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 | Tel: +61 (02) 9071 8600

Shoalhaven Starches, Independent Odour Audit (2019-2020)

Addressee(s):	Shoalhaven Starches Pty Ltd
Report Reference:	21.1002.FR1V1
Date:	21 September 2020

Quality Control

Study	Status	Prepared by:	Checked by:	Authorised by:
INTRODUCTION	Final	GCG	MD, JS	GCG
ODOUR AUDIT	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)	(R*x*)	(V*x*)
20	1002	F	R1	V1
Based upon the above, the specific reference for this version of the report is:				21.1002.FR1V1

Final Authority

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

G. Graham **21st September 2020**

Contents

Appendices

Tables

Figures

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 normal cubic metres per second would be presented as 20 $OU \cdot Nm^3 \cdot s^{-1}$ and not 20 $OU \cdot Nm^3/s$

1. INTRODUCTION

Shoalhaven Starches Pty Ltd (on behalf of the Manildra Group) has engaged Gary Graham, Director of Northstar Air Quality Pty Ltd (Northstar Air Quality) to perform the independent odour audit (2019-2020) of the Shoalhaven Starches Facility (the facility) which operates at Bolong Road, Bomaderry, NSW.

As stipulated in the NSW Government (June 2018) *Independent Audit – Post Approval Requirements*, I confirm that I am independent of Shoalhaven Starches as determined under Section 3.1.2 of the above guidance. I have completed an Independent Audit Declaration Form, and this is attached in **Appendix A** of this report.

The requirement for an Independent Odour Audit is prescribed within Schedule 3 of the consolidated conditions of Project Approval 06_0228. For clarity, the consolidated conditions are reproduced in their entity in **Table 2** (**Section 2.2**), 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 2019/20 to Q4 2019/20, aligned to the EPL reporting period. With reference to the NSW EPA website[1], it is noted that anniversary date for EPL 883 (version 23 October 2018) is stated as 30 April. Correspondingly, this report covers the period from **1 May 2019** to **30 April 2020**.

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

- Quarter 1 (Q1): May 2019 to July 2019;
- Quarter 2 (Q2): August 2019 to October 2019;
- Quarter 3 (Q3): November 2019 to January 2020; and
- Quarter 4 (Q4): February 2020 to April 2020.

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 9 September 2020 and a telephone conversation was held with Janine Goodwin and Amanda Fletcher on 16 September 2020. Confirmation of that discussion was received from Amanda Fletcher on 16 September 2020:

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

"As discussed, EPA has not received any odour complaints that can be attributed to Shoalhaven Starches in the timeframe that the odour audit is covering. We received an odour complaint in Bomaderry during February this year, however it was determined that the odour source was due to rotting vegetation in the area from the recent floods.

We have also had two other odour complaints this year, however we received them during July and August, and both times the odour was not able to be traced back to Shoalhaven Starches.

EPA has had no other issues with odour from Shoalhaven Starches."

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

Shaun Williams was contacted by email on 9 September 2020 and the following response is noted:

"I have recently assessed two modifications to the Shoalhaven Starches Ethanol Expansion Project (06_0228) being MOD 17 and MOD 18.

MOD 18 was approved by the IPC on Friday 4 September 2020 and related to the production of hand sanitiser ethanol and hand sanitiser.

MOD 17 is likely to be recommended to the IPC by the end of the week for determination. MOD 17 involves additions to building footprints, relocation of some site infrastructure and the use of woodchips as an alternate boiler fuel source.

In the Air Quality Impact Assessment (AQIA) supporting the MOD 17 application, it noted there had been an increase in odour levels in the quarterly monitoring results across the last four quarters. The AQIA notes the increase in odour levels is particularly associated to the pellet plant stack (PPES).

The Department has interest in understanding the increased odour levels attributed to the PPES and if the implemented odour controls are adequate or if new controls are required."

With regard to the DDG pellet plant stack (EPA ID 46), the measured odour emission rates are reproduced in **Appendix D**, and summarised in **Section 2.9**.

Section 2.9.3 and **Section 2.9.4** and specifically **Table 11** and **Table 12** address the relative contribution and variation of odour emission rates by source including the DDG pellet plant stack.

1.3. Site Inspection

A site inspection was performed by Gary Graham on Monday 31 August 2020. The site inspection included the following:

- Introduction and site familiarisation with Mr John Studdert (Quality Assurance & Environmental Coordinator, Manildra Group).
- Discussion of the required reporting documentation, including operational data, recent odour monitoring data, odour modelling, complaints history, operational matters, updates to the various management plans, etcetera.
- A site inspection audit, guided by Mr John Studdert, including:
  - the biofilters;

- the dried distillers' grain (DDG) plant;
- the ethanol plant.

During the site visit the facility was understood to be operating normally, with the exception of the biofilters. Biofilter B was observed to be off-line whilst being refitted, including replacement of eroded media supports and a routine replacement of the biofilter bed media. It is understood that the replacement of the biofilter bed media is performed routinely every couple of years. John Studdert reported a slight delay in the replacement of the biofilter media due to delay in shipping of the supports. Reference should be made to **Appendix B** for photographs of the biofilters taken during the site inspection.

1.4. Site Inspection Observations

1.4.1. Biofilters

The biofilters were noted to be operating sub-optimally. Biofilter B was not operational during a periodic replacement of the biofilter media and replacement of the media supports which were noted to be eroded once the spent media had been excavated. The flow normally serviced by Biofilter B had been redirected to Biofilter A, which was therefore servicing the flow typically serviced by both biofilters.

Odour was detectable in close proximity to the biofilters, but was noted to be reasonably neutral in character, and not unpleasant. The odour was not observed at a distance of more than 10 metres (m) from the biofilter. Photographs taken during the site inspection of the biofilters are presented in **Appendix B**.

1.4.2. DDG plant

Odour was detectable during the inspection of the DDG plant, although this was noted to be generally inoffensive and (anecdotally) not considered to be at an intensity that would give rise to off-site impacts.

1.4.3. Ethanol Plant

Odour was detectable during the inspection of the ethanol plant, although this was not considered to be at an intensity that would give rise to off-site impacts (anecdotally).

1.4.4. Wastewater Treatment Works

The wastewater treatment lagoons and the batch treatment works were not inspected during the site visit. Given the heavy rainfall in the two weeks prior to the site visit, the lagoons were noted to be full of rainwater and the potential for observations relating to odour control was considered to be low.

Page left intentionally blank

2. ODOUR AUDIT

2.1. Audit Compliance Criteria

As presented in NSW Government (June 2018) *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 at the time when the audit is undertaken, therefore an assessment of compliance is not relevant

2.2. Consolidated Odour Conditions and Summary of Compliance

Table 2 below presents a list of odour conditions, as prescribed in Schedule 3 of the Consolidated Conditions of Project Approval (MOD 16).

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.

Table 2 Consolidated odour conditions and summary of compliance

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
Offensive Odour			
1	The Proponent shall not cause or permit the emission of offensive odours from the site, as defined under Section 129 of the POEO Act.	**Section 2.6** provides a summary of the odour complaints, and these are replicated in full in **Appendix F**. The number of odour complaints received in this period is one (1).	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 Proponent 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.	Compliant
3	The Proponent shall implement additional mandatory odour controls as may be directed by the Secretary, arising from the Department's assessment of any:	None required.	--
	a) Independent Odour Audit (see condition 5 below);	--	Not triggered
	b) Independent Environmental Audit (see condition 4 of schedule 4); or	--	Not triggered
	c) any monitoring results, incidents or complaints related to the project.	--	Not triggered

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
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 Proponent 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.	Completed.	Compliant
3B	Should the Proponent 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.	Completed.	Compliant
3C	Deleted	None required.	--
3D	Prior to construction of any part of MOD 11 and MOD 12 as described in Schedule 2, Condition 2, the Proponent 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 Proponent 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
4	The Proponent shall prepare an Odour Management Plan for the project to the satisfaction of the Secretary. This plan must: a) be prepared in consultation with EPA by a suitably independent, qualified and experienced expert whose appointment has been endorsed by the Secretary, and submitted to the Secretary for approval within 3 months of the date of this approval;	The OMP is discussed in **Section 2.7.1**. It has been completed by The Odour Unit, who are a suitably qualified and experienced expert in odour management. It is noted that the OMP has received DPI&E review.	Compliant
	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 adequately addresses odour control.	Compliant
	c) identify triggers for remedial action; and	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.	Section 4 of the OMP presents details of the system monitoring program.	Compliant
4A	Prior to increasing ethanol production the Odour Management Plan for the project must be updated to the satisfaction of the Secretary to include the additional Appendix 3 mandatory odour controls specified in the modification approval MOD 1 – Deletion of DDG Pelletiser.	Completed.	Compliant
Independent Odour Audit			

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
5	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:	The Letter of Endorsement from the Director General is provided in **Appendix A**.	Compliant
	a) consult with the EPA and the Department	**Section 1.2** presents a summary of the consultation with the EPA and DP&E.	Compliant
	b) audit the effectiveness of the odour controls on site in regard to protecting receivers against offensive odour;	**Section 2** is the audit of the odour controls.	Compliant
	c) review the Proponent's production data (that are relevant to the odour audit) and complaint records;	**Section 2.5** presents a summary of the production data corresponding to the monitoring program dates. **Section 2.6** presents a summary of the odour complaints for the audit period.	Compliant
	d) review the Odour Management Plan for the project;	**Section 2.7.1** provides a summary of any relevant updates to the OMP. During this audit period, there are no relevant updates relevant to this odour audit.	Compliant
	e) measure all key odour sources on site, and compare the results of these measurements against the predictions in the EA;	**Note: no measurements taken as part of this audit**. Audit of monitoring data presented in **Sections 2.3** and **2.9**. The comparison against modelling assessment provided in **Section 2.10**	Compliant

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
	f) determine whether the project is complying with the requirements in this approval; and	Reference should be made to the rest of the document.	--
	g) if necessary, recommend and prioritise measures to either improve the odour controls on site and/or the Odour Management Plan, such that receivers would be protected against offensive odour from the site.	**Section 3**.	Compliant
	Note: The Secretary may vary the frequency of the audit depending on the performance of the project.	None.	--
6	Within 6 weeks of the completion of this audit, the Proponent 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.	--
Odour verification (MP 06_0228 MOD 2)			
6A	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	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report.	Compliant
	b) quarterly odour monitoring with samples taken of single vent stack (direct to atmosphere) emissions from a filling fermenter tank.	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report.	Compliant
6B	Deleted	None required	--

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
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.	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report. **Section 2.9.1** details the "process conditions" during each monitoring campaign, including which processes were not available for testing. It is noted that the Quarter 4 monitoring was not performed on the DDG exhaust stack.	Non-compliant
6D	The Proponent shall conduct odour monitoring on the relocated starch dryer described in MOD 7 in accordance with the requirements of the EPL and report the results in the independent odour audit required under Condition 5 of Schedule 3.	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report. MOD7 relates to the No5 Starch Dryer (as captured in the EPL variation dated June 2018).	Compliant
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 Proponent shall investigate and implement further odour treatment options as directed by the Secretary or the EPA.	The sequential process modifications have been modelled and assessed, up to MOD19, including further odour treatment options.	Compliant
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.	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report.	Compliant

2.3. Adoption of Previous Recommendations

Table 3 presents a summary of outstanding recommendations identified during the performance of previous odour audits.

Presented in the column 'Response' are responses by Manildra and Northstar.

Table 3 Implementation of previous outstanding recommendations

Reference	Recommendation	Response(s)	Implementation
2018-19-IOA-A	As identified at Section 2.4 and stated in the Biofilter Capacity and Condition Assessment report #22 (June 2019), the reason for the high inlet odour loading into the biofilters (173 000 OU) should be investigated.	**Manildra:** Investigation has revealed issues with the odour recovery scrubber may have contributed to high inlet odour loading into the Biofilters. These issues have been rectified and the last 3 quarters of odour testing have revealed odour treatment efficiency of > 90%. Additional scrubber cooling water to be trialled and tested during the next quarterly odour monitoring. **Northstar:** See **Section 2.4**	Resolved
2018-19-IOA-B	As identified at Section 2.4, Section 2.9.3 and stated in the Biofilter Capacity and Condition Assessment report #22 (June 2019), the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	**Manildra:** Noted, ongoing observation will continue and remedial action undertaken as required. Odour treatment efficiency of the biofilter is used to assess its operational effectiveness in treating odorous air as opposed to setting a *de facto* odour concentration standard. The last 3 quarters of odour testing have revealed odour treatment efficiency of > 90%. **Northstar:** It is considered that the odour treatment efficiency and emission standard are both objectives for assessing biofilter performance. It is acknowledged that the odour treatment efficiencies are high.	Ongoing
2018-19-IOA-C	As identified at Section 2.4 and stated in the Biofilter Capacity and Condition Assessment report #22 (June 2019), the frequency of biofilter assessments is not a Condition of Consent, but it is recommended that justification in the reduction in frequency from biannual to annual should be provided	**Manildra:** The six-monthly assessment due around December 2018 was missed however the frequency will remain at biannual. The next assessment is due in December 2019.	Resolved

Reference	Recommendation	Response(s)	Implementation
2018-19-IOA-D	As identified in Section 2.9.3, there are identified a number of reporting inconsistencies between data presented in the quarterly reports. It is recommended that this is resolved.	**Manildra:** Shoalhaven Starches to follow-up with the testing consultant to rectify the reporting inconsistencies. **Northstar:** Noted. See also **Section 2.9.3** and **Table 10**.	Ongoing
2018-19-IOA-E	As identified in Section 2.9.4 (and Table 12), there appears to be an overall increase in odour emissions from a number of sources, as compared to the corresponding data presented in the 2018-19 and 2017-18 odour audit reports. Section 2.5 identifies a general reduction in production rates between the two reporting periods. It is recommended that the reason for the general increase in odour emission against reducing production rates is explored.	**Manildra:** For the odour sources listed in section 2.9.4 (Tables 12 & 13) there are only 4 to 5 odour sources that are scalable to ethanol production rates. The other odour sources are independent of ethanol production rates i.e. Starch & Gluten Dryers, Boilers, where emissions will vary due to factors such as the numbers of dryers operating and variation in production conditions on the days of testing. **Northstar:** Noted: See also **Section 2.9.4** and **Table 12**	Ongoing
2018-19-IOA-F	As identified in Section 2.11, the resolution of the sampling plane non-conformity with AS 4323.1 at No 3 Gluten Dryer should be provided and rectified where feasible.	**Manildra:** Gluten Dryer #3 investigation revealed a vertical plate inside the ductwork. It is not feasible to remove the plate or relocate the sampling points. Testing consultant advised they are able to locate the probe to reproduce consistent flow measurements and additional sample points are used in compliance with AS4323.1. No further action required.	Resolved

The 2019-20 biofilter capacity and condition report (#23) (see **Section 2.4**) presents a flow-weighed odour inlet concentration of 10 770 OU, which is significantly reduced from the 173 000 OU presented in the 2018-19 report (#22). The high inlet odour loading to the biofilters is considered to be resolved.

2.4. 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 #22 – 9 March 2020 (report dated 11 June 2019)
- DDG Biofilter Capacity and Condition Assessment #23 – 9 March 2020 (report dated 3 April 2020)

Note: DDG Biofilter Capacity and Condition Assessment #23 has been previously reported in the 2018-19 independent odour audit report (ref: 19.1113.FR1V2, dated 24 Oct 2019), but is part of this audit period. The tables are reproduced below.

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 $m^3 \cdot hr^{-1}$.

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 – operating parameters

Date	Position	Airflow ($m^3 \cdot hr^{-1}$)	RH (%)	Observation	Air Temp (°C)	Surface Temp (°C)	UB Pressure (Pa)
11 Jun 19 (#22)	Main duct	21 500	100 %	NR	53.3	NR	+210
	DDG bf #1	15 100	100 %	saturated	53.3	36.1	+165
	DDG bf#2	6 400	100 %	saturated	52.5	38.2	+120 to +135
9-Mar-20 (#23)	Inlet (DDG1-3)	16 100	100 %	saturated	42.6	NR	+411
	DDG bf#2	9 350	100 %	saturated	39.7	38.7	+85 to +141
	Inlet (DDG4)	2 000	100 %	NR	29.5	NR	+481
	DDG bf#1	8 750	100 %	saturated	39.2	36.5	+400

Notes: bf – biofilter
UB – under bed pressure
NR – not reported

Table 5 Biofilter capacity and condition reports – odour measurements

Date	Inlet (OU)	DDG bf#1 (OU)		DDG bf#2 (OU)		Flow weighted (OU)	Efficiency (%)
		South cell	North cell	South cell	North cell		
11 June 2019 (#22)	173 000	776	891	74	588	683	99.6
9-Mar-20 (#23)	10 770	675	388	588	675	582	94.6

With reference to **Table 5**, flow weighted average odour concentrations 683 OU and 582 OU were measured which exceeds the *de facto* standard of 500 OU.

It is additionally noted that the flow-weighted inlet odour concentration of 10 770 OU measured in report #23 is significantly reduced from the measured odour concentration of 173 000 OU reported #22.

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 d*e-facto* 500 OU standard.

2.5. 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 Process Control Sheet 2019-2020 (measurements taken between 16 May 2019 and 3 March 2020).

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 6**.

Table 6 Odour monitoring and production rates

Period	Dates	Daily Ethanol Production (L)	Annual Production Rate Equivalent (ML·year^{-1})
Q1	15-May-19	603 846	220
	20-May-19	510 889	186
Q2	07-Aug-19	566 847	207
	19-Aug-19	434 192	158
Q3	01-Nov-19	267 461	98
	04-Nov-19	476 155	174
Q4	21-Feb-20	605 935	221
	27-Feb-20	409,559	149
	02-Mar-20	618,289	226
Minimum		**267,461**	**98**
Maximum		**618,289**	**226**
Mean		**499,241**	**182**
Range (Maximum / Minimum)		**2.31**	**2.31**

For comparison purposes only, the production rates reported in the 2018-19 independent odour audit report were in the range of 458 717 $L \cdot day^{-1}$ (167 $ML \cdot y^{-1}$) to 748 920 $Lday^{-1}$ (273 $ML \cdot y^{-1}$) with a mean of 610 117 $L \cdot day^{-1}$ (223 $ML \cdot y^{-1}$). The production rates during the testing periods during the 2019-20 period were lower than those in the previous year by a factor of around 19 % as a comparison of the calculated mean values.

2.6. 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 7 below presents a summary of the odour complaints received over the reporting period. Details of the complaints recorded from direct calls and response and follow-up are presented in **Appendix F**.

Table 7 Odour complaints

Date / Time	Route	Complaint	Description	Action	Complaint Status
14 Jun 2019	Direct	Odour (052)	Odour complaint received via phone message from Sue Shoeing on 14-6-2019 at 12:59pm located at Backforest Rd. Spoke to complainant on the day of the complaint. Odour described as pungent, which comes and goes and appears to be coming from the Manildra Farm.	Called the complainant on 14-6-19 to discuss details of the complaint. A survey of the complainant's location ~ 2:00pm on 14-6-19 could not identify any odour as described by the complainant. Winds were still light westerly, with the location downwind of Shoalhaven Starches Environmental Farm. An inspection of the Environmental Farm did not reveal any unusual or abnormal odours. Advised the complainant we would continue to monitor odours at the Farm and call if there were any moreodour issues.	No further correspondence received from the complainant. No other complaints received of this nature. No further action taken. Closed

2.7. Review of Management Plans (Updated 2019)

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).

2.7.1. Odour Management Plan (Updated 2019)

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

2.7.2. Pollution Incident Response Management Plan (Updated 2019)

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

- Version 1.0.J: 23/06/20. "*Update of Figure 2; update of Tables 7.1 and 7.2; update of Table 3; update of site plan s.15.2.*"

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

2.8. 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.

2.9. Odour Monitoring Results

The results of the monitoring programs performed over the monitoring period are presented in **Table 8**, **Table 9** and **Table 11**. Copies of the monitoring reports are presented in **Appendix D** of this report.

These data are taken from:

- SEMA (2019) EPL Odour Emission Survey Quarter 1, 2019-2020 (measurements taken on 15 and 20 May 2019);
- SEMA (2019) EPL Odour Emission Survey Quarter 2 2019-2020 (measurements taken on 7 and 19 August 2019);
- SEMA (2019) EPL Odour Emission Survey Quarter 3 2019-2020 (measurements taken on 1 and 4 November 2019);

- SEMA (2019) EPL Odour Emission Survey Annual & Quarter 4 2019-2020 (measurements taken on 21 and 27 February and 2 March 2020).

2.9.1. Process Conditions during the Monitoring

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

SEMA (2018) EPL Odour Emission Survey Quarter 1, 2019-202

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

Points 13, 42 and 45 (Starch Dryer 3, Boiler No.4 and Boiler No.2) were unavailable for odour emission monitoring on the days that the Quarter 1 odour emission survey was undertaken.

SEMA (2018) EPL Odour Emission Survey Quarter 2 2019-2020

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.

SEMA (2019) EPL Odour Emission Survey Quarter 3 2019-2020

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

SEMA (2019) EPL Odour Emission Survey Annual & Quarter 4 2019-2020

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

EPA ID No.46 DDG Pellet plant exhaust was not available for odour emission monitoring during the period of days that the odour emission survey was undertaken.

All other sources were monitored as per the EPL including the emission from the new DDG Dryer No. 4 which is an additional inlet stream to the Biofilter.

2.9.2. Summary of Measurements – Annual Testing

Table 8 presents a summary of the annual odour tests over the reporting period, conducted on the effluent storage dams (EPA ID nos 1, 2, 3, 5 & 6) and the sulphur oxidation pond (EPA ID 25).

Table 8 Summary of annual odour monitoring results

EPA Ref	Location	Frequency	Q4 and Annual (OU)
19	Effluent Storage Dam 1	Annual	560
20	Effluent Storage Dam 2	Annual	510
21	Effluent Storage Dam 3	Annual	510
23	Effluent Storage Dam 5	Annual	330
24	Effluent Storage Dam 6	Annual	82
25	Sulphur Oxidation Pond	Annual	250

2.9.3. Summary of Measurements – Quarterly Testing

Table 9 presents a summary of the quarterly monitoring results measured over the reporting period. The table has been presented by source (EPA source ref) and by testing quarter (Q1 to Q4, with the corresponding dates). The data is presented as odour concentrations (OU) and as mass odour emission rates (MOER) ($OU{\cdot}Nm^3{\cdot}s^{-1}$).

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

It is noted that biofilter odour concentration measurements taken during the Q1, Q2, Q3 and Q4 tests exceed the *de facto* emission standard of 500 OU. These data are highlighted in **Table 9**.

Where the quarterly testing reports having no data ('nd'), these are similarly highlighted in **Table 9** for clarity.

Table 9 Summary of quarterly odour monitoring results

EPA Ref	Location	Frequency	Q1		Q2		Q3		Q4	
			OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}	OU	OU·Nm^3·s^{-1}
8	No 1 Gluten Dryer	Quarterly	400	5 800	310	4 700	670	9 800	360	5 200
9	No 2 Gluten / Starch Dryer	Quarterly	430	5 600	330	4 300	560	7 200	600	7 800
10	No 3 Gluten Dryer	Quarterly	660	21 600	330	10 400	430	12 700	560	18 000
11	No 4 Gluten Dryer	Quarterly	470	14 000	430	12 800	305	9 100	360	10 500
12	No 1 Starch Dryer	Quarterly	280	4 100	310	4 200	220	2 800	116	1 421
13	No 3 Starch Dryer	Quarterly	nd	nd	860	15 800	200	3 800	510	8 938
14	No 4 Starch Dryer	Quarterly	300	5 200	150	2 800	200	3 600	783	13 538
16	CO_2 Scrubber Outlet	Quarterly	6 800	18 600	10 300	28 400	10 300	20 100	8 700	12 700
--	CO_2 Scrubber Inlet	Quarterly	5 300	nd	12 200	nd	8 700	nd	7 400	nd
35	Combined Stack Boilers No5&6	Quarterly	2 200	65 800	1 200	32 700	1 800	54 000	2 000	58 500
39	Inlet Pipe Biofilters A&B (DDG#1-3)	Quarterly	24 300	79 400	15 500	50 200	5 000	16 000	25 300	82 000
39A	Inlet Pipe Biofilters A&B (DDG#4)	Quarterly	nd	nd	nd	nd	nd	nd	23 200	8 500
40	Outlet of Biofilter A (east)	Quarterly	860	760	1 400	1 300	300	230	790	720
	Outlet of Biofilter A (west)	Quarterly	2 400	1 600	1 200	900	340	270	1 240	1 100
41	Outlet of Biofilter B (east)	Quarterly	2 600	2 200	1 500	1 200	520	450	850	790
	Outlet of Biofilter B (west)	Quarterly	2 000	1 800	1 500	1 200	1 500	1 200	2 400	2 000
42	Boiler 4	Quarterly	nd	nd	2 600	29 900	1 700	17 000	2 000	24 000
44	Fermenters	Quarterly	5 700	5 700	7 200	4 900	7 300	2 500	5 200	548
45	Boiler No2 Outlet	Quarterly	nd	nd	1 200	6 700	1 500	7 700	1 500	7 100
46	DDG Pellet Plant Stack	Quarterly	1 200	25 600	1 300	27 900	3 100	67 000	nd	nd
47	No 5 Starch Dryer	Quarterly	180	9 500	460	25 700	610	30 200	430	21 083

Note: (a) nd = no data.

