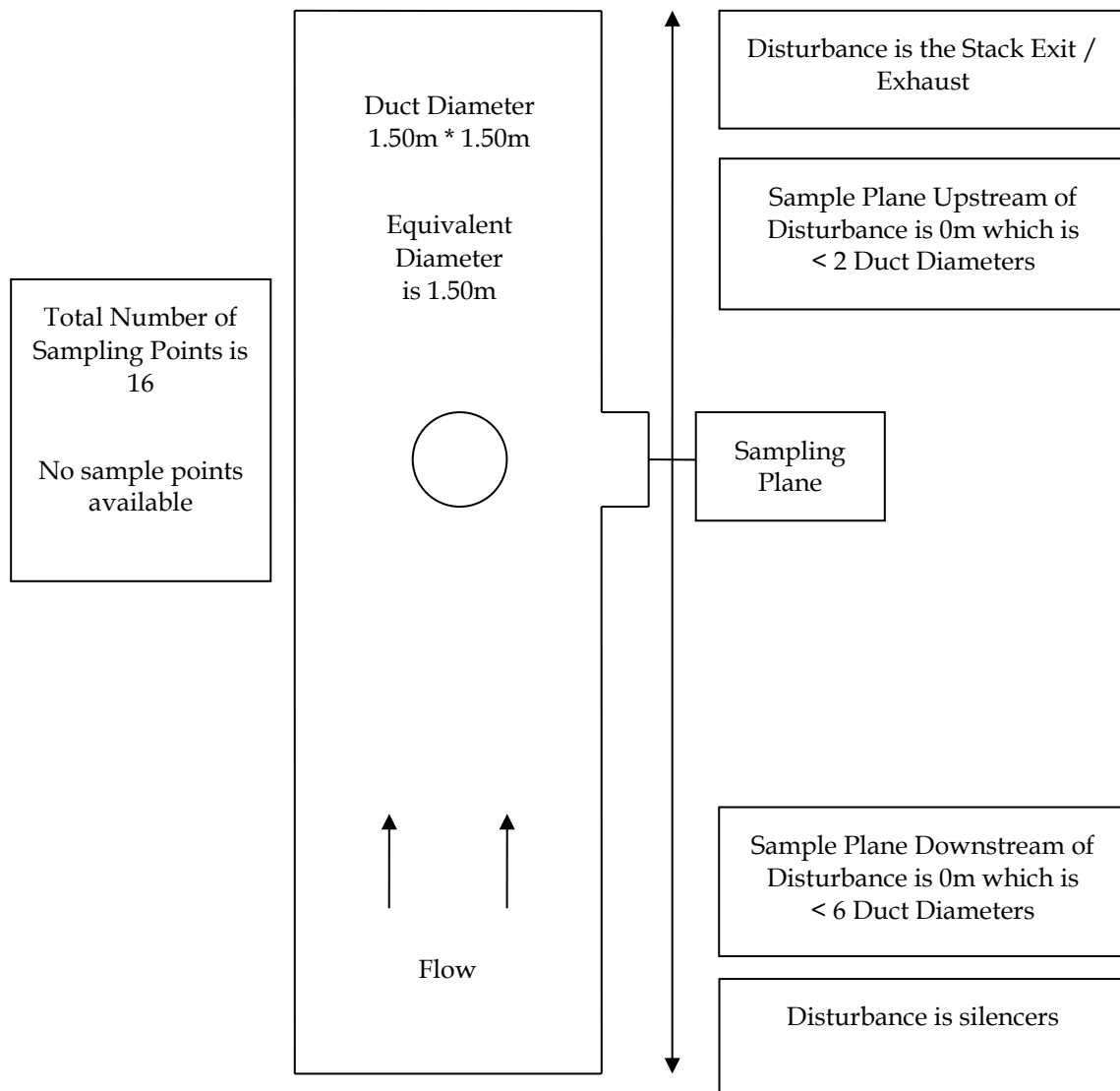
However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-8 GLUTEN DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-9 STARCH DRYER NO. 1 – SAMPLE LOCATION SCHEMATIC**



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

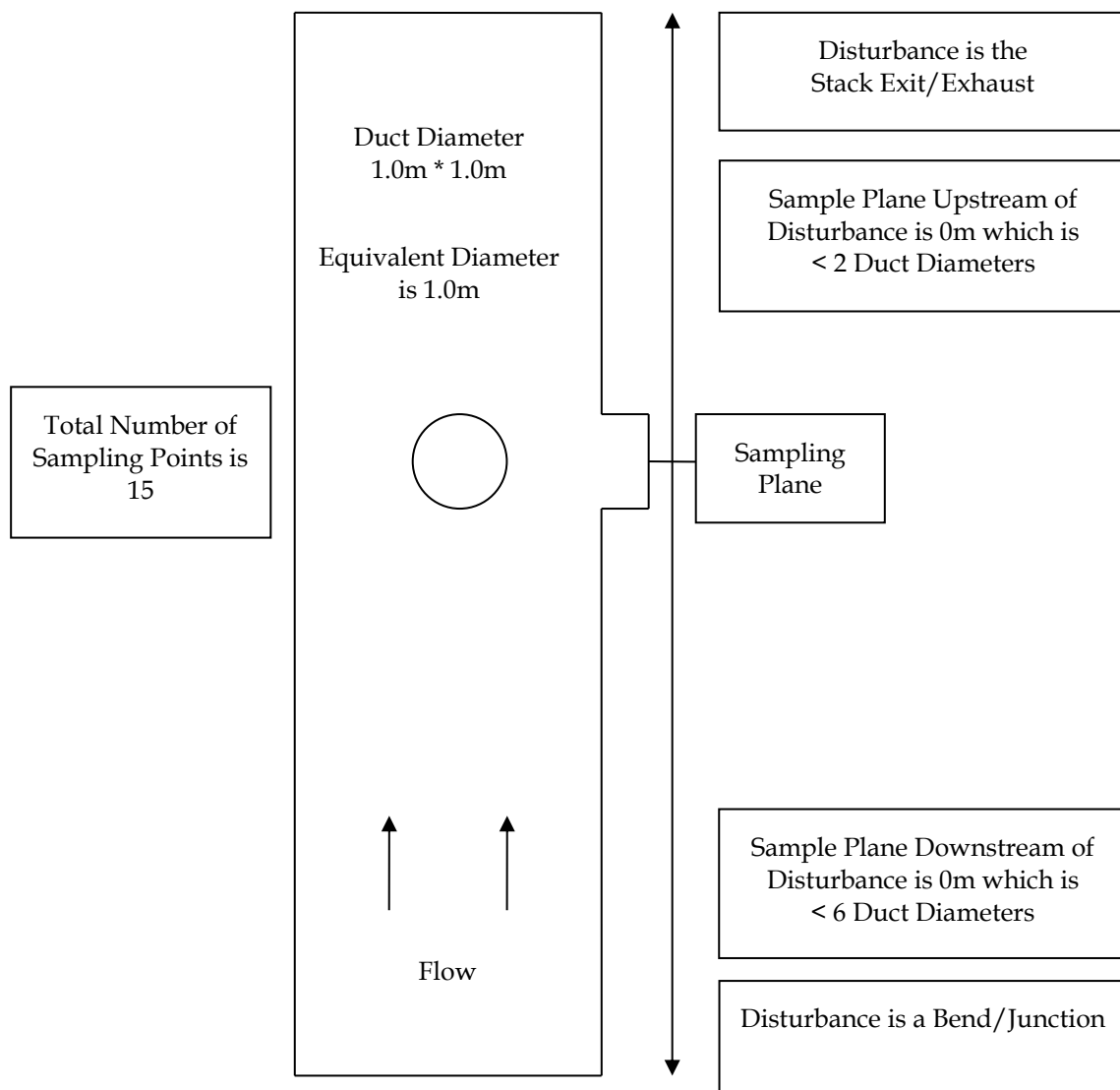
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-10 STARCH DRYER NO. 1 – SAMPLE LOCATION**



**FIGURE D-11 STARCH DRYER NO. 3 – SAMPLE LOCATION SCHEMATIC**



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

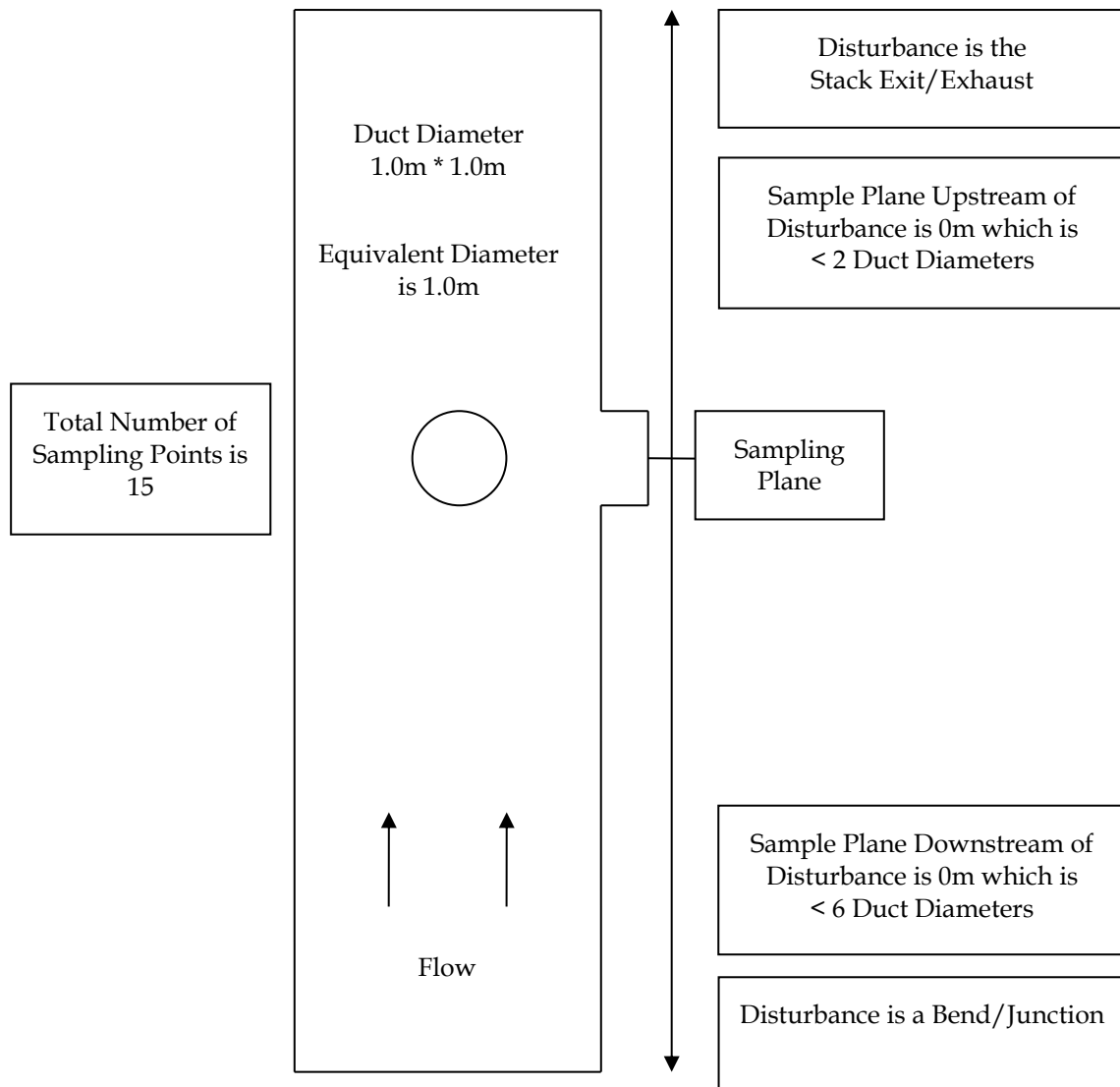
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

**FIGURE D-12 STARCH DRYER NO. 3 – SAMPLE LOCATION**



**FIGURE D-13 STARCH DRYER NO. 4 – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

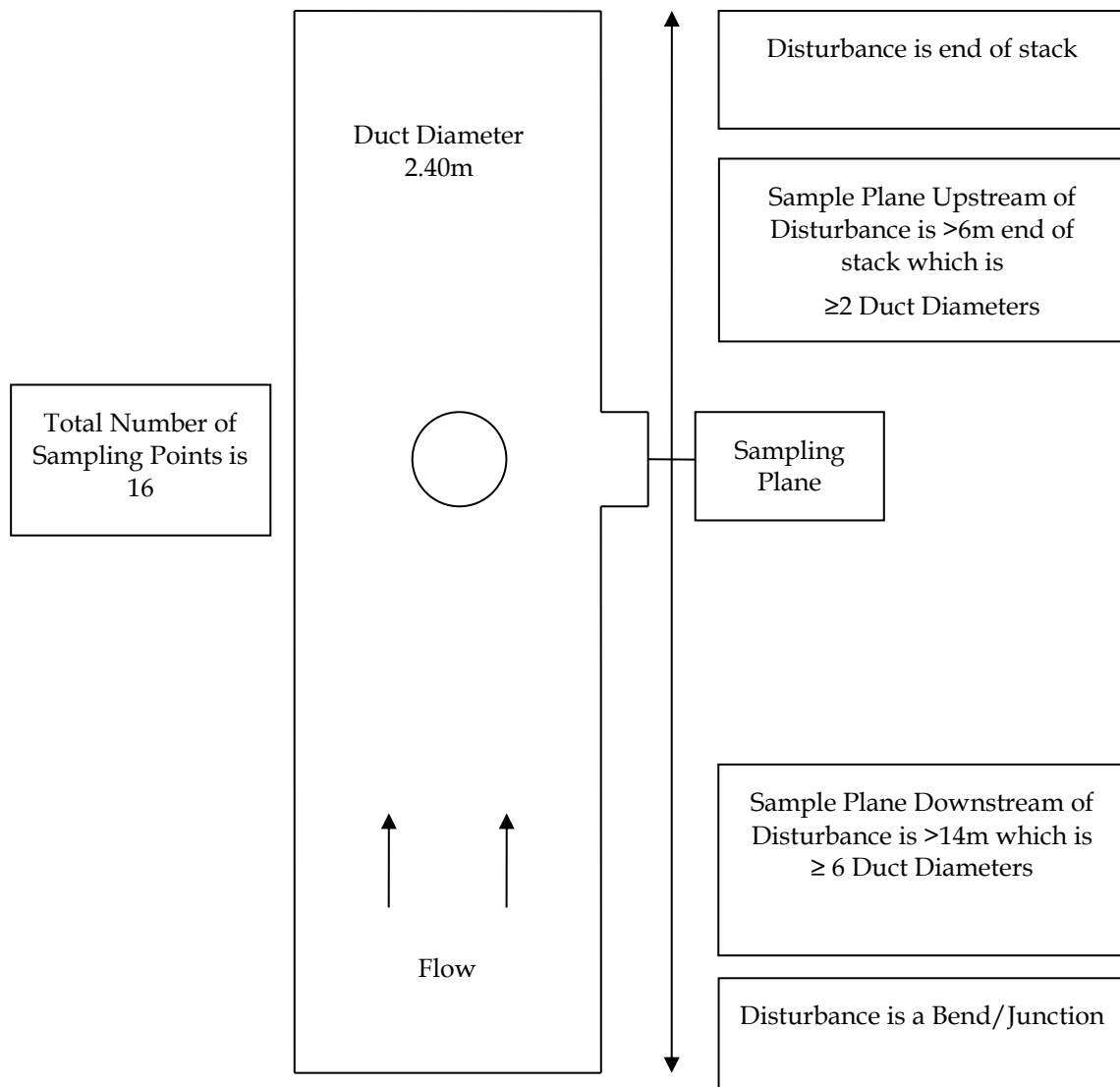
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.



**FIGURE D-14 STARCH DRYER NO. 4 – SAMPLE LOCATION**



**FIGURE D-15 STARCH DRYER NO. 5 – SAMPLE LOCATION SCHEMATIC**



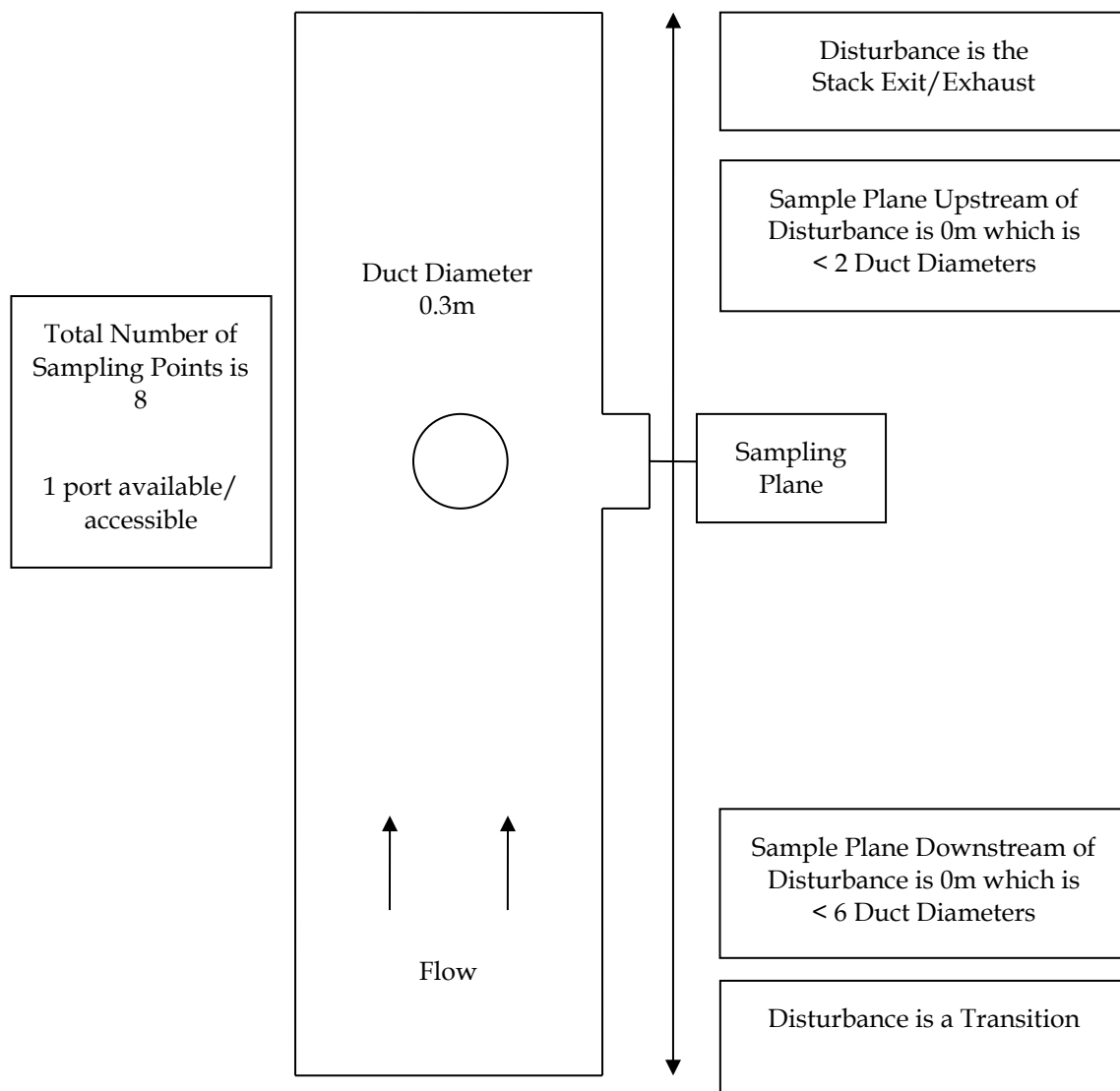
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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

**FIGURE D-16 STARCH DRYER NO. 5 – SAMPLE LOCATION**



**FIGURE D-17 FERMENTERS – SAMPLE LOCATION SCHEMATIC**



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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

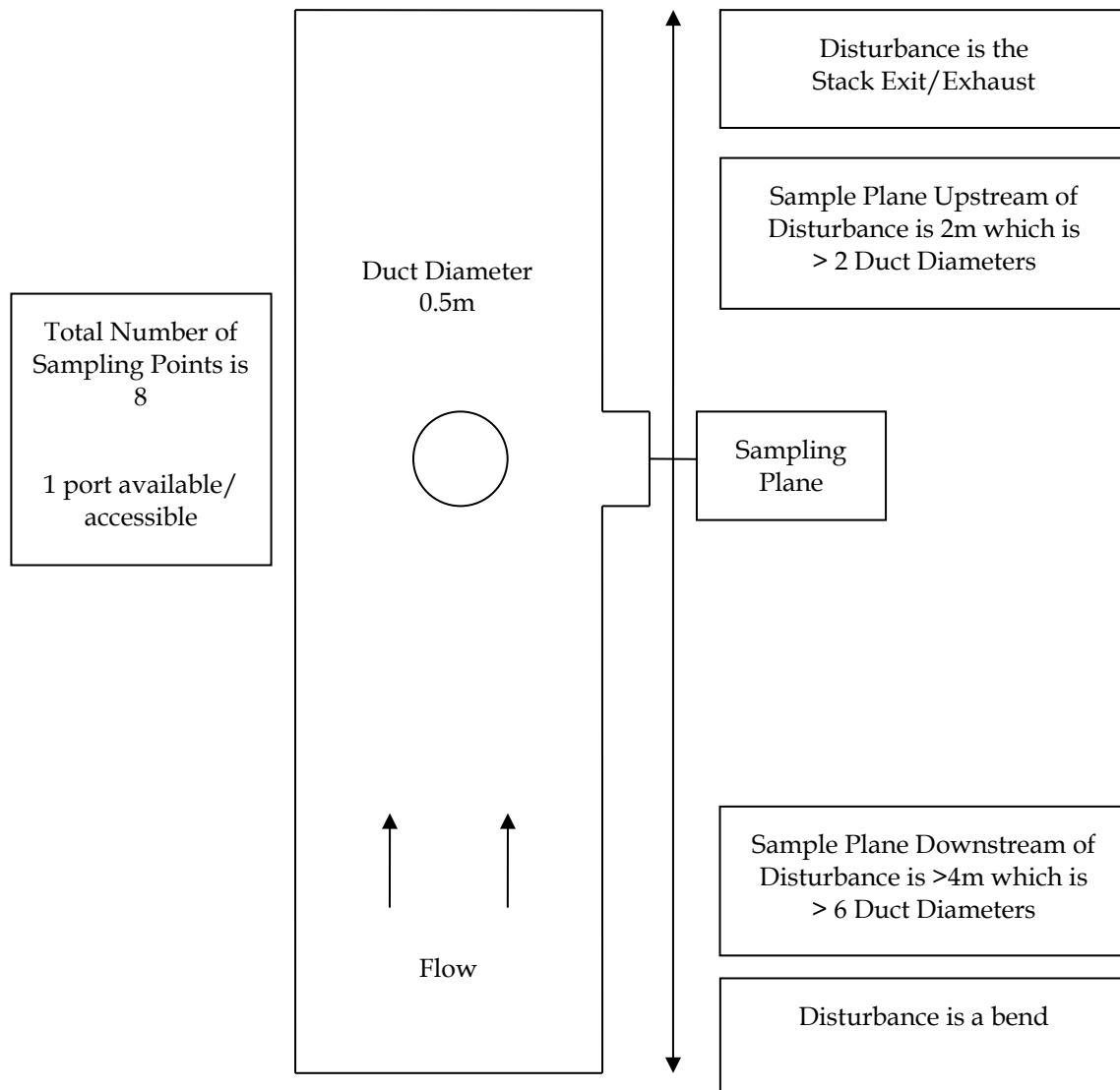
The sample location also does not meet the minimum number of access holes available.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of the velocity profile not meeting the minimum 3 metres per second (m/s) at any sampling point. Previous measurements were Average (0.9 m/s), maximum (1.1 m/s) and minimum (0.8 m/s) velocity profile. Current measurements are Average (1.7 m/s), maximum (3.5 m/s) and minimum (0 m/s) velocity profile.

**FIGURE D-18 FERMENTERS – SAMPLE LOCATION**



**FIGURE D-19 CO<sub>2</sub> SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC**

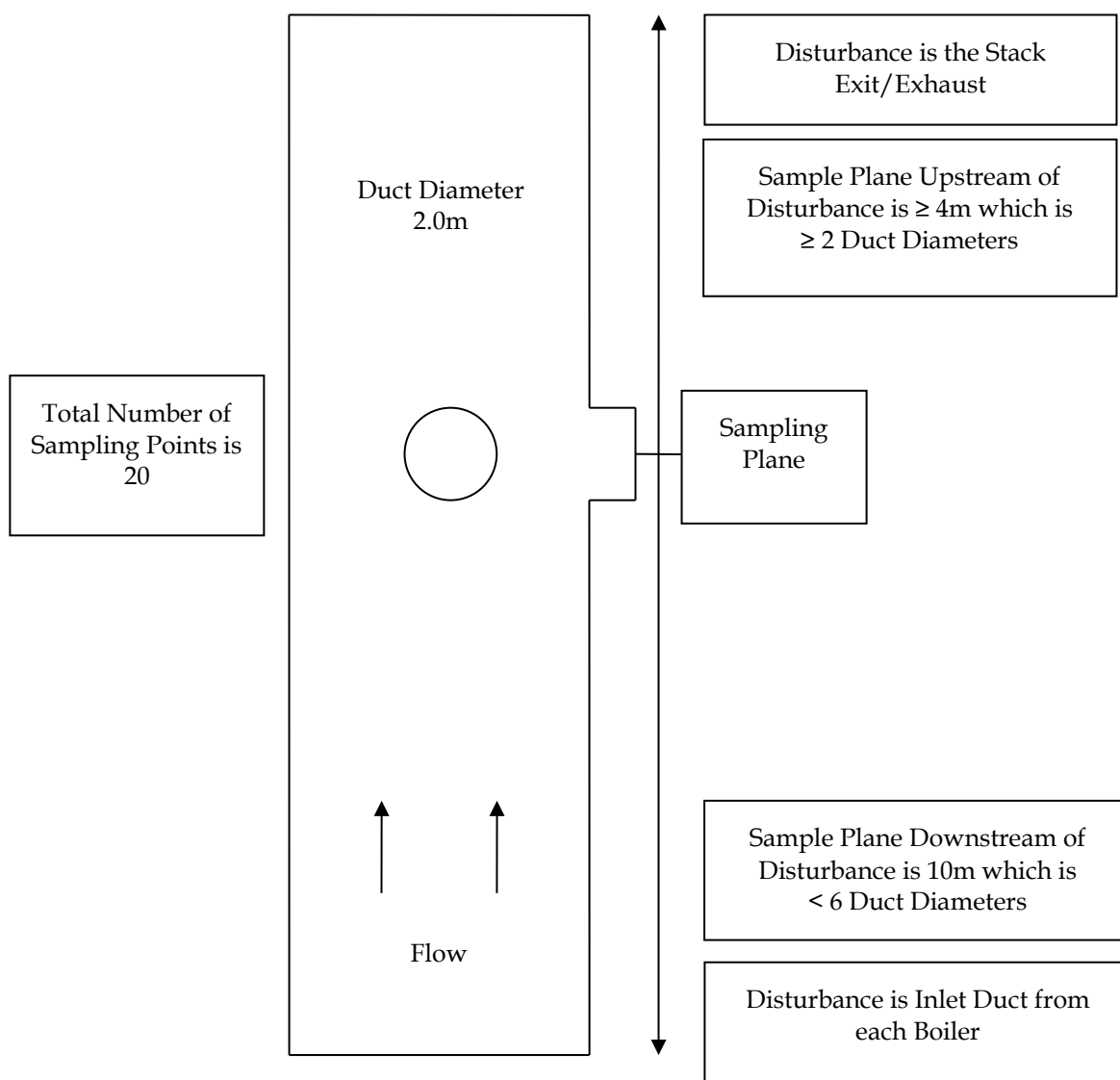


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

The sample location does not meet the minimum number of access holes available.

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

**FIGURE D-20 BOILER NOS. 5 & 6 – SAMPLE LOCATION SCHEMATIC**



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

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

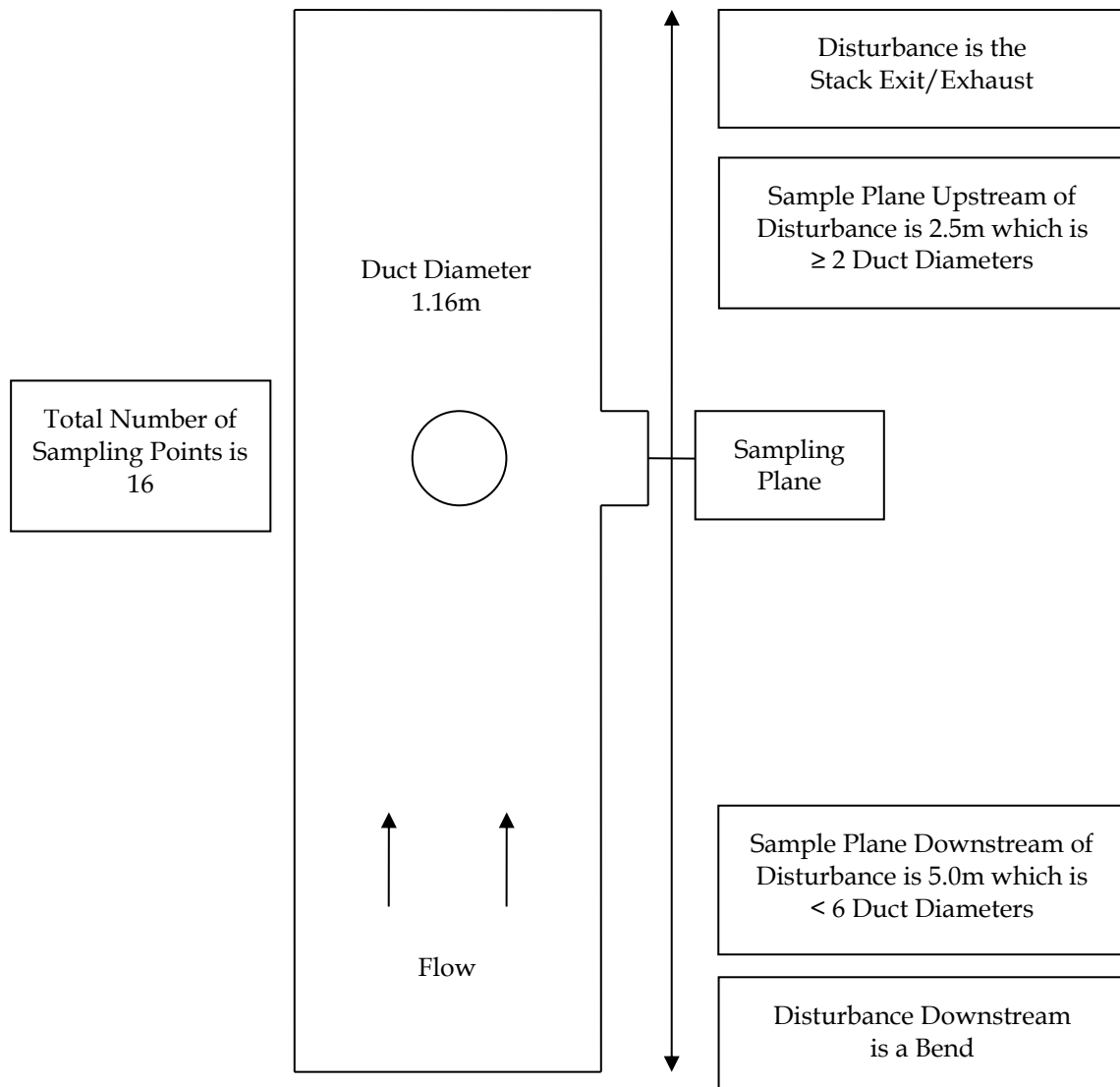
The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling.

**FIGURE D-21 BOILER NOS. 5 & 6 – SAMPLE LOCATION**





**FIGURE D-22 BOILER NO. 4- SAMPLE LOCATION SCHEMATIC**



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

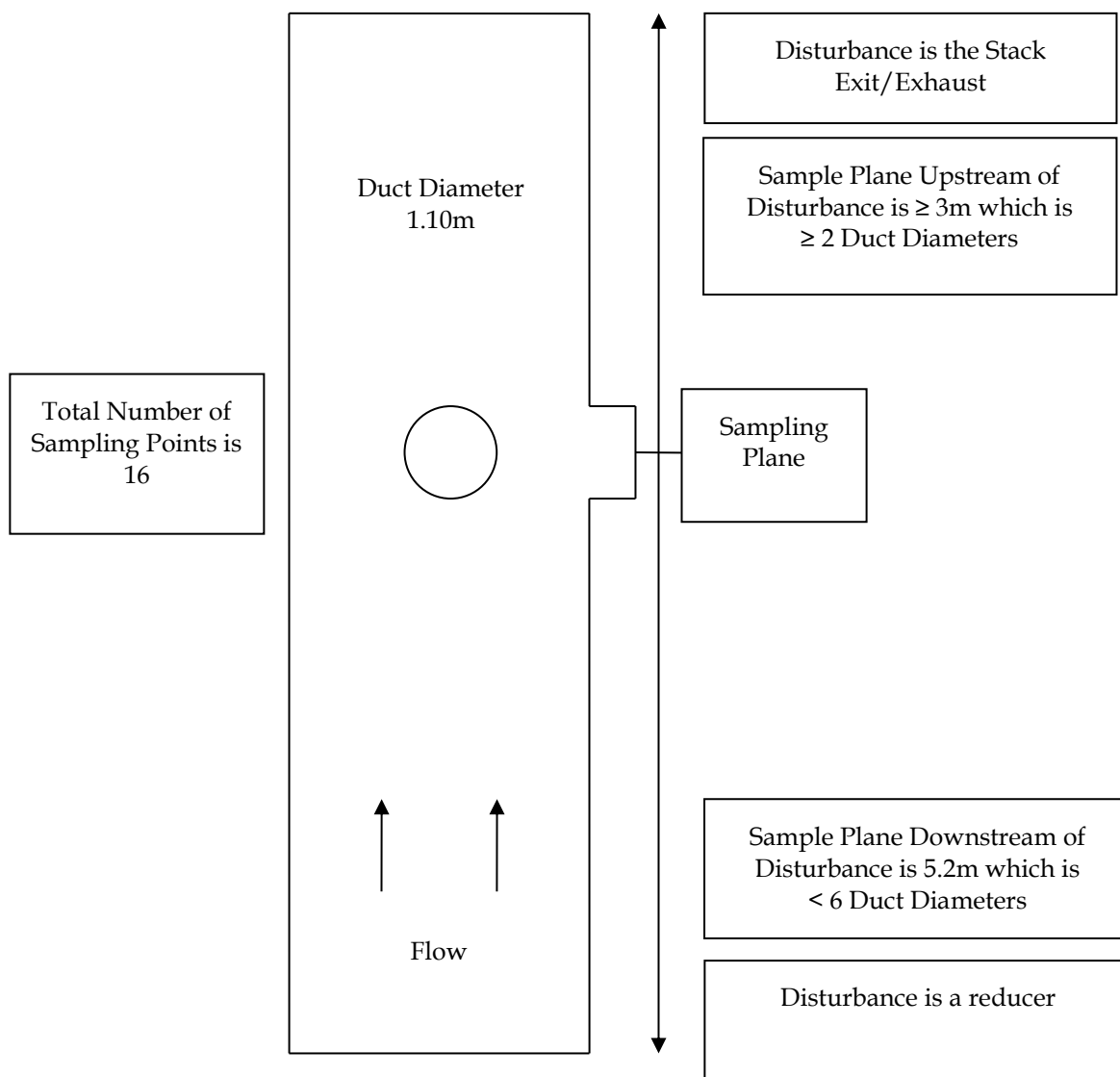
The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

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

**FIGURE D-23 BOILER NO 4 – SAMPLE LOCATION**



**FIGURE D-24 BOILER NO 2 – SAMPLE LOCATION SCHEMATIC**

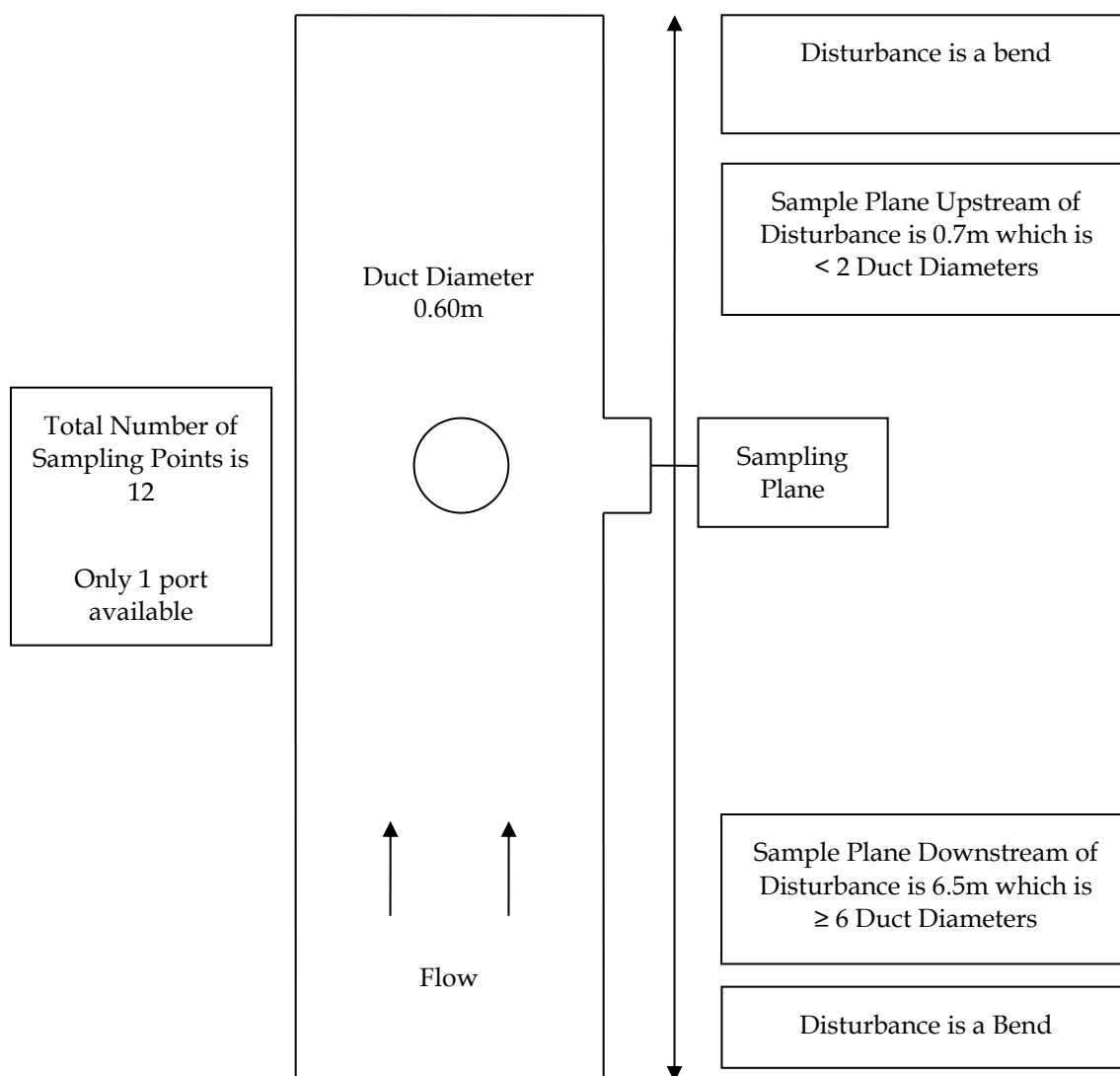


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

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

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

**FIGURE D-25 BIOFILTER INLET – SAMPLE LOCATION SCHEMATIC**



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

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

The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

The location of the sampling plane complies with AS4323.1 temperature, velocity and gas flow profile criteria for sampling with the exception of velocity meeting the minimum velocity of 3m/s at every sampling point. Maximum = 5.2 m/s, Average = 2.4 m/s, Minimum = 1.0 m/s.

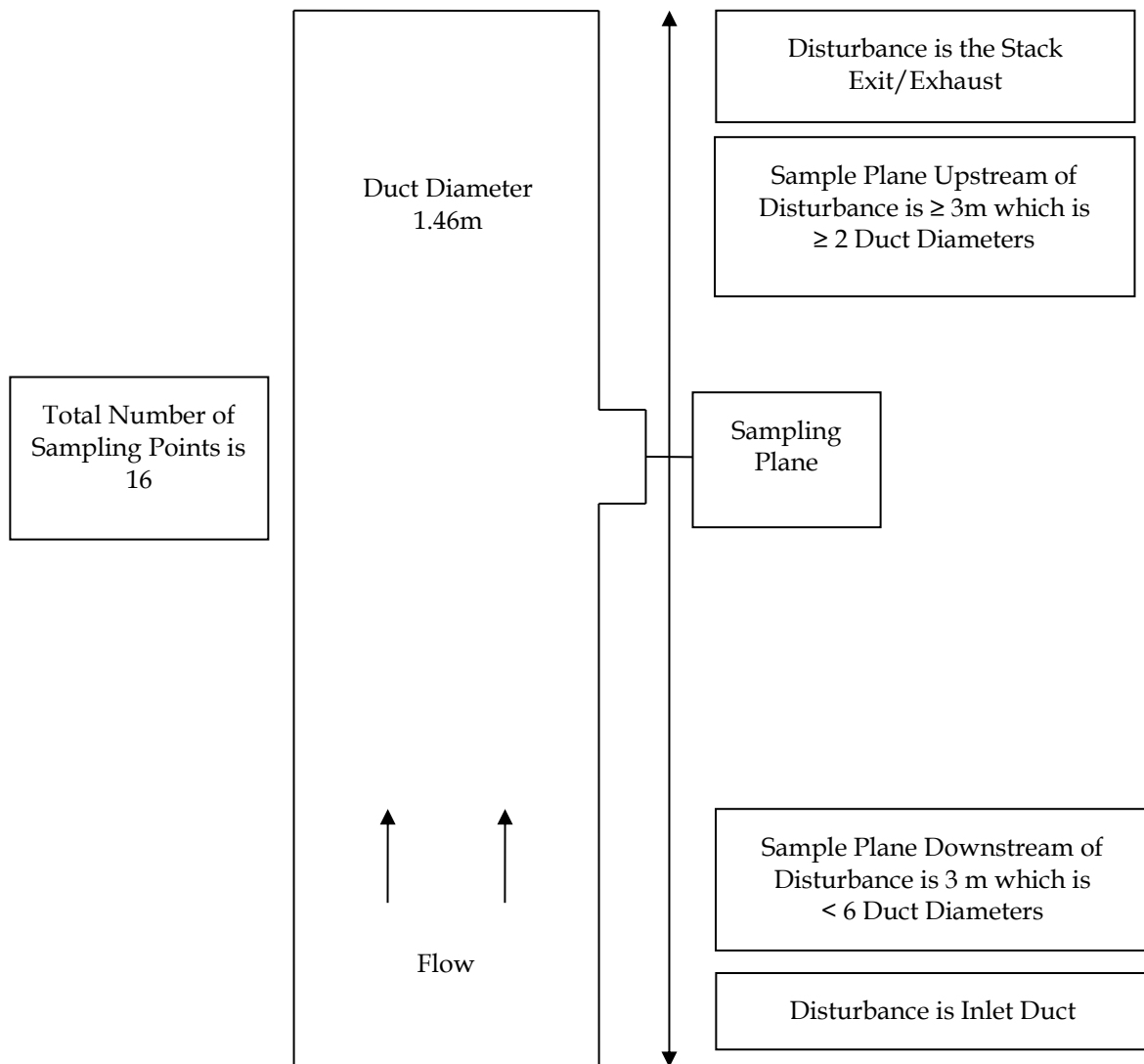
**FIGURE D-26 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION**



**FIGURE D-27 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION**



**FIGURE D-28 DDG PELLET PLANT STACK – SAMPLE LOCATION SCHEMATIC**



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

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

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



**FIGURE D-29 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH**



## APPENDIX E – ODOUR MODELLING ASSESSMENT





# **Shoalhaven Starches Modification 21 – Proposed Modification to Packing Plant and other works Air Quality Assessment**

Manildra Group

10 August 2021

→ **The Power of Commitment**



**GHD Pty Ltd | ABN 39 008 488 373**



133 Castlereagh Street, Level 15

Sydney, New South Wales 2000, Australia

**T** 61-2-9239 7100 | **F** 61-2-9239 7199 | **E** [sydmal@ghd.com](mailto:sydmal@ghd.com) | **ghd.com**

<b>Printed date</b>	10/08/2021 5:15:00 PM
<b>Last saved date</b>	10 August 2021
<b>File name</b>	<a href="https://projectsportal.ghd.com/sites/pp15_04/manildramod2122and23/ProjectDocs/12548374-REP_MOD21%20air%20quality%20assessment.docx">https://projectsportal.ghd.com/sites/pp15_04/manildramod2122and23/ProjectDocs/12548374-REP_MOD21 air quality assessment.docx</a>
<b>Author</b>	Nick Spurrett
<b>Project manager</b>	Pri Pandey
<b>Client name</b>	Manildra Group
<b>Project name</b>	Manildra Mod 21, 22 and 23 (2021)
<b>Document title</b>	Shoalhaven Starches Modification 21 – Proposed Modification to Packing Plant and other works   Air Quality Assessment
<b>Revision version</b>	Rev 1
<b>Project number</b>	12548374

**Document status**

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0	N Spurrett	E Smith, P Pandey		E Smith		05/07/2021
S4	1	N Spurrett	E Smith, P Pandey		E Smith		10/08/2021

© GHD 2021

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

# Contents

<b>1.</b>	<b>Introduction</b>	<b>1</b>
1.1	Overview	1
1.2	Background	1
1.3	Current proposal: Modification 21	4
1.4	Scope	5
1.5	Assumptions	5
1.6	Report structure	5
1.7	Limitations	6
<b>2.</b>	<b>Site location and context</b>	<b>7</b>
2.1	Site description	7
2.2	Nearby sensitive receptors	7
<b>3.</b>	<b>Operation description</b>	<b>11</b>
3.1	General overview	11
3.2	Flour mill	11
3.3	Starch plant	11
3.4	Glucose plant	12
3.5	Ethanol and distillation plants	12
3.6	DDG plant	12
3.7	Steam production	12
3.8	Environmental farm	12
3.9	Packing plant (proposed)	13
3.10	Other activities	13
3.10.1	Product load-out areas	13
3.10.2	Cooling towers	13
3.10.3	Biofilters	13
3.11	Proposed modifications	14
3.11.1	Mod 11, 12, 13, 16, 17 and 19	14
3.11.2	Mod 21	14
<b>4.</b>	<b>Criteria for assessment</b>	<b>16</b>
4.1	Odour	16
4.1.1	Odour Concentration	16
4.1.2	Measurement of Odour	16
4.1.3	EPA Criterion for Odour	16
4.1.4	Other air quality impacts	17
<b>5.</b>	<b>Meteorological data</b>	<b>19</b>
5.1	Overview	19
5.2	Meteorological modelling	19
5.2.1	Representative year discussion	20
<b>6.</b>	<b>Background air quality</b>	<b>22</b>
<b>7.</b>	<b>Odour assessment</b>	<b>24</b>
7.1	Approach	24
7.1.1	Additional recommended odour mitigation	24
7.2	Emissions inventory	25

7.2.1	Source identification	25
7.2.2	Changes to baseline odour model	26
7.2.3	Source summary and comparison	26
7.3	Dispersion modelling	33
7.4	Predicted odour impacts	33
<b>8.</b>	<b>Air quality assessment</b>	<b>36</b>
8.1	Emissions inventory	36
8.1.1	Boiler emissions	36
8.1.2	Product dryer emissions	37
8.1.3	Gas turbines	38
8.1.4	Other emission sources	38
8.2	Dispersion modelling	44
8.3	Predicted air quality impacts	44
8.3.1	Particulates	44
8.3.1.1	Incremental particulate matter	44
8.3.1.2	Cumulative particulate matter (base scenario)	45
8.3.1.3	Cumulative particulate matter (mitigation scenario)	51
8.3.2	Products of combustion	57
8.3.3	PAH, VOCs and metals	63
<b>9.</b>	<b>Conclusions</b>	<b>66</b>
<b>A1</b>	<b>Meteorology</b>	<b>69</b>
A1.1	Data Available	69
A1.2	Data Application	69
A2	Prognostic Meteorological Modelling	69
A2.1	Wind Distribution	70
A3	Diagnostic Meteorological Model - CALMET	73
A3.1	Site-specific meteorology	73

## Table index

Table 1.1	Summary of recent proposed modifications on site (2015-2020)	2
Table 2.1	Location of identified sensitive receptors	8
Table 4.1	Odour criterion for the assessment of odour	16
Table 4.2	Air quality impact assessment criteria – other pollutants	18
Table 6.1	Background Air Quality Data – Albion Park South (2016)	22
Table 6.2	Review of particulate monitoring at Albion Park South and Wollongong, $\mu\text{g}/\text{m}^3$	23
Table 7.1	Comparison of odour emissions from previous mods to current mod	28
Table 7.2	Predicted peak (99th percentile, short term averaged) odour impact at nearby receptors	34
Table 8.1	Boiler emissions estimation	36
Table 8.2	Emission inventory – Particulate matter	38
Table 8.3	Emission inventory – Products of combustion (Base scenario)	40
Table 8.4	Emission inventory – Products of combustion (Mitigation scenario)	42
Table 8.5	Maximum predicted incremental ground level TSP, $\text{PM}_{10}$ and $\text{PM}_{2.5}$ concentrations (base and mitigation scenario)	44
Table 8.6	Summary of highest measured and predicted $\text{PM}_{10}$ levels, $\mu\text{g}/\text{m}^3$ (at receptor R1)	46
Table 8.7	Summary of highest measured and predicted $\text{PM}_{2.5}$ levels, $\mu\text{g}/\text{m}^3$ (at receptor R1)	46

Table 8.8	Summary of highest measured and predicted PM <sub>10</sub> levels, µg/m <sup>3</sup> (at receptor C6)	47
Table 8.9	Summary of highest measured and predicted PM <sub>2.5</sub> levels, µg/m <sup>3</sup> (at receptor C6)	47
Table 8.10	Summary of highest measured and predicted PM <sub>10</sub> levels, µg/m <sup>3</sup> (at receptor R1)	52
Table 8.11	Summary of highest measured and predicted PM <sub>2.5</sub> levels, µg/m <sup>3</sup> (at receptor R1)	52
Table 8.12	Summary of highest measured and predicted PM <sub>10</sub> levels, µg/m <sup>3</sup> (at receptor C6)	53
Table 8.13	Summary of highest measured and predicted PM <sub>2.5</sub> levels, µg/m <sup>3</sup> (at receptor C6)	53
Table 8.14	Maximum predicted ground level Sulfur Dioxide concentrations (base scenario)	58
Table 8.15	Maximum predicted ground level Sulfur Dioxide concentrations (mitigation scenario)	58
Table 8.16	Maximum predicted ground level Nitrogen Dioxide concentrations (base scenario)	59
Table 8.17	Maximum predicted ground level Nitrogen Dioxide concentrations (mitigation scenario)	59
Table 8.18	Maximum predicted ground level Carbon Monoxide concentrations (base scenario)	60
Table 8.19	Maximum predicted ground level Carbon Monoxide concentrations (mitigation scenario)	60
Table 8.20	Maximum predicted ground level Hydrogen Fluoride concentrations (base scenario)	61
Table 8.21	Maximum predicted ground level Hydrogen Fluoride concentrations (mitigation scenario)	61
Table 8.22	99.9 percentile predicted ground level Hydrogen Chloride concentrations (base scenario)	62
Table 8.23	99.9 percentile predicted ground level Hydrogen Chloride concentrations (mitigation scenario)	62
Table 8.24	Maximum predicted ground level PAH, VOC and metals concentrations (base scenario)	64
Table 8.25	Maximum predicted ground level PAH, VOC and metals concentrations (mitigation scenario)	65
Table A1	Atmospheric Stability Classes and Distribution	76
Table B.1	Complete odour emission inventory (Mod 21 Q2)	79
Table B.2	Complete odour emission inventory (Mod 21 Q3)	84

## Figure index

Figure 2.1	Site context	9
Figure 2.2	Site location and layout	10
Figure 3.1	Site layout and major odour sources	15
Figure 4.1	Factors for estimating peak concentrations (Extract from NSW Approved Methods)	17
Figure 5.1	CALMET wind rose for the factory	20
Figure 5.2	Comparison of site weather station observations and CALMET meteorological	21
Figure 7.1	Review of biofilter outlet odour concentrations (average of biofilter A and B)	25



Figure 7.2	Odour impacts, 99th percentile, short term averaged – Modification 21	35
Figure 8.1	Maximum Predicted Incremental Ground Level PM <sub>10</sub> Concentrations (24-hour Average) (base scenario)	48
Figure 8.2	Maximum Predicted Cumulative Ground Level PM <sub>10</sub> Concentrations (24-hour Average) (base scenario)	49
Figure 8.3	Maximum Predicted Cumulative Ground Level PM <sub>2.5</sub> Concentrations (24-hour Average) (base scenario)	50
Figure 8.4	Maximum Predicted Incremental Ground Level PM <sub>10</sub> Concentrations (24-hour Average) (mitigation scenario)	54
Figure 8.5	Maximum Predicted Cumulative Ground Level PM <sub>10</sub> Concentrations (24-hour Average) (mitigation scenario)	55
Figure 8.6	Maximum Predicted Cumulative Ground Level PM <sub>2.5</sub> Concentrations (24-hour Average) (mitigation scenario)	56
Figure A1	Scatter Plot of Observed and Predicted Ambient Temperature	70
Figure A2	Nowra AWS - Annual Wind Roses (Year 2004)	71
Figure A3	Farm AWS - Annual Wind Roses (year 2004)	72
Figure A4	Wind Speed Distribution – TAPM and Farm AWS	73
Figure A5	Factory Annual Wind Rose - Year 2004	74
Figure A6	Factory Seasonal Wind Roses - Year 2004	75
Figure A7	Factory Annual Stability Rose - Year 2008	77

## Appendices

Appendix A	Meteorological analysis
Appendix B	Complete odour emission inventory
Appendix C	Site sampling reports

# 1. Introduction

## 1.1 Overview

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to conduct an air quality impact assessment for a proposed modification to the approved Shoalhaven Starches Expansion Project (SSEP) (Modification 21 or Mod 21). The Shoalhaven Starches factory is located at Bolong Road in Bomaderry, New South Wales.

This report describes the background and scope of the proposed modifications, the pollutant inventory for odorous and non-odorous emission sources and the predicted air quality impacts at identified sensitive receptors.

## 1.2 Background

Flour and grains are processed at the factory to produce ethanol, starch, gluten, glucose and distiller's dried grain (DDG). Shoalhaven Starches is the holder of Environment Protection Licence number 883 issued for the plant by the NSW EPA.

The Shoalhaven Starches Bomaderry plant currently produces around 225 million litres (ML) of ethanol per year (production quantity fluctuates year to year based on demand). On 28 January 2009 the (then) Minister for Planning issued Project Approval MP 06\_0228 for the Shoalhaven Starches Expansion Project. The Project Approval for the SSEP enabled Shoalhaven Starches, subject to certain conditions, to increase ethanol production in a staged manner at its Bomaderry Plant from the previous approved level of 126 million litres per year to 300 million litres per year. Following the Minister's determination Shoalhaven Starches have been implementing and commissioning works in accordance with this approval. Work on the change in operations has been completed, coupled to quarterly testing (independent audits) of emissions from licensed discharge points (a condition of the Licence), with the purpose to validate the predicted impacts against the original predictions in 2008 for the ethanol expansion.

The increase in ethanol production associated with the SSEP Project Approval was made in response to the NSW Government's ethanol mandate which increased the mandated ethanol content by volume in petrol in NSW from 2% to 6% in October 2011. The SSEP sought to increase ethanol production capacity at the Shoalhaven Starches site to meet the expected increase in demand for ethanol arising from this site. The increase in ethanol production required upgrades to the Stillage Recovery Plant including six additional Dried Distillers Grains Syrup (DDGS) dryers.

However, the anticipated increase in demand for ethanol has not occurred. In response, Manildra have undertaken a series of modifications to the site with a focus on exploring alternative options. These are summarised in Table 1.1.

Modifications 11, 12, 13, 16, 17 and 19 were assessed by GHD in the following documents:

- Shoalhaven Starches expansion project – Modification 11 and 12 (Project approval MP\_06\_0228) Revised odour and air quality assessment (GHD 2017)
- Shoalhaven Starches Mod 13 Air Quality Assessment Cumulative odour assessment (GHD 2017)
- Shoalhaven Starches Mod 13 Air Quality Assessment Updated Cumulative Air Quality Assessment (GHD 2017).
- Shoalhaven Starches Proposed modification application MP 06\_0228 Shoalhaven Starches Expansion Project, Proposed new speciality processing facility, new gluten dryer and other associated works at 22, 24 and 171 Bolong Rd, Bomaderry, NSW (Mod 16) (GHD, February 2019).
- Manildra Group Air Quality Assessment Mod 17, 2019 (GHD, 2020)
- Manildra Modification 19 Air Quality Assessment (GHD, 2020)

Modification 14 did not require an air quality assessment. Modification 15 was separately assessed by GHD for SupaGas in 2017.

**Table 1.1**      *Summary of recent proposed modifications on site (2015-2020)*

Modification	Summary of changes
Modification 11	<ul style="list-style-type: none"> <li>Reducing the number of approved DDGS Dryers from six to four.</li> <li>A minor modification to the footprint of the four DDG dryers.</li> <li>Relocation of the cooling towers in the DDG Plant.</li> <li>A Mill Feed Silo and structure to feed DDG dryers.</li> <li>Expanded use of the existing coal and woodchip storage area within the SS Environmental farm.</li> <li>The addition of two biofilters to cope with the increased number of DDG Dryers.</li> <li>A forklift maintenance building adjacent to the relocated DDG dryers, along with a container preparation area adjacent to the relocated DDG Dryers.</li> </ul>
Modification 12	<p>Modifications to the existing Ethanol Distillery Plant to:</p> <ul style="list-style-type: none"> <li>increase the proportion of 'beverage' grade ethanol that is able to be produced on the site. This modification will enable increased flexibility in terms of the range of types of ethanol produced at the site (i.e. between fuel, industrial and beverage grade ethanol) to meet market demands; and</li> <li>modify the type and location of the Water Balance Recovery Evaporator that has been previously approved under MOD 2 adjacent to the Ethanol Plant.</li> </ul>
Modification 13	<ul style="list-style-type: none"> <li>Modification of boilers 2 and 4, with the conversion of boiler 4 from gas fired to coal fired.</li> <li>Installation of an additional baghouse on boiler 6.</li> </ul>
Modification 14	<ul style="list-style-type: none"> <li>Modifications to the former paper mill site.</li> </ul>
Modification 15	<ul style="list-style-type: none"> <li>Construction of the SupaGas CO2 plant at the former Dairy Farmers factory site.</li> </ul>
Modification 16/17	<p>Modification 16 comprised of the following:</p> <ul style="list-style-type: none"> <li>Installation of a third flour mill C within the existing flour mill B building</li> <li>Undertaking modifications to flour mills A and B</li> <li>The construction of a new industrial building adjoining the Starch Dryer No. 5 building containing: <ul style="list-style-type: none"> <li>The new product dryer</li> <li>Plant and equipment associated with the processing of specialized speciality products.</li> <li>Addition to Starch Dryer No 5 building to house a bag house for this dryer</li> <li>Conversion of two existing gluten dryers (1 and 2) to starch dryers</li> <li>Additional sifter for the interim packing plant</li> </ul> </li> <li>Construction of a coal-fired co-generation plant to the south of the existing boiler house complex. The co-generation plant will house a new boiler (No. 8)</li> <li>Construction of lime silos: The lime injection system will consist of two storage silos and associated equipment for injecting powdered lime into each of the coal fired boilers</li> <li>Relocation of the existing boiler No. 7 to the northern side of the overall boiler house complex</li> <li>Construction of an indoor electrical substation on the northern side of Bolong Road</li> <li>Construction of an additional rail intake pit for the unloading of rail wagons</li> <li>Extension of the existing electrical substation located within the main factory area.</li> </ul> <p>Modification 17 comprised of the following:</p> <ul style="list-style-type: none"> <li>Modification to the location of the baghouse for the No. 5 Starch Dryer. As part of this baghouse relocation, an additional stack was added to starch dryer 5.</li> <li>Use of sawmilling residue (woodchips) for boiler fuel by blending woodchip with coal in Boilers 2 &amp; 4</li> <li>Installation of a new product dryer (No. 9) within the footprint of the speciality products building as approved under Mod 16.</li> <li>To install a 'services lift' to the outside of the existing staircase adjacent to the No. 5 Starches Dryer Building to allow on-going access for personnel and customers to the floors within the building</li> <li>Modification of the service conduit extending from the Shoalhaven Starches factory site on the southern side of Bolong Road to the proposed Packing Plant on the northern side of Bolong Road by elevating a section of the conduit above ground level</li> <li>Amendment to design specifications for silencers to exhaust fans for Flour Mill B</li> </ul>



Modification	Summary of changes
	<ul style="list-style-type: none"> <li>– Extension of the approved footprint for the product dryer building. The building will need to be wider than the one that has been approved</li> <li>– Installation of a wet end processing plant within the product dryer building</li> <li>– Extension of speciality products building to the north to provide bulk chemical storage to the south of the product dryer building</li> <li>– Demolition of existing stores and maintenance offices building</li> <li>– Repurposing the existing maintenance building</li> <li>– Changes to car parking arrangements.</li> </ul>
Modification 18	<p>Modification 18 comprised of the following:</p> <ul style="list-style-type: none"> <li>– Produce 120 ML/yr of hand sanitiser grade ethanol within the approved 300 ML/yr production limit</li> <li>– Repurposing of existing de-fatting building for the manufacturing of 1.5 ML/yr hand sanitiser</li> <li>– Relocation of approved, but not yet built gas fired boiler to be adjacent to ISO container storage area to the south east of the site to better service the existing distillery</li> <li>– New 24.5 m high boiler emissions stack</li> <li>– Extension of existing gantry and associated steam pipework between gas fired boiler and distillery for steam supply</li> <li>– Additional pipework to increase height of gantry from 9.75 m to 10.8 m</li> <li>– Erection of two 236,000 litre storage tanks for hand sanitiser storage</li> <li>– repurposing of de-fatting plant for hand sanitiser production storage</li> </ul>
Modification 19	<p>Modification 19 comprised of the following:</p> <ul style="list-style-type: none"> <li>– The installation of distillation columns and associated processing equipment immediately to the west of the existing Ethanol Distillery Plant. The proposed plant and equipment is of similar design, size and operation to the existing Beverage Grade Ethanol modification approved under Mod 12.</li> <li>– An additional three (3) ethanol storage tanks within the existing ethanol storage tank area.</li> <li>– The distillery modification in the proposed location will require a boundary adjustment adjacent to Bolong Road. Discussions have commenced with Shoalhaven City Council and an application has been submitted seeking a boundary adjustment with Council.</li> <li>– The construction of three (3) product silos above the existing interim packing plant. The construction of these three (3) silos will necessitate the relocation of an approved electrical substation that was approved (but not yet constructed) below and within the footprint of where it is now proposed to site the proposed product silos. This electrical sub-station is to be relocated to a position on the northern side (Bolong frontage) of the Gluten Dryer No. 5 building. North of Starch Dryer 5 Approved Baghouse.</li> <li>– The relocation of six (6) approved but not yet constructed, and the construction of an additional ten (10) product tanks. Under the existing approvals for the site ten (10) product storage tanks were to be sited to the rear of the Gluten Dryer and Specialty Product Buildings on the western side of Abernethy's Creek. Following detailed design, the diameter of the tanks has now increased and additional area is required for associated pumps and supporting equipment. As a result there is insufficient room to locate these tanks in the approved location.</li> <li>– The construction of an additional ethanol loadout immediately adjacent to and to the north of the existing loadout facility.</li> <li>– Installation of additional cooling towers within the eastern part of the site</li> <li>– The construction of a cable stay pipe bridge across Abernethy's Creek to supply power and product to these buildings.</li> <li>– The relocation of the extension of the existing electrical substation located on the eastern side of Abernethy's Creek</li> <li>– The extension of the existing car park located within the western part of the site in a south-westerly direction to provide an additional thirty-one (31) car parking staff for staff and contractors</li> </ul>

## 1.3 Current proposal: Modification 21

Shoalhaven Starches have now identified that as a result of the increase in the range of products that will be able to be produced arising from the works associated with Mod 16, amendments will be required to the approved Packing Plant on the northern side of Bolong Road to accommodate these different products.

- The approved Packing Plant made provision for 7 silos to store product awaiting packaging. To accommodate the different types of gluten and starch products that will now be able to be produced from the Specialty Product Building following Mod 16, greater flexibility will be required for the storage of the increased range of gluten and starch products on the Packing Plant site. It is therefore proposed to construct sixteen (16) smaller silos instead of the original 7 approved silos. The proposed 16 silos will each have a square footprint with dimensions of 5 metres by 5 metres, height of 30 metres and volume of 300 tonnes each.
- Additional packer feed bins will also need to be installed within the Packing Plant building to accommodate the need for improved flexibility to enable a greater range of gluten and starch products to be packed.
- Additional product transfer lines and services will also need to extend from the Specialty Product Buildings approved under Mod 16 and extend across Bolong Road to the Packing Plant via the approved underground services crossing. It is also proposed to slightly relocate the transfer lines and gantry to accommodate the amended product silos.
- To accommodate the change in equipment used within the Packing Plant, such as the additional packer feed bins, the overall footprint of the Packing plant building will need to be slightly reconfigured from that which was originally approved.
- The change in the footprint of the Packing Plant building will also necessitate a change in the layout of the approved car parking spaces associated with the Packing Plant building.

In addition to the above modifications it is also proposed to carry out the following modifications to the approved Packing Plant site:

- To enable storage of additional rail wagons and enable wagons to be taken off line for maintenance purposes a third rail siding is proposed.
- It is also proposed to increase the height of the gantry containing the product transfer lines to the product silos to provide additional clearance above the container reach stacker. The current approved gantry has a height above ground level of 14.5 metres AHD. It is proposed to lift the gantry to a minimum height above ground level of 20.0 metres AHD, with the top of the gantry to 23.4 metres AHD.
- It is also proposed to provide a train tunnel where the noise mitigation walls surrounding the container storage area terminate at the rail line, to provide additional noise attenuation.
- It is also proposed to provide a loader maintenance and cleaning area within the container storage area.

In addition to the modifications associated with the approved Packing Plant, it is also proposed to undertake the following modifications to the Approved Project.

- It is proposed to install an additional raw waste water tank within proximity of the existing raw waste water tank adjacent to the oxidation pond within the Environmental Farm and located to the north of Bolong Road (and opposite the former Paper Mill site). It is proposed that this tank will provide additional storage and act as a buffer in the case that the existing tank is required to be taken off line. This tank will have an effective volume of 3000 KL with dimensions of approximately 20 metres diameter and 12 metres height above ground level.
- It is also proposed to install a Nitrogen Generator and Storage Tanks that will supply Nitrogen to the existing and proposed ethanol storage tanks to eliminate in-tank fire risk. This facility will be located between the existing ethanol loading bay and the Bolong Road frontage of the site. This facility will comprise a Nitrogen Generator housed within a container type building. Four storage vessels comprising compressed air and mixing tanks will be sited between the Nitrogen Generator and Bolong Road. The Nitrogen that is produced will be stored in six vessels with a height above ground level of 10 metres adjacent and to the west of the Nitrogen Generator
- In order to produce ethanol, starch is essentially heated to convert it (with enzymes) into sugars which are then fermented to produce ethanol. This starch heating process is undertaken in an Indirect Cooking Facility. Shoalhaven Starches have identified that there is inadequate capacity in their current Indirect Cooking

process to accommodate both the existing ethanol production as well as that associated with the movement from lower to higher grade ethanol production under Mods 18 and 19. To provide increase indirect cooking capacity it is proposed to establish an additional Indirect Cooking Facility to be located adjacent to the existing Glucose Plant, to the north of the internal railway and to the south of the Ethanol Distillery.

- The additional Indirect Cooking Facility will comprise series of vessels housed within a structure that will have a footprint of 184.5 m<sup>2</sup> (20.5 m x 9 m) and height of 16.6 metres above ground level. The structure will include a range of processing vessels situated over three floors; and a single product feed tank.
- It is also proposed to install an additional two fermenters (No. 18 and 19) to the east of the existing evaporators and approved cooling towers to the east of the site, The additional fermenters are required to provided sufficient volume to accommodate current 'foaming' problems they are presently encountering in the existing fermenters.

## 1.4 Scope

The proposed changes (Mod 21) requires an application to the EPA assessing the associated off-site odour and air quality impacts.

In order to meet EPA NSW requirements, this report provides:

- A revised emissions inventory for odorous and combustion sources on site. A comparative analysis of the emissions inventory has been undertaken with the last major air quality assessments for the site.
- A level 2 air quality assessment of odour and air quality in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016) (the Approved Methods). Dispersion modelling was undertaken using CALPUFF version 7.
- A comparison of predicted odour and air quality results against the EPA criteria and against the previous modification results.

## 1.5 Assumptions

The major assumptions used in this assessment are as follows:

- Stack emission testing reports from the past measurements are accurate and representative of normal operations, and do not vary significantly
- The odour dispersion modelling using the NSW EPA and US EPA approved regulatory Gaussian puff dispersion model CALPUFF version 7, which was considered appropriate for the location. Limitations with the predicted odour are inherent within the model and in its ability to handle multiple buildings and stacks in a complex setup, with wake effects included. As such, the layout of the plant was simplified in order for the model to handle the setup
- Odour emissions from the major sources of odour were modelled as both variable emission and fixed point, volume and area sources in CALPUFF with appropriate dispersion characteristics
- The site representative meteorological data was obtained from previous assessments of the plant, which have been approved by EPA NSW in the past. The meteorological data is discussed in Section 5
- Small silos in the Packing Plant are conservatively assumed to be filled 24 hours a day
- Odour sources with horizontal releases have conservatively been modelled with vertical velocities of 0.1 m/s
- The VOC concentration in the biofilter exhaust is not high enough to induce density flows of the exhaust plume in ambient air
- The emissions inventory, and therefore the dispersion modelling results, is largely based on estimates and on data measured on site by Stephenson Environmental Management Australia (SEMA). Actual measurements are dependent on site conditions at the time of measurement and these conditions may change. GHD does not accept any responsibility for updating the measurements or estimates made by SEMA.