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

.

As part of the audit, the monitoring reports have been reviewed and summarised in **Table 9**. This is part of general due diligence required as part of the audit. As part of that audit task, a number of apparent reporting discrepancies have been identified in the various quarterly monitoring reports and these are summarised in **Table 10**. For clarity, the reporting discrepancies are not considered to be an "error", but specifically relate to occasional inconsistent reporting of those data between the various locations in the monitoring report, generally as a consequence of rounding data for significance.

As presented in **Table 10**, the values presented in Table 4-1 (of the monitoring report) should be numerically identical to the values presented in Appendix A as "Final" odour concentrations, and it is understood that Appendix A should present both the actual (i.e. "as received") and rounded (i.e. "final") odour concentrations. For most data reviewed as part of this audit this is true, but for the results presented in **Table 10** there are minor discrepancies which are highlighted for due diligence purposes.

Table 10 Identified reporting inconsistencies

Period	EPA ID No	Description	Reported Concentration (OU)		
			Table 4-1	Appendix A	
				"As received"	"Final"
Q1	40	Biofilter A (east)	850	854	860
Q3	8	No1 Gluten Dryer	665	665	670
	35	Boilers 5&6	1 830	1 800	1 800
	40	Biofilter A (east)	305	300	300
		Biofilter A (west)	335	340	340
		Biofilter B (east)	515	520	520
	42	Boiler 4	1 660	1 700	1 700
	44	Fermenter 10	7 350	7 349	7 300
	45	Boiler 2	1 540	1 500	1 500
Q4	9	No2 Gluten Dryer	610	600	600
	12	No1 Starch Dryer	120	116	116
	39	Inlet Pipe to Biofilters A&B DDG Dryers #1,2 & 3	25 000	25 300	25 300
	39A	Inlet Pipe to Biofilters A&B DDG Dryers #4	23 000	23 200	23 200
	40	Biofilter A (west)	1 200	1 240	1 240

Note: For clarity, it is acknowledged that odour concentrations may, and should, be rounded for significance, and the uncertainty associated with odour quantification is acknowledged. Neither of these factors are disputed.

2.9.4. Variability of Measurements

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

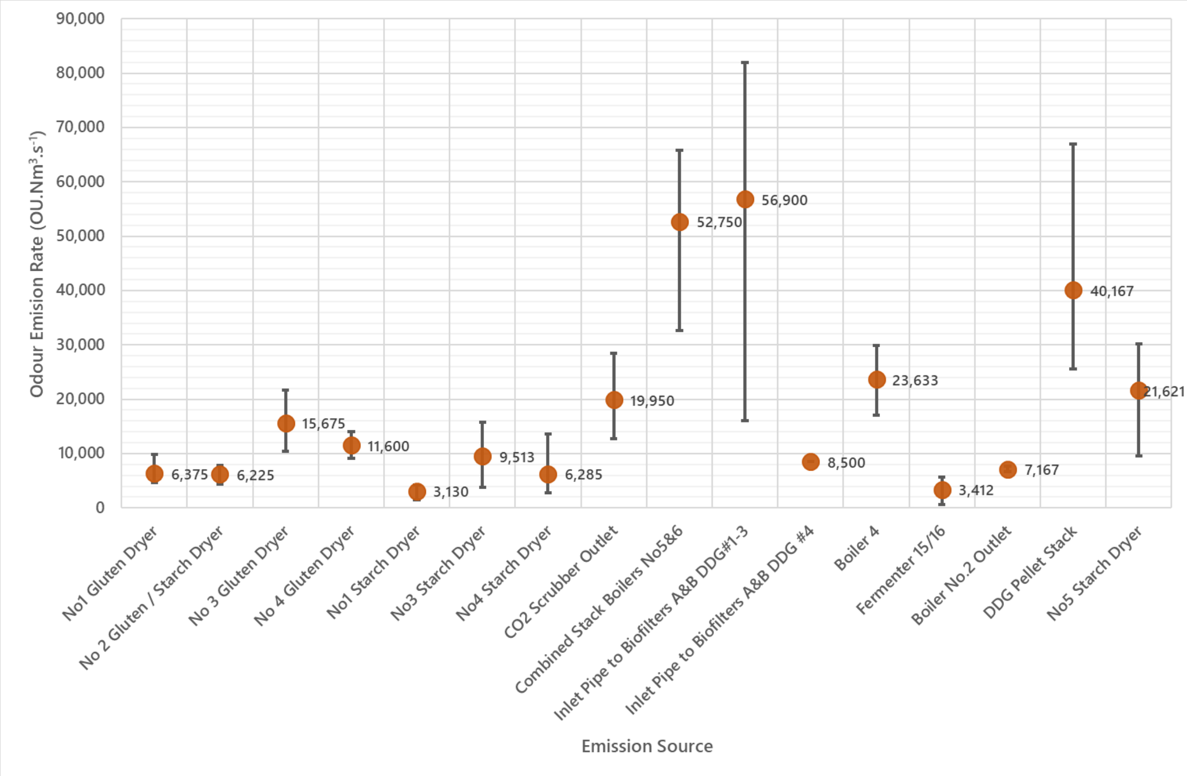
In terms of assessing the odour emission variability, the MOER (as $OU{\cdot}Nm^3{\cdot}s^{-1}$) is the critical metric and is the product of the measured odour concentration (OU) and the measured volumetric discharge rate ($Nm^3{\cdot}s^{-1}$). The variability in the MOER is presented in **Table 11**.

Table 11 Observed variability in the measured odour emission rate (by quarter)

EPA Ref	Location	MOER ($OU{\cdot}Nm^3{\cdot}s^{-1}$)					
		Count	Min.	Max.	Mean	±STDev	Max/ Min
8	No 1 Gluten Dryer	4	4 700	9 800	6 375	2 327	2.1
9	No 2 Gluten / Starch Dryer	4	4 300	7 800	6 225	1 584	1.8
10	No 3 Gluten Dryer	4	10 400	21 600	15 675	5 072	2.1
11	No 4 Gluten Dryer	4	9 100	14 000	11 600	2 211	1.5
12	No 1 Starch Dryer	4	1 421	4 200	3 130	1 306	3.0
13	No 3 Starch Dryer	3	3 800	15 800	9 513	6 021	4.2
14	No 4 Starch Dryer	4	2 800	13 538	6 285	4 938	4.8
16	CO_2 Scrubber Outlet	4	12 700	28 400	19 950	6 476	2.2
35	Combined Stack Boilers No5&6	4	32 700	65 800	52 750	14 224	2.0
39	Inlet Pipe to Biofilters A&B (DDG1-3)	4	16 000	82 000	56 900	30 843	5.1
39A	Inlet Pipe to Biofilters A&B (DDG4)	1	8 500	8 500	8 500	nd	1.0
42	Boiler 4	3	17 000	29 900	23 633	6 458	1.8
44	Fermenter 15/16	4	548	5 700	3 412	2 344	10.4
45	Boiler No2 Outlet	3	6 700	7 700	7 167	503	1.1
46	DDG Pellet Stack	3	25 600	67 000	40 167	23 267	2.6
47	No 5 Starch Dryer	4	9 500	30 200	21 621	8 897	3.2

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 OU·Nm^3·s^{-1}). Notably the measured odour emission rates from EPA 44 (Fermenter 15/16) varies by a factor of × 10.4 (although the quantum of emissions is relatively low) and EPA 39 (Inlet Pipe to Biofilters A&B [DDG1-3]) varies by a factor of ×5.1.

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 (2018) EPL Odour Emission Survey Annual & Quarter 4 2018-2019).

The data comparing the mean measured odour concentration as compared to the previous two odour audit periods is presented in **Table 12** below:

Table 12 Observed variability in the measured odour emission rate (by audit year)

EPA Ref	Source	MOER (OU·Nm^3·s^{-1})		
		2019-20	2018-19	2017-18
8	No1 Gluten Dryer	6 375	7 152	6 758
9	No2 Gluten / Starch Dryer	6 225	4 915	4 792
10	No3 Gluten Dryer	15 675	19 411	14 315
11	No4 Gluten Dryer	11 600	14 355	9 831

EPA Ref	Source	MOER ($OU \cdot Nm^3 \cdot s^{-1}$)		
		2019-20	2018-19	2017-18
12	No1 Starch Dryer	3 130	6 068	3 262
13	No3 Starch Dryer	9 513	5 376	3 504
14	No4 Starch Dryer	6 285	3 824	4 172
16	CO2 Scrubber Outlet	19 950	18 171	9 409
35	Combined Stack Boilers No5&6	52 750	43 831	35 532
39	Inlet Pipe to Biofilters A&B DDG#1-3	56 900	31 757	24 396
39A	Inlet Pipe to Biofilters A&B DDG#4	8 500	#N/A	#N/A
42	Boiler 4	23 633	18 926	3 453
44	Fermenter 15/16(A)	3 412	1 303	2 137
45	Boiler No.2 Outlet	7 167	#N/A	#N/A
46	DDG Pellet Plant Stack	40 167	46 073	47 900
47	No5 Starch Dryer	21 621	#N/A	#N/A
aggregate ($OU \cdot Nm^3 \cdot s^{-1}$)		**292 902**	**221 160**	**169 460**
mean ethanol production rate ($ML \cdot yr^{-1}$)		**182**	**223**	**237**
odour emission intensity ($OU \cdot ML^{-1}$)		**1 607**	**993**	**715**

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

The mean ethanol production rates (as $ML \cdot year^{-1}$) have been refenced from **Section 2.5**. It is noted that the production rates relate to the mean daily production rates averaged across all days during the Q1-Q4 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 increasing.

The MOER is the product of the measured odour concentration (OU) and the volumetric discharge rate ($Nm^3 \cdot s^{-1}$) expressed as $OU \cdot Nm^3 \cdot s^{-1}$. **Table 13** 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 13 Observed variability in the measured odour concentration and volumetric discharge rate

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate ($Nm^3 \cdot s^{-1}$)			
		Max	Mean	Min	Max/ Min	Max	Mean	Min	Max/ Min
8	No1 Gluten Dryer	670	435	310	2.2	15.16	14.68	14.44	1.0
9	No2 Gluten / Starch Dryer	600	480	330	1.8	13.03	12.98	12.86	1.0
10	No3 Gluten Dryer	660	495	330	2.0	32.73	31.48	29.53	1.1
11	No4 Gluten Dryer	470	391	305	1.5	29.84	29.64	29.17	1.0
12	No1 Starch Dryer	310	232	116	2.7	14.64	13.29	12.25	1.2
13	No3 Starch Dryer	860	523	200	4.3	19.00	18.30	17.53	1.1

EPA Ref	Location	Odour Concentration (OU)				Volumetric Discharge Rate ($Nm^3 \cdot s^{-1}$)			
		Max	Mean	Min	Max/ Min	Max	Mean	Min	Max/ Min
14	No4 Starch Dryer	783	358	150	5.2	18.67	17.82	17.29	1.1
16	CO2 Scrubber Outlet	10 300	9 025	6 800	1.5	2.76	2.23	1.46	1.9
35	Combined Stack Boilers No5&6	2 200	1 800	1 200	1.8	30.00	29.10	27.25	1.1
39	Inlet Pipe to Biofilters A&B DDG#1-3	25 300	17 525	5 000	5.1	3.24	3.23	3.20	1.0
39A	Inlet Pipe to Biofilters A&B DDG #4	23 200	23 200	23 200	1.0	0.37	0.37	0.37	1.0
42	Boiler 4	2 600	2 087	1 660	1.6	12.00	11.25	10.24	1.2
44	Fermenter 15/16	7 300	6 350	5 200	1.4	1.00	0.53	0.11	9.5
45	Boiler No.2 Outlet	1 500	1 400	1 200	1.3	2.50	2.14	1.78	1.4
46	DDG Pellet Stack	3 100	1 867	1 200	2.6	21.61	21.54	21.46	1.0
47	No5 Starch Dryer	610	420	180	3.4	55.87	51.80	49.03	1.1

Further to the variability in the MOER from EPA 44 Fermenter 14/15 by a factor of ×10.4 (see **Table 11**), **Table 13** shows that the measured odour concentration is relatively constant (a factor of 1.4) and the measured volumetric discharge rate, with a factor of 9.5is the driver for increasing odour emissions.

2.10. Odour Modelling

The GHD odour modelling assessment *Manildra Group – Manildra Modification 19 Air Quality Assessment* (ref: 12534209, dated August 2020) (GHD, 2020) is reproduced in **Appendix E**.

MOD 19 Modelling - Emissions Inventory

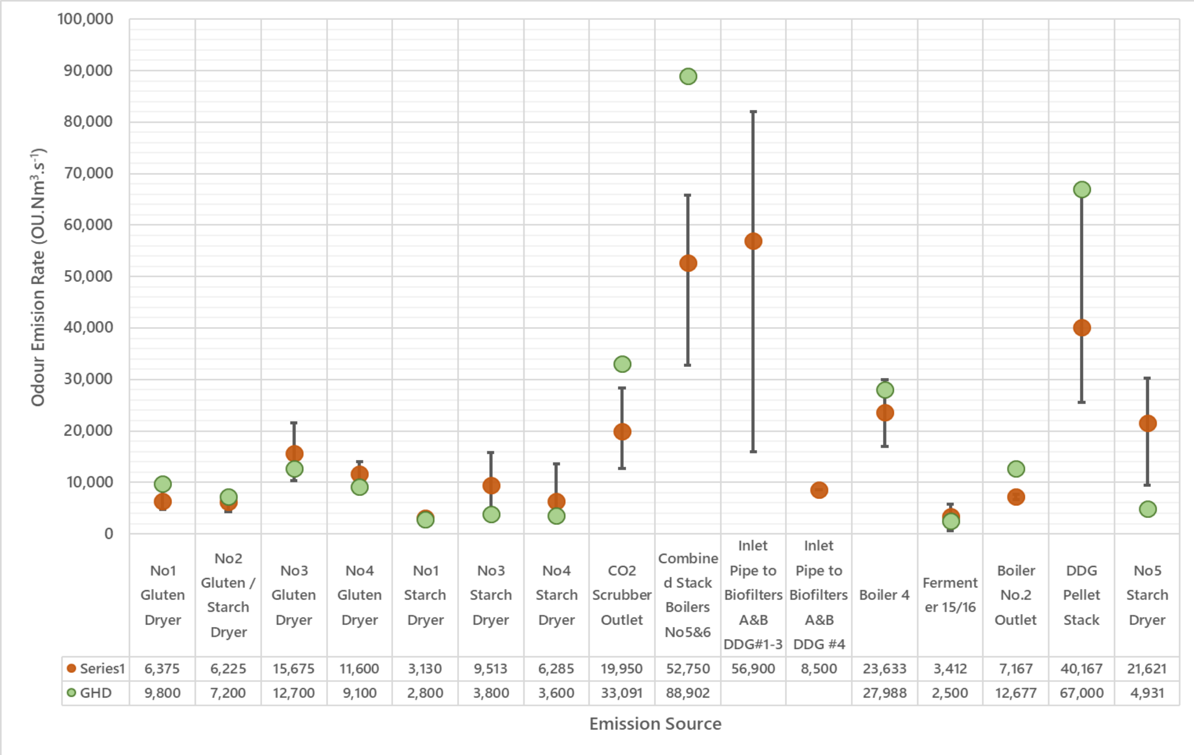
The assumptions and changes to the MOD 13, 16 & 17 odour modelling for MOD 19 are presented in section 7.1.3 of (GHD, 2020) and are reproduced below:

- *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 a 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 3, 2019 (November 2019)*
- *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 Mod 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) 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 current 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 MOD19 emissions inventory based on improvements at the site and subsequently being removed as a EPL odour sampling point*
- *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 shows a total measured odour emission rate of 292 902 $OU{\cdot}Nm^3{\cdot}s^{-1}$ and a modelled odour emission rate of 286 089 $OU{\cdot}Nm^3{\cdot}s^{-1}$, accounting for 97.7 % of that measured during the period. 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



Mod16 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 are reproduced below in **Table 14**.

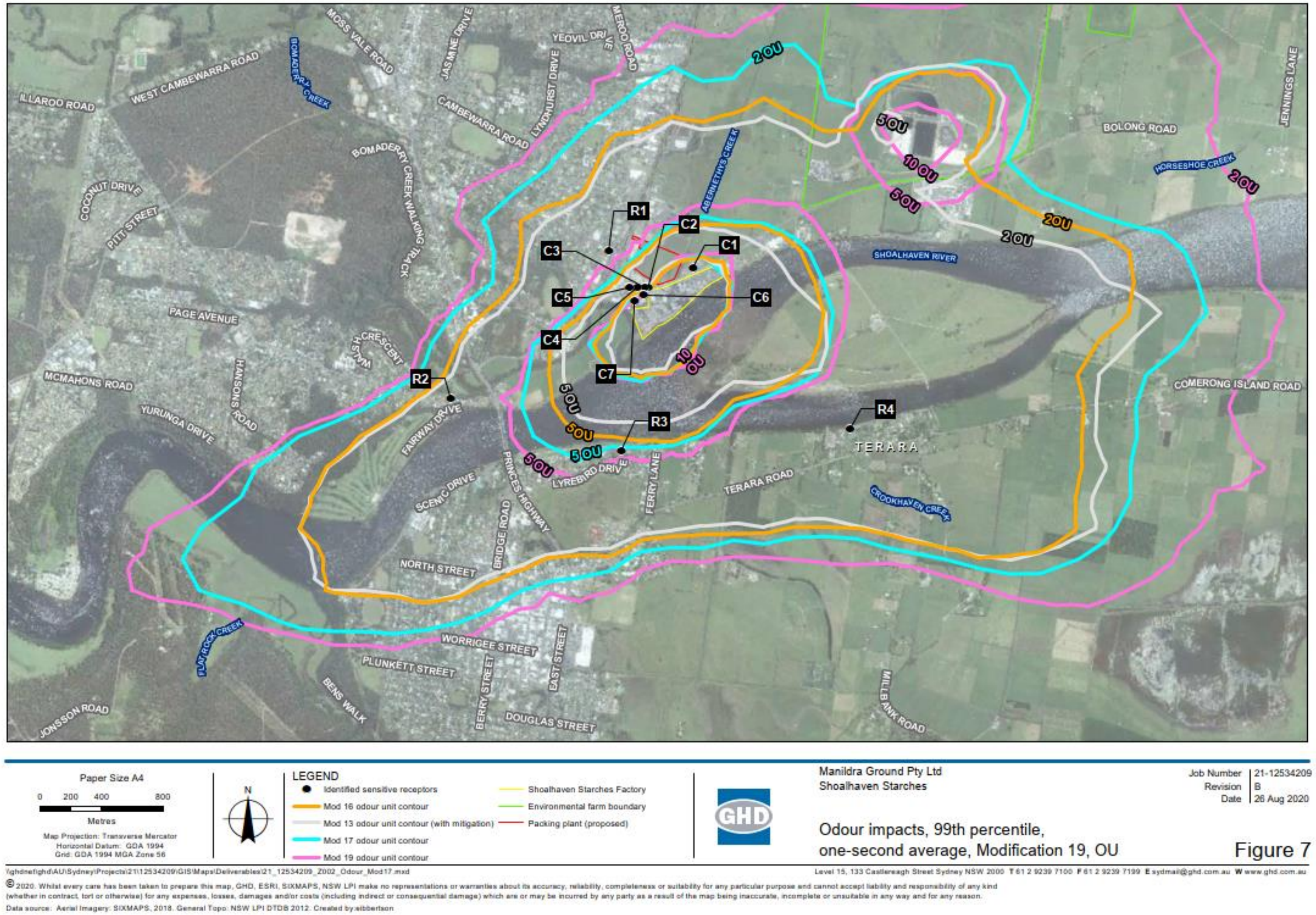
Table 14 Summary of odour modelling results (99th percentile 1-second OU)

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

Note: Predicted exceedances of the relevant criterion are highlighted

It may be noted that for MOD19 the modelling predicts compliance with stated NSW EPA criteria. The isopleth plot for the predicted odour footprints are replicated in **Figure 3** (figure 7 of (GHD, 2019).

Figure 3 Ground level odour predictions (GHD, 2020)



3. SUMMARY

Based upon the information reviewed the following recommendations are proposed.

3.1. Independent Odour Audit Non-Compliances

Table 15 below presents the observed non-compliances against the consolidated odour conditions (see **Table 2**).

Table 15 Independent odour audit non-compliances

Condition	Requirement	Evidence & Independent Audit Findings and Recommendations	Compliance Status
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.	The quarterly odour monitoring reports are discussed in **Section 2.9**, and attached as **Appendix D** to this audit report. **Section 2.9.1** details the "process conditions" during each monitoring campaign, including which processes were not available for testing. It is noted that the Quarter 4 monitoring was not performed on the DDG exhaust stack.	Non-compliant

3.2. Recommendations

Table 16 Independent odour audit recommendations

Reference	Recommendation	Implementation
2019-20 Odour Audit Recommendations		
2019-20-IOA-A	As identified at **Section 2.4** and **Section 2.9**, and as stated in the Biofilter Capacity and Condition Assessment report #23, the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing
2019-20-IOA-B	As identified in **Section 2.9.3** and **Table 10**, there are identified a number of reporting inconsistencies between data presented in the quarterly reports.	Ongoing
2018-19 Odour Audit Recommendations		
2018-19-IOA-B	As identified at Section 2.4, Section 2.9.3 (of the 2018-19 audit) and stated in the Biofilter Capacity and Condition Assessment report #22 (June 2019), the biofilters are not achieving the *de facto* 500 OU	Ongoing

Reference	Recommendation	Implementation
	standard. This should be flagged for ongoing observation and remedial action as required.	
2018-19-IOA-D	As identified in Section 2.9.3 (of the 2018-19 audit), there are identified a number of reporting inconsistencies between data presented in the quarterly reports. It is recommended that this is resolved.	Ongoing
2018-19-IOA-E	As identified in Section 2.9.4 (and Table 12) (of the 2018-19 audit), there appears to be an overall increase in odour emissions from a number of sources, as compared to the corresponding data presented in the 2018-19 and 2017-18 odour audit reports. Section 2.5 identifies a general reduction in production rates between the two reporting periods. It is recommended that the reason for the general increase in odour emission against reducing production rates is explored.	Ongoing
2017-18 Odour Audit Recommendations		
2017-18-IOA-C	As identified at Section 2.3 (of the 2017-18 audit) and stated in the Biofilter Capacity and Condition Assessment report #21 (April 2018), the biofilters are not achieving the *de facto* 500 OU standard. This should be flagged for ongoing observation and remedial action as required.	Ongoing

APPENDIX A – DIRECTOR GENERAL'S LETTER OF APPOINTMENT

NSW GOVERNMENT | Planning & Infrastructure

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

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

Ref: 10/06422-9

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

Dear Mr Studdert

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

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

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

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

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

Finally, the Department requests that you:

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

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

Yours sincerely

C. Ritchie 8/3/16.
Chris Ritchie
Director - Industry Assessments
as the Secretary's nominee

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

Independent Audit Declaration Form

Project Name:	Shoalhaven Starches
Consent Number:	06_0228
Description of Project	Shoalhaven Starches Independent Odour Audit (2019-2020)
Project Address	160 Bolong Road, Bomaderry, NSW 2541
Proponent	Shoalhaven Starches Pty Ltd
Title of Audit	Shoalhaven Starches Independent Odour Audit (2019-2020)
Date	21st September 2020

I declare that I have undertaken the Independent Audit and prepared the contents of the attached Independent Odour Audit Report and to the best of my knowledge:

- the audit has been undertaken in accordance with relevant condition(s) of consent and the Independent Audit Post Approval Requirements (Department 2018);
- the findings of the audit are reported truthfully, accurately and completely;
- I have exercised due diligence and professional judgement in conducting the audit;
- I have acted professionally, objectively and in an unbiased manner;
- I am not related to any proponent, owner or operator of the project neither as an employer, business partner, employee, or by sharing a common employer, having a contractual arrangement outside the audit, or by relationship as spouse, partner, sibling, parent, or child;
- I do not have any pecuniary interest in the audited project, including where there is a reasonable likelihood or expectation of financial gain or loss to me or spouse, partner, sibling, parent, or child;
- neither I nor my employer have provided consultancy services for the audited project that were subject to this audit except as otherwise declared to the Department prior to the audit; and
- I have not accepted, nor intend to accept any inducement, commission, gift or any other benefit (apart from payment for auditing services) from any proponent, owner or operator of the project, their employees or any interested party. I have not knowingly allowed, nor intend to allow my colleagues to do so.