## 1.6 Report structure

This report:

- Describes the operations of the plant
- Describes the site-representative meteorological and background air quality data
- Describes the proposed modifications
- Characterises odour sources at the plant, accounting for the required changes to the Mod 21 model setup
- Presents the results of odour dispersion modelling for the proposed Mod 21 scenario using CALPUFF
- Characterises non-odour sources at the plant
- Presents the results of air quality dispersion modelling for the proposed Mod 21 scenario using CALPUFF
- Presents a summary of the results and draws conclusions as to the off-site impacts (both odour and non-odour)
- Outlines the limitations of the analyses and conclusions presented.

## 1.7 Limitations

*This report: has been prepared by GHD for Shoalhaven Starches Pty Ltd and may only be used and relied on by Shoalhaven Starches Pty Ltd for the purpose agreed between GHD and Shoalhaven Starches Pty Ltd as set out in section 1.4 of this report.*

*GHD otherwise disclaims responsibility to any person other than Shoalhaven Starches Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.*

## 2. Site location and context

### 2.1 Site description

Figure 2.1 shows the site context and location of the Shoalhaven Starches plant in Bomaderry, New South Wales. It is located between the Shoalhaven River and township of Bomaderry. The plant comprises a factory, a proposed (but not yet constructed) packing plant and environmental farm. The packing plant lies immediately to the north of the factory, while the environmental farm is situated approximately 400 m to the east. Figure 2.2 shows the site location and layout.

### 2.2 Nearby sensitive receptors

The Approved Methods define a sensitive receptor as “a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area”.

The site is proximate to a number of sensitive receptors. The township of Bomaderry lies to the northwest of the factory and west of the packing plant. Nowra is situated south of the plant. Commercial and industrial sensitive receptors are located directly adjacent to the site and across from it along Bolong Road.

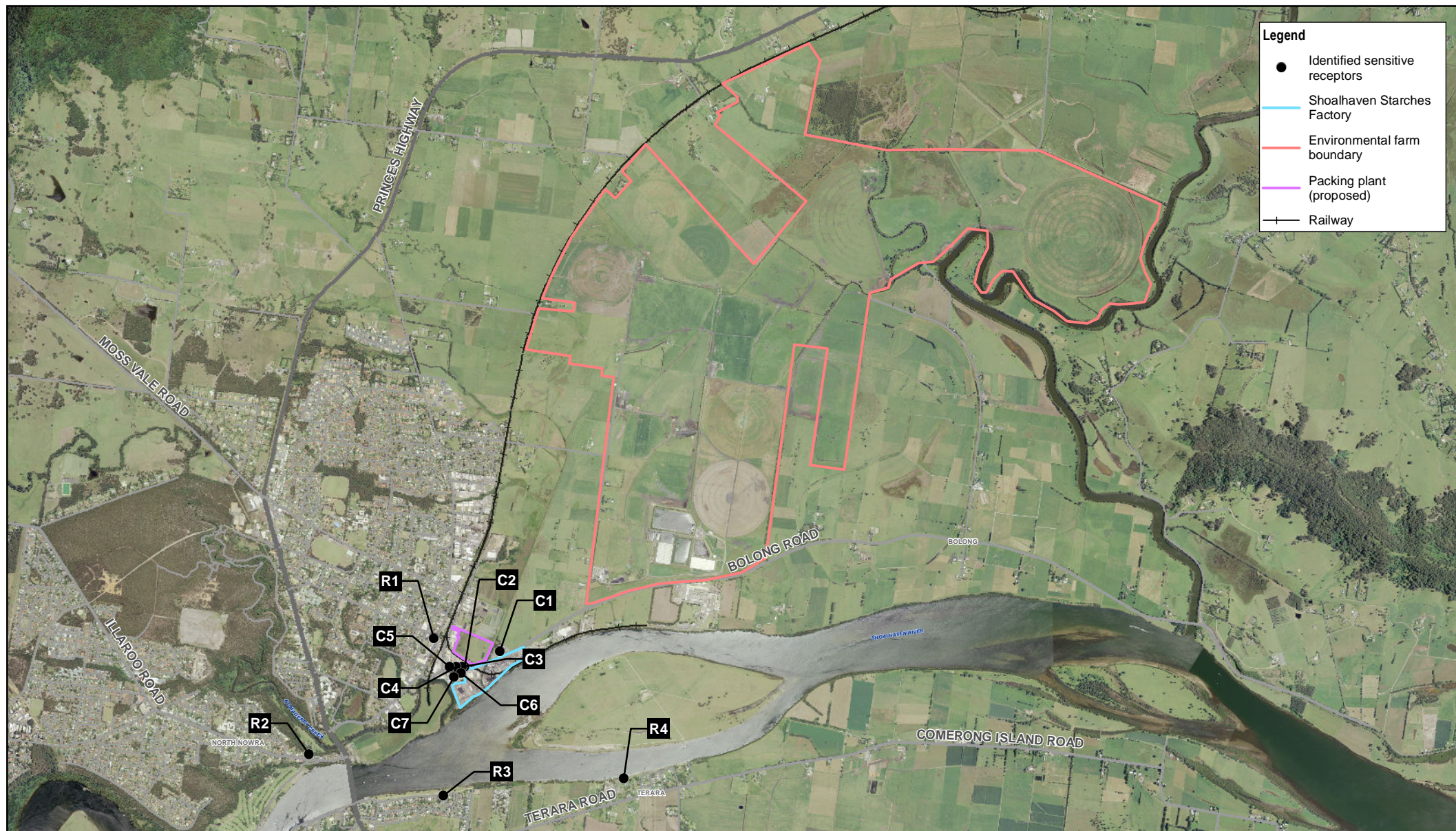
The nearest residential sensitive receptors are located between 150 to 1300 metres from the site. The nearest commercial/industrial sensitive receptors (denoted by a receptor ID beginning with C) and residential sensitive receptors (denoted by a receptor ID beginning with R) to the site have been included in the modelling and are listed in Table 2.1, including the approximate distances and orientation of each receptor from the site. The commercial/industrial receptors also include the operating times in brackets.

The sensitive receptors are shown in Figure 2.1 and Figure 2.2.

**Table 2.1**      *Location of identified sensitive receptors*

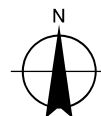
Receptor ID	Range, m	To nearest odour source	Direction	MGA56. Easting (m)	MGA56. Northing (m)
R1	150	Packing Plant	W	281,430	6,140,610
R2	1300	Factory	SW	280,400	6,139,650
R3	700	Factory	S	281,510	6,139,310
R4	1300	Factory	SE	283,000	6,139,450
C1 (7am to 5pm, weekdays)	45	Factory	N	281,977	6,140,501
C2 (8am to 5pm, weekdays)	20	Factory	N	281,685	6,140,373
C3 (8am to 5pm, weekdays)	30	Factory	N	281,663	6,140,373
C4 (7am to 4pm, weekdays)	75	Factory	NW	281,615	6,140,371
C5 (24 hours)	125	Factory	NW	281,563	6,140,372
C6 (7am to 5pm, weekdays 7am to 12pm, Saturday)	30	Factory	NW	281,655	6,140,320
C7 (8am to 5pm, weekdays, 8am to 12pm, Saturday)	55	Factory	NW	281,597	6,140,289





Paper Size ISO A4  
0 0.3 0.6 0.9 1.2  
Kilometers

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



**Manildra Group Pty Ltd**  
**Shoalhaven Starches**

Project No. **12548374**  
Revision No. **0**  
Date **20 May 2021**

**Site Context**

**FIGURE 2.1**







## 3. Operation description

### 3.1 General overview

Wheat flour and grains (wheat) are processed at the Shoalhaven Starches factory to produce ethanol, starch, gluten and glucose. Solid wastes are treated to produce distiller's dried grain (DDG), with liquid wastes being transferred to the environmental farm waste water treatment plant. Excess treated waste water is irrigated onto pasture. The main processing and materials treatment areas at Shoalhaven Starches comprise the:

- Flour mill
- Starch plant
- Glucose plant
- Ethanol and distillation plants
- DDG plant
- Packing plant
- Pellet Plant
- Environmental farm.

A brief description of the production process associated (including emission control) with each plant is given below. Figure 3.1 shows the layout of the plant in terms of its operational areas, along with the major odour sources of the plant, accounting for around 80% of total odour emissions (excluding the environmental farm).

### 3.2 Flour mill

Shoalhaven Starches commenced full operations at the flour mill in June 2011. The flour mill was originally approved by NSW Department of Planning and Environment in 2007 and was consolidated into the ethanol expansion project approval in 2008.

Proposed Modifications to the flour mill were approved in March 2016, which enabled an increase in the total flour production capacity on the site from the previously approved limit of 265,000 tonnes per annum to 400,000 tonnes per annum.

The flour is used in the plant to produce starch, gluten, glucose and ethanol. All remaining mill feed and pollard (flour sieving rejects) is processed through the DDG dryers for sale as stock feed. Flours from the various grinding operations are collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour is taken from these bins for use in existing site production processes.

All air extracted from the mill is passed through Buhler Airjet bag houses prior to being discharged to the atmosphere vertically via ten individual stacks. Approval has previously been obtained for the installation of additional plant to increase production, along with two additional exhausts from the roof of the building.

### 3.3 Starch plant

Within the starch plant, flour is processed to separate the starch from gluten (the protein component of flour). The starch is graded, dried and packed for shipment. Different grades of starch are manufactured for food and paper making applications. Starch that is not used for these applications is used as a raw material for the ethanol plant. Gluten is dried and sold for use in the food industry.

Aqueous (water-based) wastes are reused within the plant or are transferred to the environmental farm waste water treatment plant.

Starch Dryer No.5 has been constructed and is currently operational (see Figure 3.1). No change to the production volume is predicted.

### 3.4 Glucose plant

The glucose plant (contained within the starch plant area) houses two lines; the 'confectioners' glucose line and the 'brewers' glucose line. Confectioner's glucose is distinguished by having been demineralised to remove latent odours and flavours that might be carried through to the final product by the glucose.

Both processes use starch as the raw material. The starch is broken down to its constituent glucose molecules using enzymatic and hydrolytic processes. Water is removed from the resulting solutions using evaporation to produce glucose and brewer's solutions of desired concentration. The glucose product is shipped to customers in bulk containers.

The glucose manufacturing process generates aqueous wastes, mostly condensate from the evaporators, which is reused during regeneration of the ion exchangers.

### 3.5 Ethanol and distillation plants

Waste starch from the starch plant is transferred to the ethanol plant and fermented to produce ethanol. Starch (described in section 3.3), which is in suspension, is heated in jet cookers before being fermented.

Fermentation is carried out in fermentation vessels using the treated substrate to which an ethanol-producing yeast inoculum has been added. The yeast inoculum is generated using yeast propagator vessels, these being seeded using commercial strains of yeast.

Wastes from the fermenters are transferred to the DDG plant (refer to section 3.6) for processing. Fermentation liquor from the ethanol plant is transferred to the distillation plant where water and other impurities are removed to produce various grades of ethanol.

### 3.6 DDG plant

Wastes from the ethanol and distillation plant are dewatered in decanter centrifuges and dried in steam dryers to produce granular DDG. Light phase from the DDG decanters is evaporated to recover soluble protein (syrup) and produce clear condensate (liquid line). The syrup is added to the dryer feed for recovery of the solids (solids line). DDG granular product is transferred to the DDG Pellet Plant for pelletising; the DDG pellets are stored in silos. Some of the granular DDG product is stored in a storage shed until it is loaded into trucks in the DDG load-out area.

Exhaust gases from the existing DDG dryers (three) are transferred to the boiler air intake in order to destroy odorous components of the gases by combustion.

### 3.7 Steam production

Steam is generated at Shoalhaven Starches by using a combination of three gas fired boilers (numbers 1, 3 and 7) and four coal fired boilers (numbers 2, 4, 5 and 6). The combustion gases from these boilers are discharged via stacks, with boilers 5 and 6 having a combined stack. Exhaust from boilers 2 and 4 is treated in a cyclone and baghouse prior to discharge to atmosphere. Exhaust from boilers 5 and 6 is treated in a baghouse prior to discharge to atmosphere.

The number of boilers operational at any given time depends on the operational and maintenance requirements of the plant. With boiler 8 installed and coal-fired boilers operating at full capacity, only one gas-fired boiler will be operational with the other two gas-fired boilers on standby. When coal-fired boilers are not at full capacity or offline for maintenance, steam requirements are met from the natural gas boilers.

### 3.8 Environmental farm

A number of wastewater streams are produced at the factory. These consist of five clear condensate streams (distillation plant condensate, evaporator condensate, DDG condensate, a small flow from the carbon dioxide plant and boiler blowdown) and a combined 'dirty' stream from the factory processes. The 'dirty' wastewater streams are

combined in the farm tank (located at the factory) and pumped to the waste water treatment plant. Treated water is pumped back to the factory for re-use, while excess treated water is stored in dams for irrigation on the farm.

## **3.9 Packing plant (proposed)**

It is proposed that dried gluten/starch will be pneumatically transferred from the existing site to the proposed new packing plant via underground pipes. This dried material is proposed to be stored in silos.

At present, the approved packing plant has not been constructed at the Shoalhaven Starches sites. The proposed packing plant was assessed by SEMA in 2015.

The packing plant will consist of seven silos that will store either gluten or starch product. The medium and large silos are to be filled 24 hours a day, seven days a week, while the small silos can be filled at any time of the day for eight hours.

## **3.10 Other activities**

### **3.10.1 Product load-out areas**

Starch, glucose and ethanol products are loaded into road tankers from bulk storage silos and tanks. Load out of starch and glucose does not have the potential to generate odours, as these products have a low inherent odour characteristic.

Given the flammable nature of ethanol, the load out process is strictly controlled for occupational health and safety purposes. These controls have the secondary effects of minimising the potential for vapour generation and spillage.

### **3.10.2 Cooling towers**

Cooling towers operate as part of the cooling water circuit for the ethanol glucose and DDG plants. The recirculated cooling water has the potential to absorb odours and to disperse the odours to atmosphere during the evaporative cooling (aeration) process within the cooling towers. Odour sampling undertaken at the cooling towers observed a decline in odour emissions demonstrating relatively low odour emissions and it has since been removed as an EPL odour monitoring point. Manildra advised that the cooling towers are no longer a source of odour and therefore they were removed from the odour emissions inventory.

### **3.10.3 Biofilters**

Exhaust air from odorous sources at the DDG plant is captured and ducted to two existing soil-bed biofilters, each having a surface area of 110 m<sup>2</sup>, located at the southwest corner of the factory (on the southern margin of the container storage area – placed to the left lower margin in Figure 3.1). The biofilters comprise a bed of organic bark and compost material (the matrix), with distribution of the odorous airstream through the floor of the biofilter via a manifold. Biological oxidation of odorous compounds takes place as the foul air percolates upward through the matrix. The oxidation is achieved by a population of microorganisms in the bed.

While the efficiency of biofilters destroying odorous components of the waste air varies according to a range of factors including soil moisture, composition and temperature, it is very high. Any odour in the exhaust air from the biofilter is due to the inherent odour of the matrix materials and typically has an 'earthy' characteristic.

The two biofilters at the site operate in parallel and are sized so that one biofilter can be taken offline during periodic replacement of the matrix of the sister filter.

As such, a soil-bed biofilter operating as designed, with no malfunctions, will not vary significantly in its odour emissions; it will emit at the matrix background level independent of fluctuations in the input odour loading.

## 3.11 Proposed modifications

### 3.11.1 Mod 11, 12, 13, 16, 17 and 19

Modifications 11, 12 and 13 focused on changing the configuration of the DDG plant (to the southwest of the factory), changes to the ethanol distillery and modification to boilers 2 and 4. These modifications have been discussed in Section 1.2. The resulting air quality impacts have been addressed in GHD's previous quality assessments (GHD 2017).

Mod 16 focused on changing the configuration of the flour mill exhausts, conversion of gluten dryers 1 and 2 to starch, change to boiler 7's location, a new gluten dryer (no. 8) and a new coal-fired boiler (boiler 8). The resulting air quality impacts from Mod 16 have been addressed in GHD's previous air quality assessment (GHD, February 2019).

Mod 17 focused on changes to the baghouse (including the addition of a new stack) for starch dryer 5, addition of a new product dryer and use of sawmilling residue (woodchips) for boilers 2 and 4. The resulting air quality impacts from Mod 17 were assessed by GHD (2020).

Modification 19 is discussed in Section 1.3. The main changes affecting odour and air quality impacts consist of:

- Additions to the existing Ethanol Distillery Plant. The additional plant will be of a similar design, size and operation to the existing beverage grade ethanol modification approved under Mod 12.
- The construction of three (3) product silos above the existing interim packing plant.

Further discussion of these changes in the context of the dispersion modelling is presented in Section 7.

### 3.11.2 Mod 21

Modification 21 is discussed in Section 1.3. The main changes affecting odour and air quality impacts consist of:

- Modification of the packing plant layout. It is proposed to construct sixteen (16) smaller silos instead of the original 5 approved silos. However no change to total packing plant emissions is proposed.
- Installation of an additional raw waste water tank within the Environmental Farm. The proposed raw waste water tank would be equipped with a floating roof to prevent odour emissions. No additional odour emissions are anticipated.
- Increase to indirect cooking capacity by 50%. It is anticipated that this will result in a 50% increase in odour emissions from the glucose plant cooking.
- Installation of two additional fermenters (No. 18 and 19). It is understood the additional fermenters would be operated in batch mode to provide more fermenter redundancy for process upsets, fermenters cleans, etc. The overall throughput of the fermenters would not change and therefore no additional odour emissions are anticipated.

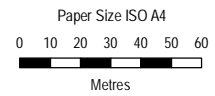
The proposal is expected to have a slight increase in odour impacts due to proposed increase in indirect cooking capacity and a neutral impact on combustion emissions compared against the previously modification (Mod 19).



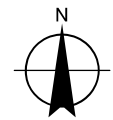


**Legend**

- Odour sources
- Shoalhaven Starches Factory
- Packing plant (proposed)
- Boiler house
- DDG Plant
- Ethanol recovery and storage area
- Fermenters
- Flour Mill
- Starch plant
- +— Railway



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



**Manildra Group Pty Ltd**  
**Shoalhaven Starches**

Project No. **12548374**  
Revision No. **0**  
Date **20 May 2021**

**Site layout and major odour sources**

**FIGURE 3.1**



## 4. Criteria for assessment

### 4.1 Odour

#### 4.1.1 Odour Concentration

Odour 'strength' or concentration is measured in odour units (OU), where 1 OU represents the concentration of a sample that can just be detected by 50% of people in a controlled situation where there is no background 'ambient' odour.

#### 4.1.2 Measurement of Odour

The most common method of measuring odour concentration is Dynamic Olfactometry using the 'forced choice' method. Dynamic olfactometry simply dilutes the odour sample in known ratios with odour free air. At each dilution, the diluted odour and a zero odour is presented in turn to six panellists via two 'sniffing' ports. Further, the selection of the port with the diluted odour sample is randomly reassigned at each presentation. Each panellist is required (forced) to nominate the port (left or right) from which the diluted odour emanates. Each panellist's response (i.e. 'guess', 'likely' or 'certain') is recorded. The sequence of presentations generally follows a decreasing dilution ratio, and when half of the panellists have correctly returned a 'certain' response, that dilution ratio is numerically equal to the concentration of the original, undiluted odour sample. Hence, for example, if the dilution needed to get the 50% response was 250:1, then by definition the original sample had an odour concentration of 250 OU.

#### 4.1.3 EPA Criterion for Odour

EPA has defined an odour criterion and the Odour Guideline specifies how it should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are:

The **F**requency of the exposure

The **I**ntensity of the odour

The **D**uration of the odour episodes

The **O**ffensiveness of the odour

The **L**ocation of the source

These factors are often referred to as the FIDOL factors.

DEC defined the odour criterion to take account of two of these factors (**F** is set at 99 percentile, **I** is set at from 2 to 7 OU). The choice of criterion odour level has also been made to be dependent on the population of the affected area, and to some extent it could be said that population is a surrogate for location – so that the **L** factor has also been considered. The relationship between the criterion odour level **C** to affected population **P** is given below.

$$C = [\log P - 4.5] \div -0.6 \quad \text{Equation 1}$$

Table 4.1 lists the values of C for various values of affected populations as obtained using equation 1.

**Table 4.1** Odour criterion for the assessment of odour

Population of affected community	Odour performance criteria (nose response odour certainty units at 99 <sup>th</sup> percentile)
Single Residence ( $\leq \sim 2$ )	7
$\sim 10$	6
$\sim 30$	5

Population of affected community	Odour performance criteria (nose response odour certainty units at 99 <sup>th</sup> percentile)
~ 125	4
~ 150	3
Urban (~2,000)	2

The NSW Approved Methods specifies a criterion of two odour units at the 99th percentile over a short term averaging nose-response time of one second for a complex mixture of odorous air pollutants in an urban area (population greater than 2000 or with schools and hospitals). The criterion is applied at the location of the nearest sensitive receptor or likely future location of sensitive receptor.

5 OU is commonly taken as a conservative measure of the odour level which can be distinguished against the ambient background level of odour, and which if offensive, could result in complaint.

1 OU generally cannot be detected in a non-laboratory situation (i.e. where the ambient background odour levels reduce the detectability of a given odorant).

As the CALPUFF dispersion model (utilised in this assessment), when operating in micrometeorological mode can only predict concentrations over an averaging period of one hour, a ratio between the one second peak concentration and 60 minute average concentration has been applied to the source odour emission rates. In this manner, the predicted one hour odour levels predicted in CALPUFF represent the corresponding one second short-term levels required to be compared to the DEC criterion. The ratio is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (i.e. near or far-field), and values are tabulated in the modelling Guideline<sup>1</sup>. This is reproduced in Figure 4.1.

**Table 6.1: Factors for estimating peak concentrations in flat terrain (Kesteven Scientific 1995 and 1998)**

Source type	Pasquill-Gifford stability class	Near-field P/M60*	Far-field P/M60*
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A-F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

\* Ratio of peak 1-second average concentrations to mean 1-hour average concentrations

**Figure 4.1 Factors for estimating peak concentrations (Extract from NSW Approved Methods)**

## 4.1.4 Other air quality impacts

Potential non-odorous air quality impacts from the site include dust and products of combustion. The following pollutants have been assessed against relevant criteria:

- Total suspended particles (TSP)
- Fine particulate matter less than 10 micron equivalent aerodynamic diameter (PM<sub>10</sub>)
- Fine particulate matter less than 2.5 micron equivalent aerodynamic diameter (PM<sub>2.5</sub>)
- Products of combustion including carbon monoxide, oxides of nitrogen (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), hydrogen chloride (HCL), heavy metals (Type I & II), total volatile organic compounds (VOC), polycyclic aromatic hydrocarbons (PAHs) and hydrogen fluoride (HF).

<sup>1</sup> Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005).

The air quality impact assessment criteria for these pollutants has been sourced from the Approved Methods and is summarised in Table 4.2.

**Table 4.2** *Air quality impact assessment criteria – other pollutants*

Pollutant	Averaging period	Percentile	Criterion
Particulate Matter PM <sub>10</sub>	24 hours	100 <sup>th</sup>	50 µg/m <sup>3</sup>
	Annual	100 <sup>th</sup>	25 µg/m <sup>3</sup>
Particulate Matter PM <sub>2.5</sub>	24 hours	100 <sup>th</sup>	25 µg/m <sup>3</sup>
	Annual	100 <sup>th</sup>	8 µg/m <sup>3</sup>
TSP	Annual	100 <sup>th</sup>	90 µg/m <sup>3</sup>
Carbon monoxide (CO)	15 minutes	100 <sup>th</sup>	100 mg/m <sup>3</sup>
	1 hour	100 <sup>th</sup>	30 mg/m <sup>3</sup>
	8 hours	100 <sup>th</sup>	10 mg/m <sup>3</sup>
Sulfur dioxide (SO <sub>2</sub> )	10 minutes	100 <sup>th</sup>	712 µg/m <sup>3</sup>
	1 hour	100 <sup>th</sup>	570 µg/m <sup>3</sup>
	24 hours	100 <sup>th</sup>	228 µg/m <sup>3</sup>
Nitrogen dioxide (NO <sub>2</sub> )	1 hour	100 <sup>th</sup>	246 µg/m <sup>3</sup>
	Annual	100 <sup>th</sup>	62 µg/m <sup>3</sup>
Hydrogen fluoride (HF)	90 days	100 <sup>th</sup>	0.25 µg/m <sup>3</sup>
	30 days	100 <sup>th</sup>	0.4 µg/m <sup>3</sup>
	7 days	100 <sup>th</sup>	0.8 µg/m <sup>3</sup>
	24 hours	100 <sup>th</sup>	1.5 µg/m <sup>3</sup>
Hydrogen Chloride (HCL)	1 hour	99.9 <sup>th</sup>	0.14 mg/m <sup>3</sup>
Polycyclic aromatic hydrocarbon (PAH)	1 hour	99.9 <sup>th</sup>	0.0004 mg/m <sup>3</sup>
<b>Type 1 metals</b>			
Antimony	1 hour	99.9 <sup>th</sup>	0.009 mg/m <sup>3</sup>
Arsenic	1 hour	99.9 <sup>th</sup>	0.00009 mg/m <sup>3</sup>
Cadmium	1 hour	99.9 <sup>th</sup>	0.000018 mg/m <sup>3</sup>
Lead	Annual	100 <sup>th</sup>	0.5 µg/m <sup>3</sup>
Mercury	1 hour	99.9 <sup>th</sup>	0.0018 mg/m <sup>3</sup>
<b>Type 2 metals</b>			
Beryllium	1 hour	99.9 <sup>th</sup>	0.000004 mg/m <sup>3</sup>
Chromium	1 hour	99.9 <sup>th</sup>	0.00009 mg/m <sup>3</sup>
Manganese	1 hour	99.9 <sup>th</sup>	0.018 mg/ m <sup>3</sup>
Nickel	1 hour	99.9 <sup>th</sup>	0.00018 mg/ m <sup>3</sup>



## 5. Meteorological data

### 5.1 Overview

A 12-month dataset was constructed using the 3D prognostic modelling package, TAPM and the diagnostic 3D meteorological model, CALMET for the period from January to December 2004. This 12 month period was chosen to be consistent with previous modelling undertaken for the 2008 Air Quality Assessment, approved at the time by EPA and to allow to a direct comparison to previous modelling. Further detail is provided in Appendix A in regards to the selection and construction of the meteorological dataset used in the modelling.

### 5.2 Meteorological modelling

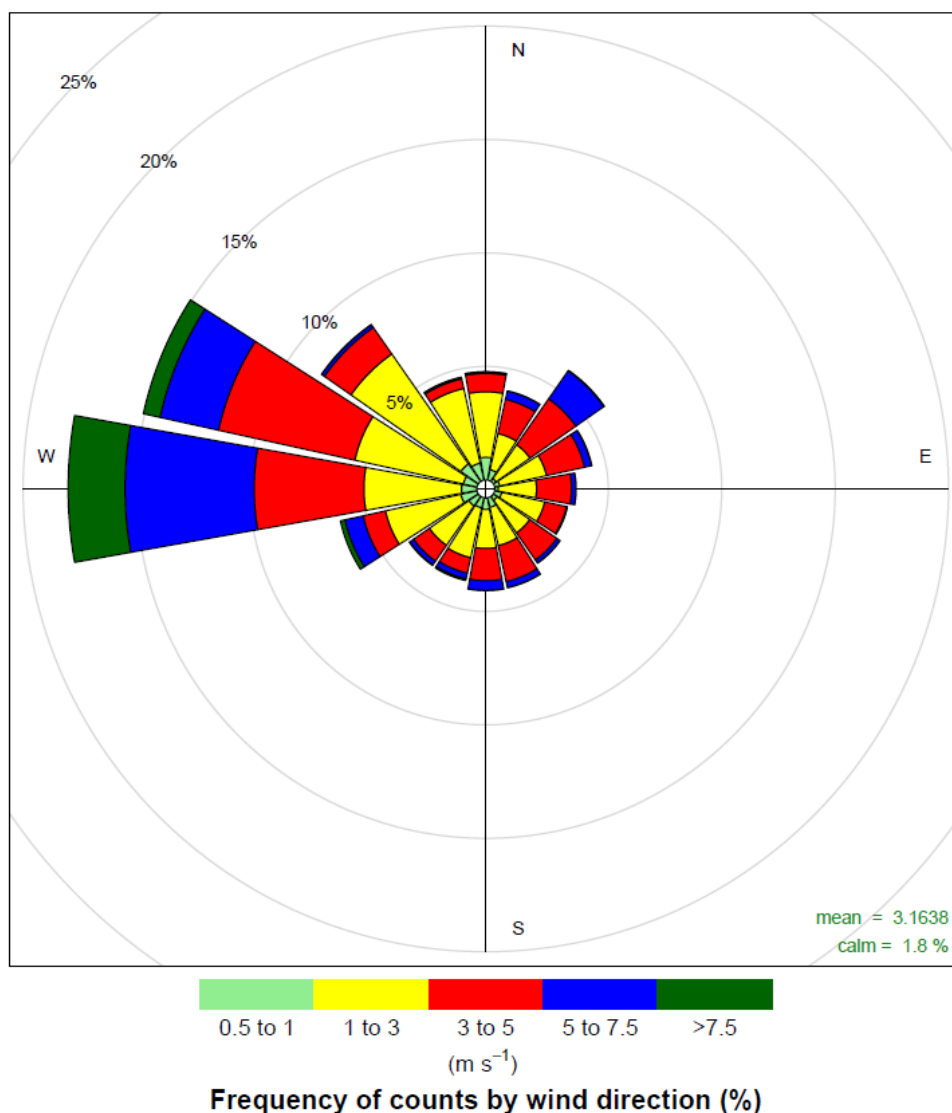
The CALMET modelling can be summarised as follows:

- Prognostic models TAPM and CALMET were used for initial wind field ‘guesses’
- Observations from both the environmental farm Automatic Weather Station (AWS) and Nowra AWS were used to optimise and check the prognostic model simulations
- Wind speeds and direction observations from the environmental farm AWS were assimilated into the prognostic model to make the data site-specific

The result of assimilating this data into the CALMET simulations makes the data site-specific (required for a Level 2 assessment), and inter-annual variability is not required to be accounted for, with the conditions of the Approved Methods met for using “*at least one-year of site-specific meteorological data*”.

An annual wind rose generated using CALMET is provided in Figure 5.1 to show the wind field at the factory. The following trends are evident from Figure 5.1:

- Annual average wind speed of 3.2 m/s
- Winds are most prevalent from the west and west northwest, accounting for around one third of all winds
- Winds are least prevalent along the north-south axis
- Light winds (shown in grey) are more prevalent from the northwest
- Drainage flows occurring during stable conditions at night time are dominated by the following distinct features (in order of scale):
  - Shoalhaven River running west to east through the site
  - Browns Mountains to the northwest of the site
  - Yalwal State Forest mountain range to the west.



**Figure 5.1** CALMET wind rose for the factory

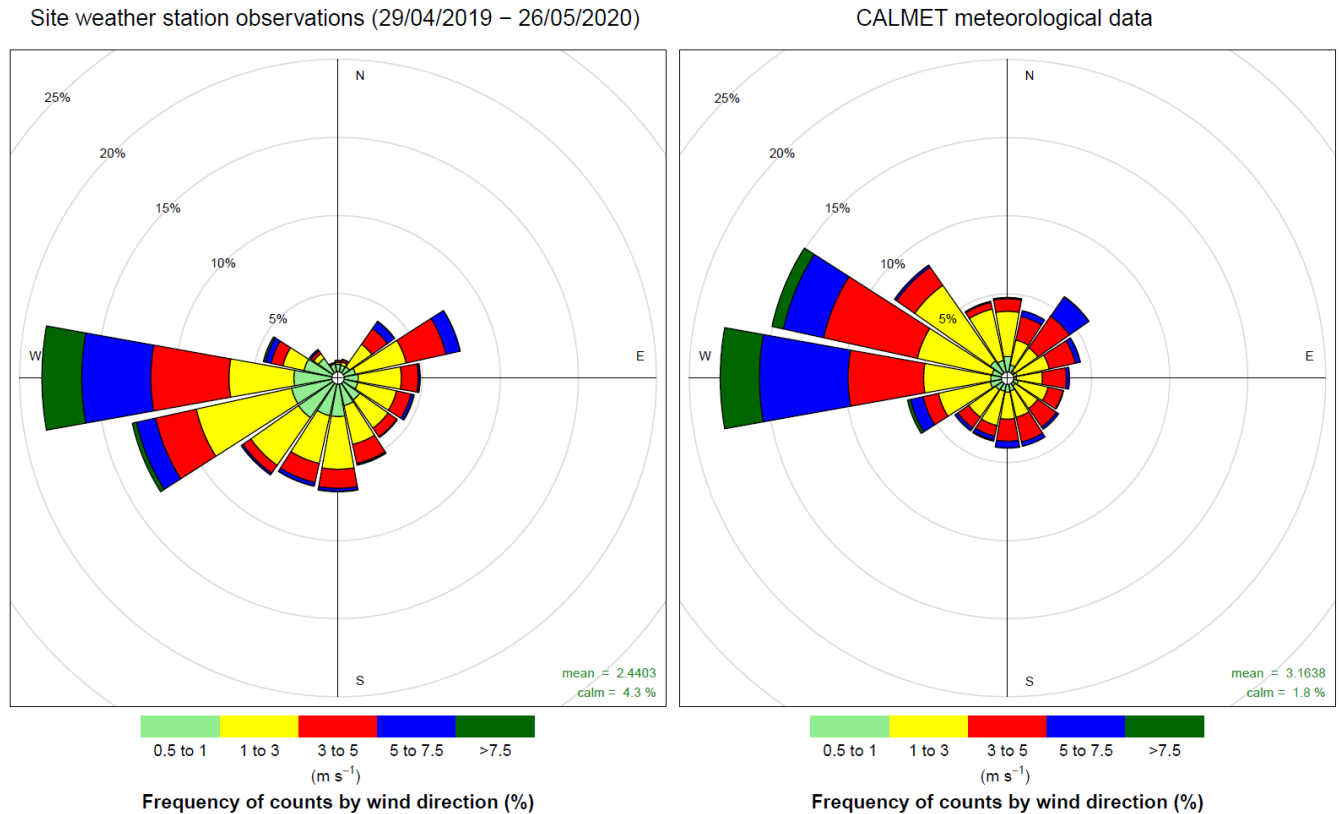
## 5.2.1 Representative year discussion

GHD has undertaken an analysis of more recent measured meteorological data from the Shoalhaven Starches site, in order to determine if the existing EPA approved model would still be considered representative, given the age of the meteorological data. Figure 5.2 below shows annual wind roses for the site for both 2004 CALMET data (the data used in this assessment) and available site observations (dated from 29/04/2019 to 26/05/2020). The following comments are provided regarding the representativeness and suitability of 2004 CALMET data for use in this assessment:

- General wind pattern alignment between observations and modelled meteorological conditions is considered acceptable. Both wind roses show winds are predominantly from the west and have an even spread of winds from the south and east. The more recent observations have a lower percentage of winds occurring from the north compared to the modelling data. Consequently, the modelling data may be over predicting impacts to the south, (i.e. potential to result in less impact at R3 located to the south of the site which is the worst case receptor in terms of odour)
- Changing the meteorological file used in modelling will not enable a direct comparison of changes at the site between modifications. Recalibration of the baseline model (running original 2008 Air Quality assessment model with new meteorological file) would be required to meaningfully compare the relative change in impacts of each modification.

- Currently, only a limited site-specific meteorological dataset exists. While the comparison of this observed dataset shows good general alignment with the modelled meteorological conditions, it is recommended that site based meteorology be reviewed at the end of 2021 or when there is a sufficient number of years available for representative analysis. Currently, insufficient quantity of data is available to conduct a representative year analysis and therefore the alignment of observations against meteorological trends over longer timeframes cannot be assessed.

Based on this review GHD finds the 2004 meteorological dataset used in the assessment appropriate for use in this assessment.



**Figure 5.2** Comparison of site weather station observations and CALMET meteorological

## 6. Background air quality

The Department of Planning, Industry and Environment (DPIE) operate a state wide air quality monitoring network, with the nearest monitoring site to Shoalhaven Starches being the Albion Park South station located approximately 34 km northeast of the site, followed by the Kembla Grange station located approximately 46 km northeast of the site, followed by the Wollongong station located approximately 54 km northeast of the site.

Use of background data from the closest DPIE monitoring station(s) was prioritised where sufficient data was available (stations prioritised in order from Albion Park South to Kembla Grange to Wollongong).

A contemporaneous assessment approach was adopted to assess PM<sub>10</sub>, PM<sub>2.5</sub> and NO<sub>2</sub> (NO<sub>2</sub> was assessed using Method 2 from the Approved Methods). Albion Park South commenced operation in 2005 meaning that contemporaneous data was not available for comparison to the GHD CALPUFF model of the site which uses meteorology from 2004. Therefore, contemporaneous 24 hour average variable PM<sub>10</sub> and PM<sub>2.5</sub> data was sourced from Wollongong station (insufficient data from Kembla Grange) and contemporaneous one hour average NO<sub>2</sub> and O<sub>3</sub> data was sourced from Kembla Grange station.

Previous modification assessments from Mod 13 (GHD, 2018) onwards utilised the following background data:

- Data from the Albion Park South station for the 2016 calendar year:
  - 1 hour, 24 hour and annual averaged SO<sub>2</sub> data for use in the cumulative assessment
  - 70<sup>th</sup> percentile PM<sub>10</sub> and PM<sub>2.5</sub> data for graphically plotting only (refer Figure 8.2 and Figure 8.3, 70<sup>th</sup> percentile concentrations were considered a reasonable representation of ambient PM<sub>10</sub> and PM<sub>2.5</sub> concentrations)
- Data from the Wollongong station for the 2016 calendar year:
  - 1 hour and 8 hour averaged CO data for use in the cumulative assessment (it is noted that CO predictions are orders of magnitude below the assessment criteria therefore no further investigation regards background CO concentrations was undertaken).

For consistency purposes to allow meaningful comparison between modifications, the same 2016 Albion Park South data was adopted for this assessment. As part of this assessment, GHD reviewed the most recent calendar year of SO<sub>2</sub> data (01/01/2020-01/01/2021) and noted that background 1 hour average SO<sub>2</sub> concentrations were that same as those recorded in 2016 while background 24 hour and annual SO<sub>2</sub> concentrations had both decreased. Therefore use of background 2016 data was considered conservative. Additionally, it is noted that particulate levels in recent years (particularly in 2019 to 2020) were not considered representative of typical concentrations due to elevated levels cause by bushfires and therefore GHD did not update the 70<sup>th</sup> percentile data used for plotting purposes.

Background levels of SO<sub>2</sub>, CO and 70<sup>th</sup> percentile PM<sub>10</sub> and PM<sub>2.5</sub> used in the assessment are provided in Table 6.1.

**Table 6.1** Background Air Quality Data – Albion Park South (2016)

Pollutant	Averaging Period	Concentration <sup>2</sup>	Units
Sulfur dioxide (SO <sub>2</sub> )	1 hour	57.6	µg/m <sup>3</sup>
	24 hour	15.7	
	Annual	1.6	
Carbon monoxide (CO) <sup>3</sup>	1 hour	1.0	mg/m <sup>3</sup>
	8 hour	0.6	
PM <sub>10</sub>	24 hours	43.2	µg/m <sup>3</sup>
	70 <sup>th</sup> percentile 24 hour average	18.3	

<sup>2</sup> Values are 100<sup>th</sup> percentile, except where stated as 70<sup>th</sup> percentile for PM<sub>10</sub> and PM<sub>2.5</sub>

<sup>3</sup> CO was sourced from the Wollongong monitoring station as this was not available at Albion Park South

Pollutant	Averaging Period	Concentration <sup>2</sup>	Units
PM <sub>2.5</sub>	Annual	14.9	µg/m <sup>3</sup>
	24 hours	30.7	
	70 <sup>th</sup> percentile 24 hour average	8.0	
	Annual	7.2	

The contemporaneous particulate assessment was undertaken using data from Wollongong in 2004. A review of particulate levels at Wollongong and Albion Park is provided in Table 6.2. Average particulate levels at Wollongong have reduced from 2004 to 2016. Levels at Albion Park South in 2016 are lower than the levels at Wollongong over the same period. Therefore use of contemporaneous 2004 PM<sub>10</sub> and PM<sub>2.5</sub> data from Wollongong is likely conservative as background concentrations have decreased over time (shown via comparison of 2004 Wollongong data to 2016 Wollongong data) and concentrations in Wollongong are higher than those closer to the site (shown via comparison of 2016 Wollongong to 2016 Albion Park data).

**Table 6.2** Review of particulate monitoring at Albion Park South and Wollongong, µg/m<sup>3</sup>

Site and Year	Albion Park 2016	Wollongong 2016	Wollongong 2004
Average PM <sub>10</sub>	14.9	17.3	25.5
70 <sup>th</sup> percentile PM <sub>10</sub>	18.3	20.7	28.8
90 <sup>th</sup> percentile PM <sub>10</sub>	25.6	29.7	37.8
Average PM <sub>2.5</sub>	7.2	7.4	9.7
70 <sup>th</sup> percentile PM <sub>2.5</sub>	8.0	8.3	12.2
90 <sup>th</sup> percentile PM <sub>2.5</sub>	11.2	11.6	16.4

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

- SO<sub>2</sub> – 10.2 µg/m<sup>3</sup>
- NO<sub>2</sub> – 54.5 µg/m<sup>3</sup>
- PM<sub>10</sub> – 28.1 µg/m<sup>3</sup>

The results show all pollutants are significantly lower than the levels recorded at Albion Park South, and would include any emissions from the Shoalhaven Starches site. The maximum levels all readily comply with the relevant criteria. Using the background SO<sub>2</sub> and CO data from the Albion Park South monitoring station in this assessment allows for additional conservatism.

# 7. Odour assessment

## 7.1 Approach

Odour sampling is conducted quarterly at Shoalhaven Starches, with varying results due to site conditions at the time of sampling, and the inherent variability and errors involved in odour sampling and olfactometry. The quarter with the overall highest site odour emission rate is chosen for modelling in order to predict a general worst-case of potential odour impacts from the site.

Conservatively, sources with different odour characteristics are all included in the cumulative odour model including sources with offensive odour (such as the DDG Plant, Ethanol Plant, Distillery, Biofilters and Farm) and sources with odour not observed to be offensive (such as Starch & Glucose dryers, Boilers and Packing Plant).

Odour sampling quarter 2 was found to have the highest overall odour profile in the last year, however the highest contributors in this quarter were:

- Biofilters A and B (odour emissions increased by 358% and 426% respectively compared to Mod 19 – refer Section 7.1.1)
- Ethanol Recovery Scrubber Discharge (odour emissions increased by 25% compared to Mod 19)
- Gluten dryers 3 and 4 and Starch dryer 3 (odour emissions increased by 152%, 120% and 79% respectively compared to Mod 19)

These sources increased substantially compared to the previous values used in Mod 19, although site operations have not significantly changed and there is no general trend of increases over time, other than this one high quarter. Therefore, these increases are attributed to natural variances in the sampling methodology.

While it is important to see how these high odour sources influence off-site odour impacts, the increase in predicted odour impacts is not a result of Mod 21 and highlights potential areas for improvements in odour control.

In order to demonstrate that the site is not increasing odour impacts the following modelling methodology has been undertaken:

- Quarter with maximum odour emissions modelled (in accordance with the methodology adopted for past modification air quality assessments) (Quarter 2) (Q2)
- Most recent quarter (Quarter 3) (Q3) modelled to demonstrate that latest site odour footprint has not increased compared to Mod 19

Proposed changes in Mod 21 will have a negligible impact on the total site odour emission rate. Based upon the above review, the following changes in Section 7.1.1 are identified outside of Mod 21 that Shoalhaven Starches should investigate to reduce odour emissions as part of the modification.

### 7.1.1 Additional recommended odour mitigation

A review of the biofilter sampling over the last seven years has shown a large increase in odour beginning in quarter 2 of 2018-19 (refer to Figure 7.1 for a review of biofilter outlet odour concentrations). This corresponds with Shoalhaven Starches directing odorous air from DDG Dryer 4 (DDG4) (flow rate of 1300 m<sup>3</sup>/h) to the biofilters. There have also been some spikes in measurements during periods when biofilter media was changed and they were being stabilised. It is anticipated that odorous air from DDG4 is contributing to overloading the biofilters and consequently resulting in higher than expected odour emissions from the biofilters.

In order to reduce odours from the existing biofilters to concentrations expected of a well performing biofilter, Shoalhaven Starches propose to install additional approved biofilter capacity. The biofilter would be located in the previously approved location next to biofilters A and B which will result in improved odour performance and would be capable of treating a higher volume of odorous air.

This upgrade is to be done concurrently with Mod 21. Implementation of the upgrade is anticipated to reduce biofilter odour concentrations to levels observed prior to the diversion of odorous air from DDG4. Therefore, odour concentrations from biofilter sampling undertaken prior to the diversion of odorous air from DDG4 have been used in this assessment. Biofilter odour concentrations from quarter 4 of 2017-2018 was selected for use in this

assessment (669.3 OU) as this was the highest measured biofilter outlet value (highest quarterly value for the average of biofilters A and B outlets) in the year before odorous air from DDG4 was diverted to the biofilter.

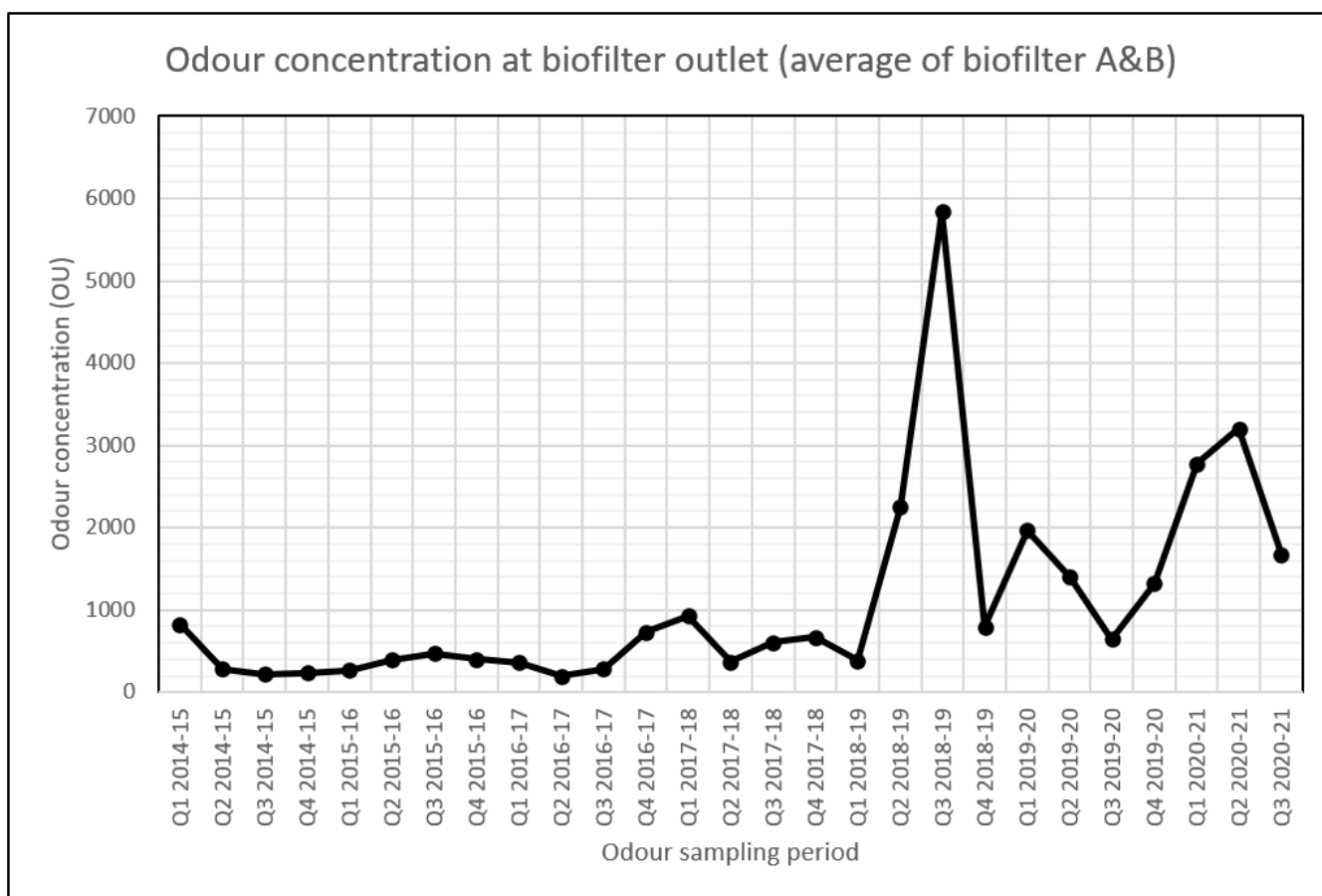


Figure 7.1 Review of biofilter outlet odour concentrations (average of biofilter A and B)

## 7.2 Emissions inventory

### 7.2.1 Source identification

Odour emanating from Shoalhaven Starches is comprised of a complex mixture of primarily odorous volatile organic compounds (VOCs). VOC speciation data from a range of principal odour sources indicates that the individual VOCs within the mixture tend to be classified under odour-based air quality criteria rather than toxicity-based<sup>4</sup> criteria. Therefore, the identified sources of odour are modelled collectively as odour.

Consistent with the previous air quality assessments, the following sources contribute to the majority of the odour impacts from the Shoalhaven Starches sites:

- DDG Plant (including Pellet Plant exhaust stack and biofilters)
- Starch Plant (Gluten and Starch Dryers)
- Ethanol Plant (yeast propagators and retention tank).

A number of other minor odour sources contribute to the remainder of the plant's odour impact. These are detailed in Appendix B.

<sup>4</sup> Based on VOC speciation data for selected sources in the DDG plant: DDG dryers, palmer cooler and condensate tanks.

## 7.2.2 Changes to baseline odour model

The baseline odour model includes all existing and proposed odour sources at the Shoalhaven Starches plant, including EPA monitored sources and all minor sources, up to Mod 19. The odour sources associated with these modifications have been discussed in depth in previous air quality assessments.

The following assumptions and additional changes were made to the baseline odour model:

- Peak odour emission rates were sourced from the odour monitoring conducted by SEMA in the previous four quarters for EPA ID sources. The sources were scaled to an ethanol production rate of 300 ML per year production. The quarter with the maximum measured total OER was selected for use in the assessment and is consistent with guidance in the Approved Methods and the recommendation from EPA (16 February 2017) that peak emissions should be assessed. The peak period was found to be quarter 2, 2020 (August 2020).
- The exit velocities and temperatures for EPA ID sources were adjusted to the modelled quarter. These measurements include the mitigation modifications made to No. 3 and No. 4 gluten dryer exhausts as part of the Mod 11 and 12 air quality assessment recommendations.
- No. 1 and No. 2 gluten dryers were proposed to be modified to starch dryers as part of 16 assessment. Therefore, the emission rates assigned to these dryers remains unchanged from the Mod 16 assessment as the dryers have not been modified yet.
- Mod 16 assessed the addition of a new gluten dryer (GD8). The emission rates assumed in Mod 16 remain unchanged as the dryer has not been constructed yet.
- Mod 17 assessed the addition of a new product dryer (No. 9) (PD9), which is planned to be installed within the speciality products building. The product dryer will comprise about 20% of the size and production capacity of the approved (but not yet constructed) Gluten Dryer 8. It is envisaged that Product Dryer 9 will be used on an interim basis to process gluten allowing for an incremental increase in processing of gluten until the approved product dryer building is constructed and gluten dryer 8 is operational.
- Once gluten dryer 8 is operational, it is envisaged that product dryer 9 will revert to processing starch. PD9 will not result in any increase in production above the current approval limit for flour processing under Mod 16 of 25,400 tonnes per week.
- For the purposes of odour modelling, as part of Mod 17, PD9 was modelled as processing gluten with odour emission rates conservatively modelled as per gluten dryer 1 (which is of a similar size). The stack from the dryer will rise above and through the roof of the speciality product building at a height of 35.6 m. The diameter of the stack is proposed to be 0.85 m. The flow rates were calculated based on 20% of the proposed gluten dryer 8.
- As part of the Mod 19 proposal, a new distillation plant (with columns and associated processing equipment) is proposed to be installed immediately to the west of the existing Ethanol Distillery Plant. One additional emission source associated with this change is the new Distillation plant Column Washing Vent (CWV2), which is a duplication of the existing source (CWV). The stack height of the new source as provided by Manildra, is 55 metres tall. Stack diameter, exit velocity and temperature were sourced from the sampling report for the similar existing source (*Odour Research Laboratories Australia (2020) Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01*).
- Cooling tower odours are not included in the Mod 19 emissions inventory based on improvements at the site and subsequently being removed as a EPL odour sampling point
- As part of the current proposal (Mod 21), the following changes were made:
  - Increased indirect cooking facility odour emissions by 50%.
  - Odour concentrations from the upgraded biofilters A and B were estimated based on sampling from quarter 4 of 2017-2018. A biofilter outlet odour concentration of 669.3 OU was adopted. This was the highest measured biofilter outlet value (highest quarterly value for the average of biofilters A and B outlets) in the year before odorous air from DDG4 was diverted to the biofilter.
- Odour emission rates were assumed to be unchanged for the other emission sources.

## 7.2.3 Source summary and comparison

Modelling for the proposed Mod 21 scenario comprised the following sources:



- 67 point sources in total throughout the site;
  - 63 point sources with constant emissions
  - Four point sources with variable emissions
- 11 area sources (consisting of two biofilters and the effluent treatment ponds)
- Five volume sources within the factory area.
- These sources are detailed in Table 7.1 and Appendix B.

A comparison of the sources between Mod 13, Mod 16, Mod 17, Mod 19 and the current modification is provided in Table 7.1. This shows that the total odour levels:

- Increased by approximately 9% between the previous (Mod 19) and current modification (Mod 21) based on quarter 2 odour sampling
- Decreased by approximately 15% between the previous (Mod 19) and current modification (Mod 21) based on quarter 3 odour sampling

Table 7.1 Comparison of odour emissions from previous mods to current mod

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s	
						Q2	Q3
Boilerhouse							
Boiler no 2	BOILR2	-	-	-	12,677	8,309	7,025
Boiler no 4	BOILR4	3,171	5,666	22,077	27,988	37,247	29,207
Boiler no 5 & 6	BOILR5	38,463	43,711	68,610	88,902	94,550	102,780
Sub total MOER		41,634	49,377	90,687	129,567	140,106	139,013
% of total MOER		15.0%	18.3%	23.8%	29.9%	29.7%	37.9%
DDG Plant							
Condenser drain	VCD	31	31	31	4,419	4,419	4,419
DDG tent storage area	DDG36	1,929	1,929	1,929	1,929	1,929	1,929
Product storage sheds	DDG34	1,023	1,023	1,023	1,023	1,023	1,023
Light phase tank	DDG19	20	20	20	74	74	74
Cooling towers	DDG46	172	172	172	-	0	0
DDG Loadout Shed Awning	DDG35	923	923	923	923	923	923
Pellet exhaust stack	PPES	38,240	31,544	88,073	67,000	84,100	40,442
Pellet silo	S12	350	350	350	350	350	350
Stillage surge tank	SST	149	149	149	173	173	173
Pellet plant fugitives (non-DDG sources)	PPF	5,771	5,771	5,771	5,771	5,771	5,771
Additional Cooling towers	CTP	172	172	172	-	0	0
Sub total MOER		48,780	42,084	98,613	81,661	98,761	55,103
% of total MOER		17.5%	15.6%	25.9%	18.9%	20.9%	15.0%
Ethanol Plant							
Yeast Propagators -tanks 4 and 5	YP45	820	820	820	820	820	820
Grain retention tank	GRT	3,250	3,250	3,250	4,535	4,535	4,535

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s	
						Q2	Q3
Ethanol recovery scrubber	ERESC	3,132	10,660	15,405	33,091	41,258	15,198
Fermenters 10-16	FERM	2,668	3,298	795	2,500	2,000	2,804
Jet cooker 1 retention tank	E13	1,067	1,067	1,067	1,067	1,067	1,067
Jet cooker 2/4 grain retention	E7	567	567	567	567	851	851
Feed to distillery	E22	83	83	83	83	83	83
<b>Sub total MOER</b>		<b>11,587</b>	<b>19,745</b>	<b>21,987</b>	<b>42,663</b>	<b>50,613</b>	<b>25,358</b>
<b>% of total MOER</b>		<b>4.2%</b>	<b>7.3%</b>	<b>5.8%</b>	<b>9.9%</b>	<b>10.7%</b>	<b>6.9%</b>
<b>Distillery</b>							
Incondensable gases vent	D6	558	558	558	558	558	558
Molec. sieve vacuum drum	D2	1,350	1,350	1,350	1,350	1,350	1,350
Column Washing Vent	CWV	23	25	27	1,399	1,218	1,218
Distillation plant Column Washing Vent	CWV2				1,399	1,218	1,218
<b>Sub total MOER</b>		<b>1,931</b>	<b>1,933</b>	<b>1,935</b>	<b>4,707</b>	<b>4,344</b>	<b>4,344</b>
<b>% of total MOER</b>		<b>0.7%</b>	<b>0.7%</b>	<b>0.5%</b>	<b>1.1%</b>	<b>1.0%</b>	<b>1.0%</b>
<b>Starch and Glucose</b>							
Flour mill A Exhaust	A4	679	679	679	679	679	679
Flour mill A Exhaust	A5	96	96	96	96	96	96
Flour mill A Exhaust	A6	449	449	449	449	449	449
Flour mill A Exhaust	A7	932	932	932	932	932	932
Drum vac receiver	C4	1,400	1,400	1,400	1,400	1,400	1,400
Dry gluten roof bin	S07	4,500	4,500	4,500	4,500	4,500	4,500
Enzyme tanks	B7	2,042	2,042	2,042	2,042	2,042	2,042
Flash vessel jet cooker	C1	970	970	970	970	970	970
Flour bin aspirator	S13A	500	500	500	500	500	500
Flourbin aspirator	S13B	500	500	500	500	500	500

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s	
						Q2	Q3
Flourbin motor drive	S06	283	283	283	283	283	283
Flour mill aspiration (Mod 8)	FMP1	266	205	205	205	205	205
Flour mill aspiration (Mod 8)	FMP2	205	266	266	266	266	266
High protein dust collector	S08	600	600	600	600	600	600
Ion exchange effluent tank	C18	250	250	250	250	250	250
No 1 gluten dryer baghouse	S02	5,925	5,166	5,166	9,800	9,800	7,136
No 1 starch dryer	S01	5,193	5,193	11,316	2,800	3,200	6,358
No 2 gluten/starch dryer	S04	2,354	5,166	5,166	7,200	6,000	3,362
No 3 gluten dryer baghouse	S03	58,917	29,036	21,696	12,700	32,000	11,540
No 3 starch dryer	S18	1,663	5,166	5,166	3,800	6,800	1,942
No 4 gluten dryer baghouse	S05	31,222	22,433	13,693	9,100	20,000	9,768
No 4 starch dryer	S19	1,824	4,008	5,020	3,600	2,500	1,848
No 5 ring dryer gluten/starch	SDR5	4,817	4,817	4,817	4,350	4,625	3,378
No 5 starch dryer (existing)	SD5C	6,800	6,800	3,393	4,931	2,123	3,172
No 5 starch dryer (new stack)	SD5N	-	-	17,387	25,269	10,877	16,256
No 6 gluten dryer	GD6	12,568	12,568	12,568	12,568	12,568	12,568
No 7 gluten dryer	GD7	9,553	9,553	9,553	9,553	9,553	9,553
Spray dryer	S20	738	738	738	738	738	738
Starch factory rejects	E10	183	183	183	183	183	183
Farm tank	F18	3,834	3,834	3,834	3,833	3,833	3,833
Pellet mill silo	PMFS	173	173	173	173	173	173
Flour Mill B Exhaust	FMBA to FMBM	5,637	4,621	4,621	3,621	3,621	3,621
Flour Mill C Exhaust	FMC1 to FMC3	n/a	1,658	1,658	1,560	1,560	1,560
Gluten dryer No.8	GD8	n/a	12,568	12,568	12,568	12,568	12,568

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s	
						Q2	Q3
Product dryer 9	PD9	n/a	n/a	5,166	9,800	9,800	7,136
<b>Sub total MOER</b>		<b>165,073</b>	<b>147,353</b>	<b>157,553</b>	<b>151,819</b>	<b>166,194</b>	<b>130,365</b>
<b>% of total MOER</b>		<b>59.3%</b>	<b>54.7%</b>	<b>41.3%</b>	<b>35.1%</b>	<b>35.2%</b>	<b>35.6%</b>
<b>Packing Plant (Not constructed)</b>							
Starch silo 1	PPL1	86	86	86	86	86	86
Starch silo 2	PPL2	86	86	86	86	86	86
Gluten silo 1	PPM1	173	173	173	173	173	173
Gluten silo 2	PPM2	173	173	173	173	173	173
Gluten silo 3	PPM3	173	173	173	173	173	173
Small gluten silo	PPS1	92	92	92	92	92	92
Small starch silo	PPS2	35	35	35	35	35	35
<b>Sub total MOER</b>		<b>818</b>	<b>818</b>	<b>818</b>	<b>818</b>	<b>818</b>	<b>818</b>
<b>% of total MOER</b>		<b>0.3%</b>	<b>0.3%</b>	<b>0.2%</b>	<b>0.2%</b>	<b>0.2%</b>	<b>0.2%</b>
<b>Area sources: Environmental farm after WWTP</b>							
Biofilter A (additional capacity to be installed as part of Mod 21)	BIO1	440	1,408	1,386	502	1,307	1,239
Biofilter B (additional capacity to be installed as part of Mod 21)	BIO2	330	803	1,111	1,648	1,208	1,187
Biofilter C	BIO3	1,089	1,089	1,089	1,089	1,089	1,307
Biofilter D	BIO4	1,280	1,280	1,280	1,280	1,281	1,208
Storage dam 1	PO1	148	71	119	1,475	948	948
Storage dam 2	PO2	1,656	248	143	973	687	687
Storage dam 3	PO3	192	569	1,231	2,962	1,626	1,626
Storage dam 5	PO5	515	971	1,922	6,538	1,248	1,248
Storage dam 6	PO6	1,775	1,435	793	3,097	1,435	1,435
Sulfur oxidation basin	SOBAS	830	349	535	1,939	489	489

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s	
						Q2	Q3
Membrane bio-reactor	MBR	62	62	62	54	54	54
<b>Sub total MOER</b>		<b>8,317</b>	<b>8,286</b>	<b>9,671</b>	<b>21,557</b>	<b>11,372</b>	<b>11,429</b>
<b>% of total MOER</b>		<b>3.0%</b>	<b>3.1%</b>	<b>2.5%</b>	<b>5.0%</b>	<b>2.4%</b>	<b>3.1%</b>
<b>Total (Mod 11 and Mod 12)</b>		<b>278,140</b>					
<b>Total (Mod 16)</b>			<b>269,595</b>				
<b>Total (Mod 17)</b>				<b>381,265</b>			
<b>Total (Mod 19)</b>					<b>432,792</b>		
<b>Total (Mod 21)</b>						<b>472,208</b>	<b>366,428</b>

## 7.3 Dispersion modelling

The odour dispersion modelling was conducted using the Gaussian puff model CALPUFF Version 7. This model is also a recognised regulatory model in NSW. Where the modelling of odour dispersion is in complex terrain (as is the case at the Shoalhaven site), CALPUFF is recommended for use under NSW Guidelines. CALPUFF is especially suited for modelling light to calm wind conditions.

The following settings were used in the simulations:

- Model: CALPUFF Version 7
- The receptor grid was 10 km x 10 km, with a 200 m grid resolution
- The nearest receptors from the townships of Bomaderry (to the west) and Nowra (to the south) were used as sensitive receptors, along with a few isolated residences around the factory and environmental farm
- Ground level receptor heights have been modelled using the same terrain data as the original 2008 GHD assessment. This terrain data was used in the CALMET 2004 model which is used for CALPUFF modelling
- Emissions were scaled based on a nose-response time for odour of one second, applying a peak-to-mean ratio to the one hour average concentration of 2.3 for wake affected point sources and volume sources, and variable scaling for non-wake affected sources and area sources
- Meteorology was taken from the CALMET 2004 synthesised dataset, approved for use in previous studies
- Building wake effects (including changes to the building layouts) were modelled to the extent practicable.

## 7.4 Predicted odour impacts

Table 7.2 and Figure 7.2 shows the predicted 99<sup>th</sup> percentile odour impacts (one second nose-response time) for the proposed Mod 21 operations based on quarter 2 and quarter 3 odour sampling concentrations and the previous modifications.

The predicted odour levels for Mod 21 Q2 show a slight increase in odour at receptors R1 – R4, C1, C4, C5 and C7 compared to Mod 19 while predicted odour levels for Mod 21 Q3 show a slight decrease at receptors C2, C3 and C6 compared to Mod 19.

The fluctuation in odour predictions for this modification compared with the previous modification is attributed to variability in odour sampling. The results for Mod 21 Q3 show that the impact assessment odour criteria are achieved at all residential sensitive receptors.

Seven commercial/industrial receptors are included in the assessment. These are all located within approximately 125 m of the site. One second, 99<sup>th</sup> percentile odour impacts have been predicted based on the hours of operation of the receptors as per Section 2.2 (i.e. predicted odour impacts when the sites are not operational have been excluded from the assessment).

Mod 21 predicted marginal exceedances of the 6 OU criteria (assumed the same criteria as R1) at commercial/industrial receptors C2, C3, C4, C5, and C7 due to the higher quarterly odour sampling results.

Commercial receptors C1 and C6 are located approximately 45 and 80 metres from the site. Given the industrial nature of these receptor, and its existing proximity to the site no significant odour impacts are anticipated from the proposal.

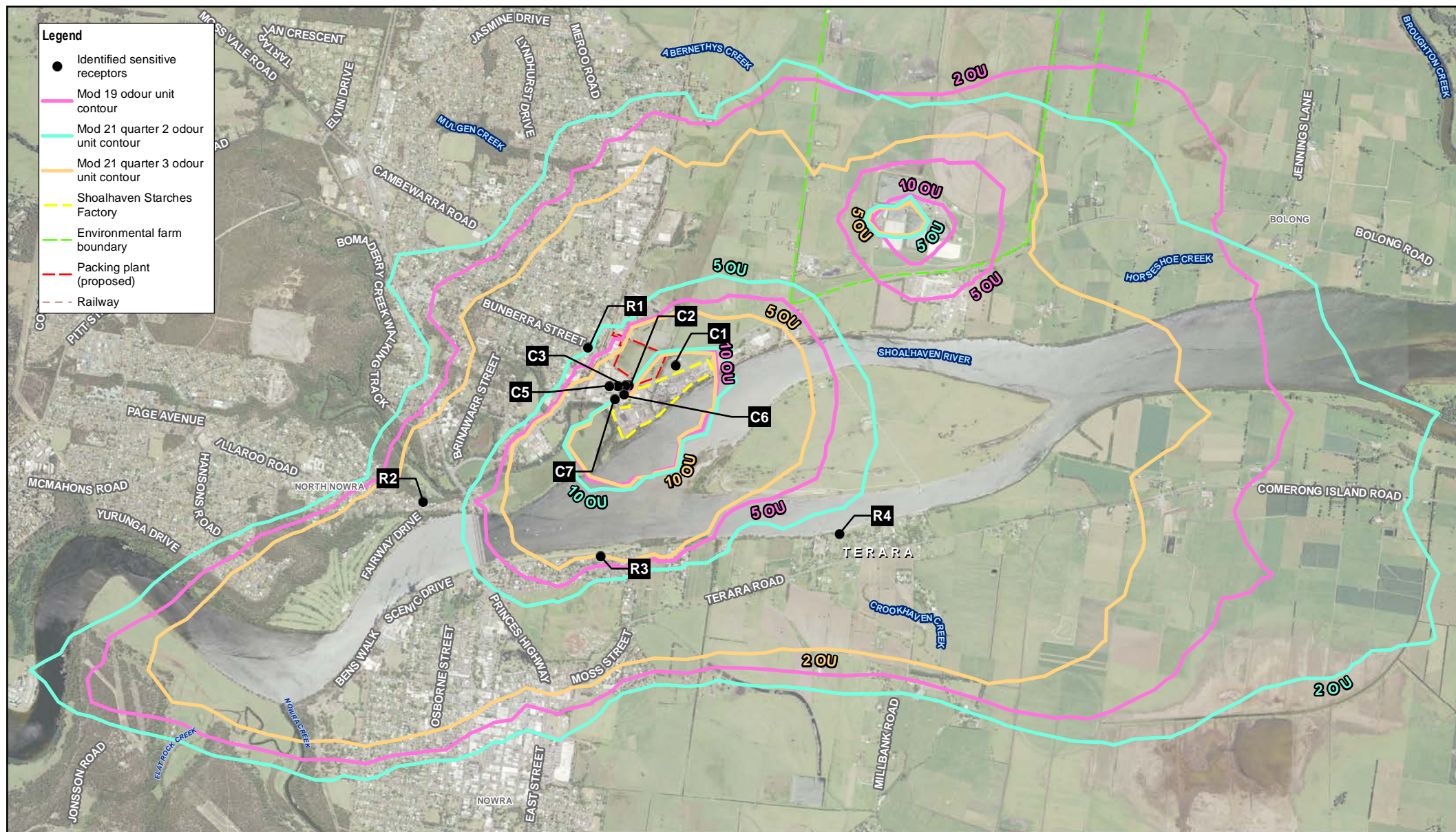
Two odour complaints (one in October 2020 and one in March 2021) attributed to the Shoalhaven Starches plant was received in the last year.