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)

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

APPENDIX B – BIOFILTER PHOTOGRAPHS

APPENDIX C – DDG BIOFILTER CAPACITY AND CONDITION ASSESSMENT REPORTS

TO: JOHN STUDDERT
COMPANY: MANILDRA GROUP, SHOALHAVEN STARCHES
FROM: TERRY SCHULZ
DATE: 3 APRIL 2020
SUBJECT: DDG BIOFILTER PERFORMANCE AND CONDITION ASSESSMENT 23 – 9 MARCH 2020

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 23, undertaken on 9 March 2020 by TOU.

2. Biofilter Design – DDG Biofilters 1 & 2

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

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

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

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

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

Airflow:	15.8 m/s,16,100 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	42.6°C
Inlet air pressure:	+411 Pa

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

Airflow:	9.2 m/s, 9,350 m^3/hr (ϕ = 600 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	39.7°C
Inlet air pressure:	+290 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	38.7°C (mean)
Duct pressure in header manifold:	+191 Pa
Biofilter under-bed drain pressure:	+141 Pa Cell 1, + 85 Pa Cell 2

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

Airflow:	7.8 m/s, 2,000 m^3/hr (ϕ = 300 mm)
Inlet air relative humidity:	100%
Inlet air temperature:	29.5°C
Inlet air pressure:	+481 Pa

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

Airflow:	8,750 m^3/hr
Inlet air relative humidity:	100%
Inlet air temperature:	39.2°C

Inlet air pressure:	+400 Pa
Biofilter outlet air humidity:	saturated
Biofilter surface air temperature:	36.5ºC (mean)

The combined total flow to the biofilters is 18,100 m^3/hr

The distribution of airflow to the two biofilters is now relatively even, when compared to historical results. This is a desirable outcome.

5. Spatial Testing Results

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

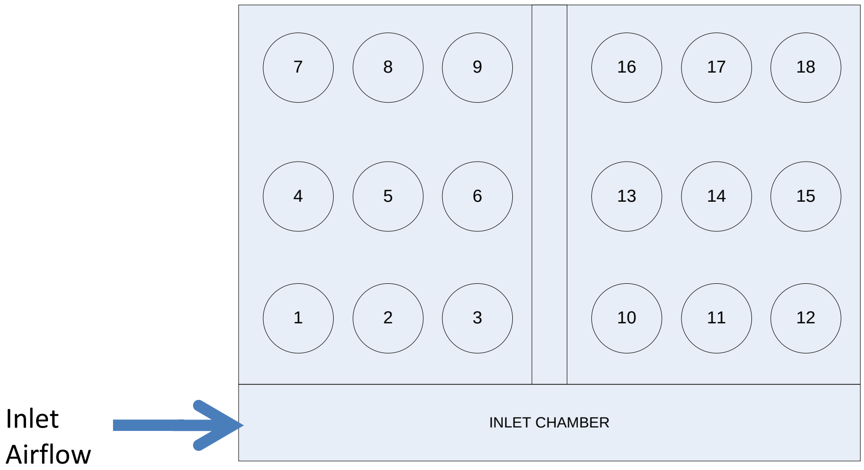


Figure 5.1 Spatial Testing Locations – DDG Biofilter 1

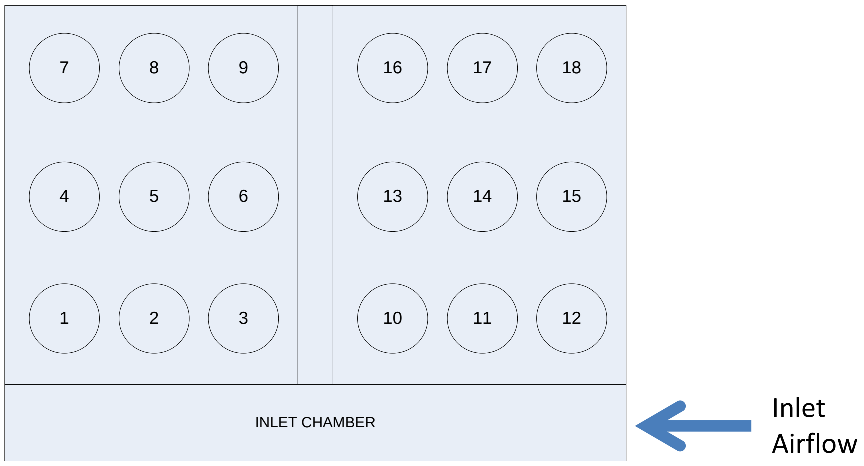


Figure 5.2 Spatial Testing Locations – DDG Biofilter 2

Table 5.1 – Spatial airflow results: DDG Biofilter 1: 9 March 2020

Biofilter Cell	Location ID	Outflow Velocity (m/s)	Mean Outlet Temperature (^{0}C)
Cell 1 (Northern Cell)	Location 1	0.71	See **Section 4**
	Location 2	0.50	
	Location 3	0.64	
	Location 4	0.87	
	Location 5	0.72	
	Location 6	0.63	
	Location 7	0.62	
	Location 8	0.63	
	Location 9	0.64	
Cell 2 (Southern Cell)	Location 10	0.66	
	Location 11	0.75	
	Location 12	0.70	
	Location 13	0.66	
	Location 14	0.60	
	Location 15	0.59	
	Location 16	0.67	
	Location 17	0.72	
	Location 18	0.71	

Table 5.2 – Spatial airflow results: DDG Biofilter 2: 9 March 2020

Biofilter Cell	Location ID	Outflow Velocity (m/s)	Mean Outlet Temperature (^{0}C)
Cell 1 (Southern Cell)	Location 1	0.79	See **Section 4**
	Location 2	0.96	
	Location 3	1.07	
	Location 4	1.08	
	Location 5	0.63	
	Location 6	0.91	
	Location 7	1.07	
	Location 8	0.94	
	Location 9	0.81	
Cell 2 (Northern Cell)	Location 10	0.97	
	Location 11	0.83	
	Location 12	0.97	
	Location 13	0.75	
	Location 14	0.80	
	Location 15	0.88	
	Location 16	1.00	
	Location 17	0.81	
	Location 18	0.71	

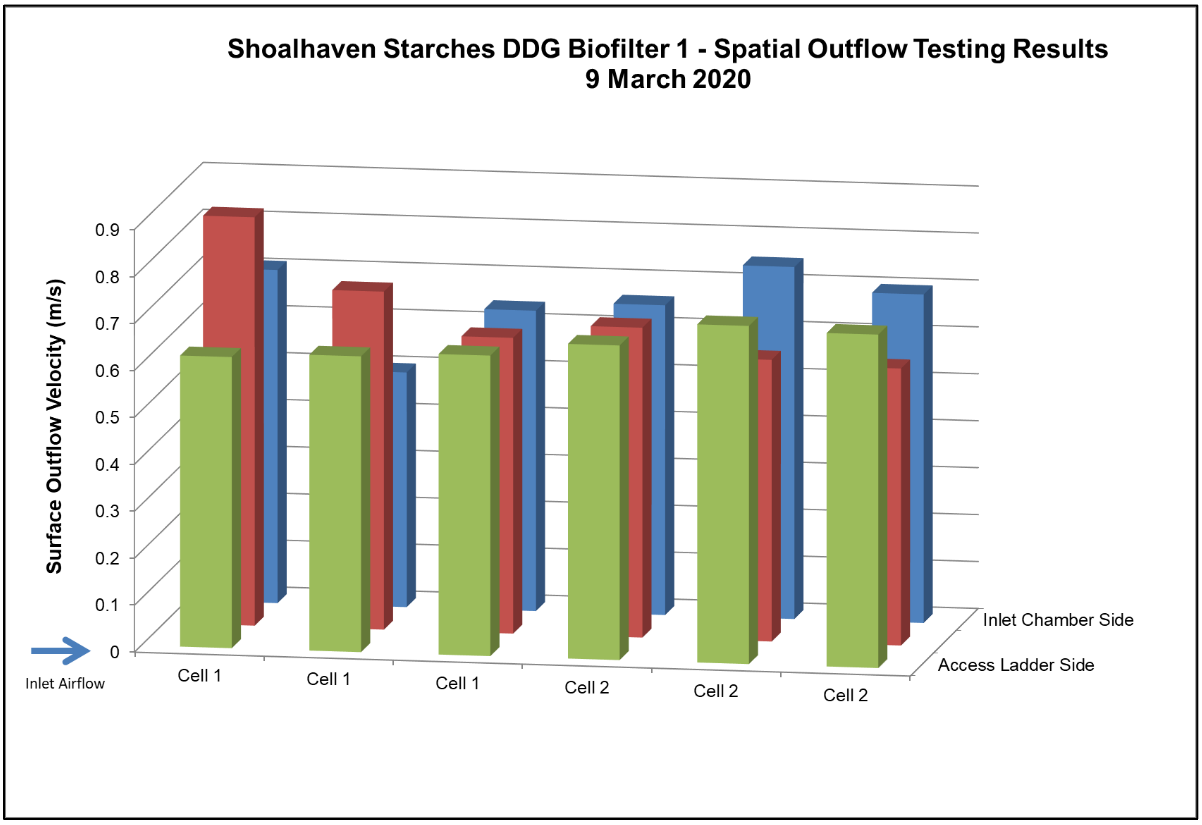


Figure 5.3 – Biofilter 1: Spatial Outflow Testing Results on 9 March 2020

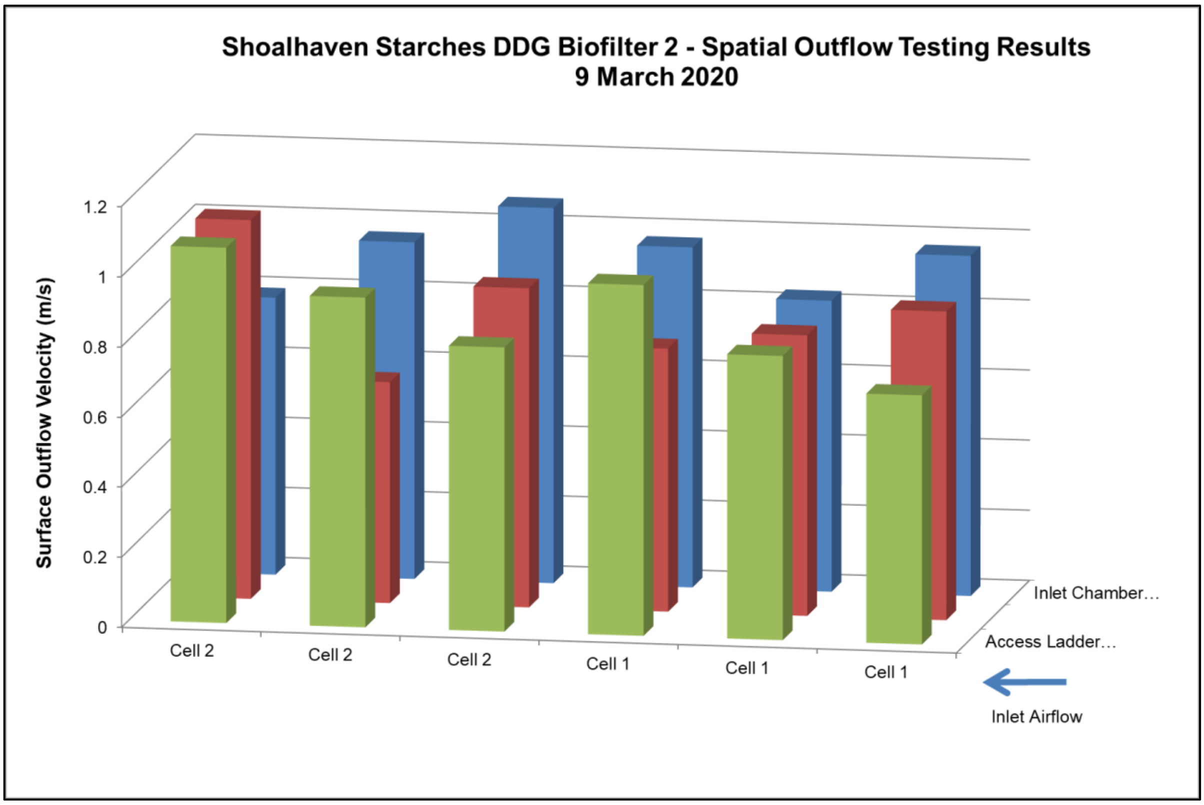


Figure 5.4 – Biofilter 2: Spatial Outflow Testing Results on 9 March 2020

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. On this occasion a further sample was collected from the new 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:

Common Biofilter Inlet:	9,770 ou (nutty, grainy, oily)
Dryer #4 Duct:	18,800 ou (nutty, grainy, oily)
Flow Weighted Inlet to biofilters:	10,770 ou
Biofilter 2 Cell 2 Outlet – Southern Cell:	588 ou (earthy, musty)
Biofilter 2 Cell 1 Outlet – Northern Cell:	675 ou (earthy, musty)
Biofilter 1 Cell 2 Outlet: - **Southern Cell:**	675 ou (earthy, musty)
Biofilter 1 Cell 1 Outlet – Northern Cell:	388 ou (earthy, musty)
Mean Result:	582 ou
Mean Odour Destruction Efficiency:	94.6%

The above results indicate that both biofilters appear to be again operating extremely well.

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 **Figures 7.1 - 7.5** and include temperature, airflow, back-pressure, and odour concentration.