**Table 7.2** Predicted peak (99th percentile, short term averaged) odour impact at nearby receptors

Receptor	Range, m	To nearest odour source	Direction	2009 EA approved 'base case' Odour criterion	Odour impact, OU, 99 <sup>th</sup> percentile, nose-response time					
					Mod 13	Mod 16	Mod 17 <sup>5</sup>	Mod 19	Mod 21 (Q2)	Mod 21 (Q3)
R1 Bomaderry	150	Packing Plant	W	6	3.3	3.5	4	4	5	4
R2 North Nowra	1300	Factory	SW	3	2.5	2.6	3	3	4	3
R3 Nowra	700	Factory	S	5	4	4.6	5	5	6	5
R4 Terara	1300	Factory	SE	5	3.7	3.7	4	4	5	4
C1	45	Factory	N	n/a	n/a	10.3	12	12	14	12
C2	20	Factory	N	n/a	n/a	5.8	8	10	10	9
C3	30	Factory	N	n/a	n/a	5.3	7	9	9	8
C4	75	Factory	NW	n/a	n/a	4.4	6	7	8	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7	8	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10	10	9
C7	55	Factory	NW	n/a	n/a	4.8	7	8	9	8

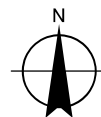
<sup>5</sup> Predicted odour concentrations rounded to nearest whole number from MOD17 onwards as per EPA advice





Paper Size ISO A4  
0 170 340 510 680 850 1,020  
Metres

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



Manildra Group Pty Ltd  
Shoalhaven Starches

Project No. 12548374  
Revision No. 0  
Date 30 Jun 2021

Odour impacts, 99<sup>th</sup> percentile,  
short term averaged – Modification 21

**FIGURE 7.2**

## 8. Air quality assessment

### 8.1 Emissions inventory

In addition to odour emissions, the operation of the Shoalhaven Starches plant also has the potential to generate emissions of particulate matter and products of combustion.

The emissions inventory for Modification 21 includes all existing air emissions sources and those proposed in previous Modifications (up to and including Modification 19). Emission rates were estimated for a factory throughput of 300 ML per annum (maximum approved throughput).

No new emission sources are proposed as part of Modification 21, however the assessment was updated to include the most recent sampling data.

Two air quality scenarios were considered as part of Modification 21. The scenarios consider different arrangement of active boiler to fulfil the steam generation requirements of the site. It is noted that surplus steam generation capacity is installed on site (additional boilers and proposed gas turbines) so that boilers can be offline for periods in accordance with boiler statutory requirements and for maintenance and cleaning. The air quality scenarios considered as part of Mod 21 included:

- Base scenario: No change from Mod 19 boiler fuel usage.
- Mitigation scenario: revised boiler operation to replace the use of coal fired boiler 8 with gas fired boilers 7 and 8. In addition, all remaining coal fired-boilers were operated at maximum throughput to conservatively assess worst case operations which is expected to occur while boilers operate using coal.

The proposed boiler and fuel usage for each scenario is summarised in Table 8.1.

The emissions estimation methodology adopted for Modification 21 was consistent with that of previous modifications. Modification 21 emission rates were updated based on most recent sampling data to reflect the site's current operations. Assumptions and changes made to the baseline air quality model as part of this assessment are discussed in detail below for each of the individual source types.

#### 8.1.1 Boiler emissions

Emission estimation based on site specific sampling data was prioritised where available, however sampling data for gas fired boilers was not available. Therefore, emissions factors from the *National Pollutant Inventory Emission estimation technique manual for Combustion in boilers Version 3.6 (December 2011)* (NPI factors) were used (emissions factors for natural gas ( $\leq 30$  MW wall fired)). Boiler emission rates were updated based on recent site sampling reports which are provided in Appendix C. Emission was scaled based on proposed boiler fuel usage rates for Modification 19 provided by Manildra.

Boiler emissions were estimated based on the properties outlined in Table 8.1.

Table 8.1 Boiler emissions estimation

Boiler	Fuel type	Modification 21 fuel usage		Emission estimation methodology <sup>6</sup>
		Base scenario	Mitigation scenario	
Boiler 1	Gas	71.5 GJ/hour	84 GJ/hour	NPI factors

<sup>6</sup> PAH and FL emissions for all boilers have been calculated based on the emission factors listed in *National Pollutant Inventory Emission estimation technique manual For Combustion in boilers Version 3.6 (December 2011)* Table 10

Boiler	Fuel type	Modification 21 fuel usage		Emission estimation methodology <sup>6</sup>
		Base scenario	Mitigation scenario	
Boiler 2	Coal and woodchips	Coal: 1.17 t/hr Woodchips: 0.62 t/hr	Coal: 1.2 t/hr Woodchips: 0.31 t/hr	Coal: SEMA (2020) Compliance Stack Emission Survey – Q2 2020-2021 - Boiler 2 - Report No. 7102  Woodchips: Average of past sampling data as presented in GHD (2020)
Boiler 3	Standby boiler, operation not proposed and therefore not included in this assessment			
Boiler 4	Coal and woodchips	Coal: 2.43 t/hr Woodchips: 0.74 t/hr	Coal: 3.0 t/hr Woodchips: 0.37 t/hr	Coal: SEMA (2020) Compliance Stack Emission Survey – Q2 2020-2021 - Boiler 4 - Report No. 7103  Woodchips: Average of past sampling data as presented in GHD (2020)
Boiler 5/6	Coal	12.2 t/hr	12.1 t/hr	SEMA (2020) Compliance Stack Emission Survey – Q2 2020-2021 - Boiler 5&6 - Report No. 7104A
Boiler 7	Gas	Standby boiler, operation not proposed for base scenario	66 GJ/hour	NPI factors
Boiler 8C	Coal	8.3 t/hr	Standby boiler, operation not proposed for mitigation scenario	Scaled off boiler 5/6 emission rates based on proposed fuel usage rates
Boiler 8G	Gas	Standby boiler, operation not proposed for base scenario	131 GJ/hour	NPI factors

Boiler details and modelled emission rates used as part of the Modification 19 air quality assessment are summarised in Table 8.2 and Table 8.3.

## 8.1.2 Product dryer emissions

The following updates have been made to the site emissions inventory for the product dryers:

- NO<sub>x</sub> emissions from dryers without NO<sub>x</sub> sampling results (gluten dryer 8 (GD8), spray dryer 5 (S20) and product dryer 9 (PD9)) were estimated based on the flowrate of the dryers and the average sampled exhaust NO<sub>x</sub> concentration from starch dryers 4 and 5 and gluten dryers 1, 2, 3, 4, 6, 7 and ring dryer 5.
- CO and SO<sub>2</sub> emissions from all dryers fitted with an auxiliary gas burner (gluten dryers 1, 2, 3, 4, 5, 6 and 7, ring dryer 5, starch dryers 3, 4 and 5, spray dryer 5 and product dryer 9) were estimated based on NPI factors (emissions factors for natural gas (tangential fired)) and projected gas consumption (gas usage split evenly across all dryers).

- Particulate emissions from starch dryer 5, which is fitted with a cyclone, were estimated based on an in-stack concentration of 5 mg/m<sup>3</sup> and provided flowrate<sup>7</sup>.
- All other dryer emissions sources are as per Mod 19.

### 8.1.3 Gas turbines

Mod 21 proposes to fulfil the steam generation requirements of the site by using boilers only. The approved but not yet constructed gas turbines assessed as part of the 2008 air quality assessment (GHD, 2008) would be allocated to standby mode, therefore they would not be operated and consequently they were not included in this assessment.

### 8.1.4 Other emission sources

Other emissions sources would remain unchanged from previous air quality assessments. The modelled TSP and PM<sub>10</sub> emission rates from all sources are summarised in Table 8.2 and the modelled products of combustion, PAH, VOCs and metals emission rates from Mod 21 base and mitigation scenarios are summarized in Table 8.3 and Table 8.4 respectively. It is noted that only boiler emission rates vary between the base and mitigation scenarios, all other sources remain unchanged between scenarios.

**Table 8.2** Emission inventory – Particulate matter

Discharge Point	Model ID	EPA ID	Emission control	Base scenario		Mitigation scenario	
				TSP	PM <sub>10</sub>	TSP	PM <sub>10</sub>
Boiler No. 1	BOILR1		Gas-fired	0.072	0.072	0.084	0.084
Boiler No. 2	BOILR2	45	Cyclone and fabric filter	0.072	0.052	0.086	0.061
Boiler No. 4	BOILR4	42	Cyclone and fabric filter	0.15	0.13	0.21	0.18
Boiler No. 5/6	BOILR5	35	Fabric filter	0.24	0.1	0.24	0.1
Boiler No. 7	BOILR7		Gas-fired			0.066	0.066
Boiler No. 8C	BOILR8		Cyclone and fabric filter	0.17	0.069		
Boiler No. 8G	BOILR8G		Gas-fired			0.13	0.13
Gluten dryer No. 1	S02	8	Fabric filter	0.015	0.0003	0.015	0.0003
Gluten dryer No. 2	S04	9	Fabric filter	0.015	0.001	0.015	0.001
Gluten dryer No. 3	S03	10	Fabric filter	0.02	0.02	0.02	0.02
Gluten dryer No. 4	S05	11	Fabric filter	0.02	0.02	0.02	0.02
Ring Dryer No. 5	SDR5		Fabric filter	0.012	0.012	0.012	0.012
Gluten dryer No. 6	GD6		Fabric filter	0.02	0.02	0.02	0.02
Gluten Dryer No. 7	GD7		Fabric filter	0.035	0.035	0.035	0.035
Gluten Dryer No. 8	GD8		Fabric filter	0.02	0.02	0.02	0.02
Starch dryer No. 1	S01	12	Cylone and wet-scrubber	0.044	0.033	0.044	0.033
Starch dryer No. 3	S18		Cylone and wet-scrubber	0.04	0.013	0.04	0.013
Starch dryer No. 4	S19	14	Cylone and wet-scrubber	0.057	0.029	0.057	0.029
Starch dryer No. 5	SD5C	47	Cyclone	0.062	0.062	0.062	0.062

<sup>7</sup>An in-stack TSP conc of 5 mg/m<sup>3</sup> was taken from SEMA (2015) Air Quality Impact Assessment (Cumulative Impact) Starch Dryer 5 Relocation V3 29/10/2015

Discharge Point	Model ID	EPA ID	Emission control	Base scenario		Mitigation scenario	
				TSP	PM <sub>10</sub>	TSP	PM <sub>10</sub>
No. 5 Starch Dryer	SD5N		Cyclone	0.32	0.32	0.32	0.32
Spray dryer 5	S20		Fabric filter	0.0028	0.0019	0.0028	0.0019
Flour Mill	FMP1, FMP2		Fabric filter	0.0005	0.0005	0.0005	0.0005
New Flour Mill B (MOD 10)	FMBA-FMBF		Fabric filter	0.0037	0.0037	0.0037	0.0037
Flour Mill C (new)	FMC1-FMC3		Fabric filter	0.0013	0.0013	0.0013	0.0013
DDG Pellet Plant (MOD 4 & MOD 5)	PPF		Fabric filter	0.25	0.25	0.25	0.25
Packing Plant (MOD 9 approved)	PPL1-2, PPM1-3, PPS1-2		Fabric filter	0.016	0.016	0.016	0.016
Silo source 1 (combined stack for 3 silos)	SILO1		Fabric filter	0.0042	0.0042	0.0042	0.0042
Silo source 2 (combined stack for 6 silos)	SILO2		Fabric filter	0.0042	0.0042	0.0042	0.0042
Silo source 3 (combined stack for 2 silos)	SILO3		Fabric filter	0.017	0.017	0.017	0.017
Silo source 4 (combined stack for 6 silos)	SILO4		Fabric filter	0.0042	0.0042	0.0042	0.0042
Silo source 5 (combined stack for 3 silos)	SILO5		Fabric filter	0.013	0.013	0.013	0.013
Product dryer 9	PD9		Fabric filter	0.015	0.0003	0.015	0.0003



Table 8.3 Emission inventory – Products of combustion (Base scenario)

Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 8C	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No. 6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5
Model ID	BOILR1	BOILR2	BOILR4	BOILR5	BOILR8	S02	S04	S03	S05	SDR5	GD6	GD7	GD8	S18	S19	SD5C	SD5N	S20
Fuel type	Natural gas	Coal and woodchip	Coal and woodchip	Coal	Coal	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Status / details	Existing boilers					Natural gas is fed through to the dryers for combustion												
Stack height (m)	25	40	41	54	54	25.5	27	21	30	25	35	29	29	20	20	33.5	30	19
Exhaust temp. (K)	453	475	436	403	403	344	337	347	345	320	346	341	346	309	312	341	341	344
Stack diameter (m)	0.9	0.7	0.9	2.1	2.0	3.2	3.2	2.5	2.7	1.2	1.7	1.8	1.9	1.2	1.2	2.4	2.4	1.4
Exhaust velocity (m/s)	25.0	27.7	28.4	14.5	11.8	14.0	17.0	11.0	21.0	10.0	20.0	19.0	20.0	23.0	22.0	2.9	14.7	8.0
Oxygen (%)	ND	10.9	15	8.5	ND	20.9	20.9	20.9	20.6	ND	20.9	20.9	ND	20.9	20.9	ND	ND	20.5
Moisture (%)	ND	5	4	5.7	ND	7.3	5.9	6.3	6.4	ND	7.0	6.5	ND	5.8	3.2	ND	ND	3.5
Exhaust Flow rate, actual (m3/s)	ND	9.2	20	48.0	ND	19.3	20.5	15.1	28.6	ND	27.2	25.3	ND	28.0	26.2	ND	ND	12.1
Ratio (Actual to normalised flow)	ND	1.8	1.7	1.5	ND	1.4	1.2	1.4	1.4	ND	1.4	1.3	ND	1.2	1.2	ND	ND	1.3
Emission rate (g/s)																		
CO	0.82	0.57	2.6	3.3	2.24	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.0023	0.012	0.014
SO <sub>2</sub>	0.011	1.9	3.9	20	13.3	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00011	0.00055	0.00066
NO <sub>2</sub>	0.49	2.1	6.1	17	11.9	0.12	0.02	0.43	0.060	0.075	0.10	0.062	0.23	0.038	0.036	0.016	0.082	0.048
VOC	0.054	0.013	0.14	0.19	0.127	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (As) Type I	1.9E-06	4.6E-05	2.4E-04	1.7E-04	1.1E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Cd) Type I	1.1E-05	3.0E-06	4.7E-06	4.1E-06	2.8E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Pb) Type I	4.9E-06	1.7E-04	3.1E-04	6.0E-04	4.1E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Hg) Type I	2.5E-06	9.8E-06	1.0E-05	2.5E-05	1.7E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (Be) Type II	1.2E-08	2.5E-06	1.0E-05	2.5E-05	1.7E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr) Type II	1.4E-05	2.3E-05	7.9E-05	6.0E-05	4.1E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (Co) Type II	7.9E-07	9.9E-06	3.3E-05	8.2E-05	5.6E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese (Mn) Type II	3.7E-06	9.9E-05	1.2E-04	2.3E-04	1.6E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Ni) Type II	2.0E-05	5.4E-05	2.3E-04	2.9E-04	2.0E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Se) Type II	2.3E-07	5.4E-05	2.7E-04	1.7E-04	1.1E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)	6.2E-06	1.1E-04	9.0E-05	3.2E-05	2.2E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Emission rates, normalised (mg/m <sup>3</sup> )																		
CO	51.6	61.7	146.7	68.7	60.3	0.1	0.1	0.3	0.1	1.3	0.3	0.3	0.3	0.5	0.6	0.2	0.2	1.2
SO <sub>2</sub>	0.7	210.5	214.6	408.0	358.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
NO <sub>2</sub>	30.6	223.5	338.4	363.5	319.3	1.1	0.2	8.0	0.5	6.6	2.2	1.3	4.0	1.5	1.4	1.3	1.3	4.2

Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 8C	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No. 6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5
TSP	4.5	7.8	8.3	5.1	4.5	0.1	0.1	0.4	0.2	1.0	0.4	0.7	0.4	1.5	2.3	5.0	5.0	0.2
Type 1 and 2 metals (combined)	0.004	0.051	0.072	0.034	0.030	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.0007	0.0003	0.0003	0.0001	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.0002	0.0011	0.0006	0.0005	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC	3.4	1.4	7.8	3.9	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-
The emission rate limits are as follows: Protection of the Environment Operations (Clean Air) Regulation (2010): CO: 125 mg/m <sup>3</sup> , SO <sub>2</sub> : 1000 mg/m <sup>3</sup> , NO <sub>2</sub> : 500 mg/m <sup>3</sup> , TSP: 50 mg/m <sup>3</sup> , Type 1 and 2 metals (combined): 1 mg/m <sup>3</sup> , Cadmium: 0.2 mg/m <sup>3</sup> , Mercury: 0.2 mg/m <sup>3</sup> , VOC: 40 mg/m <sup>3</sup> , HCL: 100 mg/m <sup>3</sup> , FL: 50 mg/m <sup>3</sup> EPA: SO <sub>2</sub> : 600 mg/m <sup>3</sup> , NO <sub>2</sub> : 500 mg/m <sup>3</sup> , TSP: 30 mg/m <sup>3</sup> , Type 1 and 2 metals (combined): 1 mg/m <sup>3</sup> , Cadmium: 0.2 mg/m <sup>3</sup> , Mercury: 0.2 mg/m <sup>3</sup> , VOC: 40 mg/m <sup>3</sup> .																		

Table 8.4 Emission inventory – Products of combustion (Mitigation scenario)

Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 7	Boiler No. 8G	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No. 6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5
Model ID	BOILR1	BOILR2	BOILR4	BOILR5	BOILR7	BOILR8G	S02	S04	S03	S05	SDR5	GD6	GD7	GD8	S18	S19	SD5C	SD5N	S20
Fuel type	Natural gas	Coal and woodchip	Coal and woodchip	Coal	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Status / details	Existing boilers					New boiler approved in Mod 18	Natural gas is fed through to the dryers for combustion												
Stack height (m)	25	40	41	54	25	24	25.5	27	21	30	25	35	29	29	20	20	33.5	30	19
Exhaust temp. (K)	453	475	436	403	453	527	344	337	347	345	320	346	341	346	309	312	341	341	344
Stack diameter (m)	0.9	0.7	0.9	2.1	1.0	1.7	3.2	3.2	2.5	2.7	1.2	1.7	1.8	1.9	1.2	1.2	2.4	2.4	1.4
Exhaust velocity (m/s)	25.0	27.7	28.4	14.5	25.0	10.3	14.0	17.0	11.0	21.0	10.0	20.0	19.0	20.0	23.0	22.0	2.9	14.7	8.0
Oxygen (%)	ND	10.9	15	8.5	ND	ND	20.9	20.9	20.9	20.6	ND	20.9	20.9	ND	20.9	20.9	ND	ND	20.5
Moisture (%)	ND	5	4	5.7	ND	ND	7.3	5.9	6.3	6.4	ND	7.0	6.5	ND	5.8	3.2	ND	ND	3.5
Exhaust Flow rate, actual (m3/s)	ND	9.2	20	48.0	ND	ND	19.3	20.5	15.1	28.6	ND	27.2	25.3	ND	28.0	26.2	ND	ND	12.1
Ratio (Actual to normalised flow)	ND	1.8	1.7	1.5	ND	ND	1.4	1.2	1.4	1.4	ND	1.4	1.3	ND	1.2	1.2	ND	ND	1.3
<b>Emission rate (g/s)</b>																			
CO	0.96	0.48	3.6	3.3	0.75	1.5	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.0023	0.012	0.014
SO <sub>2</sub>	0.013	2.4	5.5	19	0.010	0.020	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00011	0.00055	0.00066
NO <sub>2</sub>	0.57	2.4	8.7	17	0.45	0.88	0.12	0.024	0.43	0.060	0.075	0.10	0.062	0.23	0.038	0.036	0.016	0.082	0.048
VOC	0.063	0.010	0.19	0.19	0.049	0.098	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (As) Type I	-	4.2E-05	1.8E-04	1.7E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Cd) Type I	2.3E-06	4.9E-05	3.3E-04	1.7E-04	1.8E-06	3.5E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Pb) Type I	1.3E-05	2.4E-06	5.1E-06	4.1E-06	9.8E-06	2.0E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Hg) Type I	5.7E-06	1.6E-04	4.3E-04	5.9E-04	4.5E-06	8.8E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium (Be) Type II	2.9E-06	1.0E-05	1.4E-05	2.5E-05	2.3E-06	4.6E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Cr) Type II	1.4E-08	3.1E-06	1.4E-05	2.5E-05	1.1E-08	2.1E-08	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (Co) Type II	1.6E-05	2.7E-05	1.0E-04	5.9E-05	1.3E-05	2.5E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese (Mn) Type II	9.2E-07	1.1E-05	4.8E-05	8.2E-05	7.3E-07	1.4E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Ni) Type II	4.3E-06	7.2E-05	1.7E-04	2.3E-04	3.4E-06	6.7E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Se) Type II	2.4E-05	6.7E-05	3.2E-04	2.9E-04	1.9E-05	3.7E-05	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)	2.7E-07	6.0E-05	3.9E-04	1.7E-04	2.1E-07	4.2E-07	-	-	-	-	-	-	-	-	-	-	-	-	-



Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 7	Boiler No. 8G	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No .6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5
Emission rates, normalised (mg/m³)																			
CO	60.2	51.8	197.4	68.1	38.3	64.1	0.1	0.1	0.3	0.1	1.3	0.3	0.3	0.3	0.5	0.6	0.2	0.2	1.2
SO <sub>2</sub>	0.8	262.1	307.1	404.7	0.5	0.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
NO <sub>2</sub>	35.7	259.1	480.3	360.6	22.7	38.0	1.1	0.2	8.0	0.5	6.6	2.2	1.3	4.0	1.5	1.4	1.3	1.3	4.2
TSP	5.3	9.4	11.5	5.0	3.4	5.6	0.1	0.1	0.4	0.2	1.0	0.4	0.7	0.4	1.5	2.3	5.0	5.0	0.2
Type 1 and 2 metals (combined)	0.004	0.051	0.101	0.034	0.003	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.0008	0.0003	0.0003	0.0001	0.0005	0.0008	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.0002	0.0011	0.0008	0.0005	0.0001	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC	3.9	1.1	10.8	3.9	2.5	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-
The emission rate limits are as follows: Protection of the Environment Operations (Clean Air) Regulation (2010): CO: 125 mg/m³, SO <sub>2</sub> : 1000 mg/m³, NO <sub>2</sub> : 500 mg/m³, TSP: 50 mg/m³, Type 1 and 2 metals (combined): 1 mg/m³, Cadmium: 0.2 mg/m³, Mercury: 0.2 mg/m³, VOC: 40 mg/m³, HCL: 100 mg/m³, FL: 50 mg/m³ EPA: SO <sub>2</sub> : 600 mg/m³, NO <sub>2</sub> : 500 mg/m³, TSP: 30 mg/m³, Type 1 and 2 metals (combined): 1 mg/m³, Cadmium: 0.2 mg/m³, Mercury: 0.2 mg/m³, VOC: 40 mg/m³.																			

## 8.2 Dispersion modelling

The air quality dispersion modelling was conducted using the Gaussian puff model CALPUFF Version 7. The model settings were as described in Section 8.2.

## 8.3 Predicted air quality impacts

### 8.3.1 Particulates

#### 8.3.1.1 Incremental particulate matter

The impact of dust emissions principally relates to the potential effect on human health of inhalation of particles in the air column, and it is the finer fraction that have the greater potential to cause respiratory health effects. EPA have advised to assess PM<sub>2.5</sub>, if PM<sub>10</sub> impacts are significant. As the boilers are proposed to be converted to gas fired, it is anticipated that particulate emissions would be primarily composed of finer fraction particulates.

The PM<sub>2.5</sub> emissions from some sources on site are not known, however guidance is available for estimates of PM<sub>2.5</sub> from gas fired boilers in the NPI. NPI emission factors for gas fired boilers state that PM<sub>2.5</sub> emissions are equal to that of PM<sub>10</sub> emissions. Therefore a ratio of PM<sub>10</sub> to PM<sub>2.5</sub> emissions of 1:1 was adopted.

A summary of the maximum incremental predicted levels at each receptor site for Mod 21 base and mitigation scenarios is presented in Table 8.5. The worst case predicted incremental 24 hour PM<sub>10</sub> level at a residential sensitive receptors is at R1 with a level of 7.7 µg/m<sup>3</sup> for the base scenario and 7.6 µg/m<sup>3</sup> for the mitigation scenario.

**Table 8.5** Maximum predicted incremental ground level TSP, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations (base and mitigation scenario)

Receptor	Base scenario					Mitigation scenario				
Pollutant	TSP	PM <sub>10</sub>		PM <sub>2.5</sub>		TSP	PM <sub>10</sub>		PM <sub>2.5</sub>	
Averaging period	Annual	24 hour	Annual	24 hour	Annual	Annual	24 hour	Annual	24 hour	Annual
Criteria µg/m <sup>3</sup>	90	50	25	25	8	90	50	25	25	8
R1	0.7	7.5	0.6	7.5	0.6	0.7	7.6	0.7	7.6	0.7
R2	0.4	3.8	0.3	3.8	0.3	0.4	3.9	0.4	3.9	0.4
R3	0.6	5.0	0.6	5.0	0.6	0.6	5.2	0.6	5.2	0.6
R4	0.9	4.4	0.9	4.4	0.9	0.9	4.4	0.9	4.4	0.9
C1	2.0	12.0	1.6	12.0	1.6	2.1	12.8	1.7	12.8	1.7
C2	2.8	15.5	2.5	15.5	2.5	2.9	16.0	2.6	16.0	2.6
C3	2.6	15.8	2.4	15.8	2.4	2.7	16.2	2.5	16.2	2.5
C4	2.3	15.2	2.1	15.2	2.1	2.3	15.4	2.1	15.4	2.1
C5	1.9	12.6	1.7	12.6	1.7	1.9	12.7	1.8	12.7	1.8
C6	3.2	16.5	2.9	16.5	2.9	3.3	16.7	3.1	16.7	3.1
C7	2.7	15.7	2.5	15.7	2.5	2.8	16.4	2.6	16.4	2.6

### 8.3.1.2 Cumulative particulate matter (base scenario)

A contemporaneous assessment has been undertaken for the year 2004 in accordance with the Approved Methods. Predicted 24 hour PM<sub>2.5</sub> and PM<sub>10</sub> values from the site in 2004 have been added to the 24 hour measured values at Wollongong for every day in the year. Predicted cumulative particulate matter concentrations for the base scenario are presented in this section while those for the mitigation scenario are presented in Section 8.3.1.3.

The top predicted, measured and total concentrations at the most impacted residential receptor (R1) and commercial receptor (C6) for Mod 21 base scenario are presented in Table 8.6 to Table 8.9 below. The background and incremental contributions for the highest cumulative concentrations are also included.

Results of the assessment show full compliance with the PM<sub>2.5</sub> and PM<sub>10</sub> 24 hour criteria at the worst impacted residential sensitive receptor R1.

Results of the assessment predict exceedances of the PM<sub>10</sub> 24 hour criteria for three days and the PM<sub>2.5</sub> 24 hour criteria for four days of the year at the worst impacted commercial receptor C6. The exceedances are bold in Table 8.8 and Table 8.9. The exceedances are primarily attributed to high background concentrations as background PM<sub>10</sub> accounts for 94%, 92% and 97% of the criteria and background PM<sub>2.5</sub> accounts for 89%, 80%, 58% and 65% of the criteria on the days of the predicted exceedances.

Plots of the predicted 24 hour maximum PM<sub>10</sub> levels are provided in Figure 8.1 (incremental impact) and in Figure 8.2 (cumulative impact with 70<sup>th</sup> percentile PM<sub>10</sub> levels at Albion Park South 2016 for comparative purposes).

Plots of the predicted 24 hour maximum PM<sub>2.5</sub> levels are provided in Figure 8.3 (cumulative impact with 70<sup>th</sup> percentile PM<sub>2.5</sub> levels at Albion Park South 2016 for comparative purposes).

**Table 8.6** Summary of highest measured and predicted PM<sub>10</sub> levels, µg/m<sup>3</sup> (at receptor R1)

Top 10 PM <sub>10</sub> background		Top 10 PM <sub>10</sub> incremental		Top 10 PM <sub>10</sub> cumulative			
Date	PM <sub>10</sub> background	Date	PM <sub>10</sub> increment	Date	PM <sub>10</sub> cumulative	Background contribution	Site contribution
08/03/2004	49.0	10/03/2004	7.5	08/03/2004	49.0	49.0	0.0
27/11/2004	48.4	22/03/2004	6.6	26/03/2004	48.7	46.1	2.6
21/02/2004	47.0	17/08/2004	4.3	27/11/2004	48.7	48.4	0.3
26/03/2004	46.1	23/09/2004	3.6	21/02/2004	47.8	47.0	0.8
08/12/2004	43.7	01/03/2004	3.4	09/02/2004	44.3	43.1	1.2
10/01/2004	43.4	28/03/2004	3.3	08/12/2004	43.8	43.7	0.1
09/02/2004	43.1	04/04/2004	3.3	10/01/2004	43.4	43.4	0.0
06/02/2004	41.2	22/01/2004	3.2	06/02/2004	42.7	41.2	1.5
07/12/2004	40.8	09/11/2004	3.1	07/12/2004	41.3	40.8	0.5
20/02/2004	40.4	16/10/2004	3.0	22/01/2004	41.2	38.0	3.2

**Table 8.7** Summary of highest measured and predicted PM<sub>2.5</sub> levels, µg/m<sup>3</sup> (at receptor R1)

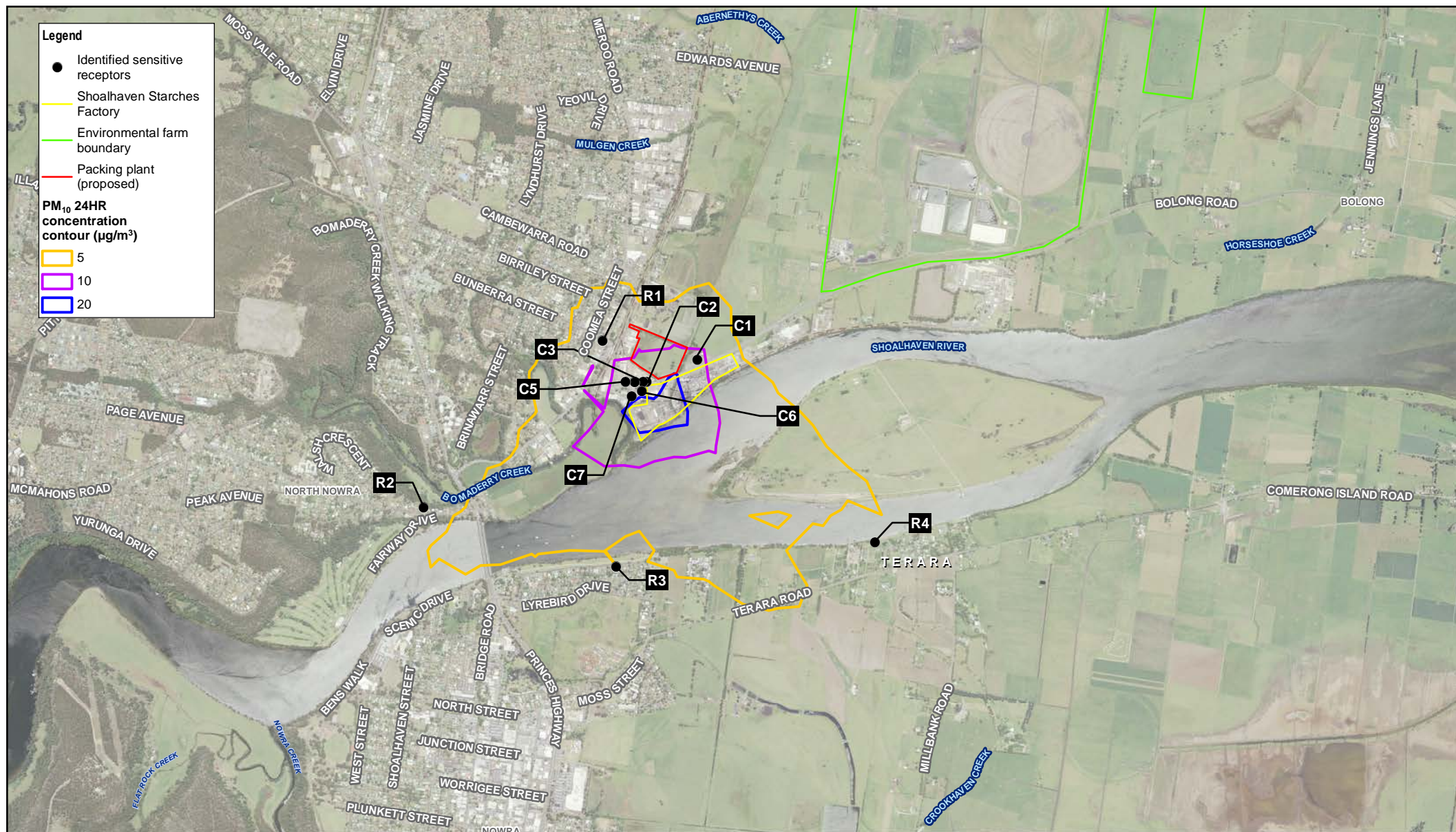
Top 10 PM <sub>2.5</sub> background		Top 10 PM <sub>2.5</sub> incremental		Top 10 PM <sub>2.5</sub> cumulative			
Date	PM <sub>2.5</sub> background	Date	PM <sub>2.5</sub> increment	Date	PM <sub>2.5</sub> cumulative	Background contribution	Site contribution
10/01/2004	22.6	10/03/2004	7.5	21/02/2004	23.1	22.3	0.8
21/02/2004	22.3	22/03/2004	6.6	10/01/2004	22.6	22.6	0.0
26/03/2004	19.9	17/08/2004	4.3	26/03/2004	22.5	19.9	2.6
06/02/2004	19.0	23/09/2004	3.6	06/02/2004	20.5	19.0	1.5
09/02/2004	18.3	01/03/2004	3.4	09/02/2004	19.5	18.3	1.2
11/02/2004	17.9	28/03/2004	3.3	11/02/2004	18.9	17.9	1.0
09/03/2004	17.6	04/04/2004	3.3	13/03/2004	17.9	17.0	0.9
08/03/2004	17.5	22/01/2004	3.2	07/05/2004	17.8	16.1	1.7
08/03/2004	17.5	09/11/2004	3.1	27/11/2004	17.8	17.5	0.3
13/03/2004	17.0	16/10/2004	3.0	07/02/2004	17.7	16.2	1.5

**Table 8.8** Summary of highest measured and predicted PM<sub>10</sub> levels, µg/m<sup>3</sup> (at receptor C6)

Top 10 PM <sub>10</sub> background		Top 10 PM <sub>10</sub> incremental		Top 10 PM <sub>10</sub> cumulative			
Date	PM <sub>10</sub> background	Date	PM <sub>10</sub> increment	Date	PM <sub>10</sub> cumulative	Background contribution	Site contribution
08/03/2004	49.0	22/03/2004	16.5	21/02/2004	<b>55.5</b>	47.0	8.5
27/11/2004	48.4	10/03/2004	14.0	26/03/2004	<b>53.1</b>	46.1	7.0
21/02/2004	47.0	25/02/2004	12.7	27/11/2004	<b>51.7</b>	48.4	3.3
26/03/2004	46.1	20/10/2004	12.2	08/03/2004	49.0	49.0	0.0
08/12/2004	43.7	20/03/2004	11.6	09/02/2004	46.0	43.1	2.9
10/01/2004	43.4	17/08/2004	11.1	08/12/2004	45.9	43.7	2.2
09/02/2004	43.1	02/03/2004	10.9	22/01/2004	45.8	38.0	7.8
06/02/2004	41.2	19/10/2004	10.7	07/12/2004	44.5	40.8	3.7
07/12/2004	40.8	09/11/2004	10.6	06/02/2004	44.1	41.2	2.9
20/02/2004	40.4	18/10/2004	10.1	10/01/2004	43.4	43.4	0.0

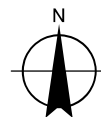
**Table 8.9** Summary of highest measured and predicted PM<sub>2.5</sub> levels, µg/m<sup>3</sup> (at receptor C6)

Top 10 PM <sub>2.5</sub> background		Top 10 PM <sub>2.5</sub> incremental		Top 10 PM <sub>2.5</sub> cumulative			
Date	PM <sub>2.5</sub> background	Date	PM <sub>2.5</sub> increment	Date	PM <sub>2.5</sub> cumulative	Background contribution	Site contribution
10/01/2004	22.6	22/03/2004	16.5	21/02/2004	<b>30.8</b>	22.3	8.5
21/02/2004	22.3	10/03/2004	14.0	26/03/2004	<b>26.9</b>	19.9	7.0
26/03/2004	19.9	25/02/2004	12.7	20/03/2004	<b>26.1</b>	14.5	11.6
06/02/2004	19.0	20/10/2004	12.2	07/02/2004	<b>25.1</b>	16.2	8.9
09/02/2004	18.3	20/03/2004	11.6	13/03/2004	23.7	17.0	6.7
11/02/2004	17.9	17/08/2004	11.1	10/03/2004	22.9	8.9	14.0
09/03/2004	17.6	02/03/2004	10.9	11/02/2004	22.8	17.9	4.9
08/03/2004	17.5	19/10/2004	10.7	10/01/2004	22.6	22.6	0.0
08/03/2004	17.5	09/11/2004	10.6	03/04/2004	22.4	12.5	9.9
13/03/2004	17.0	18/10/2004	10.1	06/02/2004	21.9	19.0	2.9



Paper Size ISO A4  
0 150 300 450 600 750 900  
Metres

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



Manildra Group Pty Ltd  
Shoalhaven Starches

**Maximum Predicted Incremental  
Ground Level PM<sub>10</sub> Concentrations  
(24-hour Average) (base scenario)**

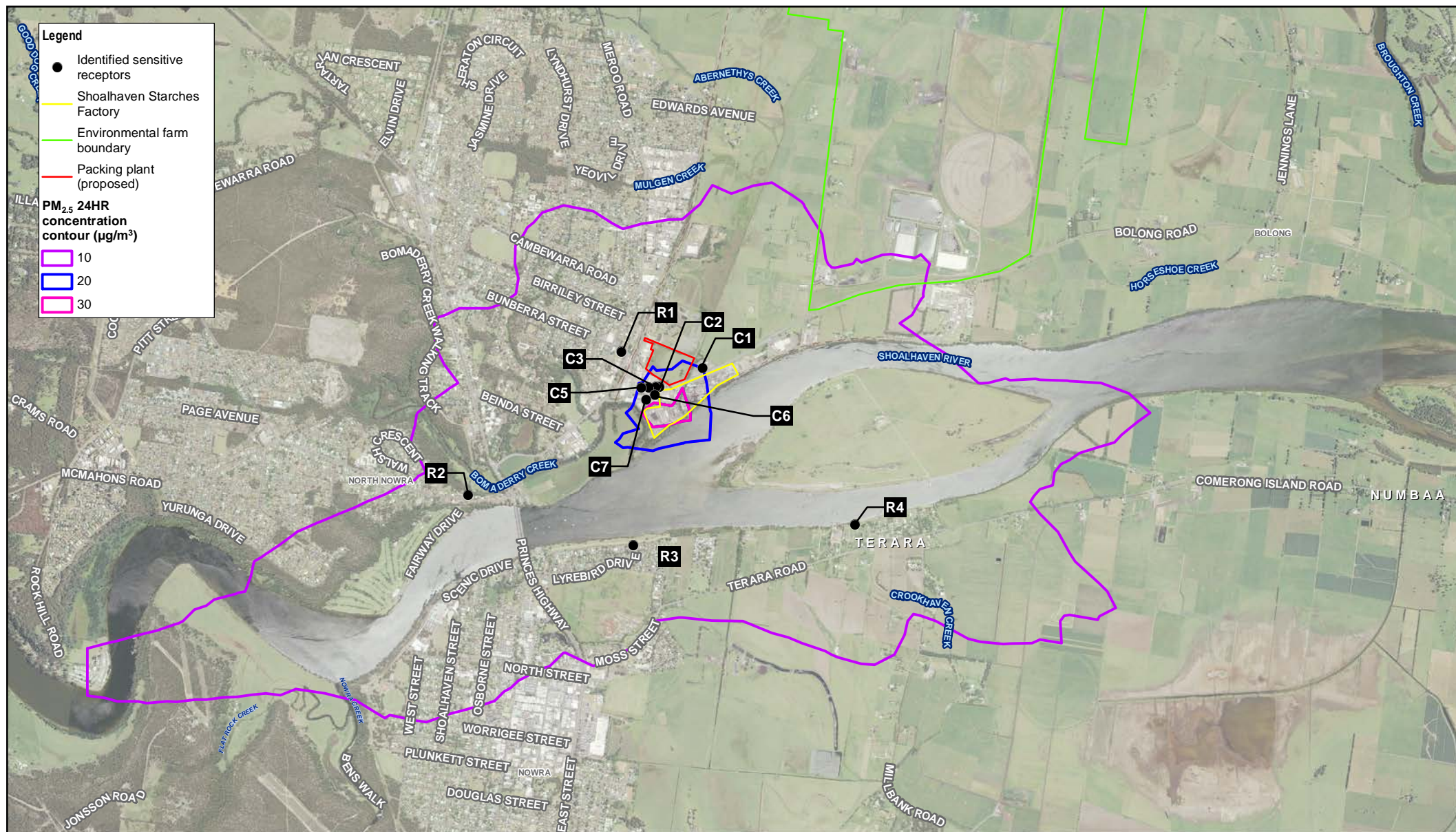
Project No. 12548374  
Revision No. 0  
Date 30 Jun 2021

**FIGURE 8.1**



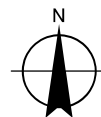






Paper Size ISO A4  
0 200 400 600 800 1,000 1,200  
Metres

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



Manildra Group Pty Ltd  
Shoalhaven Starches

**Maximum Predicted Cumulative  
Ground Level PM<sub>2.5</sub> Concentrations  
(24-hour Average) (base scenario)**

Project No. 12548374  
Revision No. 0  
Date 30 Jun 2021

**FIGURE 8.3**



### 8.3.1.3 Cumulative particulate matter (mitigation scenario)

The top predicted, measured and total concentrations at the most impacted residential receptor (R1) and commercial receptor (C6) for Mod 21 mitigation scenario are presented in Table 8.6 to Table 8.9 below. The background and incremental contributions for the highest cumulative concentrations are also included.

Results of the assessment show full compliance with the PM<sub>2.5</sub> and PM<sub>10</sub> 24 hour criteria at the worst impacted residential sensitive receptor R1.

Results of the assessment predict exceedances of the PM<sub>10</sub> 24 hour criteria for three days and the PM<sub>2.5</sub> 24 hour criteria for four days of the year at the worst impacted commercial receptor C6. The exceedances are bold in Table 8.8 and Table 8.9. Similarly to the results presented in Section 8.3.1.2, the exceedances are primarily attributed to high background concentrations as background PM<sub>10</sub> accounts for 94%, 92% and 97% of the criteria and background PM<sub>2.5</sub> accounts for 89%, 80%, 58% and 65% of the criteria on the days of the predicted exceedances.

Plots of the predicted 24 hour maximum PM<sub>10</sub> levels are provided in Figure 8.4 (incremental impact) and in Figure 8.5 (cumulative impact with 70<sup>th</sup> percentile PM<sub>10</sub> levels at Albion Park South 2016 for comparative purposes).

Plots of the predicted 24 hour maximum PM<sub>2.5</sub> levels are provided in Figure 8.6 (cumulative impact with 70<sup>th</sup> percentile PM<sub>2.5</sub> levels at Albion Park South 2016 for comparative purposes).

**Table 8.10** Summary of highest measured and predicted PM<sub>10</sub> levels, µg/m<sup>3</sup> (at receptor R1)

Top 10 PM <sub>10</sub> background		Top 10 PM <sub>10</sub> incremental		Top 10 PM <sub>10</sub> cumulative			
Date	PM <sub>10</sub> background	Date	PM <sub>10</sub> increment	Date	PM <sub>10</sub> cumulative	Background contribution	Site contribution
08/03/2004	49.0	10/03/2004	7.6	08/03/2004	49.0	49.0	0.0
27/11/2004	48.4	22/03/2004	6.8	26/03/2004	48.8	46.1	2.7
21/02/2004	47.0	17/08/2004	4.4	27/11/2004	48.7	48.4	0.3
26/03/2004	46.1	23/09/2004	3.7	21/02/2004	47.8	47.0	0.8
08/12/2004	43.7	01/03/2004	3.5	09/02/2004	44.4	43.1	1.3
10/01/2004	43.4	04/04/2004	3.4	08/12/2004	43.8	43.7	0.1
09/02/2004	43.1	22/01/2004	3.3	10/01/2004	43.4	43.4	0.0
06/02/2004	41.2	28/03/2004	3.3	06/02/2004	42.7	41.2	1.5
07/12/2004	40.8	09/11/2004	3.3	22/01/2004	41.3	38.0	3.3
20/02/2004	40.4	16/10/2004	3.1	07/12/2004	41.3	40.8	0.5

**Table 8.11** Summary of highest measured and predicted PM<sub>2.5</sub> levels, µg/m<sup>3</sup> (at receptor R1)

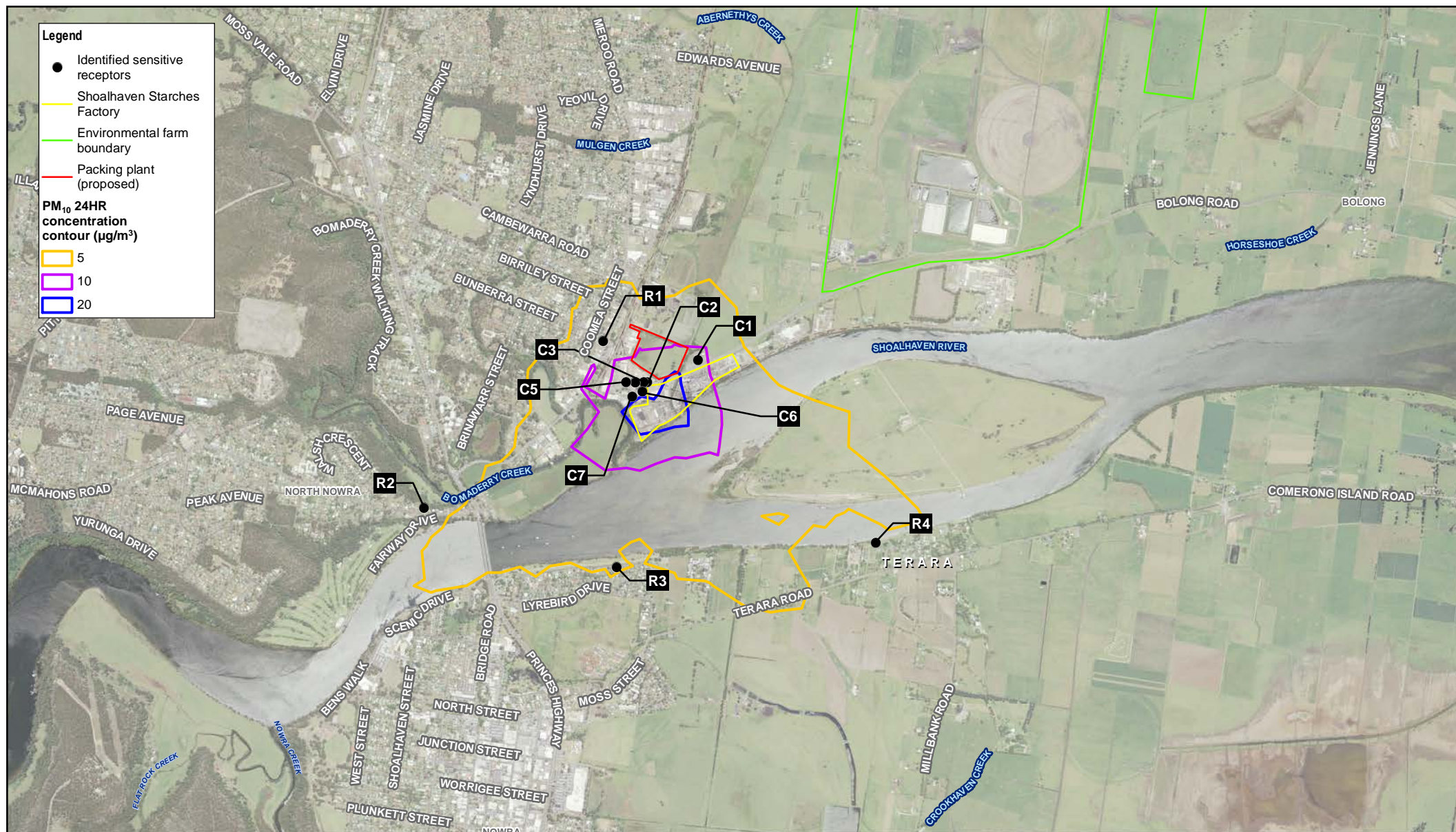
Top 10 PM <sub>2.5</sub> background		Top 10 PM <sub>2.5</sub> incremental		Top 10 PM <sub>2.5</sub> cumulative			
Date	PM <sub>2.5</sub> background	Date	PM <sub>2.5</sub> increment	Date	PM <sub>2.5</sub> cumulative	Background contribution	Site contribution
10/01/2004	22.6	10/03/2004	7.6	21/02/2004	23.1	22.3	0.8
21/02/2004	22.3	22/03/2004	6.8	10/01/2004	22.6	22.6	0.0
26/03/2004	19.9	17/08/2004	4.4	26/03/2004	22.6	19.9	2.7
06/02/2004	19.0	23/09/2004	3.7	06/02/2004	20.5	19.0	1.5
09/02/2004	18.3	01/03/2004	3.5	09/02/2004	19.6	18.3	1.3
11/02/2004	17.9	04/04/2004	3.4	11/02/2004	18.9	17.9	1.0
09/03/2004	17.6	22/01/2004	3.3	13/03/2004	18.0	17.0	1.0
08/03/2004	17.5	28/03/2004	3.3	07/05/2004	17.9	16.1	1.8
08/03/2004	17.5	09/11/2004	3.3	27/11/2004	17.8	17.5	0.3
13/03/2004	17.0	16/10/2004	3.1	07/02/2004	17.8	16.2	1.6

**Table 8.12** Summary of highest measured and predicted PM<sub>10</sub> levels, µg/m<sup>3</sup> (at receptor C6)

Top 10 PM <sub>10</sub> background		Top 10 PM <sub>10</sub> incremental		Top 10 PM <sub>10</sub> cumulative			
Date	PM <sub>10</sub> background	Date	PM <sub>10</sub> increment	Date	PM <sub>10</sub> cumulative	Background contribution	Site contribution
08/03/2004	49.0	22/03/2004	16.7	21/02/2004	<b>56.1</b>	47.0	9.1
27/11/2004	48.4	10/03/2004	14.0	26/03/2004	<b>53.5</b>	46.1	7.4
21/02/2004	47.0	25/02/2004	13.7	27/11/2004	<b>51.9</b>	48.4	3.5
26/03/2004	46.1	20/10/2004	12.7	08/03/2004	49.0	49.0	0.0
08/12/2004	43.7	20/03/2004	11.7	08/12/2004	46.1	43.7	2.4
10/01/2004	43.4	17/08/2004	11.6	09/02/2004	46.0	43.1	2.9
09/02/2004	43.1	19/10/2004	11.6	22/01/2004	46.0	38.0	8.0
06/02/2004	41.2	02/03/2004	11.5	07/12/2004	44.7	40.8	3.9
07/12/2004	40.8	09/11/2004	11.0	06/02/2004	44.1	41.2	2.9
20/02/2004	40.4	18/10/2004	10.7	10/01/2004	43.4	43.4	0.0

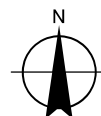
**Table 8.13** Summary of highest measured and predicted PM<sub>2.5</sub> levels, µg/m<sup>3</sup> (at receptor C6)

Top 10 PM <sub>2.5</sub> background		Top 10 PM <sub>2.5</sub> incremental		Top 10 PM <sub>2.5</sub> cumulative			
Date	PM <sub>2.5</sub> background	Date	PM <sub>2.5</sub> increment	Date	PM <sub>2.5</sub> cumulative	Background contribution	Site contribution
10/01/2004	22.6	22/03/2004	16.7	21/02/2004	<b>31.4</b>	22.3	9.1
21/02/2004	22.3	10/03/2004	14.0	26/03/2004	<b>27.3</b>	19.9	7.4
26/03/2004	19.9	25/02/2004	13.7	20/03/2004	<b>26.2</b>	14.5	11.7
06/02/2004	19.0	20/10/2004	12.7	07/02/2004	<b>25.5</b>	16.2	9.3
09/02/2004	18.3	20/03/2004	11.7	13/03/2004	24.2	17.0	7.2
11/02/2004	17.9	17/08/2004	11.6	10/03/2004	22.9	8.9	14.0
09/03/2004	17.6	19/10/2004	11.6	03/04/2004	22.8	12.5	10.3
08/03/2004	17.5	02/03/2004	11.5	11/02/2004	22.8	17.9	4.9
08/03/2004	17.5	09/11/2004	11.0	10/01/2004	22.6	22.6	0.0
13/03/2004	17.0	18/10/2004	10.7	18/02/2004	22.2	16.0	6.2



Paper Size ISO A4  
0 150 300 450 600 750 900  
Metres

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



Manildra Group Pty Ltd  
Shoalhaven Starches

**Maximum Predicted Incremental  
Ground Level PM<sub>10</sub> Concentrations  
(24-hour Average) (mitigation scenario)**

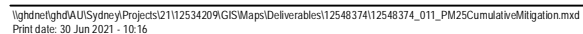
Project No. 12548374  
Revision No. 0  
Date 30 Jun 2021

**FIGURE 8.4**









## 8.3.2 Products of combustion

The primary pollutants in coal and gas fired boiler emissions are oxides of nitrogen (NO<sub>x</sub>), formed by the high temperatures in the combustors, carbon monoxide (CO), VOCs, and polycyclic aromatic hydrocarbons (PAH) all formed by incomplete combustion of the fuel.

All pollutants have all been assessed against their relevant criteria from the Approved Methods.

Predicted levels for SO<sub>2</sub>, NO<sub>2</sub>, CO, HF and HCL for base and mitigation scenarios are provided in Table 8.14 to Table 8.23.

For the base scenario:

- Compliance was predicted at all receptors for SO<sub>2</sub>, CO, HF and HCL
- The predicted levels for nitrogen dioxide exceed the criteria at all receptors assuming 100% of NO<sub>x</sub> will be converted to NO<sub>2</sub> as per Method 1 (Section 8.1.1) of the Approved Methods. This is considered extremely conservative as in reality, only a fraction of the NO will be converted to NO<sub>2</sub>.
- Therefore, a more detailed assessment has been undertaken using Method 2 (Section 8.2.2) of the Approved Methods. Method 2 is based on NO reacting with ozone in the atmosphere to form NO<sub>2</sub>. Background ozone data was sourced from Kembla Grange for the year 2004. The calculated NO<sub>2</sub> levels using Method 2 are provided in Table 8.16. Using this method exceedances are predicted at commercial/industrial sensitive receptor C1 for two hours of the modelled year (0.02% of the time) and at receptor C2 for one hour of the modelled year C2 (0.05% of the time).

For the mitigation scenario:

- Compliance was predicted at all receptors for SO<sub>2</sub>, CO, HF and HCL
- The predicted levels for nitrogen dioxide exceed the criteria at commercial/industrial sensitive receptors C1, C2, C3, C6 and C7 assuming 100% of NO<sub>x</sub> will be converted to NO<sub>2</sub> as per Method 1 of the Approved Methods.
- Compliance was predicted at all receptors for NO<sub>2</sub> using Method 2 of the Approved Methods.

### Effect of Mod 21 changes

Minor variances between Mod 21 base scenario and previous Mod 19 were predicted. These variances were attributed to fluctuations in combustion emission sampling data.

The Mod 21 mitigation scenario was predicted to reduce combustion pollutant impacts compared with Mod 21 base scenario. This is attributed to Mod 21 mitigation scenario use of gas as a fuel source to replace coal as air emissions from gas are typically lower than coal.

**Table 8.14** Maximum predicted ground level Sulfur Dioxide concentrations (base scenario)

Receptor	Total impact (Incremental plus background) (µg/m³)			
Criteria, µg/m³	712 (10 min¹)	570 (1 hour)	228 (24 hour)	60 (Annual)
Background, µg/m³	No data²	57.6	15.7	1.6
Bomaderry (R1)	241.0	185.8	46.8	5.1
North Nowra (R2)	182.5	144.9	41.7	3.6
Nowra (R3)	218.4	170.0	34.3	2.6
Terara (R4)	170.5	136.5	24.4	2.2
C1	475.6	349.7	90.4	9.0
C2	552.6	403.5	69.8	9.7
C3	506.7	371.4	66.8	9.2
C4	427.1	315.9	64.8	8.4
C5	365.9	273.0	66.1	7.7
C6	467.5	344.0	75.0	10.0
C7	396.9	294.7	74.2	9.1

Note 1: The 10 minute concentrations were calculated from the hourly values by applying a peak to mean factor of  $(60/10)^{0.2}$ .

Note 2: The 10 minute background levels were assumed to be the same as the 1 hour background levels in the absence of monitoring data.

**Table 8.15** Maximum predicted ground level Sulfur Dioxide concentrations (mitigation scenario)

Receptor	Total impact (Incremental plus background) (µg/m³)			
Criteria, µg/m³	712 (10 min¹)	570 (1 hour)	228 (24 hour)	60 (Annual)
Background, µg/m³	No data²	57.6	15.7	1.6
Bomaderry (R1)	189.6	149.8	39.4	4.4
North Nowra (R2)	150.5	122.5	36.0	3.2
Nowra (R3)	202.1	158.6	35.7	2.6
Terara (R4)	143.1	117.3	24.5	2.2
C1	468.2	344.6	95.3	8.9
C2	429.4	317.4	65.4	9.0
C3	392.6	291.7	61.9	8.5
C4	329.0	247.3	64.4	7.6
C5	280.7	213.5	62.6	6.8
C6	381.1	283.6	75.7	9.5
C7	323.5	243.4	77.7	8.4

Note 1: The 10 minute concentrations were calculated from the hourly values by applying a peak to mean factor of  $(60/10)^{0.2}$ .

Note 2: The 10 minute background levels were assumed to be the same as the 1 hour background levels in the absence of monitoring data.



**Table 8.16** Maximum predicted ground level Nitrogen Dioxide concentrations (base scenario)

Receptor	Total impact (Incremental plus background) (µg/m³)		
Criteria, µg/m³	246 (1 hour, Method 1)	246 (1 hour, Method 2)	62 (Annual)
Background, µg/m³	80.8	n/a	7.1
Bomaderry (R1)	318.8	140.4	15.3
North Nowra (R2)	281.9	117.4	11.8
Nowra (R3)	369.7	199.6	10.9
Terara (R4)	323.4	183.2	9.9
C1	795.0	<b>268.1</b>	31.9
C2	795.6	<b>256.9</b>	34.1
C3	714.2	218.7	31.8
C4	615.3	167.4	27.9
C5	496.1	158.2	24.1
C6	714.7	178.2	35.4
C7	611.8	171.6	30.2

**Table 8.17** Maximum predicted ground level Nitrogen Dioxide concentrations (mitigation scenario)

Receptor	Total impact (Incremental plus background) (µg/m³)		
Criteria, µg/m³	246 (1 hour, Method 1)	246 (1 hour, Method 2)	62 (Annual)
Background, µg/m³	80.8	n/a	7.1
Bomaderry (R1)	110.9	109.4	10.9
North Nowra (R2)	89.5	98.3	9.4
Nowra (R3)	140.2	133.0	8.8
Terara (R4)	78.9	122.4	8.2
C1	374.4	236.7	19.2
C2	319.9	151.3	19.1
C3	286.5	149.8	18.1
C4	228.6	145.7	16.3
C5	185.6	141.9	14.8
C6	301.1	151.2	19.8
C7	246.8	142.2	17.6

**Table 8.18** Maximum predicted ground level Carbon Monoxide concentrations (base scenario)

Receptor	Total impact (Incremental plus background) (mg/m <sup>3</sup> )		
Criteria, µg/m <sup>3</sup>	100 (15 min <sup>1</sup> )	30 (1 hour)	10 (8 hour)
Background, µg/m <sup>3</sup>	No data <sup>2</sup>	1	0.6
Bomaderry (R1)	1.05	1.04	0.62
North Nowra (R2)	1.04	1.03	0.62
Nowra (R3)	1.05	1.04	0.62
Terara (R4)	1.03	1.02	0.61
C1	1.14	1.10	0.68
C2	1.14	1.11	0.67
C3	1.13	1.09	0.66
C4	1.10	1.08	0.65
C5	1.08	1.06	0.64
C6	1.13	1.10	0.66
C7	1.11	1.08	0.65

Note 1: The 15 minute concentrations were calculated from the hourly values by applying a peak to mean factor of (60/15)<sup>0.2</sup>.

Note 2: The 15 minute background levels were assumed to be the same as the 1 hour background levels in the absence of monitoring data.

**Table 8.19** Maximum predicted ground level Carbon Monoxide concentrations (mitigation scenario)

Receptor	Total impact (Incremental plus background) (mg/m <sup>3</sup> )		
Criteria, µg/m <sup>3</sup>	100 (15 min <sup>1</sup> )	30 (1 hour)	10 (8 hour)
Background, µg/m <sup>3</sup>	No data <sup>2</sup>	1	0.6
Bomaderry (R1)	1.05	1.04	0.62
North Nowra (R2)	1.05	1.04	0.62
Nowra (R3)	1.07	1.06	0.63
Terara (R4)	1.04	1.03	0.61
C1	1.17	1.13	0.70
C2	1.16	1.12	0.68
C3	1.14	1.11	0.67
C4	1.11	1.08	0.65
C5	1.09	1.07	0.65
C6	1.15	1.11	0.68
C7	1.13	1.10	0.66

Note 1: The 15 minute concentrations were calculated from the hourly values by applying a peak to mean factor of (60/15)<sup>0.2</sup>.

Note 2: The 15 minute background levels were assumed to be the same as the 1 hour background levels in the absence of monitoring data.

**Table 8.20**      *Maximum predicted ground level Hydrogen Fluoride concentrations (base scenario)*

Receptor	Total impact (Incremental plus background) (µg/m³)			
Criteria, µg/m³	1.5 (24 hour)	0.8 (7 day)	0.4 (30 day)	0.5 (90 day)
Background, µg/m³	No data	No data	No data	No data
Bomaderry (R1)	0.37	0.12	0.08	0.07
North Nowra (R2)	0.31	0.09	0.07	0.04
Nowra (R3)	0.20	0.03	0.02	0.02
Terara (R4)	0.09	0.02	0.01	0.01
C1	0.84	0.32	0.14	0.09
C2	0.61	0.24	0.16	0.14
C3	0.58	0.23	0.15	0.13
C4	0.53	0.22	0.14	0.11
C5	0.57	0.20	0.13	0.11
C6	0.64	0.28	0.18	0.15
C7	0.62	0.26	0.18	0.14

**Table 8.21**      *Maximum predicted ground level Hydrogen Fluoride concentrations (mitigation scenario)*

Receptor	Total impact (Incremental plus background) (µg/m³)			
Criteria, µg/m³	1.5 (24 hour)	0.8 (7 day)	0.4 (30 day)	0.5 (90 day)
Background, µg/m³	No data	No data	No data	No data
Bomaderry (R1)	0.27	0.08	0.06	0.05
North Nowra (R2)	0.23	0.07	0.06	0.03
Nowra (R3)	0.21	0.04	0.02	0.02
Terara (R4)	0.09	0.02	0.01	0.01
C1	0.86	0.32	0.14	0.09
C2	0.52	0.21	0.14	0.11
C3	0.49	0.20	0.13	0.11
C4	0.50	0.18	0.12	0.10
C5	0.49	0.17	0.10	0.09
C6	0.61	0.25	0.16	0.13
C7	0.62	0.23	0.15	0.12

**Table 8.22** 99.9 percentile predicted ground level Hydrogen Chloride concentrations (base scenario)

Receptor	Averaging Period	Incremental Impact (mg/m <sup>3</sup> )	Background Concentration (mg/m <sup>3</sup> )	Total Impact (mg/m <sup>3</sup> )	Criteria (mg/m <sup>3</sup> )
Bomaderry (R1)	1 hour	0.001	-	0.001	0.14
North Nowra (R2)	1 hour	0.001	-	0.001	0.14
Nowra (R3)	1 hour	0.001	-	0.001	0.14
Terara (R4)	1 hour	0.000	-	0.000	0.14
C1	1 hour	0.002	-	0.002	0.14
C2	1 hour	0.002	-	0.002	0.14
C3	1 hour	0.002	-	0.002	0.14
C4	1 hour	0.002	-	0.002	0.14
C5	1 hour	0.001	-	0.001	0.14
C6	1 hour	0.002	-	0.002	0.14
C7	1 hour	0.002	-	0.002	0.14

**Table 8.23** 99.9 percentile predicted ground level Hydrogen Chloride concentrations (mitigation scenario)

Receptor	Averaging Period	Incremental Impact (mg/m <sup>3</sup> )	Background Concentration (mg/m <sup>3</sup> )	Total Impact (mg/m <sup>3</sup> )	Criteria (mg/m <sup>3</sup> )
Bomaderry (R1)	1 hour	0.001	-	0.001	0.14
North Nowra (R2)	1 hour	0.000	-	0.000	0.14
Nowra (R3)	1 hour	0.000	-	0.000	0.14
Terara (R4)	1 hour	0.000	-	0.000	0.14
C1	1 hour	0.002	-	0.002	0.14
C2	1 hour	0.001	-	0.001	0.14
C3	1 hour	0.001	-	0.001	0.14
C4	1 hour	0.001	-	0.001	0.14
C5	1 hour	0.001	-	0.001	0.14
C6	1 hour	0.001	-	0.001	0.14
C7	1 hour	0.001	-	0.001	0.14

### 8.3.3 PAH, VOCs and metals

The maximum predicted (99.9 percentile, 1-hour average) ground level incremental PAH, VOC and metal concentrations (with the exception of lead which is presented as a 100 percentile annually averaged concentration to align with its assessment criteria), within and beyond the factory site boundary for the base and mitigation scenarios are provided in Table 8.24 and Table 8.25 respectively. The predicted levels are significantly lower than the respective EPA principal toxic air pollutant criteria for all substances both within and beyond the site boundary.

#### **Effect of Mod 21 changes**

No new sources of PAH, VOC or metal emissions are proposed as part of Mod 21 base scenario compared to those assessed in Mod 19. Minor variations in predicted concentrations for Mod 21 mitigation scenario are attributed to the proposed boilers operation and fuel usage changes.

**Table 8.24** Maximum predicted ground level PAH, VOC and metals concentrations (base scenario)

Receptor	Incremental Impact (mg/m <sup>3</sup> )										
Pollutant	PAH	VOC	Antimony	Arsenic	Cadmium	Mercury	Beryllium	Chromium	Manganese	Nickel	Lead
Criteria	4.00E-04 mg/m <sup>3</sup> (1 hour)	Individual VOCs (1 hour)	9.00E-03 mg/m <sup>3</sup> (1 hour)	9.00E-05 mg/m <sup>3</sup> (1 hour)	1.80E-05 mg/m <sup>3</sup> (1 hour)	1.80E-03 mg/m <sup>3</sup> (1 hour)	4.00E-06 mg/m <sup>3</sup> (1 hour)	9.00E-05 mg/m <sup>3</sup> (1 hour)	1.80E-02 mg/m <sup>3</sup> (1 hour)	1.80E-04 mg/m <sup>3</sup> (1 hour)	5.0E-04 mg/m <sup>3</sup> (Annual) <sup>8</sup>
Bomaderry (R1)	1.2E-06	1.4E-03	1.2E-06	1.7E-06	1.1E-07	1.8E-07	1.0E-07	6.6E-07	1.7E-06	2.1E-06	1.6E-07
North Nowra (R2)	1.0E-06	1.4E-03	1.2E-06	1.7E-06	1.0E-07	1.6E-07	8.3E-08	6.6E-07	1.6E-06	2.1E-06	9.5E-08
Nowra (R3)	1.6E-06	1.7E-03	1.3E-06	2.2E-06	1.6E-07	2.0E-07	7.8E-08	8.8E-07	1.9E-06	2.5E-06	5.9E-08
Terara (R4)	7.7E-07	9.9E-04	7.4E-07	1.1E-06	8.6E-08	1.3E-07	5.9E-08	4.6E-07	1.2E-06	1.4E-06	3.4E-08
C1	4.0E-06	4.9E-03	4.0E-06	6.0E-06	3.7E-07	5.9E-07	2.8E-07	2.4E-06	5.6E-06	7.3E-06	4.0E-07
C2	3.5E-06	4.5E-03	3.4E-06	5.2E-06	3.9E-07	5.2E-07	2.5E-07	2.2E-06	4.8E-06	6.4E-06	4.4E-07
C3	3.2E-06	4.2E-03	3.2E-06	4.7E-06	3.6E-07	4.8E-07	2.3E-07	2.0E-06	4.4E-06	5.8E-06	4.1E-07
C4	2.6E-06	3.3E-03	2.5E-06	3.7E-06	2.7E-07	3.9E-07	1.9E-07	1.5E-06	3.6E-06	4.7E-06	3.5E-07
C5	2.2E-06	2.7E-03	2.1E-06	3.0E-06	2.1E-07	3.1E-07	1.7E-07	1.2E-06	2.9E-06	3.8E-06	3.0E-07
C6	3.3E-06	4.4E-03	3.3E-06	5.0E-06	3.8E-07	5.0E-07	2.3E-07	2.1E-06	4.6E-06	6.1E-06	4.7E-07
C7	2.5E-06	3.2E-03	2.5E-06	3.6E-06	2.9E-07	3.7E-07	2.0E-07	1.5E-06	3.4E-06	4.5E-06	4.0E-07
Maximum level (on site)	7.8E-06	8.3E-03	6.7E-06	1.1E-05	1.3E-06	9.0E-07	3.6E-07	4.2E-06	8.9E-06	1.2E-05	6.7E-07

<sup>8</sup> Lead criteria converted from µg/m<sup>3</sup> to mg/m<sup>3</sup> so that all results have consistent units

**Table 8.25** Maximum predicted ground level PAH, VOC and metals concentrations (mitigation scenario)

Receptor	Incremental Impact (mg/m <sup>3</sup> )										
Pollutant	PAH	VOC	Antimony	Arsenic	Cadmium	Mercury	Beryllium	Chromium	Manganese	Nickel	Lead
Criteria	4.00E-04 mg/m <sup>3</sup> (1 hour)	Individual VOCs (1 hour)	9.00E-03 mg/m <sup>3</sup> (1 hour)	9.00E-05 mg/m <sup>3</sup> (1 hour)	1.80E-05 mg/m <sup>3</sup> (1 hour)	1.80E-03 mg/m <sup>3</sup> (1 hour)	4.00E-06 mg/m <sup>3</sup> (1 hour)	9.00E-05 mg/m <sup>3</sup> (1 hour)	1.80E-02 mg/m <sup>3</sup> (1 hour)	1.80E-04 mg/m <sup>3</sup> (1 hour)	5.0E-04 mg/m <sup>3</sup> (Annual) <sup>9</sup>
Bomaderry (R1)	4.4E-07	1.7E-03	1.2E-06	1.8E-06	1.3E-07	1.8E-07	1.1E-07	7.8E-07	1.4E-06	2.2E-06	1.5E-07
North Nowra (R2)	4.1E-07	1.8E-03	1.2E-06	2.0E-06	1.4E-07	1.7E-07	1.1E-07	8.1E-07	1.4E-06	2.3E-06	9.0E-08
Nowra (R3)	6.0E-07	2.6E-03	1.7E-06	2.8E-06	2.0E-07	2.5E-07	1.5E-07	1.2E-06	2.0E-06	3.4E-06	6.3E-08
Terara (R4)	3.1E-07	1.2E-03	8.3E-07	1.3E-06	1.0E-07	1.4E-07	7.6E-08	5.7E-07	9.9E-07	1.6E-06	3.5E-08
C1	1.5E-06	6.5E-03	4.8E-06	7.4E-06	4.3E-07	6.8E-07	4.5E-07	3.0E-06	5.6E-06	8.9E-06	4.3E-07
C2	1.3E-06	5.7E-03	3.9E-06	6.2E-06	4.6E-07	5.7E-07	3.5E-07	2.6E-06	4.5E-06	7.4E-06	4.4E-07
C3	1.2E-06	5.2E-03	3.5E-06	5.6E-06	4.2E-07	5.2E-07	3.2E-07	2.4E-06	4.1E-06	6.7E-06	4.1E-07
C4	9.7E-07	4.1E-03	2.8E-06	4.4E-06	3.3E-07	4.1E-07	2.5E-07	1.9E-06	3.2E-06	5.2E-06	3.5E-07
C5	8.0E-07	3.4E-03	2.3E-06	3.6E-06	2.6E-07	3.3E-07	2.0E-07	1.6E-06	2.7E-06	4.3E-06	3.0E-07
C6	1.3E-06	5.7E-03	3.7E-06	5.9E-06	4.6E-07	5.5E-07	3.4E-07	2.5E-06	4.3E-06	7.1E-06	4.8E-07
C7	9.4E-07	4.1E-03	2.7E-06	4.2E-06	3.5E-07	4.0E-07	2.5E-07	1.8E-06	3.1E-06	5.1E-06	4.1E-07
Maximum level (on site)	2.6E-06	1.1E-02	9.0E-06	1.5E-05	1.6E-06	1.3E-06	7.2E-07	5.5E-06	9.5E-06	1.6E-05	7.4E-07

<sup>9</sup> Lead criteria converted from µg/m<sup>3</sup> to mg/m<sup>3</sup> so that all results have consistent units

## 9. Conclusions

GHD was engaged by Manildra to conduct an air quality and odour impact assessment for a proposed modification to the approved SSEP. The modification proposes to modify the packing plant, install an additional raw waste water tank within the Environmental Farm and increase the indirect cooking capacity by 50%.