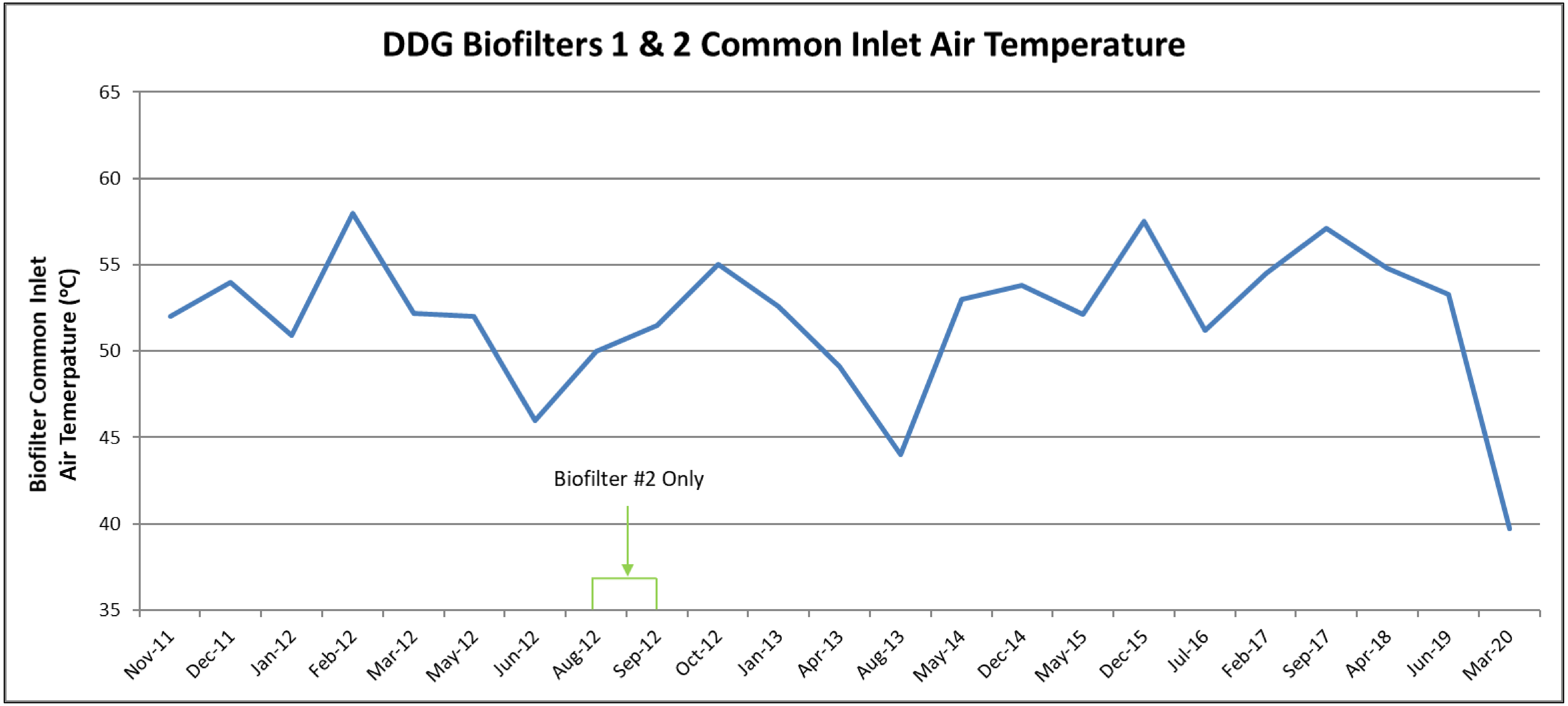


Figure 7.1 – DDG Biofilters 1 & 2 Common Inlet Air Temperature Monitoring

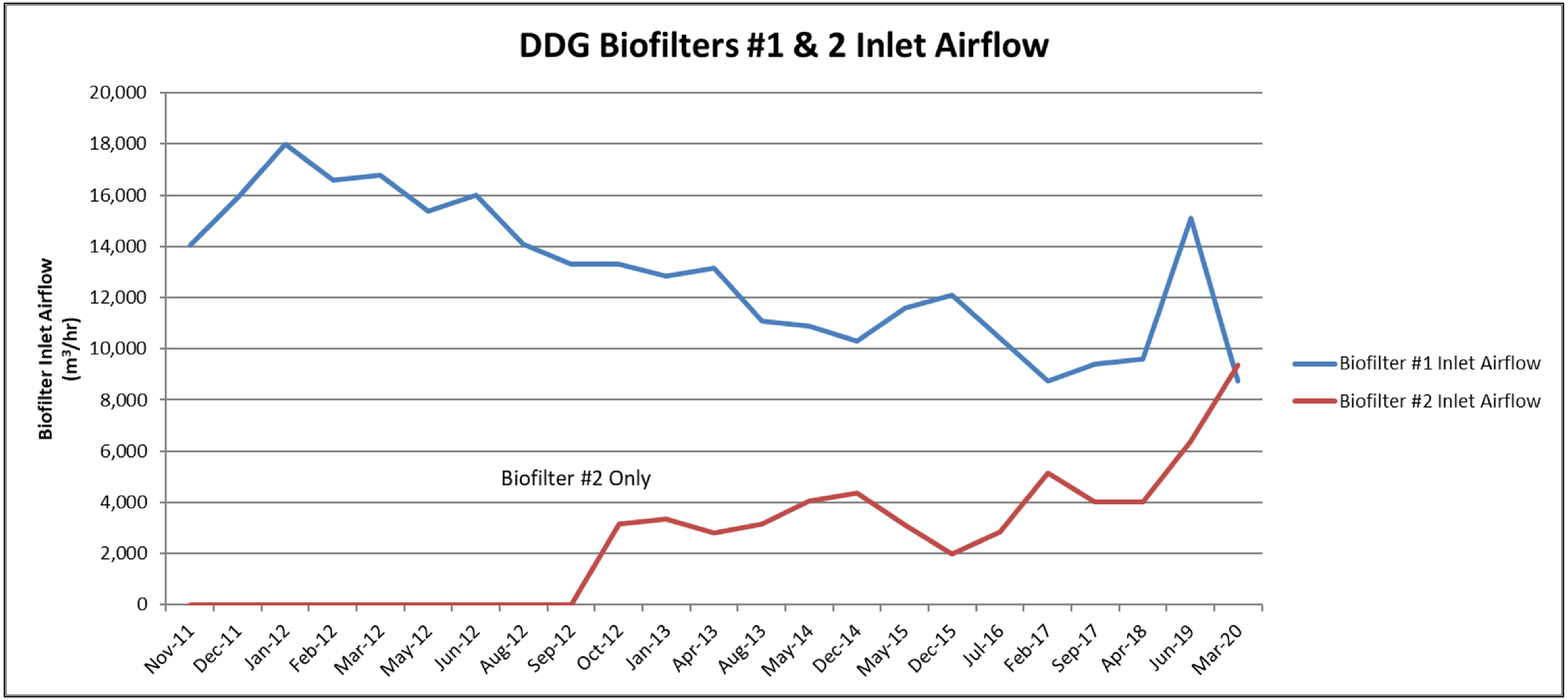


Figure 7.2 – DDG Biofilters 1 & 2 Inlet Airflows

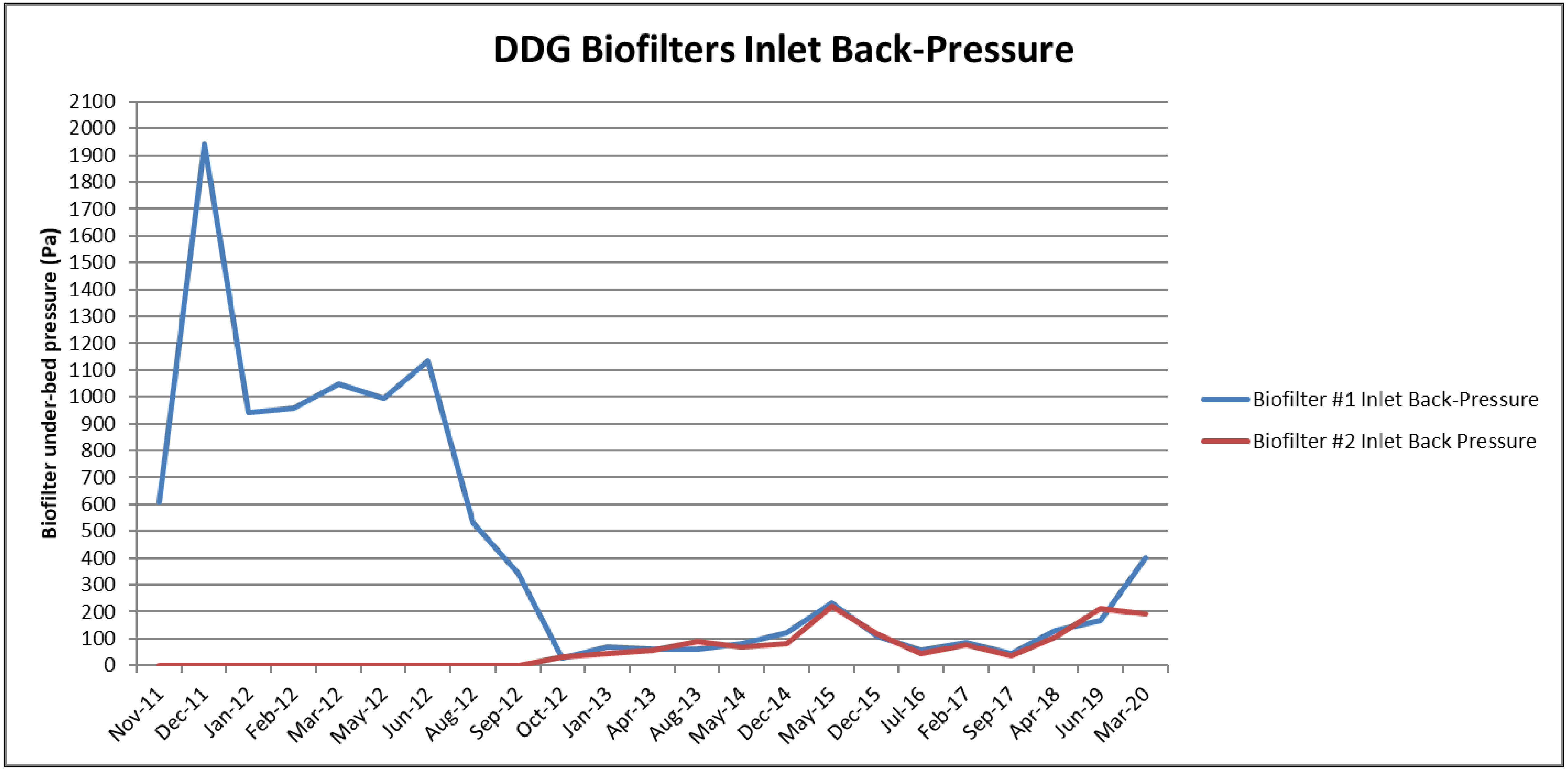


Figure 7.3 – DDG Biofilters 1 & 2 Inlet Back-Pressures

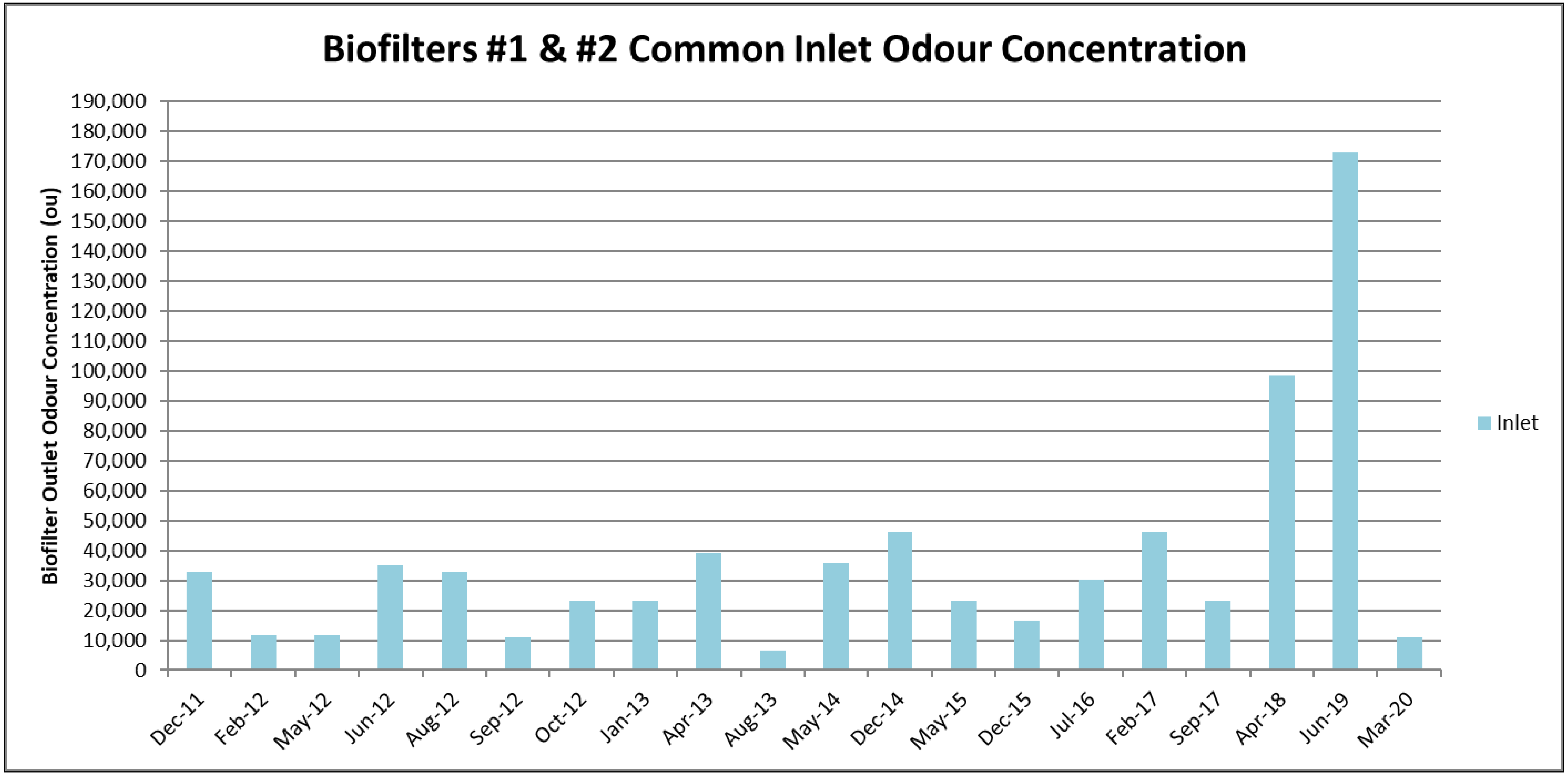


Figure 7.4 – DDG Biofilters 1 & 2 Common Odour Inlet Concentration

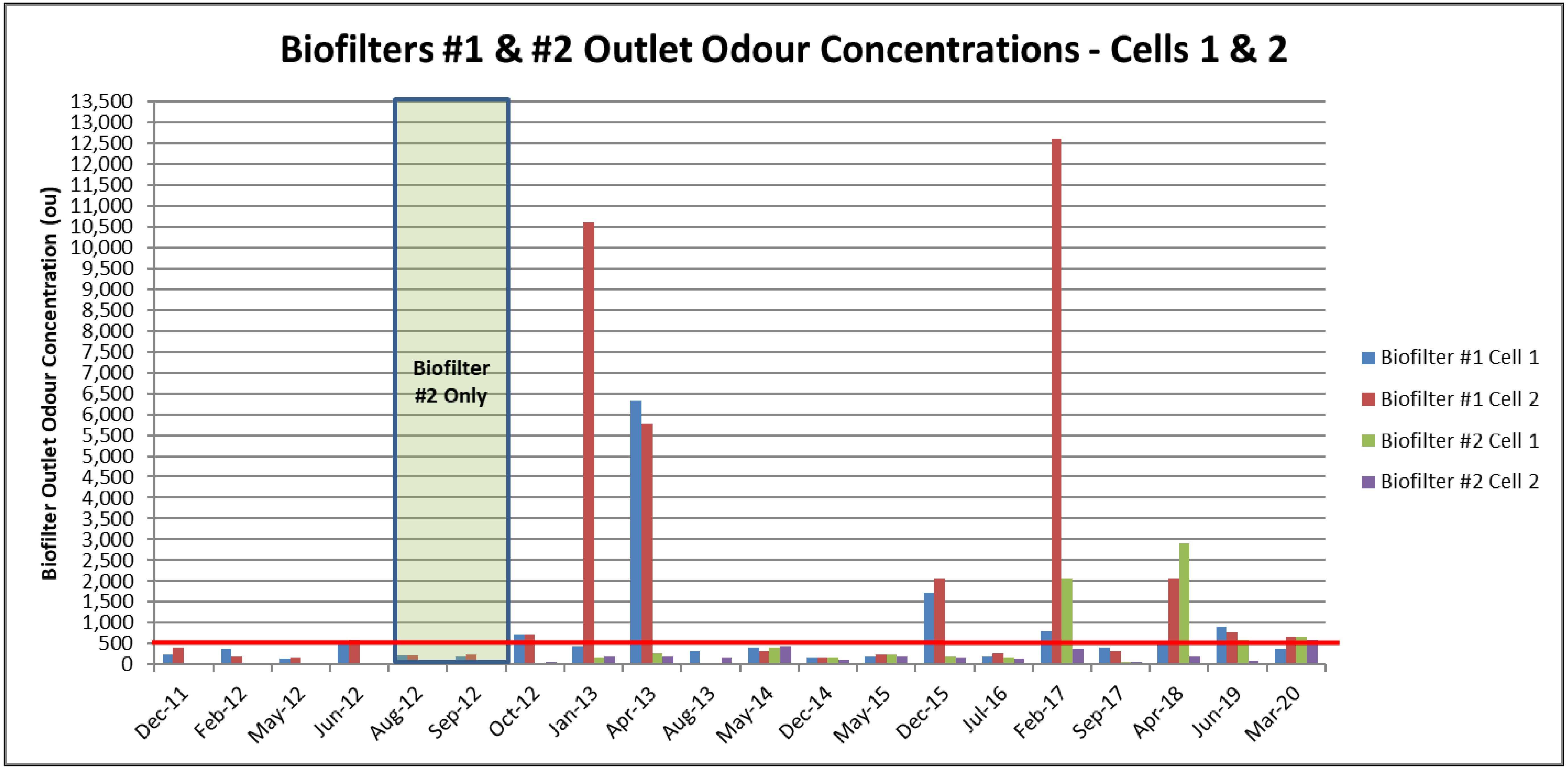


Figure 7.5 – DDG Biofilters 1 & 2 Odour Outlet Concentrations

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 characteristic biofilter odour was not detectable 30 metres downwind of the biofilters. There was no evidence of DDG odour.

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 returned to the historical airflow rate, following a ‘spike’ in flow results in the previous assessment. The distribution of airflow between the two biofilters is now relatively even (48%/52% in favour of Biofilter 2). This is desirable from both a performance and medium life perspective;

- The addition of the new airflow from Dryer #4 has added 2,000 m^3/hr to the airflow, without any detrimental consequences.

- While the mean flow-weighted outlet odour concentration of 582 ou slightly exceeded the nominal 500 ou target concentration, the lack of any residual DDG odour character in the treated samples suggests that the measured odour was due to the odour from the biofilter medium itself;

- The slight decrease in odour removal efficiency is due to the large decrease in inlet odour concentration;

- The inlet odour concentration, now supplemented with the new Dryer #4 odour input, has returned to the pre-2017 data range. This is a very comfortable odour concentration for the biofilters;

- The temperatures of the inlet air and the biofilter outflows was lower than expected. This biofilter system has shown itself to be resilient to elevated and variable temperatures. The reason for the decrease in temperature is unknown;

- Biofilter back-pressures show a normal small increase, from the previous assessments; and

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

11. Concluding Remarks

In summary, the condition and performance of both biofilters were excellent. No action is required.

The next annual assessment is scheduled for **September 2020**.

The Odour Unit Pty Ltd

Signed by:

Terry Schulz
Managing Director

Attachment:

- Odour Concentration Laboratory Results: 10 March 2020

THE ODOUR UNIT PTY LTD

Level 3 Suite 12
56 Church Avenue
MASCOT NSW 2020

Phone: +61 2 9209 4420
Email: info@odourunit.com.au
Internet: 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	John Studdert	Facsimile	(02) 4423 8331
Sampling Site	Bomaderry, NSW	Email	john.studdert@manildra.com.au
Sampling Method	Drum & Pump	Sampling Team	TOU

Order details:

Order requested by	John Studdert	Order accepted by	T. Schulz
Date of order	Refer to correspondence	TOU Project #	N1752L
Order number	Refer to correspondence	Project Manager	T. Schulz
Signed by	John 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 ºC ±3 ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: 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: Monday, 16 March 2020

Panel Roster Number: SYD20200310_028

A. Schulz
NSW Laboratory Coordinator

D. Hepple
Authorised Signatory

Odour Sample Measurement Results
Panel Roster Number: SYD20200310_028

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.m³/m²/s) (See Note:1)*
Sample #1 -- Biofilter 1 Cell 1	SC20226	09.03.2020 1350 hrs	10.03.2020 1034 hrs	5	10	--	--	388	388	--
Sample #2 -- Biofilter 1 Cell 2	SC20227	09.03.2020 1359 hrs	10.03.2020 1109 hrs	5	10	--	--	675	675	--
Sample #3 -- Biofilter 2 Cell 1	SC20228	09.03.2020 1410 hrs	10.03.2020 1142 hrs	5	10	--	--	675	675	--
Sample #4 -- Biofilter 2 Cell 2	SC20229	09.03.2020 1419 hrs	10.03.2020 1301 hrs	5	10	--	--	588	588	--
Sample #5 -- Biofilter Common Inlet	SC20230	09.03.2020 1427 hrs	10.03.2020 1341 hrs	5	8	--	--	9,770	9,770	--
Sample #6-- Dryer Duct 4 (new)	SC20231	09.03.2020 1435 hrs	10.03.2020 1415 hrs	5	10	--	--	18,800	18,800	--

Samples Received in Laboratory – From: TOU Date: 10.03.2020 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	SYD20200310_028	51,400	$20 \leq \chi \leq 80$	832	62	Yes

Comments

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

SC20226 sour, fermented
SC20227 sour, fermented
SC20228 sour, fermented
SC20229 sour, fermented
SC20230 grain, nutty oil
SC20231 grain, 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, 2019-2020

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.:	**6080/S25115B/19**
Dates of Survey:	**May 15 and 20, 2019**
Date of Issue:	**14 June, 2019**

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

EPL ODOUR EMISSION SURVEY QUARTER 1, 2019-2020

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: 6080/S25115B/19

DATE OF SURVEY: MAY 15 AND 20, 2019

DATE OF ISSUE: 14 JUNE, 2019

P W STEPHENSON

J WEBER

M KIMBER

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF TABLES – APPENDICES

TABLE OF FIGURES – APPENDICES

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_2) 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, 2019-2020 odour test results are presented in this report. The tests were conducted on 15 and 20 May 2019.

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_2 Scrubber outlet	1	Quarterly
Not specified	CO_2 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
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.5	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/m³	=	kilograms per cubic metre
m/s	=	metres per second
m³/s	=	cubic metres per second
mg/m³	=	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/m³	Quarterly	TM-23
Flow	m³/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)

Pollutant	Units	Frequency	Approved Method
Cadmium	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Mercury	mg/m^3	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^3	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m^3	Annual	TM-4
Temperature	^oC	Quarterly	TM-2
Total Solid Particles	mg/m^3	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m^3	Quarterly	TM-34
Volumetric Flowrate	m^3/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.

Points 13, 42 and 45 (Starch Dryer 3, Boiler No.4 and Boiler No.2) were unavailable for odour emission monitoring on the days that the Quarter 1 odour emission survey was undertaken.

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 6080/ORLA/01 and 02 are 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, 2019-2020

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	20/05/2019	400
9	No.2 Gluten Dryer	20/05/2019	430
10	No.3 Gluten Dryer	20/05/2019	660
11	No.4 Gluten Dryer	20/05/2019	470
12	No.1 Starch Dryer	20/05/2019	280
13	No.3 Starch Dryer	Not sampled	--
14	No.4 Starch Dryer	20/05/2019	300
16	Carbon Dioxide Scrubber Outlet	15/05/2019	6800
--	Carbon Dioxide Scrubber Inlet	15/05/2019	5300
35	Combined Stack No.5 & 6 Boilers	20/05/2019	2200
42*	Boiler No.4 Outlet	Not sampled	--
44	Fermenter (No. 16)	15/05/2019	5700
45*	Boiler No.2 Outlet	Not sampled	--
46	DDG Pellet Plant Stack	15/05/2019	1200
47	No.5 Starch Dryer	15/05/2019	180

Key: ou = odour units
* = EPL ID Nos. 13, 42 and 45 were unavailable to test on any of the days monitoring was undertaken

TABLE 4-2 EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, Q1, 2019-2020

EPA ID No.	**Description**	**Date**	**Odour Concentration** (ou)
39	Inlet to Biofilters A & B	15/05/2019	24300
40	Outlet of Biofilter A (east)	15/05/2019	850
40	Outlet of Biofilter A (west)	15/05/2019	2400
41	Outlet of Biofilter B (east)	15/05/2019	2600
41	Outlet of Biofilter B (west)	15/05/2019	2000

Key: ou = odour units

5 CONCLUSIONS

SEMA completed the odour sampling and analysis at Shoalhaven Starches manufacturing facility at Bomaderry for Quarter 1, 2019 - 2020.

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. Note Starch Dryer No.3 was not available for testing.

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. Note Boiler No.4 was undergoing maintenance this quarter and was not available for testing.

Figure 5-8 graphically shows the Bio-filter emission concentrations since autumn 2010.

Figure 5-9 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

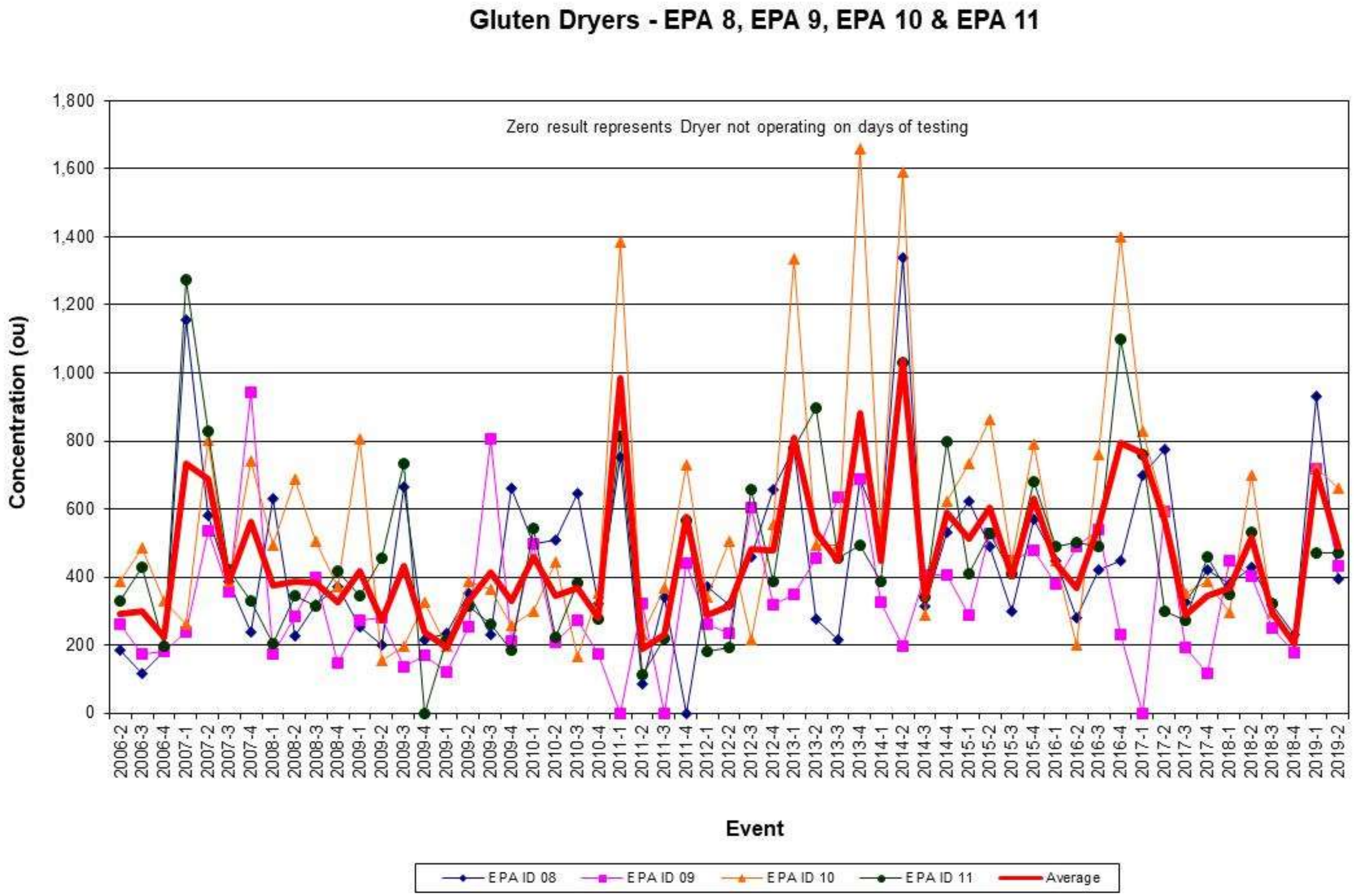


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1 & 4

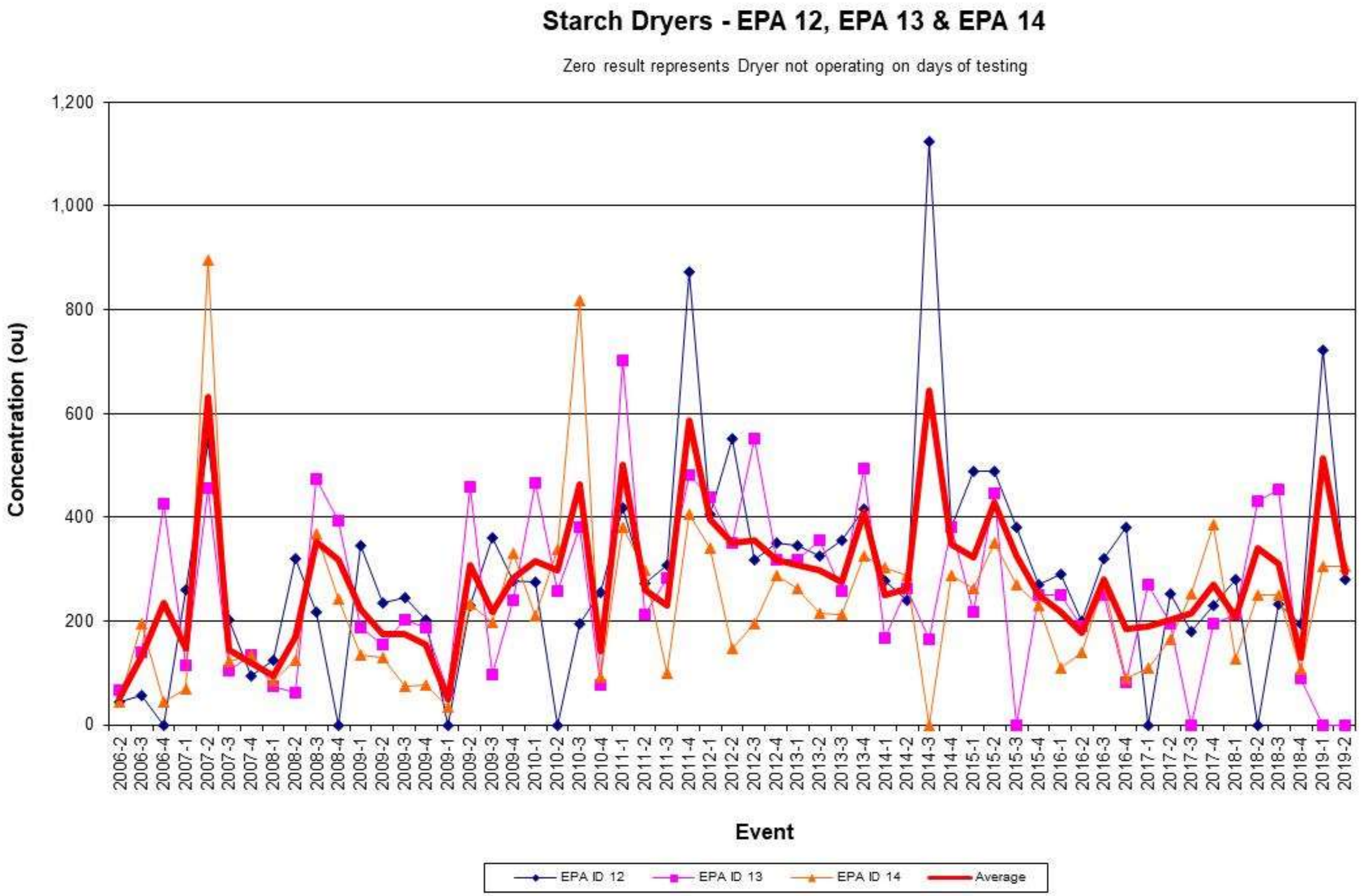


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5

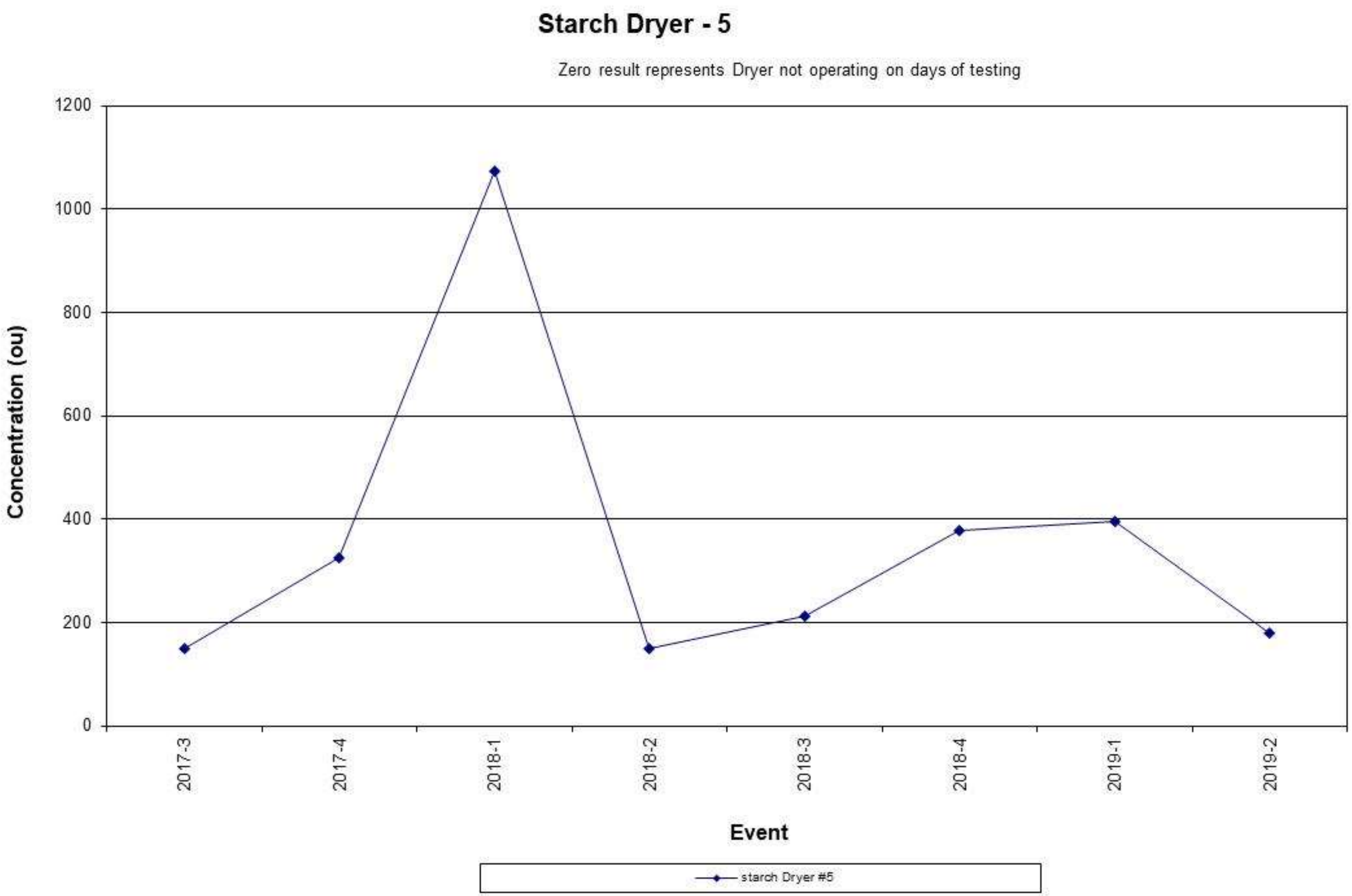


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS

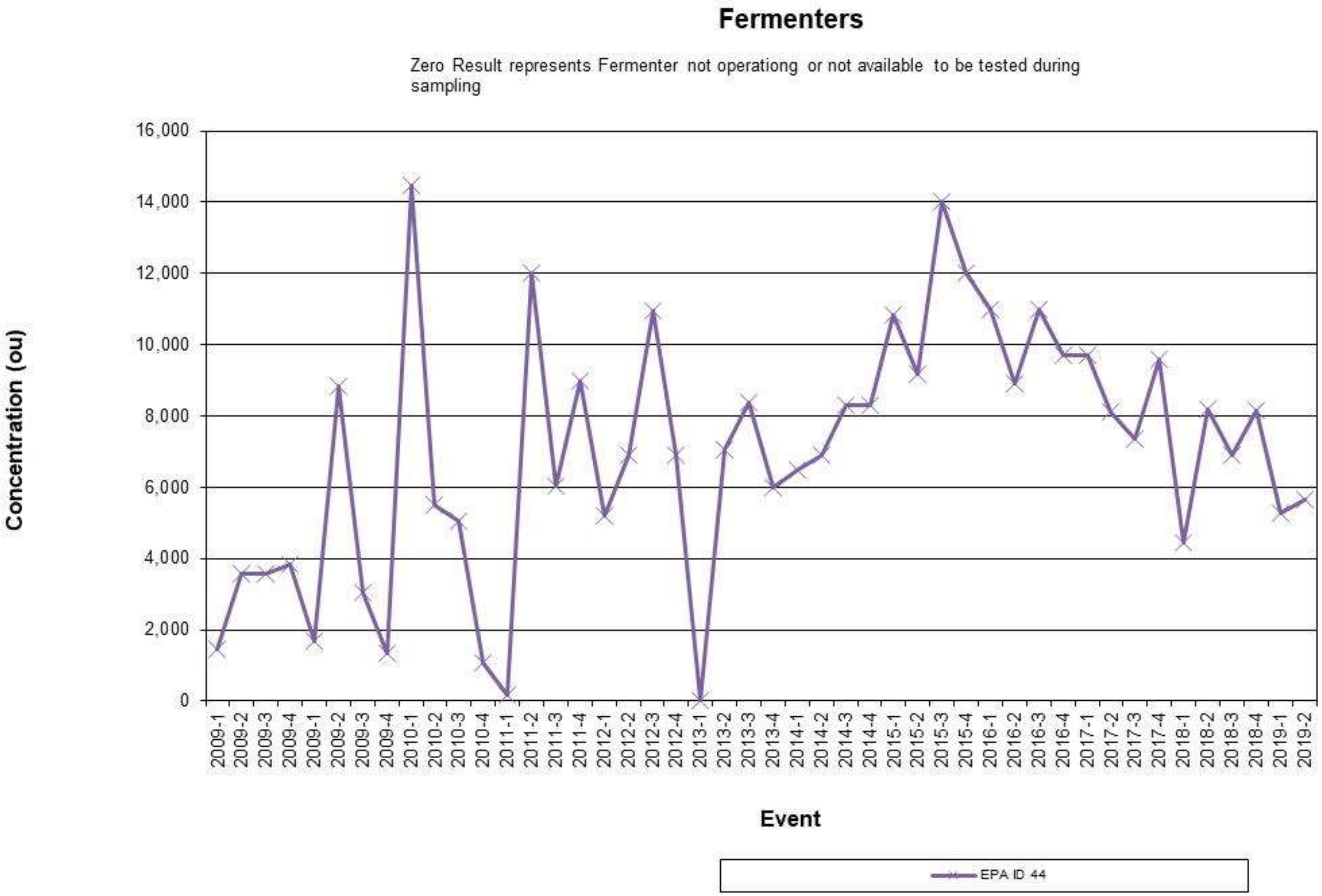


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET

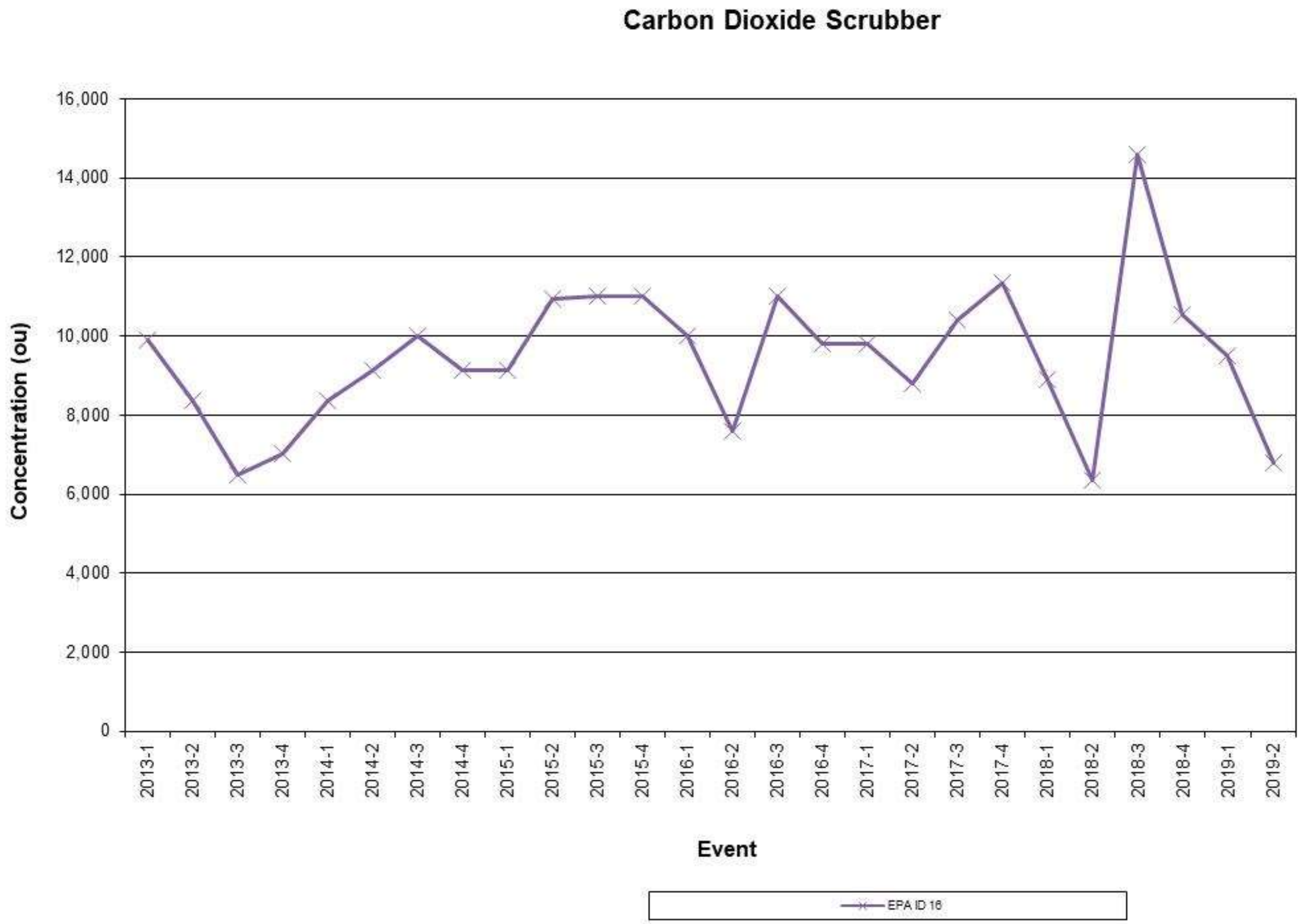


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK

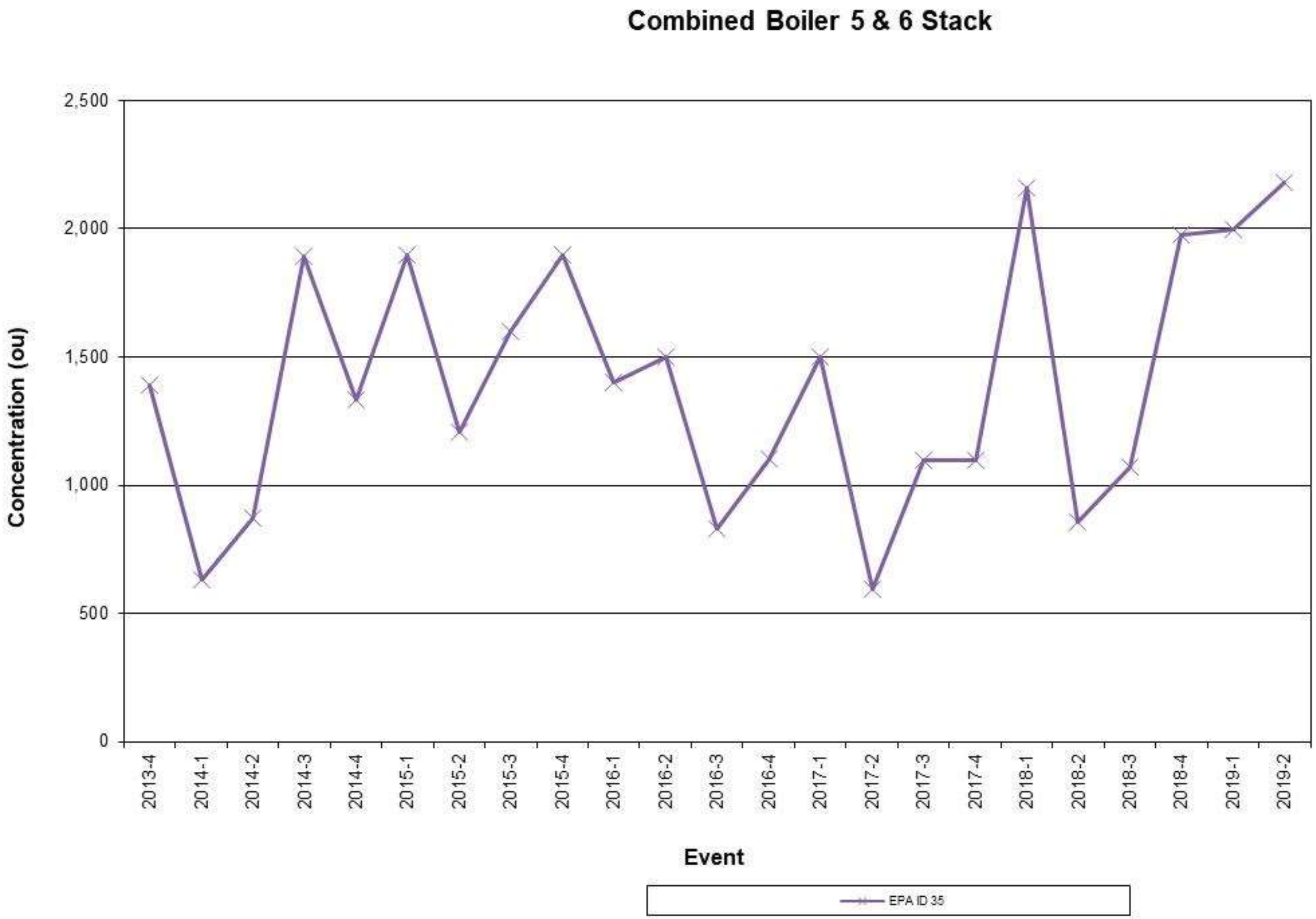


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK

Note: Not available for testing Quarter 1 2019-2010.

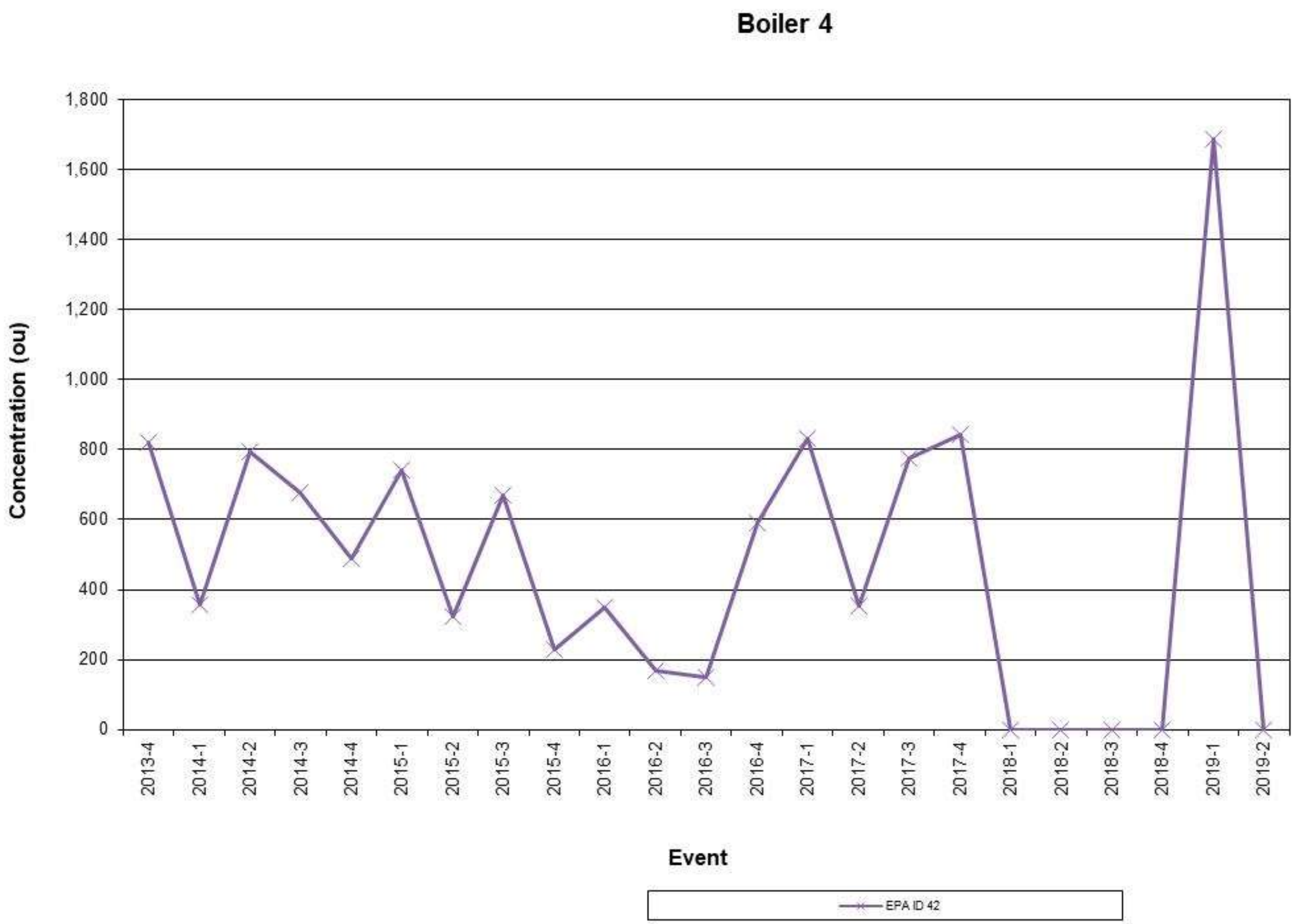


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS

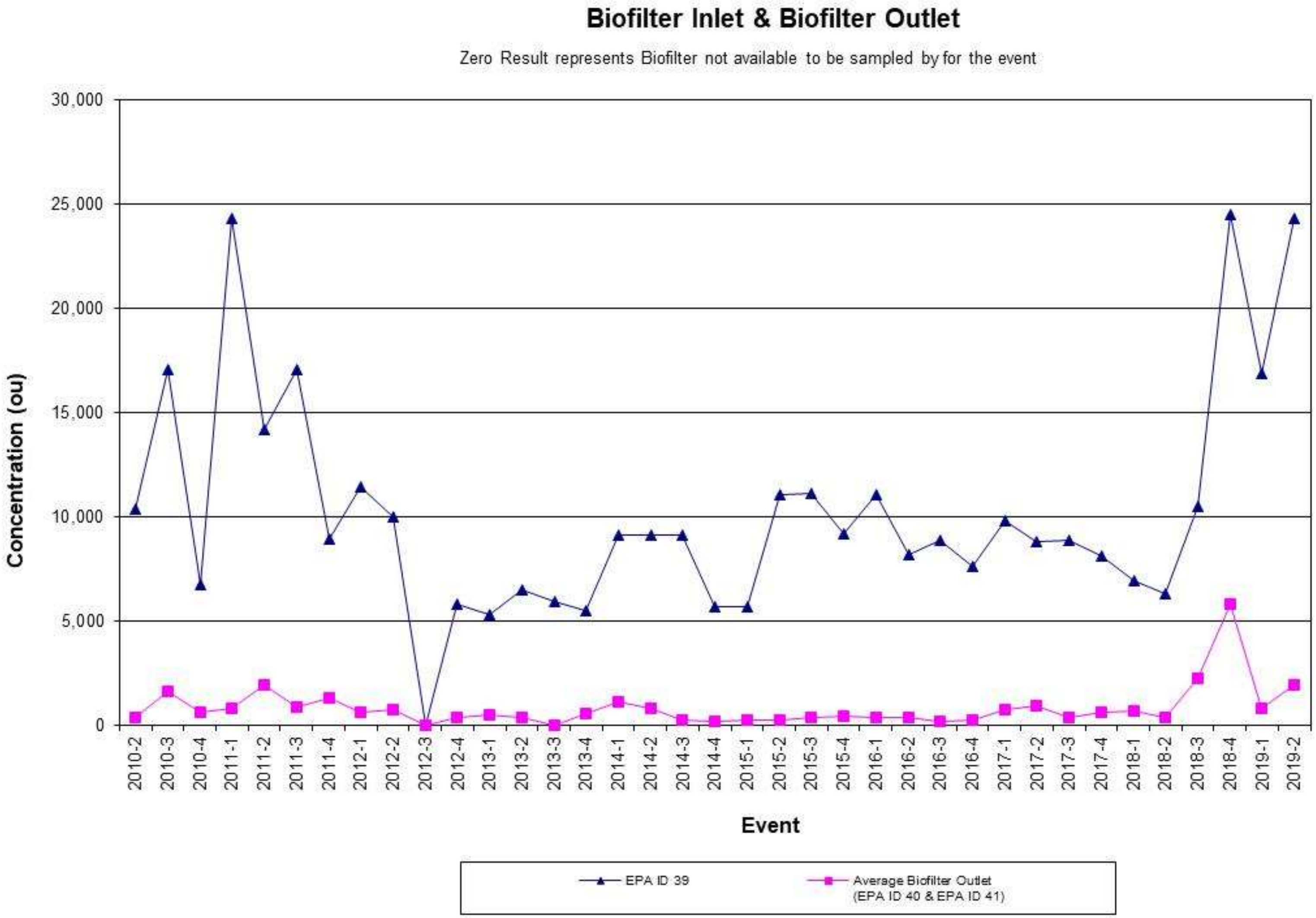
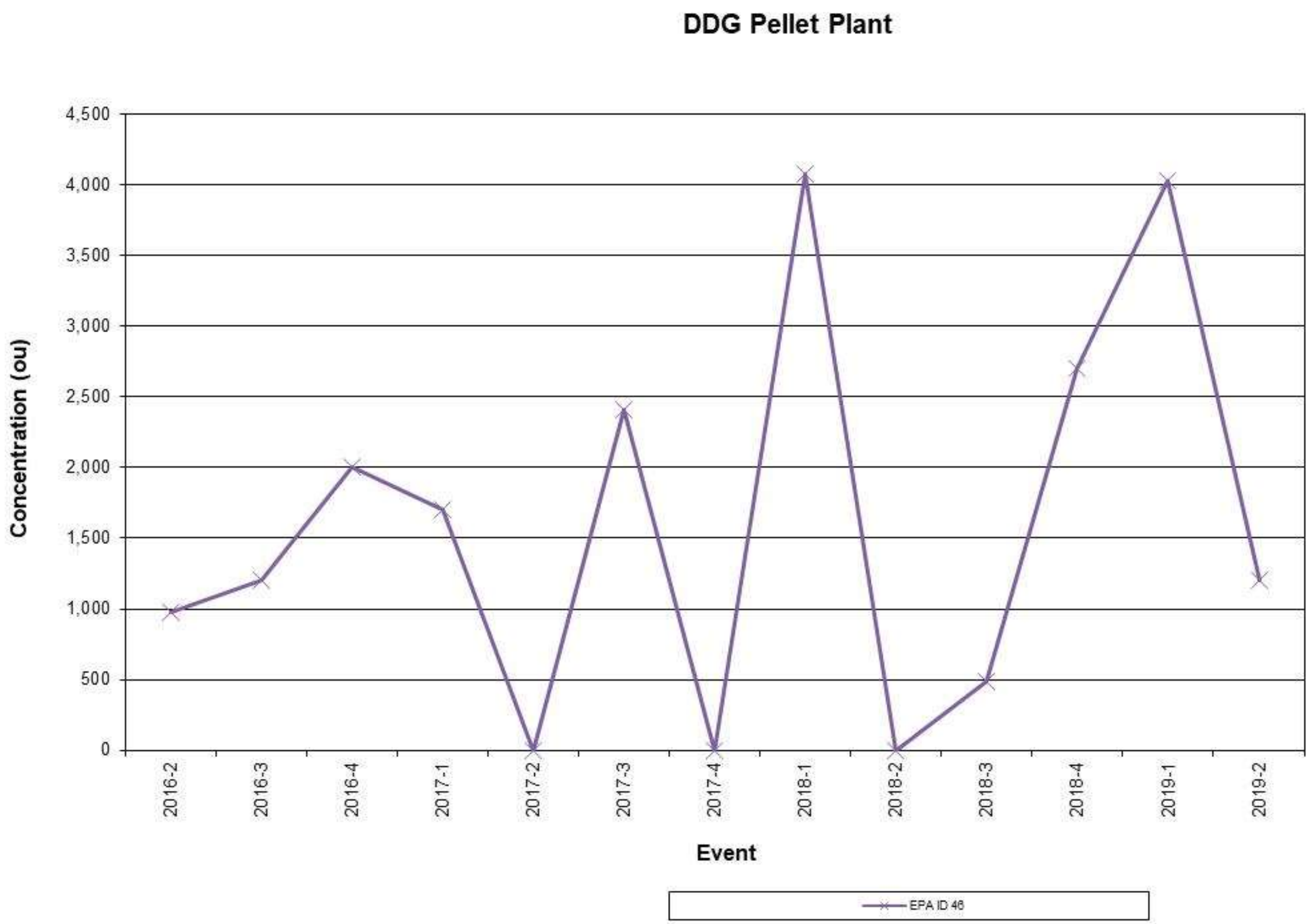


FIGURE 5-9 CONCENTRATION DDG PELLET PLANT STACK



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: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the colour, as in 'it smells like …' *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.*

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^oC) connected to a chromel/alumel (K-type) thermocouple probe.