In addition, Manildra propose to install additional approved biofilter capacity in the previously approved location to improve odour performance. It is recommended that Manildra have additional biofilter capacity installed prior to commissioning of Mod 21.

Odour dispersion modelling was undertaken for the quarter with maximum odour emissions (in accordance with the methodology adopted for past modification air quality assessments) (Quarter 2) and for the most recent quarter (Quarter 3).

Modelling of the quarter 2 predicted a marginal increase in odour impacts resulting in an exceedance at residential receptors R2 and R3. This exceedance was primarily attributed to high quarterly odour sampling results.

Modelling of the most recent quarter 3 predicted compliance of the odour criteria at all residential receptors.

Dispersion modelling of particulates, combustion products, PAH, VOCs and metals was undertaken for base and mitigation scenarios.

For both base and mitigation scenarios, minor exceedances of the cumulative 24 hour PM<sub>10</sub> and PM<sub>2.5</sub> criteria were predicted at commercial receptor C1. These particular matter exceedances were primarily attributed to high background concentrations that occurred on the days where exceedances were predicted.

For the base scenario, nitrogen dioxide concentrations were predicted to exceed the criteria at commercial/industrial sensitive receptor C1 for two hours of the modelled year (0.02% of the time) and C2 for one hour of the modelled year C2 (0.05% of the time) for the base scenario. There were no predicted exceedances of the nitrogen dioxide criteria in the mitigation scenario where the use of coal boiler 8 was replaced with the use of gas boiler 7 and gas boiler 8.

Therefore it is recommended that Manildra investigate opportunities to use gas fired boilers instead of coal. It is understood that Manildra will be incorporating the conversion of coal fired boilers to gas as part of the future proposal to construct a gas fired co-generation plant as part of the future Modification 23.

Compliance was predicted for all other air quality species for both scenarios.



# Appendices

# **Appendix A**

**Meteorological analysis**

The following section is taken from the Shoalhaven Starches Report on Ethanol Upgrade: Air Quality Assessment (GHD, 2008), and describes the meteorology of the area and how the dataset was compiled.

## A1 Meteorology

The three-dimensional meteorological data for a CALPUFF model simulation are provided by CALMET<sup>10</sup>, its meteorological pre-processor. CALMET requires meteorological input from surface weather station networks and upper air stations.

The following sub-sections describe the available meteorological data, how the data was applied and the features of the dispersion meteorological data used to run CALPUFF.

### A1.1 Data Available

Wind data were collected at three locations within the Shoalhaven Starches facility. Of these three stations, only one station, the automated weather station (AWS) located near the storage ponds at the environmental farm (hereafter referred to as Farm AWS), is compliant with the Australian Standard for the measurement of horizontal wind for air quality applications (AS 2923:1987). The other two stations, in particular the weather station located at the factory, are compromised by building and equipment infrastructure. Wind data have been collected at the Farm AWS since 2003, with the most complete data set collected in 2004.

The nearest source of additional surface meteorological data was the Bureau of Meteorology (BoM) Nowra AWS located approximately 12 km to the west at the Royal Australian Navy base at Nowra (HMAS ALBATROSS). This data source was considered to be too far from the subject area to be site-representative.

The nearest source of upper air meteorological data was also the HMAS ALBATROSS site, which does irregular upper air soundings based on operational requirements. However, the time gap between these vertical atmospheric soundings is too large to be suitable for use as model input.

### A1.2 Data Application

To take full advantage of the CALPUFF features, described in Section 7.1, and make use of the available meteorological data described above, a combined prognostic/diagnostic meteorological modelling approach was used to synthesise the three-dimensional meteorological data input required by CALPUFF.

The regional-scale prognostic meteorological model, TAPM<sup>11</sup>, was used to simulate the meteorology over the subject site with consideration to the DECC *Approved Methods*. TAPM is an approved model for specialist applications and its use, as part of this assessment, is described in the next section.

The observations from the Farm AWS and Nowra AWS were first used for optimising and checking the performance of the prognostic model simulation.

Wind speed and wind direction data from the Farm AWS were then assimilated into the prognostic model.

The subsequent TAPM output (with assimilated Farm AWS data) was then passed to meteorological pre-processor model CALMET (version 5.5).

## A2 Prognostic Meteorological Modelling

TAPM (version 3.0.7) was developed at CSIRO Division of Atmospheric Research as a PC-based prognostic modelling system that can predict regional scale three-dimensional meteorology. TAPM accesses databases of synoptic weather analyses from the Bureau of Meteorology. The model then provides the link between the

<sup>10</sup> Scire J.S., E.M. Insley, R.J. Yamartino, and M.E. Fernau, 1995: A User's Guide for the CALMET Meteorological Model. Report prepared for the USDA Forest Service by EARTH TECH, Concord, MA. See: <http://www.src.com/calpuff/calpuff1.htm>

<sup>11</sup> Hurley, P. The Air Pollution Model (TAPM) version 3. CSIRO Atmospheric Research Paper No. 31, 2005

synoptic large-scale flows and local climatology, which includes characterising such factors as local land use and topography, and their influence on atmospheric stability and mixing height.

TAPM was initially configured with a nested model grid coverage designed to capture:

- Broad scale synoptic flows
- Regional to local scale wind channelling
- The influence of local land use

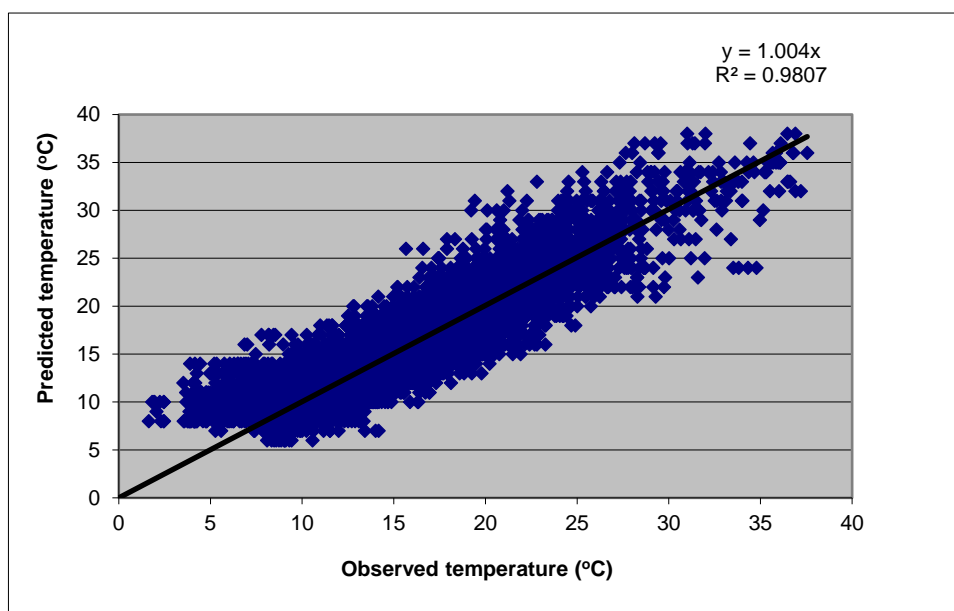
The nested grids were then configured with surface characteristics, such as terrain elevation, surface type (land use and vegetation type), soil type and deep soil moisture content.

Specific model settings were:

- Four nested grids at 1 000 m, 3 000 m, 10 000 m and 25 000 m resolution, with 55 x 55 grid points. The grid was set to ensure the locations of the Farm AWS and Nowra AWS were within the inner nested grid
- Surface vegetation and precipitation processes were included, whereas, non-hydrostatic processes were not included

Following an initial model run, the model output from the grid point nearest to the Farm AWS was compared with data recorded at that station. Specifically, the predicted hourly ambient temperatures and the annual wind rose (wind speed and direction distributions) were compared with corresponding recordings. Model output from the model grid point nearest to the Nowra AWS was also compared with an annual wind rose derived from data recorded at that station.

Figure A1 shows the scatter plot of observed and predicted ambient temperature at the Farm AWS. The determined optimal model configuration produced a correlation coefficient of 0.88 for predicted temperature. The strong correlation between predicted and recorded temperature indicates that the model is accurately calculating the surface energy balance, which, in turn, adds confidence to the hourly varying predictions made for atmospheric stability and the height of the mixed layer.



**Figure A1** Scatter Plot of Observed and Predicted Ambient Temperature

## A2.1 Wind Distribution

Figure A2 shows the predicted (a) and observed (b) wind roses for the location of the Nowra AWS. The directional distribution of winds predicted by TAPM shows reasonable agreement with the recorded observations and with the wind patterns expected for this region.

Figure A3 shows the predicted (a) and observed (b) wind roses for the location of the Farm AWS after the initial TAPM simulation. The directional distribution of winds predicted by TAPM shows reasonable agreement with the recorded wind patterns expected for this region.

The wind speed and direction observations from the Farm AWS were assimilated into the prognostic model simulation to improve the ability of the model to capture the effects of local wind channelling and low wind speed conditions. The improvement to wind direction distributions in the model output is clearly evident in Figure A3(c). The marked improvement in the capture of low wind events is examined below.

It is understood that TAPM performs reasonably well at simulating low wind speeds when the atmosphere is unstable but is known to perform relatively poorly during stable atmospheric conditions<sup>12</sup>. This is a critical factor in this assessment given that odour emissions occur 24-hours per day, resulting in predictions of maximum odour impact dominating during these conditions.

Figure A4 shows a histogram of wind speed distribution for observations at the Farm AWS, predictions from TAPM and predictions from TAPM after wind speed and direction data from the Farm AWS were assimilated into TAPM. It is clear from this figure that TAPM did reasonably well at originally predicting moderate to high wind speeds but did relatively poorly predicting low wind speeds. However, Figure A4 also shows that the representation of low winds in the TAPM output was significantly improved once the Farm AWS data were assimilated into the model.

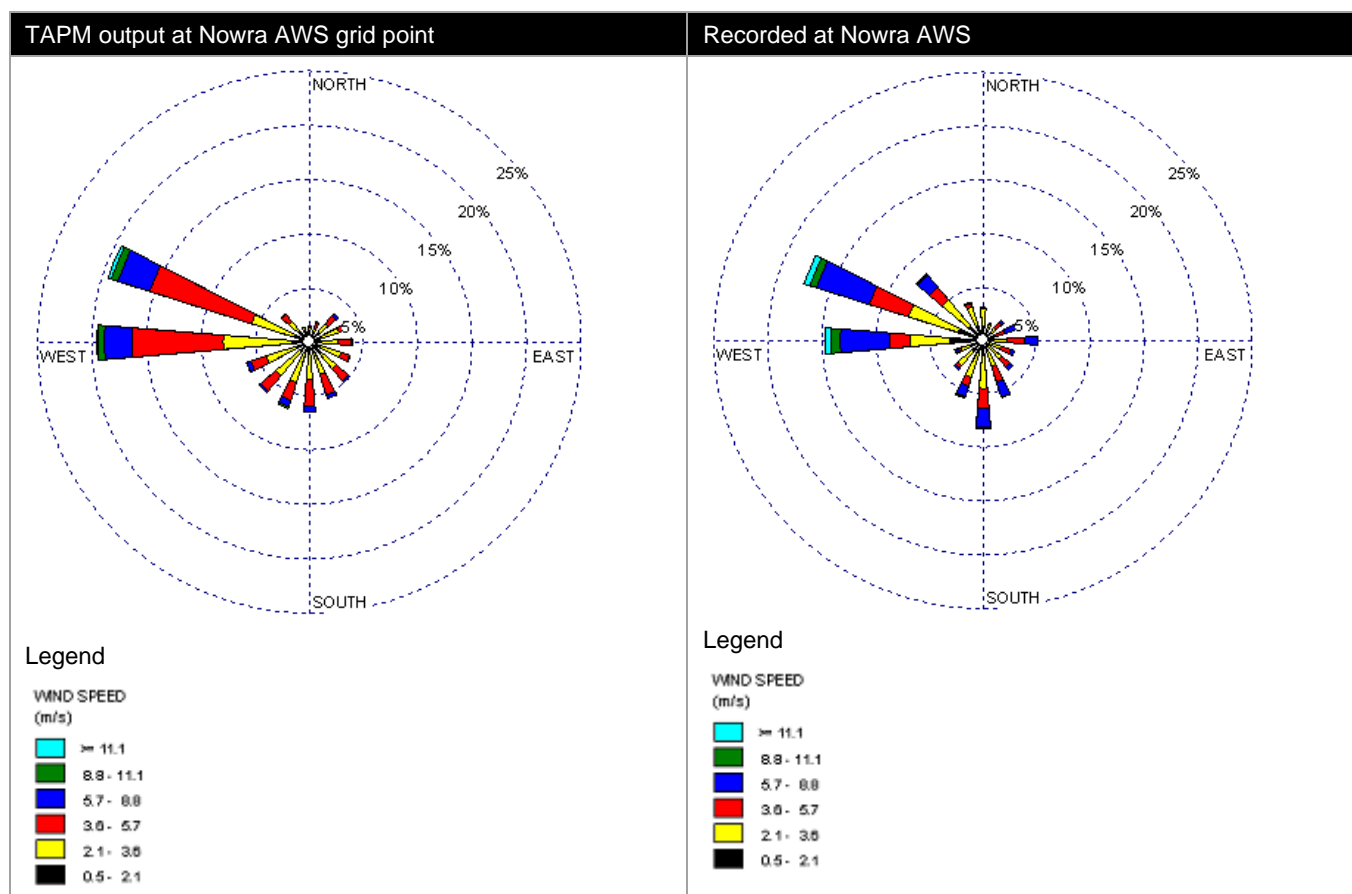
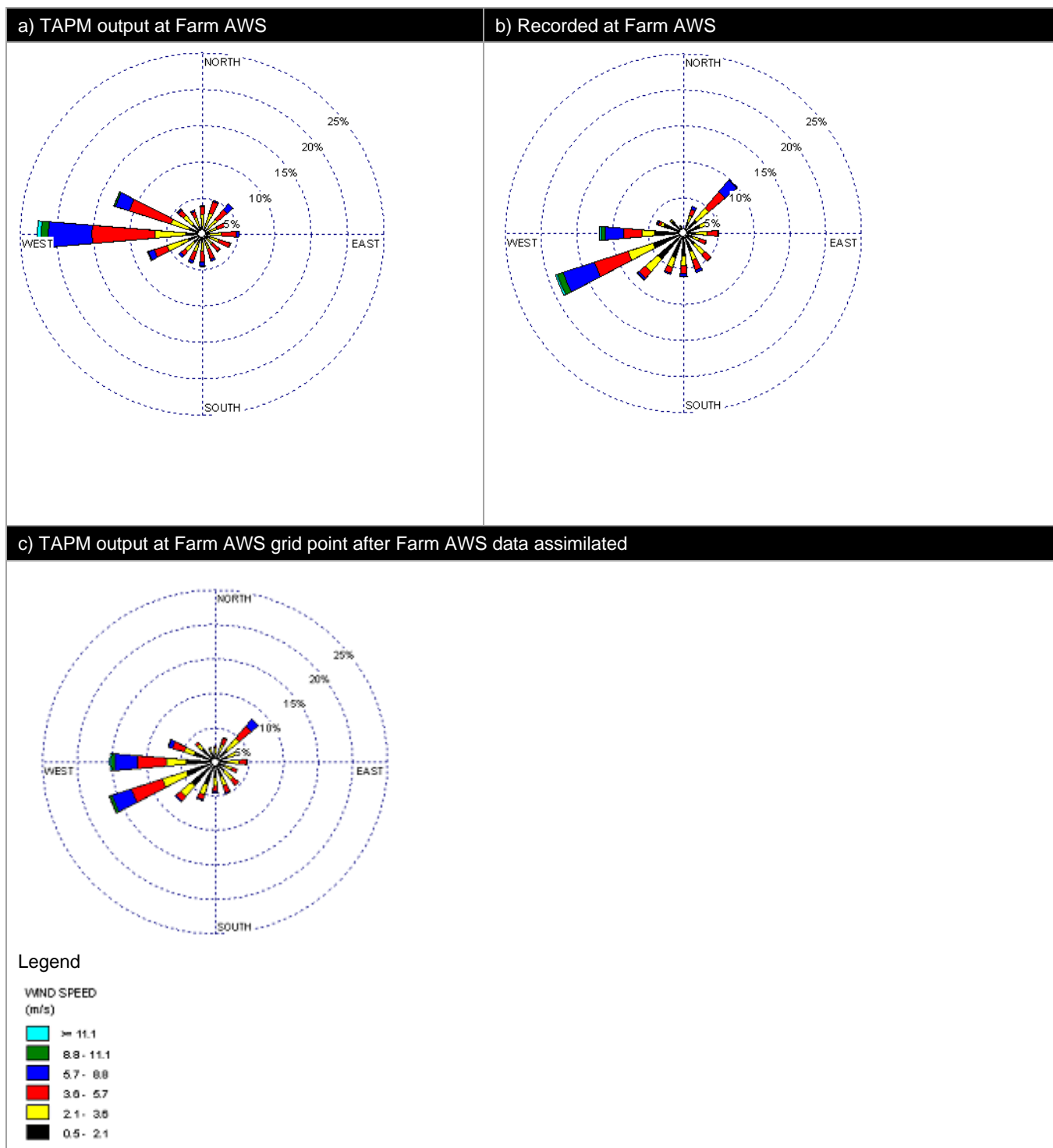


Figure A2 Nowra AWS - Annual Wind Roses (Year 2004)

<sup>12</sup> Luhar, A., Hurley, P. and Rayner, K. Improving Land Surface Processes in TAPM. Part 2: Low Wind Stable Conditions. 14<sup>th</sup> IUAPPA World Congress 2007



**Figure A3** Farm AWS - Annual Wind Roses (year 2004)

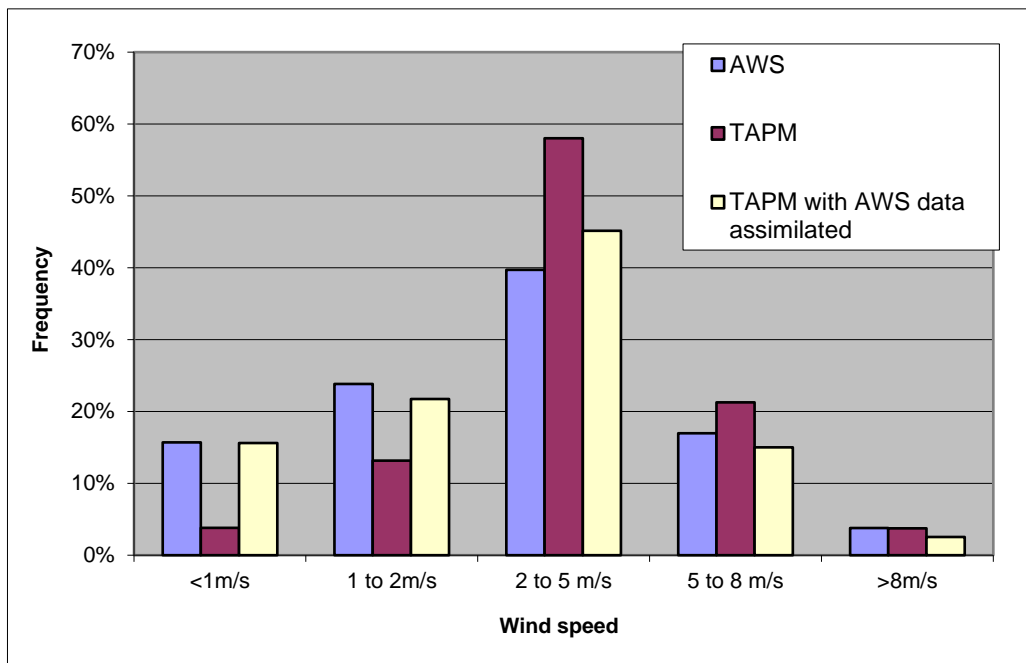


Figure A4 Wind Speed Distribution – TAPM and Farm AWS

To further investigate the effect of data assimilation on model output, a sensitivity analysis was conducted to compare the subsequent CALPUFF model predictions using meteorological input derived with and without the assimilation of observed wind speed and wind direction data from the Farm AWS into TAPM. Good agreement was found in the general pattern of dispersion (i.e. similar directions of poor dispersion), however, the highest ground level odour concentrations were predicted when the assimilated meteorological data file was used, which was expected given the higher frequency of light winds.

## A3 Diagnostic Meteorological Model - CALMET

The TAPM output (with assimilated data) was then passed to model CALMET (version 5.5)<sup>13</sup>, which is the 3D meteorological diagnostic model pre-processor to the CALPUFF 3D puff based dispersion model.

Hourly varying 3D meteorological data, at a 1000 m resolution, were extracted from the TAPM inner nested grid and passed to CALMET in their entirety as initial guess fields. Surface meteorological parameters and vertical profile data were also extracted from TAPM at a grid point near the factory, and used as if they were observations in the diagnostic model (i.e. pseudo-data).

CALMET was configured with a 15 km by 15 km grid at 200 m resolution and with local scale surface characteristics, such as terrain elevation and land use (e.g. forest or sparse growth, water or residential). The land use and terrain elevation information was derived from US Geological Survey and AusLig data, respectively, with adjustments based upon inspection of aerial photographs, topographical and land uses maps, and a site inspection.

CALMET was used to produce hourly site-representative winds and micrometeorological information, which was used with the CALPUFF 3D puff-based dispersion model to assess the impacts of the air pollutants on the surrounding land uses.

### A3.1 Site-specific meteorology

Figure A5 shows a wind rose that illustrates the distribution of wind speed and direction at the location of the Factory. On an annual basis the prevailing winds are from the west with winds also from the west-north-west, north-west, west-south-west and north-east. The mean wind speed is 3.2 m/s, with higher speed winds associated

<sup>13</sup> Scire J.S., E.M. Insley, R.J. Yamartino, and M.E. Fernau, 1995: A User's Guide for the CALMET Meteorological Model. Report prepared for the USDA Forest Service by EARTH TECH, Concord, MA. See: <http://www.src.com/calpuff/calpuff1.htm>

with westerly winds with speeds up to 11 m/s; such speeds are not reached from other directions. The highest frequency of light winds occurs from the south-west, west and north.

Figure A6 provides a seasonal breakdown of the predicted wind distribution at the Factory, this figure reveals a north-easterly predominance during summer (sea-breeze) and a westerly predominance during the other seasons, in particular during winter.

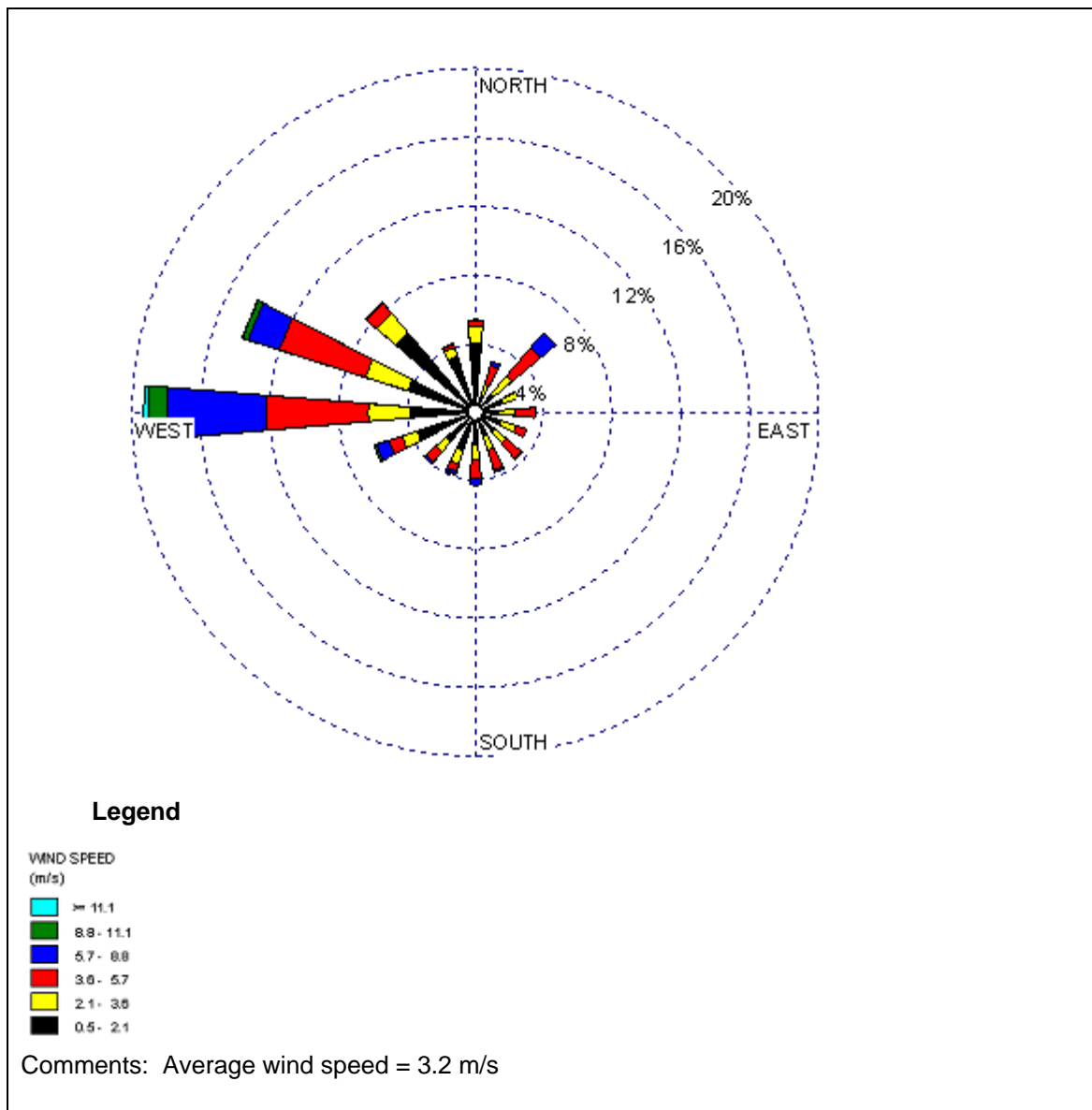
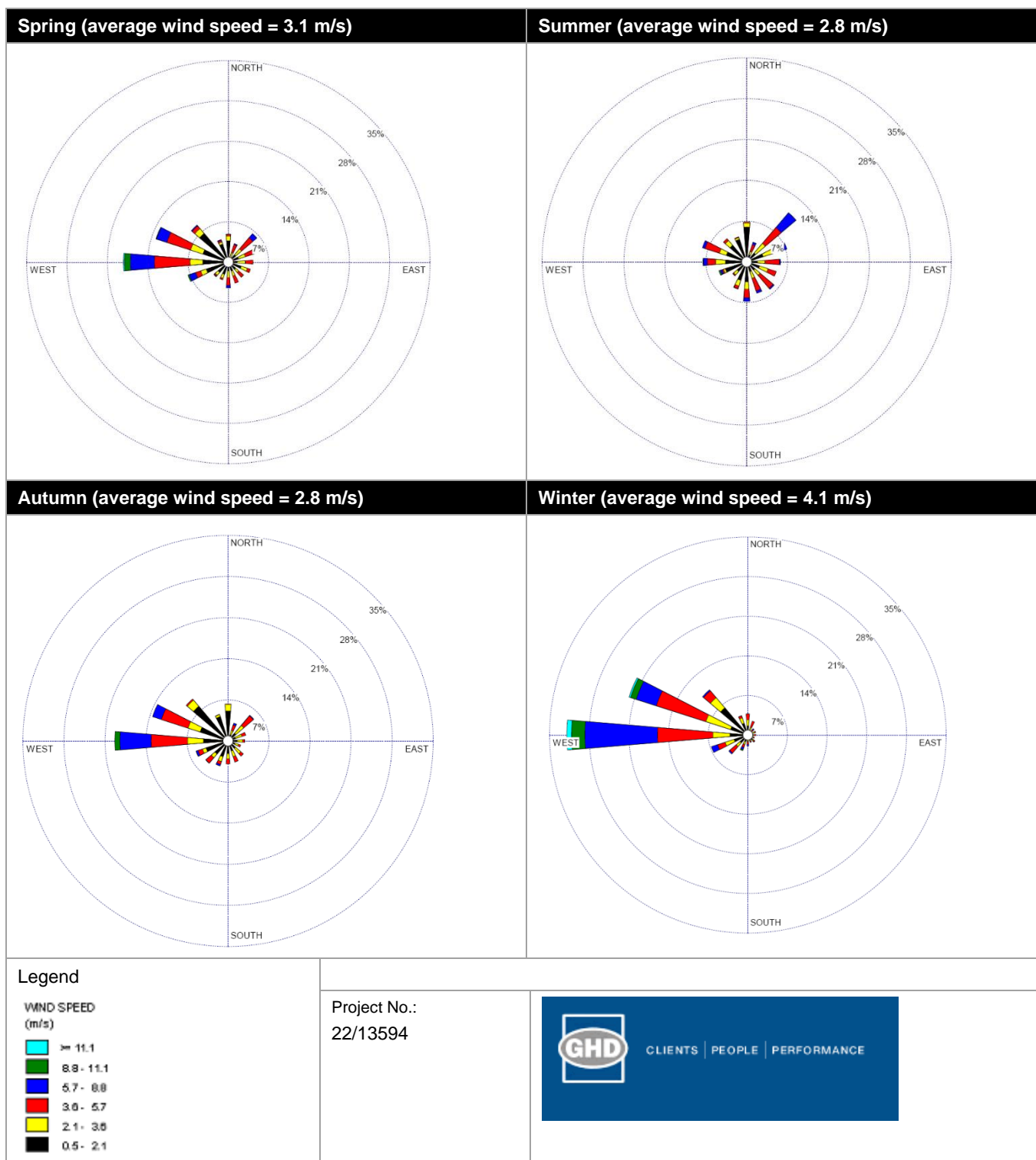


Figure A5 Factory Annual Wind Rose - Year 2004





**Figure A6** *Factory Seasonal Wind Roses - Year 2004*

A categorised measure of atmospheric stability is also output from the model. These can be broadly defined as listed in Table A1.

**Table A1**      *Atmospheric Stability Classes and Distribution*

Stability Class	Description	Frequency of Occurrence <sup>14</sup>
A	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.	2%
B	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.	14%
C	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.	17%
D	Neutral atmospheric conditions. Occur during the day or night with stronger winds. Or during periods of total cloud cover, or during twilight (transition) period.	22%
E	Slightly stable atmospheric conditions occurring during the night-time with some cloud and/or light-moderate winds.	12%
F	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.	32%

Potential off-site odour impact would tend to be maximised when winds are light and the atmosphere is stable, conditions that typically occur during the early evening and night-time. Table A1 shows that these conditions occurred for approximately 44% of the time.

The occurrence of stable air flows is of significance as these generally provide the conditions for worst case dispersion of emissions to air from ground based (or near-ground based) sources, and hence potentially the highest impact to odour amenity. This is due to the limited mixing in the vertical plane of these light wind airflows, and hence less dilution of the emissions from the majority of odour sources, which are either at ground level or wake affected short stacks. Therefore, the distribution of light wind stable flows can define the directions of “poor odour dispersion” from the factory and environmental farm.

Vertical mixing of airflows can be brought about by two mechanisms. The first is mechanical mixing caused by the shear stresses as air moves over rough terrain. The second is via thermal convective mixing, which has the potential to occur significantly only during daytime. The occurrence of unstable and strong-wind neutral air flows generally provide the conditions for the highest ground level concentrations due to emissions to air from elevated stack sources, such as the coal-fired boiler exhaust stacks found at the factory.

A rose that illustrates the directional distribution of the predicted atmospheric stability is shown in Figure A7. During these stable periods, the regional scale cool air drainage flows down the river valley from the west to dominate the transport and dispersion of emissions to air from the factory and environmental farm. To a lesser extent, local slope drainage flows from the elevated terrain located to the north, west-north-west and west-south-west of the site would also generate these conditions for poor dispersion.