6.4 OXYGEN (O_2)

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

O_2 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
^oC	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	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	6080			
Project Name	Shoalhaven Starches			
Test Location	**EPA ID 8 Gluten Dryer No.1**	**EPA ID 9 Gluten Dryer No.2**	**EPA ID 10 Gluten Dryer No.3**	**EPA ID 11 Gluten Dryer No.4**
Date	20-May-2019			
	Dry			
Run	1	1	1	1
Method	TM-1, TM-2 & TM-22			
Sample Start Time (hrs)	16:35	12:30	18:40	17:55
Sample Stop Time (hrs)	17:00	12:49	19:02	18:17
Inlet/Exhaust	Exhaust			
Stack Temperature (^{o}C)	75.9	66.0	77.0	76.5
Stack Cross-Sectional area (m^2)	1.43	1.09	4.41	2.31
Average Stack Gas Velocity (m/s)	13.6	16.7	10.1	17.3
Actual Gas Flow Volume (am^3/min)	1,160	1,100	2,680	2,390
Total Normal Gas Flow Volume (m^3/min)	877	778	1,960	1,790
Total Normal Gas Flow Volume (m^3/s)	14.6	13.0	32.7	29.8
Total Stack Pressure (kPa)	102.8	94.4	103.2	101.5
Moisture Content (% by volume)	5.1	5.7	8.0	4.7
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^3)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5177	5174	5178	5179
SEMA Number	727539	727536	727540	727541
Sample Start Time (hrs)	16:50	12:45	18:52	18:07
Sample Finish Time (hrs)	17:00	12:48	19:02	18:17
Odour Concentration (As Received) (ou)	396	432	660	470
Odour Concentration (Final) (ou)	400	430	660	470
Normal MOER (As Received) (ou m^3/s)	5,787	5,600	21,591	13,984
Normal MOER (Final) (ou m^3/s)	5,800	5,600	21,600	14,000
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit			
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

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

Emission Test Results			
Project Number	6080		
Project Name	Shoalhaven Starches		
Test Location	**EPA ID 12 Starch Dryer No.1**	**EPA ID 14 Starch Dryer No.4**	**EPA ID 47 Starch Dryer No.5**
Date	20-May-2019	20-May-2019	15-May-2019
	Dry	Dry	Dry
Run	1	1	1
Method	TM-1,TM-2 & TM-22		
Sample Start Time (hrs)	17:12	12:05	10:38
Sample Stop Time (hrs)	17:35	12:30	11:00
Inlet/Exhaust	Exhaust		
Stack Temperature (°C)	40.1	45.3	62.2
Stack Cross-Sectional area (m^2)	2.25	1.00	4.52
Average Stack Gas Velocity (m/s)	7.7	20.8	14.6
Actual Gas Flow Volume (am^3/min)	1,040	1,250	3,970
Total Normal Gas Flow Volume (m^3/min)	877	1,020	3,130
Total Normal Gas Flow Volume (m^3/s)	14.6	16.9	52.2
Total Stack Pressure (kPa)	102.9	103.0	102.7
Moisture Content (% by volume)	4.4	6.9	4.3
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8
Dry Gas Density (kg/m^3)	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9
Analysis	Odour		
Method	AS4323.3		
ORLA Number	5176	5175	5162
SEMA Number	727538	727537	727523
Sample Start Time (hrs)	17:25	15:55	10:50
Sample Finish Time (hrs)	17:35	16:05	11:00
Odour Concentration (As Received) (ou)	280	305	181
Odour Concentration (Final) (ou)	280	300	180
Normal MOER (As Received) (ou m^3/s)	4,091	5,162	9,448
Normal MOER (Final) (ou m^3/s)	4,100	5,200	9,500
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit		
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

TABLE A- 3 EMISSION TEST RESULTS – BOILER 5 & 6 STACK

Emission Test Results	
Project Number	6080
Project Name	Shoalhaven Starches
Test Location	**EPA ID 35 Boilers No.5 & 6 Combined Stack**
Date	20-May-2019
	Dry
Run	1
Method	TM-1 & TM-2 & TM-22
Sample Start Time (hrs)	14:19
Sample Stop Time (hrs)	14:41
Inlet/Exhaust	Exhaust
Stack Temperature (^oC)	143
Stack Cross-Sectional area (m^2)	3.14
Average Stack Gas Velocity (m/s)	15.3
Actual Gas Flow Volume (am^3/min)	2,880
Total Normal Gas Flow Volume (m^3/min)	1,810
Total Normal Gas Flow Volume (m^3/s)	30.2
Total Stack Pressure (kPa)	101.8
Moisture Content (% by volume)	4.9
Molecular Weight Dry Stack Gas (g/gmole)	30.1
Dry Gas Density (kg/m^3)	1.34
Oxygen (%)	8.4
Analysis	Odour
Method	AS4323.3
ORLA Number	5173
SEMA Number	727535
Sample Start Time (hrs)	14:31
Sample Finish Time (hrs)	14:41
Odour Concentration (As Received) (ou)	2181
Odour Concentration (Final) (ou)	2200
Normal MOER (As Received) (ou m^3/s)	65,796
Normal MOER (Final) (ou m^3/s)	65,800
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit
Calculations entered by	JW
Calculations checked by	PWS

TABLE A-4 EMISSION TEST RESULTS – CO_2 SCRUBBER OUTLET & FERMENTER 16

<table>
<tr><th colspan="4">Emission Test Results</th></tr>
<tr><td>Project Number</td><td colspan="3">6080</td></tr>
<tr><td>Project Name</td><td colspan="3">Shoalhaven Starches</td></tr>
<tr><td>Test Location</td><td>EPA ID 16 CO₂ Scrubber Outlet</td><td>EPA ID 16 CO₂ Scrubber Inlet</td><td>EPA ID 44 Fermenter 16</td></tr>
<tr><td>Date</td><td colspan="3">15-May-2019</td></tr>
<tr><td></td><td>Dry</td><td>Dry</td><td>Dry</td></tr>
<tr><td>Run</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Method</td><td colspan="3">TM-1,TM-2 & TM-22</td></tr>
<tr><td>Sample Start Time (hrs)</td><td>12:35</td><td>12:35</td><td>12:34</td></tr>
<tr><td>Sample Stop Time (hrs)</td><td>12:56</td><td>12:56</td><td>12:55</td></tr>
<tr><td>Inlet/Exhaust</td><td>Exhaust</td><td>Inlet</td><td>Exhaust</td></tr>
<tr><td>Stack Temperature (°C)</td><td>18.3</td><td>18.0</td><td>34.0</td></tr>
<tr><td>Stack Cross-Sectional area (m²)</td><td>0.20</td><td rowspan="10">Exhaust gas flow details as for outlet. Inlet sample port is not compliant with TM-1.</td><td>0.07</td></tr>
<tr><td>Average Stack Gas Velocity (m/s)</td><td>14.9</td><td>2.1</td></tr>
<tr><td>Actual Gas Flow Volume (am³/min)</td><td>176</td><td>8.7</td></tr>
<tr><td>Total Normal Gas Flow Volume (m³/min)</td><td>164</td><td>7.6</td></tr>
<tr><td>Total Normal Gas Flow Volume (m³/s)</td><td>2.7</td><td>0.13</td></tr>
<tr><td>Total Stack Pressure (kPa)</td><td>102.8</td><td>102.9</td></tr>
<tr><td>Moisture Content (% by volume)</td><td>1.9</td><td>3.8</td></tr>
<tr><td>Molecular Weight Dry Stack Gas (g/gmole)</td><td>31.2</td><td>30.0</td></tr>
<tr><td>Dry Gas Density (kg/m³)</td><td>1.39</td><td>1.34</td></tr>
<tr><td>Oxygen (%)</td><td>0.1</td><td>10.2</td></tr>
<tr><td>Analysis</td><td colspan="3">Odour</td></tr>
<tr><td>Method</td><td colspan="3">AS4323.3</td></tr>
<tr><td>ORLA Number</td><td>5170</td><td>5169</td><td>5168</td></tr>
<tr><td>SEMA Number</td><td>727531</td><td>727530</td><td>727529</td></tr>
<tr><td>Sample Start Time (hrs)</td><td>12:46</td><td>12:46</td><td>12:46</td></tr>
<tr><td>Sample Finish Time (hrs)</td><td>12:56</td><td>12:56</td><td>12:55</td></tr>
<tr><td>Odour Concentration (As Received) (ou)</td><td>6,800</td><td>5,263</td><td>5,656</td></tr>
<tr><td>Odour Concentration (Final) (ou)</td><td>6,800</td><td>5,300</td><td>5700</td></tr>
<tr><td>Normal MOER (As Received) (ou m³/s)</td><td>18,599</td><td>---</td><td>716</td></tr>
<tr><td>Normal MOER (Final) (ou m³/s)</td><td>18,600</td><td>---</td><td>700</td></tr>
<tr><td>Mass Odour Emission Rate Limit (ou m³/s)</td><td colspan="3">No Limit</td></tr>
<tr><td>Calculations entered by</td><td>JW</td><td>JW</td><td>JW</td></tr>
<tr><td>Calculations checked by</td><td>PWS</td><td>PWS</td><td>PWS</td></tr>
</table>

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

Emission Test Results		
Project Number	6080	
Project Name	Shoalhaven Starches	
Test Location	**EPA ID 46 DDG Pellet Plant Stack**	**EPA ID 39 Inlet to Biofilters A & B**
Date	15-May-2019	
	Dry	Dry
Run	1	1
Method	TM-1 & TM-2 & TM-22	
Sample Start Time (hrs)	11:27	13:52
Sample Stop Time (hrs)	11:52	14:15
Inlet/Exhaust	Exhaust	
Stack Temperature (^oC)	43.1	54.6
Stack Cross-Sectional area (m^2)	1.67	0.28
Average Stack Gas Velocity (m/s)	14.9	16.0
Actual Gas Flow Volume (am^3/min)	1,500	272
Total Normal Gas Flow Volume (m^3/min)	1,280	196
Total Normal Gas Flow Volume (m^3/s)	21.3	3.3
Total Stack Pressure (kPa)	102.9	98.5
Moisture Content (% by volume)	2.89	10.98
Molecular Weight Dry Stack Gas (g/gmole)	28.84	28.84
Dry Gas Density (kg/m^3)	1.29	1.29
Oxygen (%)	20.9	20.9
Analysis	Odour	
Method	AS4323.3	
ORLA Number	5163	5171
SEMA Number	727524	727532
Sample Start Time (hrs)	11:42	14:05
Sample Finish Time (hrs)	11:52	14:15
Odour Concentration (As Received) (ou)	1,202	4,050
Odour Concentration (Final) (ou)	1,200	24,300
Normal MOER (As Received) (ou m^3/s)	25,578	13,238
Normal MOER (Final) (ou m^3/s)	25,600	79,400
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS (EPL IDS 40 & 41)

Emission Test Results				
Project Number	6080			
Project Name	Shoalhaven Starches			
Test Location	**EPL ID 40 Biofilter A East**	**EPL ID 40 Biofilter A West**	**EPL ID 41 Biofilter B East**	**EPL ID 41 Biofilter B West**
Date	15-May-2019			
Run	1	1	1	1
Method	TM-2 & TM-22			
Sample Start Time (hrs)	13:52	14:38	14:05	14:38
Sample Stop Time (hrs)	14:17	14:58	14:26	15:00
Inlet/Exhaust	Exhaust			
Stack Temperature (^{o}C)	47.1	37.3	45.2	46.8
Proportion of Inlet air flow	**28%**	**20%**	**25%**	**27%**
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5164	5165	5166	5167
SEMA Number	727525	727526	727527	727528
Sample Start Time (hrs)	14:07	14:48	14:16	14:50
Sample Finish Time (hrs)	14:17	14:58	14:26	15:00
Odour Concentration (As Received) (ou)	854	2385	2608	2007
Odour Concentration (Final) (ou)	860	2400	2600	2000
Normal MOER (As Received) (ou m^3/s)	757	1586	2167	1779
Normal MOER (Final) (ou m^3/s)	760	1600	2200	1800
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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Starch dryer 5, Biofilter inlet, Biofilter A east & west outlets , Biofilter B outlets east & west, Fermenter, DDG Pellet plant stack, CO_2 Scrubber inlet & outlet
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	6080/ORLA/01
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5162 - 5171
	SEMA Sample number(s):	727523 - 727532
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	15 May 2019
	Order number:	5011
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	12 June 2019

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76{,}895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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.

12 June 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 6080/ORLA/01

Sample ID & Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou)[1]	Sample Odour Concentration (ou)[2]	Odour Character & Hedonic Tone[^+]
Starch Dryer No.5	727523	15/05/2019 10:50	5162	16/05/2019 10:12	4	8	Nil	181	180	Drain, septic, swamp, varnish, ash, oil, smoke, yeast, paint, chlorine, rubber (-3)[^]
DDG pellet stack	727524	15/05/2019 11:42	5163	16/05/2019 10:40	4	8	Nil	1202	1200	Wheat, cooking chips, oil, caramel, coffee, ash, burning rubber, yeast, (0)[^]
Biofilter A east outlet	727525	15/05/2019 14:16	5164	16/05/2019 11:33	4	8	Nil	854	850	Vinyl, solvent, wheat, hessian, grain, soil, decay, swamp (-4)[^]
Biofilter A west outlet	727526	15/05/2019 14:50	5165	16/05/2019 12:01	4	8	Nil	2385	2400	Musty, wheat, grease, hessian, grain, mould, swamp, decay, sweet, (-3)[^]
Biofilter B east outlet	727527	15/05/2019 14:07	5166	16/05/2019 12:29	4	8	Nil	2608	2600	Compost, swamp, wood, rotten, wheat plastic, hessian, paint, grain, drain, dirt (-3)[^]
Biofilter B west outlet	727528	15/05/2019 14:48	5167	16/05/2019 12:58	4	8	Nil	2007	2000	Compost, rotten swamp, earth, paint, hessian, wheat, grain, musty, sweet (-3)[^]
Fermenter 16	727529	15/05/2019 12:46	5168	16/05/2019 13:35	4	8	Nil	5656	5700	Cooked apple, plastic, caramel liqueur, alcohol, varnish, coconut, vinegar, (-1)[^]
CO_2 scrubber inlet	727530	15/05/2019 12:46	5169	16/05/2019 14:03	4	8	Nil	5263	5300	Apple yoghurt, caramel liqueur, wine, alcohol, vinegar, ink, carbon paper (-1)[^]
CO_2 scrubber outlet	727531	15/05/2019 12:46	5170	16/05/2019 14:31	4	8	Nil	6800	6800	Apple yoghurt, caramel liqueur, alcohol, coconut, vinegar, sweet (-2)[^]
Biofilter inlet	727532	15/05/2019 14:05	5171	16/05/2019 15:00	4	8	6	4050	24300	Wheat, cereal, grain, hessian, alcohol, yeast, swamp, dust, plastic, paint (-2)

Odour Research Laboratories Australia

Odour Panel Calibration Results – 6080/ORLA/01

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5161A	62	1679	37	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution and rounding

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] Target Range for reference gas n-butanol is $20 \le \chi \le 80$ ppb and compliance with AS/NZ4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration. Panellist Rolling Average: SR = 60.4, PR = 51.0, TL = 38.6, PRA = 36.0

^ 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 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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Starch dryers 1 & 4, Gluten Dryers 1, 2, 3 & 4 and Boilers 5&6
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	6080/ORLA/02
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5172 - 5180
	SEMA Sample number(s):	727535 - 727542
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	20 May 2019
	Order number:	5013
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	12 June 2019

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76{,}895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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.

12 June 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 6080/ORLA/0

Sample ID & Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone^ +
Sample ID: EPA 35 Boiler 5 & 6	727535	20/05/2019 14:31	5173	21/05/2019 10:15	4	8	Nil	2181	2200	(-2)^
Sample ID: EPA 9 No. 2 Gluten Dryer	727536	20/05/2019 12:30	5174	21/05/2019 10:45	4	8	Nil	432	430	(-2)^
Sample ID: EPA 14 No. 4 Starch Dryer	727537	20/05/2019 15:55	5175	21/05/2019 11:13	4	8	Nil	305	300	(-2)^
Sample ID: EPA 12 No.1 Starch Dryer	727538	20/05/2019 17:25	5176	21/05/2019 11:41	4	8	Nil	280	280	(-2)^
Sample ID: EPA 8 No. 1 Gluten Dryer	727539	20/05/2019 16:50	5177	21/05/2019 12:01	4	8	Nil	396	400	(-3)^
Sample ID: EPA 10 No. 3 Gluten Dryer	727540	20/05/2019 18:52	5178	21/05/2019 12:40	4	8	Nil	661	660	(-3)^
Sample ID: EPA 11 No. 4 Gluten Dryer	727541	20/05/2019 18:07	5179	21/05/2019 13:09	4	8	Nil	470	470	(-3)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 6080/ORLA/02

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5172	62	1195	52	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution and rounding

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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. Panellist Rolling Average: SR = 60.4 PR = 50.9, TL = 38.6, PRA = 35.9

^ 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 panellist 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
769	Thermocouple	15-Jan-19	15-Jul-19
920	Thermocouple	15-Jan-19	15-Jul-19
858	Digital Temperature Reader	15-Jan-19	15-Jul-19
885	Digital Manometer	21-Jan-19	21-Jan-20
720	Thermocouple	15-Jan-19	15-Jul-19
768	Thermocouple	15-Jan-19	15-Jul-19
857	Digital Temperature Reader	15-Jan-19	15-Jul-19
815	Digital Manometer	21-Jan-19	21-Jan-20
613	Barometer	21-Jan-19	21-Jan-20
725	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
947	VANE Anomometer	23-Oct-17	23-Oct-19
946	Combustion analyzer	22-Jan-19	22-Jul-19
753	Personal Sampler	09-Apr-19	09-Apr-20
678	Personal Sampler	09-Apr-19	09-Apr-20
832	Personal Sampler	14-Mar-19	14-Mar-20

Gas Mixtures used for Analyser Span Response

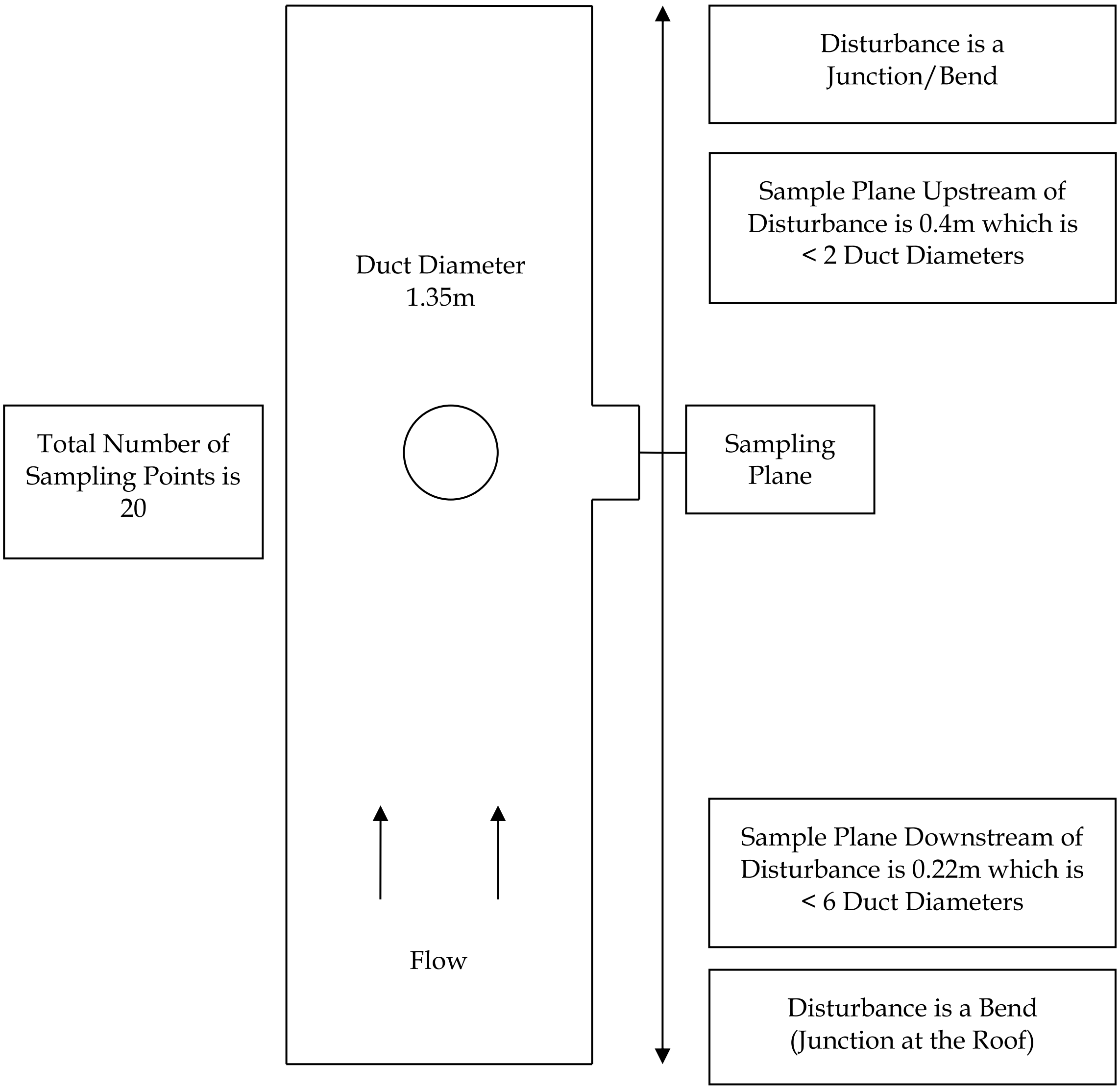
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

TABLE C-2 INSTRUMENT CALIBRATION DETAILS DAY 2

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
769	Thermocouple	15-Jan-19	15-Jul-19
920	Thermocouple	15-Jan-19	15-Jul-19
857	Digital Temperature Reader	15-Jan-19	15-Jul-19
815	Digital Manometer	21-Jan-19	21-Jan-20
947	VANE Anomometer	23-Oct-17	23-Oct-19
613	Barometer	21-Jan-19	21-Jan-20
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
753	Personal Sampler	09-Apr-19	09-Apr-20
946	Combustion analyzer	22-Jan-19	22-Jul-19
Gas Mixtures used for Analyser Span Response			
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



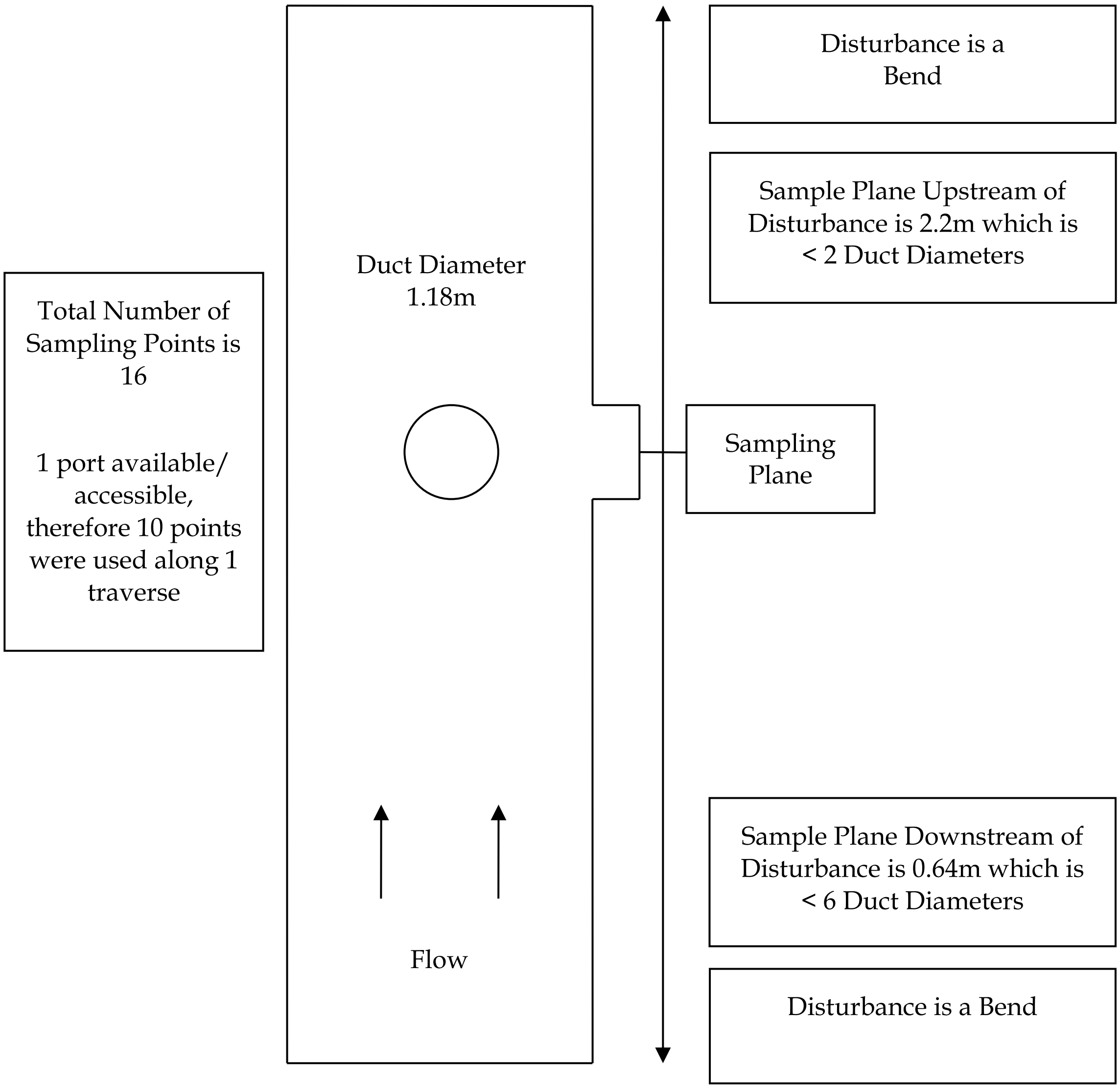
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



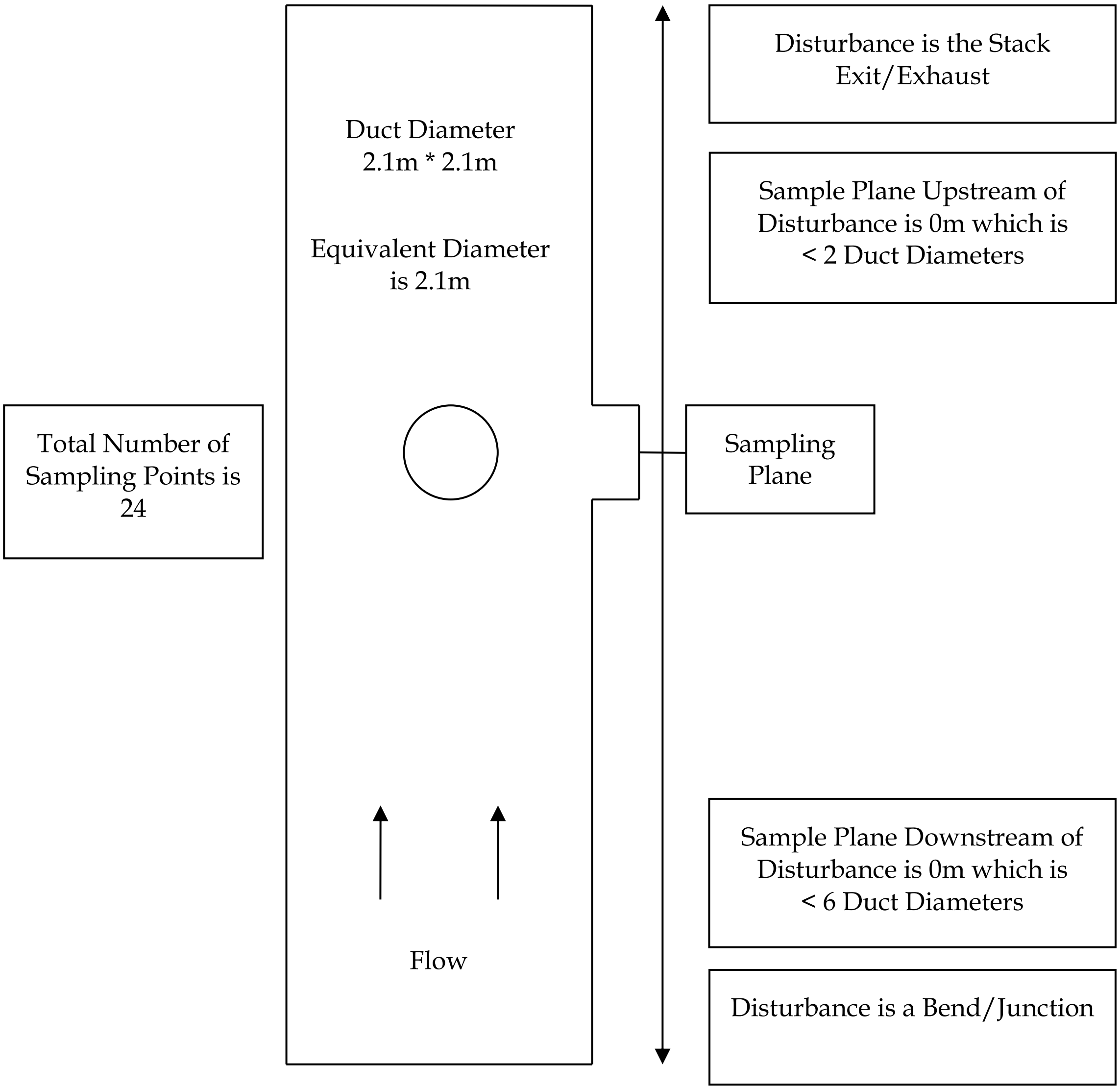
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

FIGURE D-4 GLUTEN DRYER NO. 2 – SAMPLE LOCATION

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



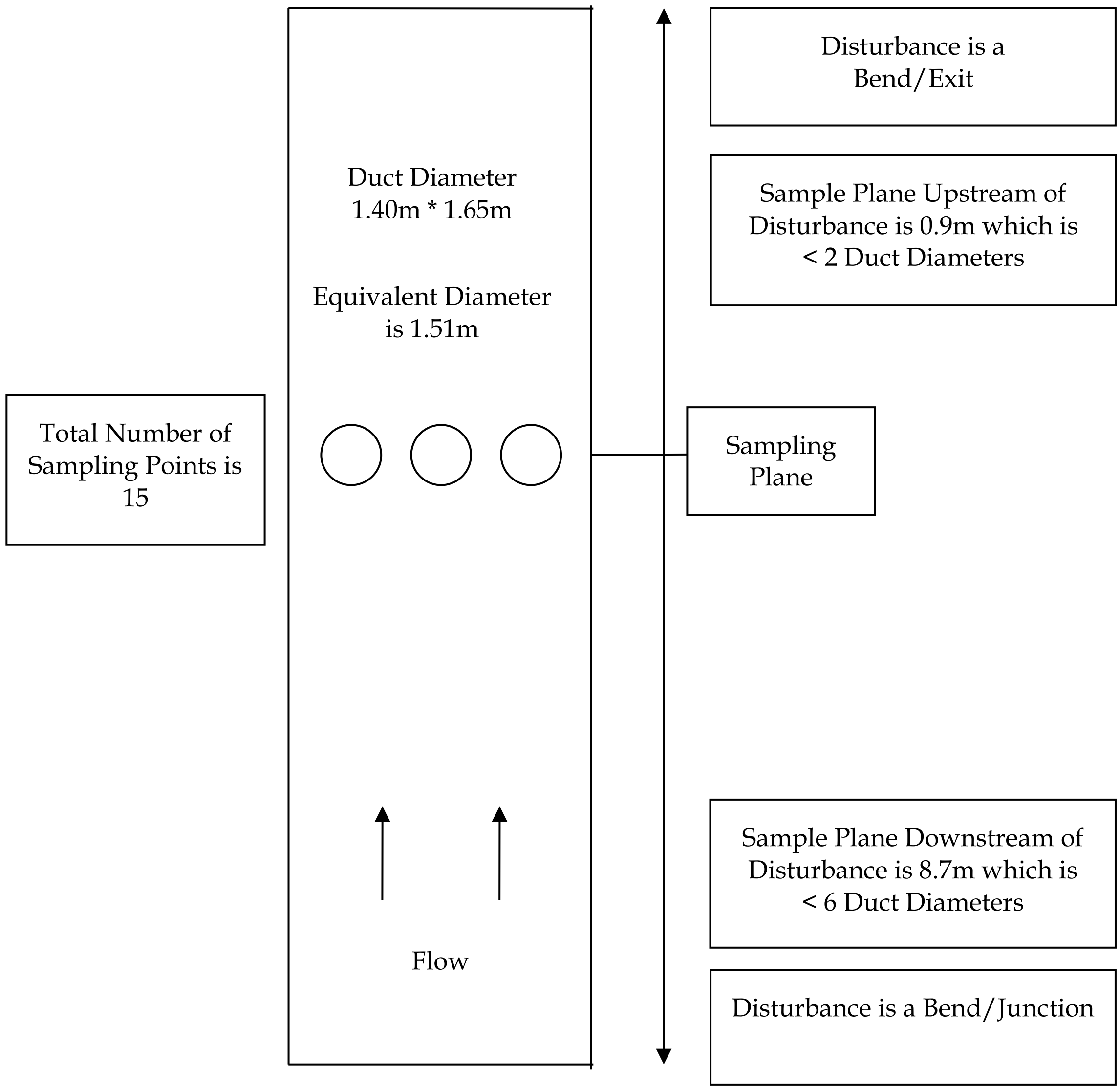
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



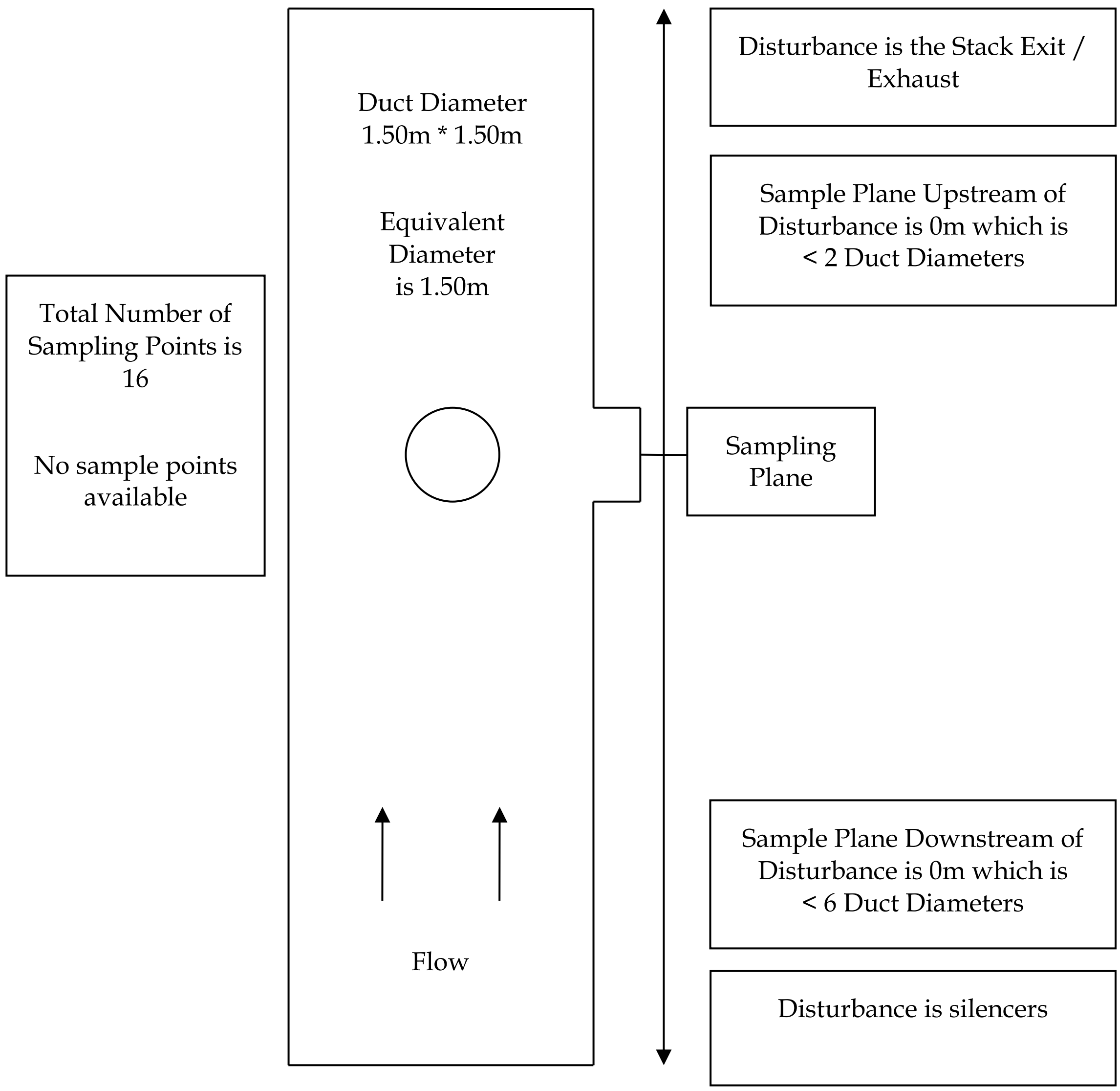
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exit 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



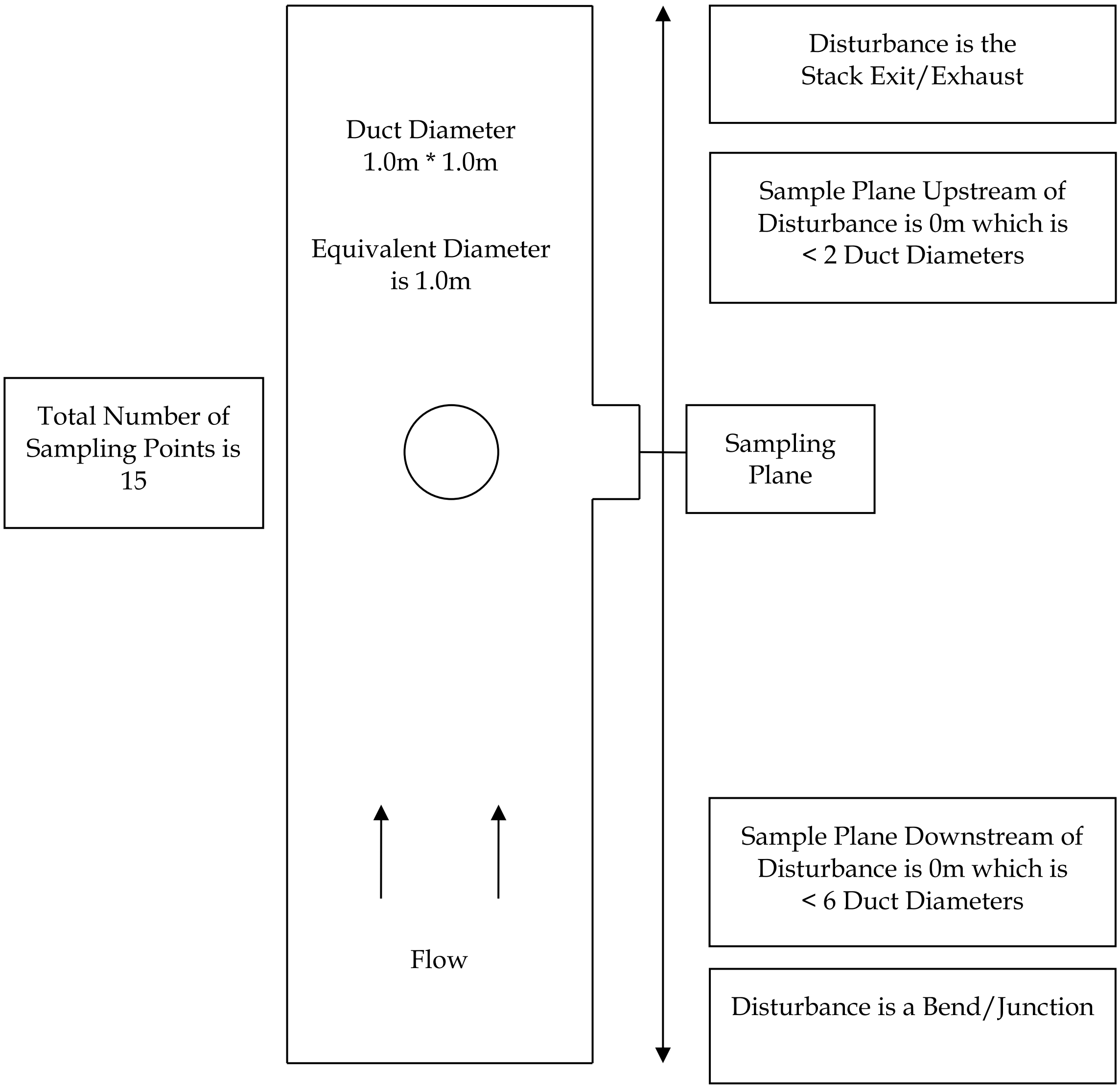
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-10 STARCH DRYER NO. 1 – SAMPLE LOCATION

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



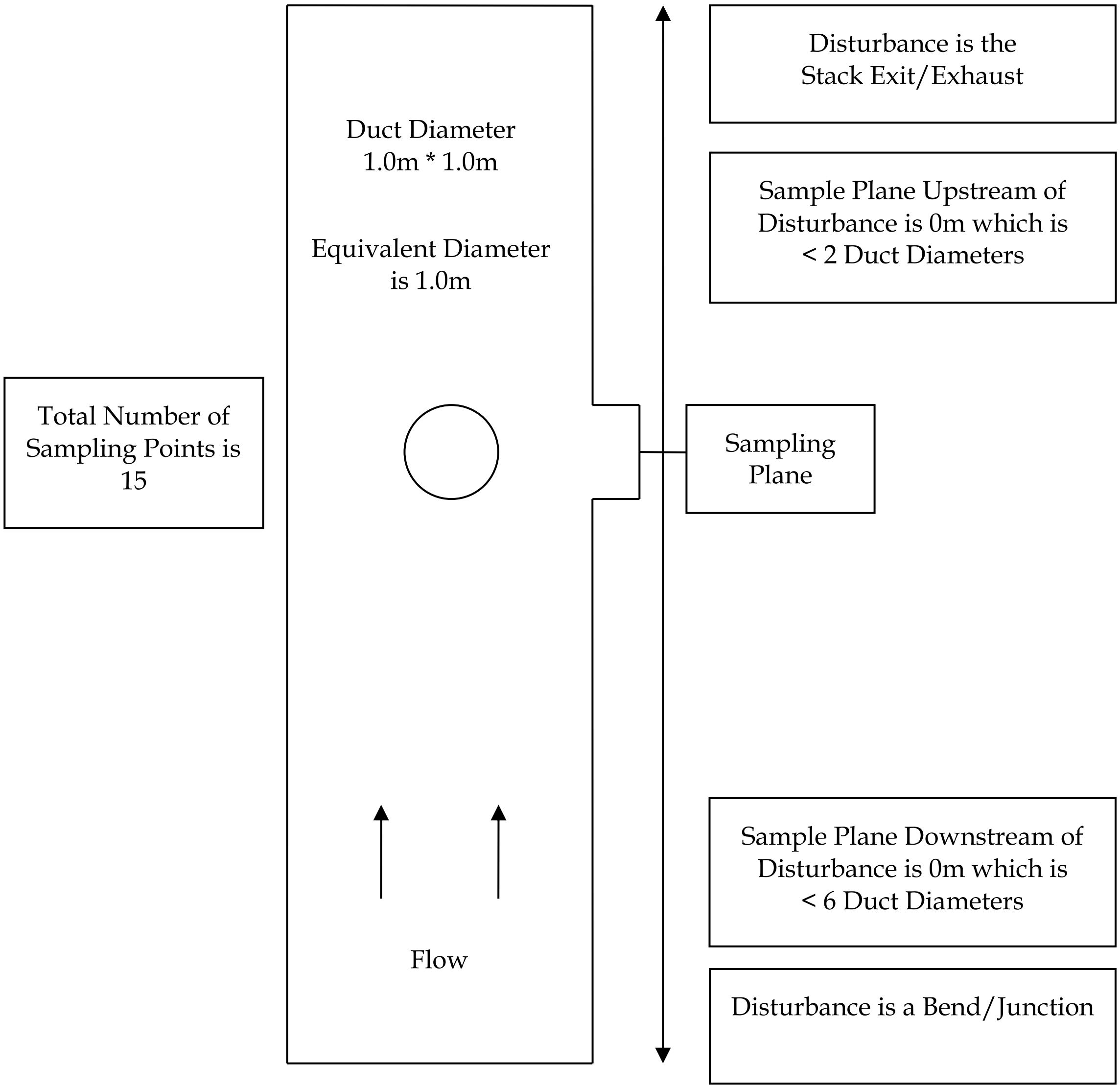
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-12 STARCH DRYER NO. 3 – SAMPLE LOCATION

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



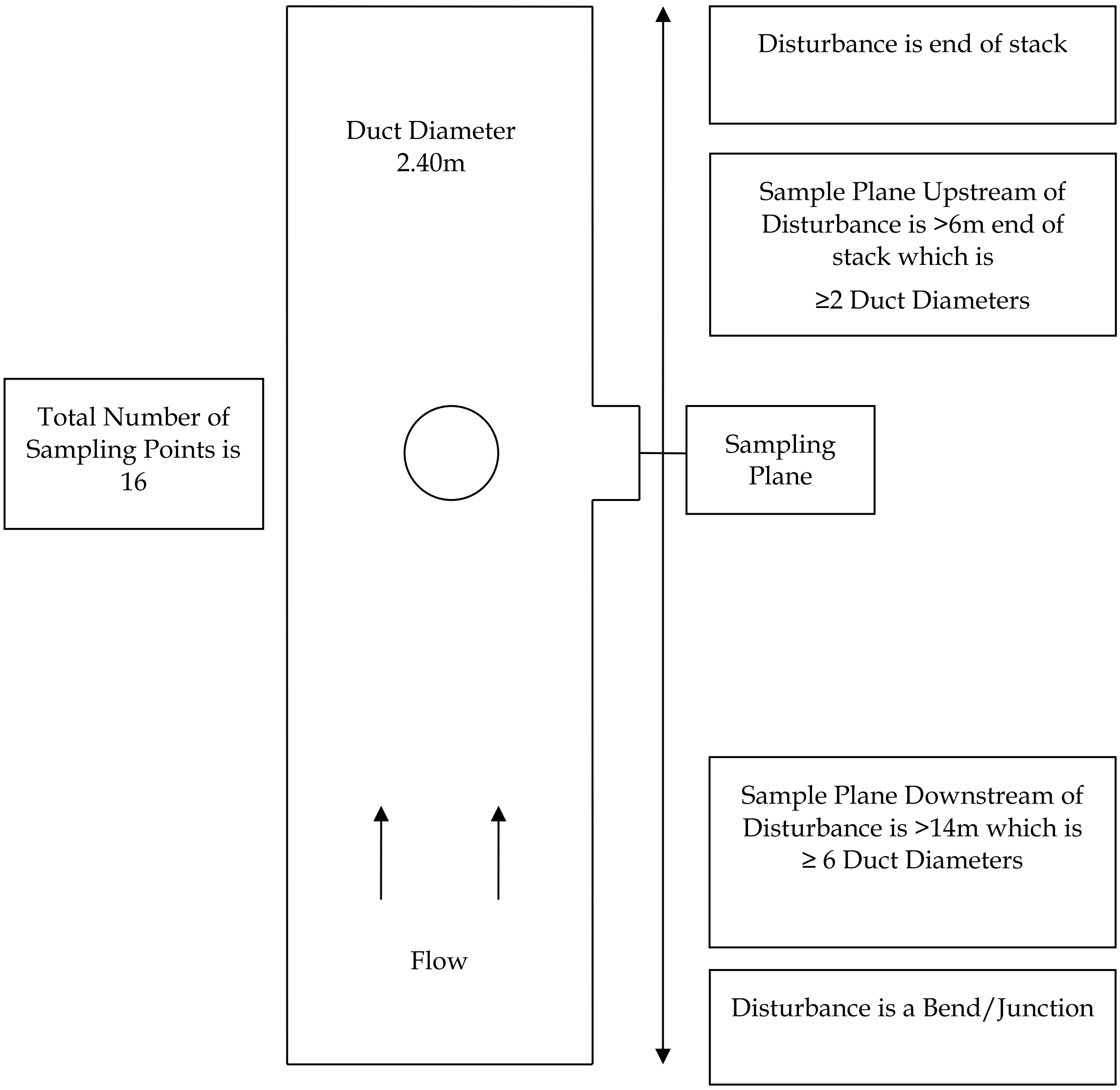
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