<sup>14</sup> Stability data in this table extracted from Factory meteorological data

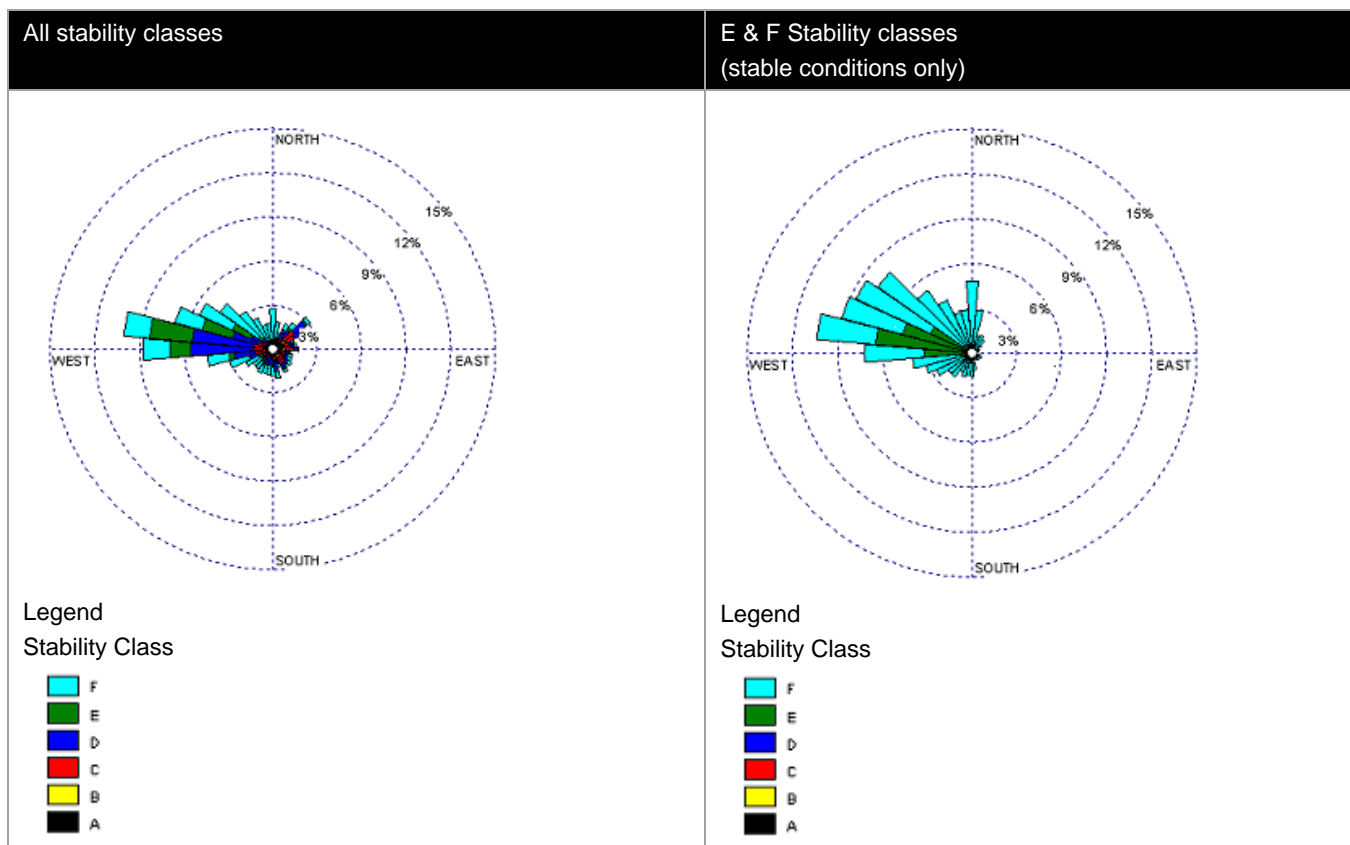


Figure A7 Factory Annual Stability Rose - Year 2008

# **Appendix B**

**Complete odour emission inventory**

**Table B.1** Complete odour emission inventory (Mod 21 Q2)

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Boiler No. 2	45	BOILR2	tall wake free	40.0	0.65	29.8	30	8,309	Variable
Boiler No. 4	42	BOILR4	tall wake free	41.0	0.90	28.1	28	37,247	Variable
Combined Boiler Stack for No. 5 & 6 Boilers	35	BOILR5	tall wake free	54.0	2.1	16.7	412.5	94,550	Variable
Light phase recovery tank		DDG19	wake affected	11.0	0.1	3.3	362.2	74	170
Pellet Mill Silo (proposed)		PMFS	wake affected	23.0	0.2	7.0	320.0	173	398
Pellet Plant exhaust stack	46	PPES	tall wake free	49.2	1.5	10.9	323.2	70,900	Variable
Pellet silo (mill feed silo)		S12	wake affected	2.0	0.3	0.1	304.2	350	805
Stillage surge tank		SST	wake affected	2.0	0.2	3.3	359.7	173	397
Vent condenser drain		VCD	wake affected	24.1	0.3	0.3	300.2	4,419	10,163
Ethanol Recovery Scrubber Discharge	16	ERESC	wake affected	28.0	0.3	9.3	295.4	41,258	94,894
Fermenters (10-16)	44	FERM	tall wake free	21.0	0.3	3.1	302.7	2,000	4,600
Yeast propagators - tanks 4 & 5		YP45	wake affected	17.0	0.3	3.0	310.6	820	1,886
Cyclone and fabric filter		A4	wake affected	33.0	1.3	7.3	300.3	679	1,562
Cyclone and fabric filter		A5	wake affected	33.0	0.9	5.2	303.2	96	221
Cyclone and fabric filter		A6	wake affected	33.0	1.1	5.3	293.2	449	1,033

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Cyclone and fabric filter		A7	wake affected	33.0	1.1	10.2	322.2	932	2,144
Drum vacuum receiver		C4	wake affected	21.0	0.2	11.0	319.7	1,400	3,220
Dry gluten roof bin		S07	wake affected	25.0	0.7	0.1	328.2	4,500	10,350
Enzyme Tanks		B7	wake affected	6.0	0.5	0.3	327.2	2,042	4,696
Feed transfer to distillery		E22	wake affected	15.0	0.3	0.1	300.2	83	191
Flash Vessel Jet Cooker		C1	wake affected	21.0	0.1	0.1	350.2	970	2,231
Flour bin aspirator		S13A	wake affected	2.5	0.4	0.1	306.2	500	1,150
Flour bin aspirator		S13B	wake affected	2.5	0.4	0.1	306.2	500	1,150
Flour bin motor drive		S06	wake affected	24.0	0.3	0.1	307.2	283	651
Flour mill stack proposed and approved 1		FMP2	wake affected	31.8	0.7	4.4	322.2	266	612
Flour mill stack proposed and approved 2		FMP1	wake affected	33.4	0.9	4.2	300.3	205	472
Retention - tank 2 (now located in adjacent tank)		GRT	wake affected	21.0	0.2	18.0	360.2	4,535	10,430
High protein dust collector		S08	wake affected	24.5	0.4	0.1	316.2	600	1,380
Incondensable gases vent		D6	wake affected	13.0	0.2	0.6	309.0	558	1,284
Ion exchange effluent tank		C18	wake affected	2.5	0.5	0.1	307.2	250	575
Jet cooker 1 - retention tank		E13	wake affected	10.0	0.3	0.1	362.2	1,067	2,454

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Jet cooker 2 & 4 - Retention		E7	wake affected	9.0	0.1	3.1	373.2	851	1,956
Molecular Sieve - Vacuum drum		D2	wake affected	10.0	0.1	13.0	337.2	1,350	3,105
No. 1 Gluten Dryer baghouse	8	S02	wake affected	25.5	3.2	0.1	344.4	9,800	22,540
No. 1 Starch Dryer	12	S01	wake affected	26.0	1.3	6.8	309.1	3,200	7,360
No. 2 Gluten Dryer baghouse (No 2 Starch Dryer)	9	S04	wake affected	27.0	3.2	0.1	336.0	6,000	13,800
No. 3 Gluten Dryer baghouse	10	S03	wake affected	21.0	2.5	11.6	343.1	32,000	73,600
No. 3 Starch Dryer	13	S18	wake affected	20.0	1.2	20.0	307.2	6,800	15,640
No. 4 Gluten Dryer baghouse	11	S05	wake affected	30.0	2.7	16.0	346.5	20,000	46,000
No. 4 Starch Dryer	14	S19	wake affected	20.0	1.2	21.2	309.8	2,500	5,750
No. 5 Ring Dryer Starch		SDR5	wake affected	25.0	1.2	0.1	320.0	4,625	10,638
No. 5 Starch Dryer (existing)	47	SD5C	wake affected	33.5	2.4	2.9	340.3	2,123	4,882
No. 5 Starch Dryer (new)		SD5N	wake affected	30.0	2.4	14.7	340.3	10,877	25,018
No. 6 Gluten Dryer		GD6	wake affected	35.0	1.7	19.1	346.2	12,568	28,906
No. 7 Gluten Dryer		GD7	wake affected	29.0	1.8	19.3	341.2	9,553	21,972
Spray dryer		S20	wake affected	19.0	1.4	0.1	335.2	738	1,697
Starch factory rejects collection tank		E10	wake affected	8.0	0.1	0.1	308.2	183	421

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Large Starch Silo 1		PPL1	wake affected	26.5	0.2	6.8	323.3	86	199
Large Starch Silo 2		PPL2	wake affected	26.5	0.2	6.8	323.3	86	199
Medium Gluten Silo 1		PPM1	wake affected	20.7	0.2	6.8	322.7	173	398
Medium Gluten Silo 2		PPM2	wake affected	20.7	0.2	6.8	322.7	173	398
Medium Gluten Silo 3		PPM3	wake affected	20.7	0.2	6.8	322.7	173	398
Small Gluten Silo		PPS1	wake affected	34.3	0.2	18.6	322.7	92	211
Small Starch Silo		PPS2	wake affected	34.3	0.2	18.6	318.5	35	81
Biofilter A	40	BIO1	area					1,307	Variable
Biofilter B	41	BIO2	area					1,208	Variable
Biofilter C		BIO3	area					1,089	Variable
Biofilter D		BIO4	area					1,281	Variable
Effluent storage dam 1	19	PO1	area					948	Variable
Effluent storage dam 2	20	PO2	area					687	Variable
Effluent storage dam 3	21	PO3	area					1,626	Variable
Effluent storage dam 5	23	PO5	area					1,248	Variable
Effluent storage dam 6	24	PO6	area					1,435	Variable
Sulphur Oxidisation Basin	25	SOBAS	area					489	Variable
Membrane bio-reactor		MBR	wake affected					54	Variable
DDG load out shed - awning		DDG35	volume					923	2,123
DDG product storage sheds		DDG34	volume					1,023	2,353
DDG tent storage area		DDG36	volume					1,929	4,437



Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Pellet plant fugitives (discharged direct to atmosphere)		PPF	wake affected					5,771	13,273
Farm tank		F18	volume					3,833	8,817
Column washing vent		CWV	wake affected	48.0	0.1	8.8	312.1	1,218	2,801
Flour Mill B		FMBA	wake affected	39.5	0.7	12.2	322.2	687	1,581
Flour Mill B		FMBB	wake affected	39.5	1.0	2.8	322.2	214	492
Flour Mill B		FMBC	wake affected	39.5	1.0	4.9	322.2	659	1,516
Flour Mill B		FMBD	wake affected	39.5	0.7	29.1	300.3	748	1,720
Flour Mill B		FMBE	wake affected	39.5	1.1	10.2	300.3	748	1,720
Flour Mill B		FMBF	wake affected	39.5	1.1	3.5	300.3	566	1,301
Flour Mill C		FMC1	wake affected	37.6	0.7	12.2	322.2	687	1,581
Flour Mill C		FMC2	wake affected	37.6	0.7	6.5	293.2	214	492
Flour Mill C		FMC3	wake affected	37.6	0.7	11.7	322.2	659	1,516
Gluten dryer no. 8		GD8	wake affected	29.0	1.9	19.1	346.2	12,568	28,906
Product dryer no. 9		PD9	wake affected	35.6	0.9	15.3	345.5	9,800	22,540
Beverage Ethanol D500 Vent (Column washing vent 2)		CWV2	wake affected	55.0	0.1	8.8	312.1	1,218	2,801

**Table B.2** Complete odour emission inventory (Mod 21 Q3)

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Boiler No. 2	45	BOILR2	tall wake free	40.0	0.65	29.8	30	7,025	Variable
Boiler No. 4	42	BOILR4	tall wake free	41.0	0.90	28.1	28	29,207	Variable
Combined Boiler Stack for No. 5 & 6 Boilers	35	BOILR5	tall wake free	54.0	2.1	16.7	412.5	102,780	Variable
Light phase recovery tank		DDG19	wake affected	11.0	0.1	3.3	362.2	74	170
Pellet Mill Silo (proposed)		PMFS	wake affected	23.0	0.2	7.0	320.0	173	398
Pellet Plant exhaust stack	46	PPES	tall wake free	49.2	1.5	10.9	323.2	40,442	Variable
Pellet silo (mill feed silo)		S12	wake affected	2.0	0.3	0.1	304.2	350	805
Stillage surge tank		SST	wake affected	2.0	0.2	3.3	359.7	173	397
Vent condenser drain		VCD	wake affected	24.1	0.3	0.3	300.2	4,419	10,163
Ethanol Recovery Scrubber Discharge	16	ERESC	wake affected	28.0	0.3	9.3	295.4	15,198	34,956
Fermenters (10-16)	44	FERM	tall wake free	21.0	0.3	3.1	302.7	2,804	6,449
Yeast propagators - tanks 4 & 5		YP45	wake affected	17.0	0.3	3.0	310.6	820	1,886
Cyclone and fabric filter		A4	wake affected	33.0	1.3	7.3	300.3	679	1,562
Cyclone and fabric filter		A5	wake affected	33.0	0.9	5.2	303.2	96	221
Cyclone and fabric filter		A6	wake affected	33.0	1.1	5.3	293.2	449	1,033

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Cyclone and fabric filter		A7	wake affected	33.0	1.1	10.2	322.2	932	2,144
Drum vacuum receiver		C4	wake affected	21.0	0.2	11.0	319.7	1,400	3,220
Dry gluten roof bin		S07	wake affected	25.0	0.7	0.1	328.2	4,500	10,350
Enzyme Tanks		B7	wake affected	6.0	0.5	0.3	327.2	2,042	4,696
Feed transfer to distillery		E22	wake affected	15.0	0.3	0.1	300.2	83	191
Flash Vessel Jet Cooker		C1	wake affected	21.0	0.1	0.1	350.2	970	2,231
Flour bin aspirator		S13A	wake affected	2.5	0.4	0.1	306.2	500	1,150
Flour bin aspirator		S13B	wake affected	2.5	0.4	0.1	306.2	500	1,150
Flour bin motor drive		S06	wake affected	24.0	0.3	0.1	307.2	283	651
Flour mill stack proposed and approved 1		FMP2	wake affected	31.8	0.7	4.4	322.2	266	612
Flour mill stack proposed and approved 2		FMP1	wake affected	33.4	0.9	4.2	300.3	205	472
Retention - tank 2 (now located in adjacent tank)		GRT	wake affected	21.0	0.2	18.0	360.2	4,535	10,430
High protein dust collector		S08	wake affected	24.5	0.4	0.1	316.2	600	1,380
Incondensable gases vent		D6	wake affected	13.0	0.2	0.6	309.0	558	1,284
Ion exchange effluent tank		C18	wake affected	2.5	0.5	0.1	307.2	250	575
Jet cooker 1 - retention tank		E13	wake affected	10.0	0.3	0.1	362.2	1,067	2,454

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Jet cooker 2 & 4 - Retention		E7	wake affected	9.0	0.1	3.1	373.2	851	1,956
Molecular Sieve - Vacuum drum		D2	wake affected	10.0	0.1	13.0	337.2	1,350	3,105
No. 1 Gluten Dryer baghouse	8	S02	wake affected	25.5	3.2	0.1	344.4	7,136	16,413
No. 1 Starch Dryer	12	S01	wake affected	26.0	1.3	6.8	309.1	6,358	14,623
No. 2 Gluten Dryer baghouse (No 2 Starch Dryer)	9	S04	wake affected	27.0	3.2	0.1	336.0	3,362	7,733
No. 3 Gluten Dryer baghouse	10	S03	wake affected	21.0	2.5	11.6	343.1	11,540	26,542
No. 3 Starch Dryer	13	S18	wake affected	20.0	1.2	20.0	307.2	1,942	4,467
No. 4 Gluten Dryer baghouse	11	S05	wake affected	30.0	2.7	16.0	346.5	9,768	22,466
No. 4 Starch Dryer	14	S19	wake affected	20.0	1.2	21.2	309.8	1,848	4,250
No. 5 Ring Dryer Starch		SDR5	wake affected	25.0	1.2	0.1	320.0	3,378	7,768
No. 5 Starch Dryer (existing)	47	SD5C	wake affected	33.5	2.4	2.9	340.3	3,172	7,296
No. 5 Starch Dryer (new)		SD5N	wake affected	30.0	2.4	14.7	340.3	16,256	37,388
No. 6 Gluten Dryer		GD6	wake affected	35.0	1.7	19.1	346.2	12,568	28,906
No. 7 Gluten Dryer		GD7	wake affected	29.0	1.8	19.3	341.2	9,553	21,972
Spray dryer		S20	wake affected	19.0	1.4	0.1	335.2	738	1,697
Starch factory rejects collection tank		E10	wake affected	8.0	0.1	0.1	308.2	183	421

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Large Starch Silo 1		PPL1	wake affected	26.5	0.2	6.8	323.3	86	199
Large Starch Silo 2		PPL2	wake affected	26.5	0.2	6.8	323.3	86	199
Medium Gluten Silo 1		PPM1	wake affected	20.7	0.2	6.8	322.7	173	398
Medium Gluten Silo 2		PPM2	wake affected	20.7	0.2	6.8	322.7	173	398
Medium Gluten Silo 3		PPM3	wake affected	20.7	0.2	6.8	322.7	173	398
Small Gluten Silo		PPS1	wake affected	34.3	0.2	18.6	322.7	92	211
Small Starch Silo		PPS2	wake affected	34.3	0.2	18.6	318.5	35	81
Biofilter A	40	BIO1	area					2,400	Variable
Biofilter B	41	BIO2	area					3,192	Variable
Biofilter C		BIO3	area					1,089	Variable
Biofilter D		BIO4	area					1,281	Variable
Effluent storage dam 1	19	PO1	area					948	Variable
Effluent storage dam 2	20	PO2	area					687	Variable
Effluent storage dam 3	21	PO3	area					1,626	Variable
Effluent storage dam 5	23	PO5	area					1,248	Variable
Effluent storage dam 6	24	PO6	area					1,435	Variable
Sulphur Oxidisation Basin	25	SOBAS	area					489	Variable
Membrane bio-reactor		MBR	wake affected					54	Variable
DDG load out shed - awning		DDG35	volume					923	2,123
DDG product storage sheds		DDG34	volume					1,023	2,353
DDG tent storage area		DDG36	volume					1,929	4,437

Source	EPA ID	ID	Source type	Height (m)	Diameter (m)	Exit velocity (m/s)	Exit temperature (K)	OER after control (OUm <sup>3</sup> /s)	Peak to mean adjusted total OER (OUm <sup>3</sup> /s)
Pellet plant fugitives (discharged direct to atmosphere)		PPF	wake affected					5,771	13,273
Farm tank		F18	volume					3,833	8,817
Column washing vent		CWV	wake affected	48.0	0.1	8.8	312.1	1,218	2,801
Flour Mill B		FMBA	wake affected	39.5	0.7	12.2	322.2	687	1,581
Flour Mill B		FMBB	wake affected	39.5	1.0	2.8	322.2	214	492
Flour Mill B		FMBC	wake affected	39.5	1.0	4.9	322.2	659	1,516
Flour Mill B		FMBD	wake affected	39.5	0.7	29.1	300.3	748	1,720
Flour Mill B		FMBE	wake affected	39.5	1.1	10.2	300.3	748	1,720
Flour Mill B		FMBF	wake affected	39.5	1.1	3.5	300.3	566	1,301
Flour Mill C		FMC1	wake affected	37.6	0.7	12.2	322.2	687	1,581
Flour Mill C		FMC2	wake affected	37.6	0.7	6.5	293.2	214	492
Flour Mill C		FMC3	wake affected	37.6	0.7	11.7	322.2	659	1,516
Gluten dryer no. 8		GD8	wake affected	29.0	1.9	19.1	346.2	12,568	28,906
Product dryer no. 9		PD9	wake affected	35.6	0.9	15.3	345.5	7,136	16,413
Beverage Ethanol D500 Vent (Column washing vent 2)		CWV2	wake affected	55.0	0.1	8.8	312.1	1,218	2,801

# **Appendix C**

**Site sampling reports**



[ghd.com](http://ghd.com)

→ **The Power of Commitment**



## APPENDIX F – ODOUR COMPLAINT RECORDS



## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

Complaint No: CC-ESHOAL059

Customer Code: SCUST90123

Date Lodged: 20-Jul-2020

<b>Customer:</b> Environmental Protection Authority (EPA) Queanbeyan	
<b>Batch No.:</b>	<b>Product:</b>
<b>Complaint Detail:</b> Odour complaint 16-7-20 [REDACTED]	
<p><b>Problem:</b> Odour complaint received via EPA email 16-7-20 @ 3:01 pm. The complainant is located on [REDACTED]</p> <p>The complainant has described the odour as an electrical, acrid smell that also smelled similar to a combination of yeast and smoke. He was insistent that it did not smell like the same type of smoke as a house wood fire. He notices the odour at night, and when there are strong winds blowing towards him from the direction of premises. He has also said that he has friends in Bomaderry who have experienced this same odour.</p>	
<b>Cause Cat:</b>	ODOUR      Odour
<b>Cause:</b>	Unknown.
<b>Who To Do:</b>	
<b>Action Required By:</b> 22-Jul-2020	
<p><b>Action:</b> Investigation into the complaint was unable to identify a likely cause. A response to the EPA was sent 20-7-2020 (see attached) as follows:</p> <p>We do not have any odours on site typically described as electrical, acrid or smoke-like.</p> <p>The odours associated with our premises are typically described as vegemite/yeasty odours.</p> <p>We have reviewed our odour recovery controls and note they were operating as normal around the time of the complaint.</p> <p>We are unable to advise where this odour may be coming from.</p>	
<p><b>Review:</b> No further complaints received of this nature.</p> <p>No further correspondence received from the EPA.</p> <p>No further action taken.</p>	



## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

Complaint No: CC-ESHOAL059

Customer Code: SCUST90123

Date Lodged: 20-Jul-2020

Status:	9 Closed	Dept:	SHOQA
Approved By:	Studdert.John	Manufacturing Site:	Shoalhaven Starches
Date:	23-Aug-2021	Product Rejected:	No
Recorded By:	Studdert.John	Potential Claim:	No

## John Studdert

**From:** John Studdert  
**Sent:** Monday, 20 July 2020 4:04 PM  
**To:** Amanda Fletcher  
**Cc:** Janine Goodwin; Ming Leung; Scott Foggo  
**Subject:** RE: Odour complaint from North Nowra

Hi Amanda,

We do not have any odours on site typically described as electrical, acrid or smoke-like.

The odours associated with our premises are typically described as vegemite/yeasty odours.

We have reviewed our odour recovery controls and note they were operating as normal around the time of the complaint.

We are unable to advise where this odour may be coming from.

Regards,

**John Studdert** | Quality Assurance & Environmental Coordinator  
 160 Bolong Rd Bomaderry, NSW 2541  
 P: +61 2 4423 8254 | M: [REDACTED]  
 E: john.studdert@manildra.com.au  
[manildra.com.au](http://manildra.com.au)



**From:** Amanda Fletcher <Amanda.Fletcher@epa.nsw.gov.au>  
**Sent:** Thursday, 16 July 2020 3:01 PM  
**To:** John Studdert <John.Studdert@manildra.com.au>  
**Cc:** Janine Goodwin <Janine.Goodwin@epa.nsw.gov.au>  
**Subject:** Odour complaint from North Nowra

Hi John

As discussed, we've had a complaint regarding odour from the premises. The complainant is a resident on [REDACTED] About a month ago, the complainant began to notice a smell that caused him discomfort. The complainant has been having respiratory issues since the bushfires and has said that this odour is aggravating his symptoms. He has also had guests at his house who have also noticed this odour, and have claimed that it was causing them symptoms like itchy eyes and sore throats. He has had his property inspected to rule out these symptoms being caused by something in his house.

The complainant has described the odour as an electrical, acrid smell that also smelled similar to a combination of yeast and smoke. He was insistent that it did not smell like the same type of smoke as a house wood fire. He notices the odour at night, and when there are strong winds blowing towards him from the direction of premises. He has also said that he has friends in Bomaderry who have experienced this same odour.

In the first instance, would you be able to let me know where you think this odour may be coming from?

Thanks

Amanda

**Amanda Fletcher**

**Regional Operations Officer**

Regulatory Operations – Regional South  
 NSW Environment Protection Authority

02 6229 7002

Amanda.Fletcher@epa.nsw.gov.au [www.epa.nsw.gov.au](http://www.epa.nsw.gov.au) @EPA\_NSW

**Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555**



Please send all official electronic correspondence to [queanbeyan@epa.nsw.gov.au](mailto:queanbeyan@epa.nsw.gov.au)

This email is intended for the addressee(s) named and may contain confidential and/or privileged information. If you are not the intended recipient, please notify the sender and then delete it immediately.



## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

Complaint No: CC-ESHOAL060

Customer Code: SCUST90123

Date Lodged: 20-Oct-2020

<b>Customer:</b> Environmental Protection Authority (EPA) Queanbeyan	
<b>Batch No.:</b>	<b>Product:</b>
<b>Complaint Detail:</b> Odour & Air Quality Complaint Bomaderry 16-10-2020	
<p><b>Problem:</b> Odour complaint received via EPA on 16-10-2020 as follows:</p> <p>Odour complaint from a resident in Bomaderry. The complainant's name is [REDACTED] and his mobile is [REDACTED]. He lives to the west of the premises.</p> <p>[REDACTED] complaint is mostly about the strength of odour coming from Shoalhaven Starches, and is predominantly affected by odour during SE winds, and in the mornings and nights. He says the odour varies, and can smell like vegemite, methylated spirits, baking cakes, and rotten eggs. He says this has been an ongoing issue for the past 8 years.</p> <p>[REDACTED] is also affected by what he describes as a "black carbon powder" and says that it is sticky and difficult to remove from his indoor and outdoor furnishings.</p>	
<b>Cause Cat:</b>	ODOUR Odour
<b>Cause:</b>	Unknown.
<b>Who To Do:</b>	
<b>Action Required By:</b> 22-Oct-2020	



## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

Complaint No: CC-ESHOAL060

Customer Code: SCUST90123

Date Lodged: 20-Oct-2020

<b>Action:</b>	<p>A response to EPA's email 16-10-20 was submitted 20-10-2020 (see attached) as follows:</p> <ol style="list-style-type: none"> <li>1. Is there any changes in processes that happen at the premises during the mornings and nights that would produce stronger odours compared to the daytime?</li> </ol> <p>There are no changes in processes during the mornings and nights that would produce stronger odours compared to the daytime. A potential cause of stronger odours is the still weather conditions being more frequent during the mornings and nights creating poor odour dispersion.</p> <ol style="list-style-type: none"> <li>2. If you have any monitoring data from the past 3 years that doesn't get supplied to us via the annual returns it would be appreciated if you could send that through.</li> </ol> <p>Please see attached ambient air quality monitoring conducted in Bomaderry over four quarters during 2015 - 2016.</p> <ol style="list-style-type: none"> <li>3. Is there any emissions from the premises that could be characterised as a black powder, as described by Mr Trevillian?</li> </ol> <p>Potential sources of black powder emissions from the premises include the coal stockpiles and the coal-fired boilers.</p> <p>The details of the complaint were discussed with the complainant as well.</p>		
<b>Review:</b>	<p>No further correspondence received from the EPA.</p> <p>No further action taken.</p>		
<b>Status:</b>	9 Closed	<b>Dept:</b>	SHOQA
<b>Approved By:</b>	Studdert.John	<b>Manufacturing Site:</b>	
<b>Date:</b>	23-Aug-2021	<b>Product Rejected:</b>	No
<b>Recorded By:</b>	Studdert.John	<b>Potential Claim:</b>	No

## John Studdert

**From:** John Studdert  
**Sent:** Tuesday, 20 October 2020 11:12 AM  
**To:** Amanda Fletcher  
**Cc:** Janine Goodwin; Ming Leung; Scott Foggo  
**Subject:** RE: Odour and air quality complaint - resident in Bomaderry  
**Attachments:** 5482 Shoalhaven Bomaderry AAQMS Final Summary report.pdf

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Hi Amanda,

Please see our responses below in red.

Please do not hesitate to contact me if you require any further information.

Regards,

**John Studdert** | Quality Assurance & Environmental Coordinator  
 160 Belong Rd Bomaderry, NSW 2541  
 P: +61 2 4423 8254 | M: [REDACTED]  
 E: [john.studdert@manildra.com.au](mailto:john.studdert@manildra.com.au)  
[manildra.com.au](http://manildra.com.au)



**From:** Amanda Fletcher <[Amanda.Fletcher@epa.nsw.gov.au](mailto:Amanda.Fletcher@epa.nsw.gov.au)>  
**Sent:** Friday, 16 October 2020 2:31 PM  
**To:** John Studdert <[John.Studdert@manildra.com.au](mailto:John.Studdert@manildra.com.au)>  
**Cc:** Janine Goodwin <[Janine.Goodwin@epa.nsw.gov.au](mailto:Janine.Goodwin@epa.nsw.gov.au)>  
**Subject:** Odour and air quality complaint - resident in Bomaderry



## John Studdert

**From:** John Studdert  
**Sent:** Tuesday, 20 October 2020 11:12 AM  
**To:** Amanda Fletcher  
**Cc:** Janine Goodwin; Ming Leung; Scott Foggo  
**Subject:** RE: Odour and air quality complaint - resident in Bomaderry  
**Attachments:** 5482 Shoalhaven Bomaderry AAQMS Final Summary report.pdf

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Hi Amanda,

Please see our responses below in red.

Please do not hesitate to contact me if you require any further information.

Regards,

John Studdert | Quality Assurance & Environmental Coordinator  
 160 Bolong Rd Bomaderry, NSW 2541  
 P: +61 2 4423 8254 | M: [REDACTED]  
 E: [john.studdert@manildra.com.au](mailto:john.studdert@manildra.com.au)  
[manildra.com.au](http://manildra.com.au)



**From:** Amanda Fletcher <[Amanda.Fletcher@epa.nsw.gov.au](mailto:Amanda.Fletcher@epa.nsw.gov.au)>  
**Sent:** Friday, 16 October 2020 2:31 PM  
**To:** John Studdert <[John.Studdert@manildra.com.au](mailto:John.Studdert@manildra.com.au)>  
**Cc:** Janine Goodwin <[Janine.Goodwin@epa.nsw.gov.au](mailto:Janine.Goodwin@epa.nsw.gov.au)>  
**Subject:** Odour and air quality complaint - resident in Bomaderry

Hi John

As discussed, we've received an odour complaint from a resident in Bomaderry. [REDACTED] He lives to the west of the premises.

[REDACTED] complaint is mostly about the strength of odour coming from Shoalhaven Starches, and is predominantly affected by odour during SE winds, and in the mornings and nights. He says the odour varies, and can smell like vegemite, methylated spirits, baking cakes, and rotten eggs. He says this has been an ongoing issue for the past 8 years.

[REDACTED] is also affected by what he describes as a "black carbon powder" and says that it is sticky and difficult to remove from his indoor and outdoor furnishings.

To assist EPA with our investigation, could you please supply the following information:

1. Is there any changes in processes that happen at the premises during the mornings and nights that would produce stronger odours compared to the daytime?  
*There are no changes in processes during the mornings and nights that would produce stronger odours compared to the daytime. A potential cause of stronger odours is the still weather conditions being more frequent during the mornings and nights creating poor odour dispersion.*
2. If you have any monitoring data from the past 3 years that doesn't get supplied to us via the annual returns it would be appreciated if you could send that through.  
*Please see attached ambient air quality monitoring conducted in Bomaderry over four quarters during 2015 - 2016.*
3. Is there any emissions from the premises that could be characterised as a black powder, as described by [REDACTED] Potential sources of black powder emissions from the premises include the coal stockpiles and the coal-fired boilers.

Thank you

Amanda

**Amanda Fletcher**  
 Operations Officer – Regional South  
 Regulatory Operations  
 NSW Environment Protection Authority  
 D 02 6229 7002 | M [REDACTED]





## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

**Complaint No:** CC-ESHOAL061

**Customer Code:** SCUST90124

**Date Lodged:** 22-Oct-2020

<b>Customer:</b> Community Environmental Complaint - Direct			
<b>Batch No.:</b> N/A		<b>Product:</b> N/A	
<b>Complaint Detail:</b> Odour Complaint - Bomaderry 22-10-20			
<b>Problem:</b> Complaint received via phone call on 22-10-20 at 2:15pm. The complainant, who wished to remain anonymous, is located near the Bomaderry TAFE / Princes Hwy area is complaining of odour that comes and goes, and is more pronounced during the mornings.			
<b>Cause Cat:</b> ODOUR      Odour			
<b>Cause:</b> Unknown.  Odour may be more pronounced during the early mornings during calm/still weather conditions resulting in poor odour dispersion.			
<b>Who To Do:</b>			
<b>Action Required By:</b> 24-Oct-2020			
<b>Action:</b> A drive around the Bomaderry area at approximately 2:30 pm on the day of the complaint detected a very faint 'DDG' odour downwind of the plant on Bolong Rd & Beinda St, which could not be detected when travelling towards the Princes Hwy near the complainants location.  A review of the factory's odour recovery / treatment systems at the time of the complaint were noted to be operating as normal.			
<b>Review:</b> No further complaints received of this nature.  No further action taken.			
<b>Status:</b>	9      Closed	<b>Dept:</b>	SHOQA
<b>Approved By:</b>	Studdert.John	<b>Manufacturing Site:</b>	Shoalhaven Starches
<b>Date:</b>	23-Aug-2021	<b>Product Rejected:</b>	No
<b>Recorded By:</b>	Studdert.John	<b>Potential Claim:</b>	No



## MANILDRA GROUP OF COMPANIES

### Environmental Complaint

Complaint No: CC-ESHOAL063

Customer Code: SCUST90124

Date Lodged: 22-Mar-2021

<b>Customer:</b> Community Environmental Complaint - Direct			
<b>Batch No.:</b> N/A		<b>Product:</b> N/A	
<b>Complaint Detail:</b> Odour complaint Bomaderry 22-3-2021			
<b>Problem:</b> Complaint received via phone call on 22-3-2021 at 4:00 pm from [REDACTED] located at [REDACTED] Bomaderry, noted a Fermenter/Yeasty odour. [REDACTED]			
<b>Cause Cat:</b> ODOUR      Odour			
<b>Cause:</b> Unknown. Based on the odour description possibly the DDG or Ethanol Fermentation Plant odour.			
<b>Who To Do:</b>			
<b>Action Required By:</b> 24-Mar-2021			
<b>Action:</b> The details of the complaint and the odour recovery systems on site were discussed with the complainant. A drive around the [REDACTED] on the day of the complaint identified a slight DDG type odour. The wind was noted to be light, from the ESE direction, downwind from the Plant. The site's odour recovery / treatment systems at the time of the complaint were noted to be operating as normal.			
<b>Review:</b> No further complaints of this nature received. No further action taken.			
<b>Status:</b>	9      Closed	<b>Dept:</b>	SHOQA
<b>Approved By:</b>	Studdert.John	<b>Manufacturing Site:</b>	Shoalhaven Starches
<b>Date:</b>	23-Aug-2021	<b>Product Rejected:</b>	No
<b>Recorded By:</b>	Studdert.John	<b>Potential Claim:</b>	No