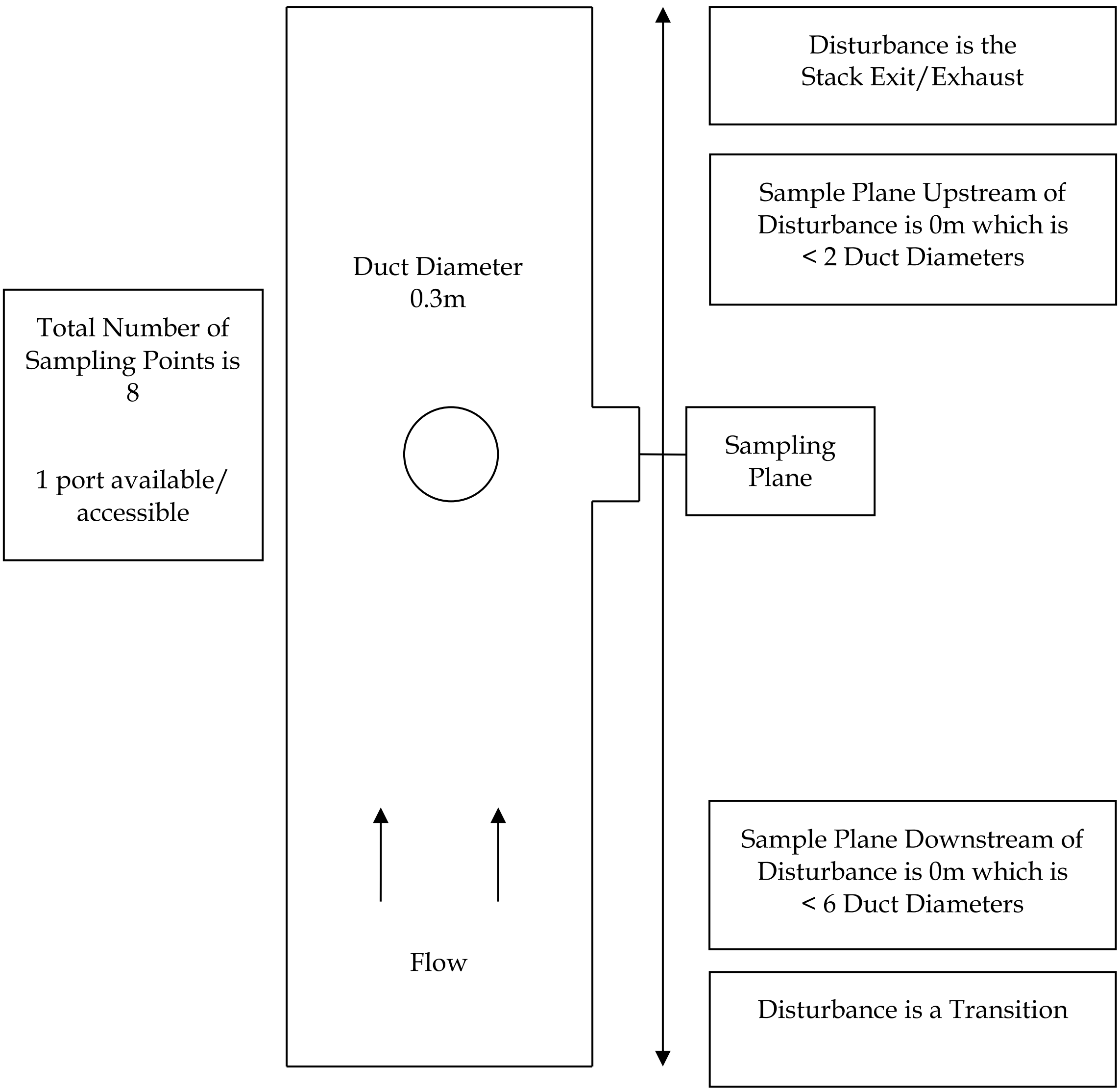


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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.

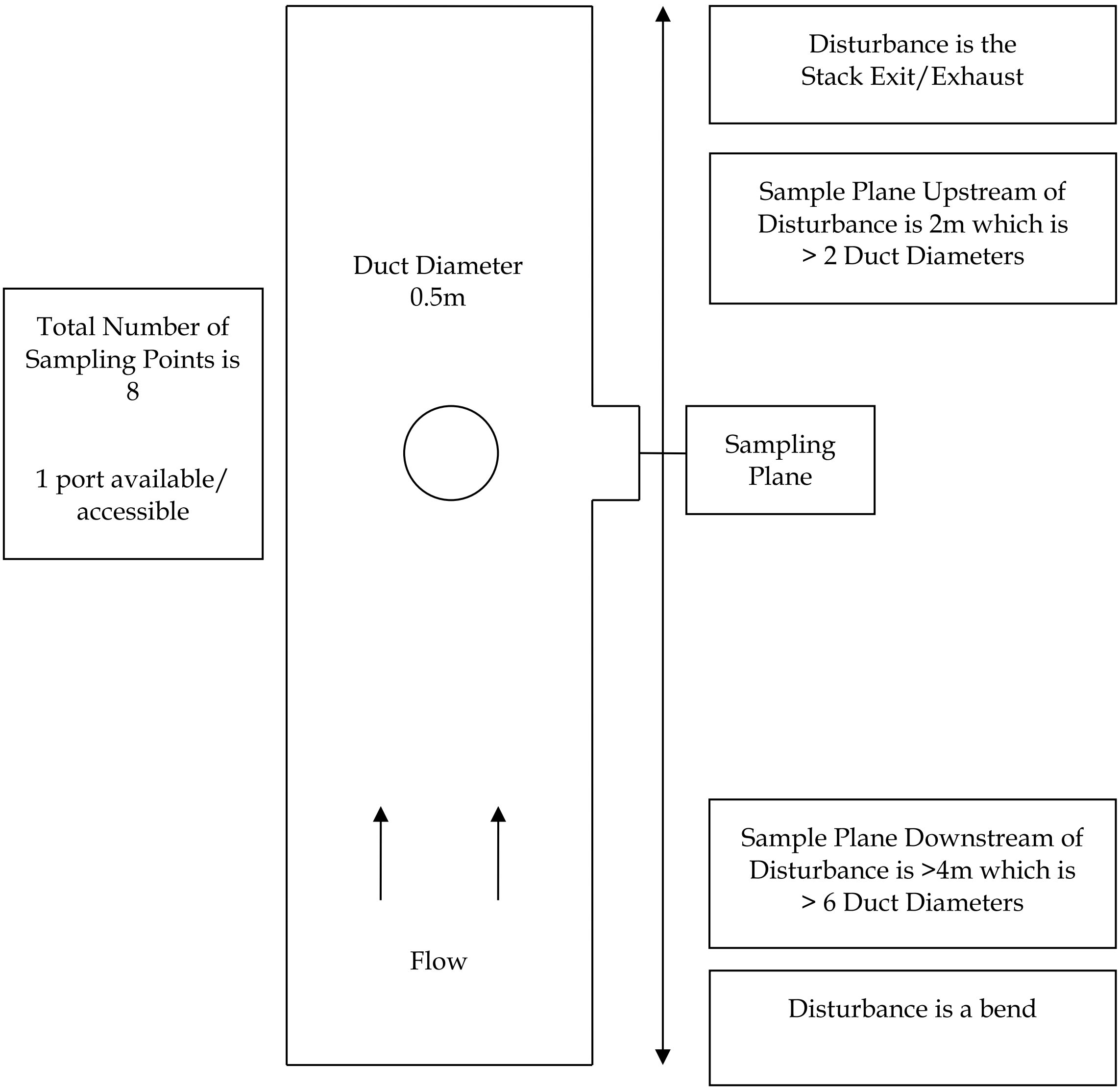
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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_2 SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC

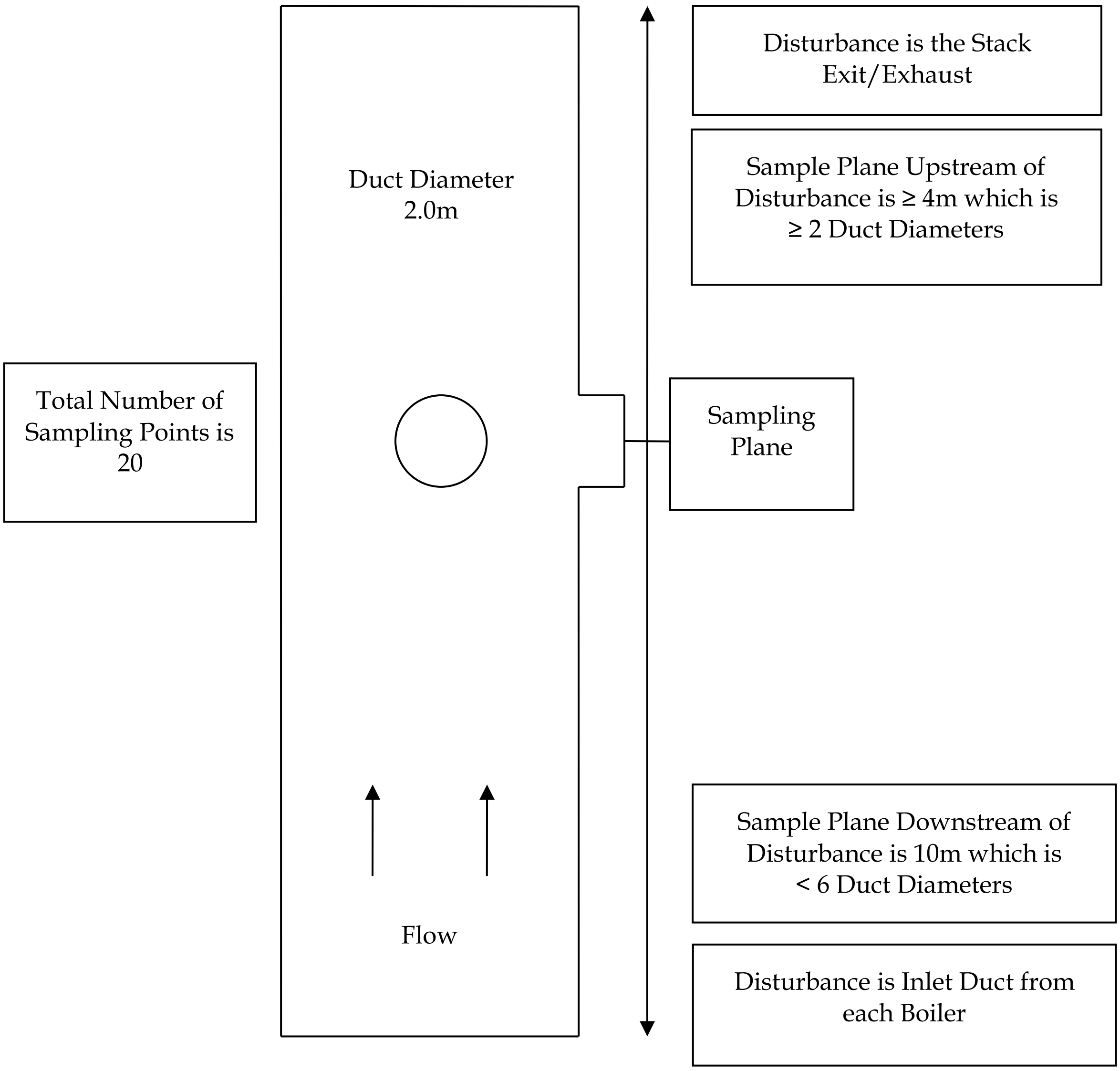


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

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



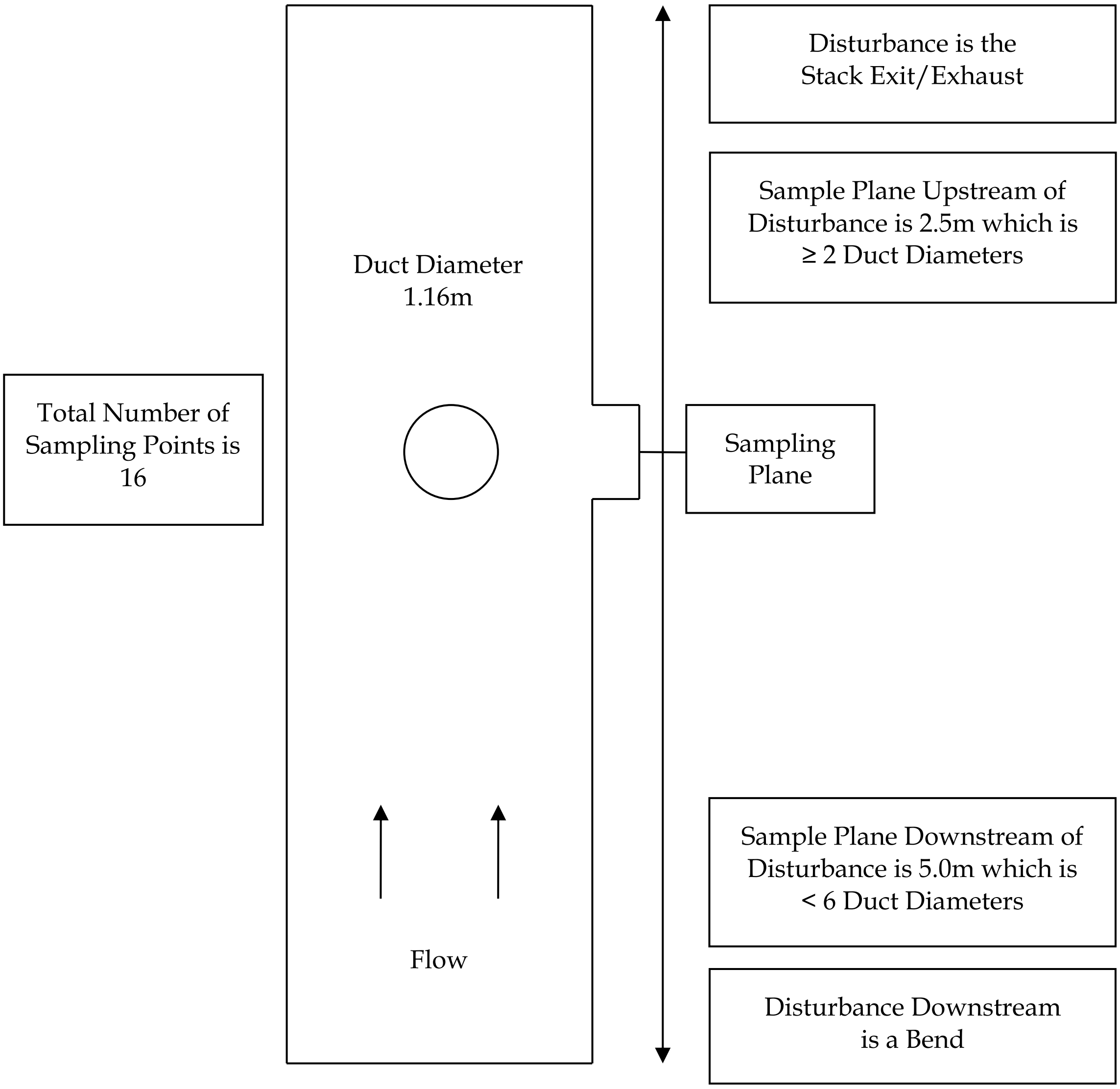
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



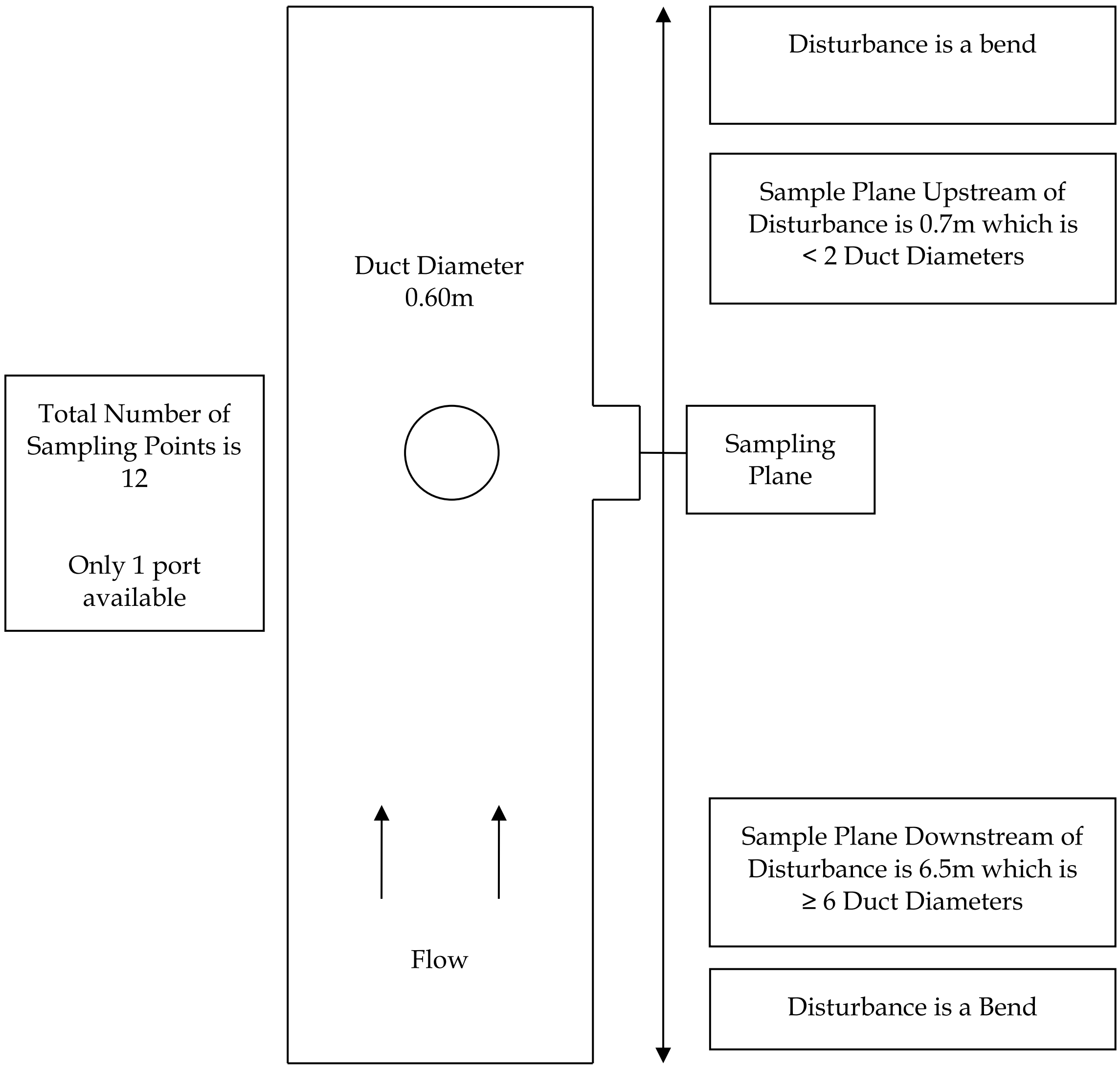
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

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

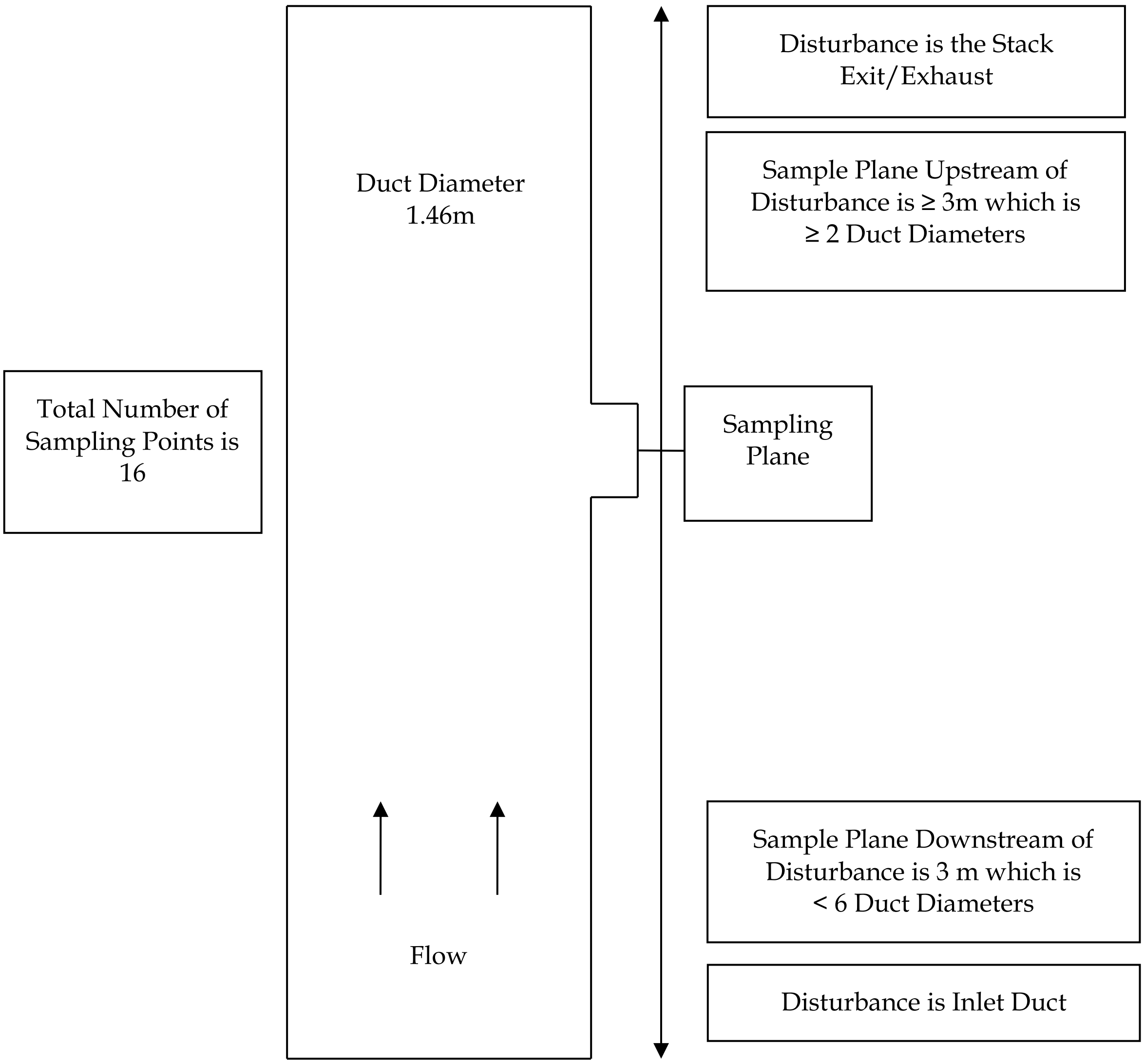
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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-25 BIOFILTER OUTLET EAST EPL ID 40 & 41 – SAMPLE LOCATION

FIGURE D-26 BIOFILTER OUTLET WEST EPL ID 41 – SAMPLE LOCATION

FIGURE D- 27 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-28 DDG PELLET PLANT STACK – SAMPLE LOCATION PHOTOGRAPH

Stephenson

Environmental Management Australia

EPL ODOUR EMISSION SURVEY QUARTER 2, 2019-2020

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: **7006/S25115B/19**

DATES OF SURVEY: **7 AND 19 AUGUST 7, 2019**

DATE OF ISSUE: **4 SEPTEMBER, 2019**

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

EPL Odour Emission Survey Quarter 2, 2019-2020

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.:	**7006/S25115B/19**
Date of Survey:	**7 and 19 August, 2019**
Date of Issue:	**4 September, 2019**

P W Stephenson

J Weber

M Kimber

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF TABLES – APPENDICES

TABLE OF FIGURES – APPENDICES

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_2) 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 2, 2019-2020 odour test results are presented in this report. The tests were conducted on 7th and 19th August 2019.

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_2 Scrubber outlet	1	Quarterly
Not specified	CO_2 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
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/m³	=	kilograms per cubic metre
m/s	=	metres per second
m³/s	=	cubic metres per second
mg/m³	=	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/m³	Quarterly	TM-23
Flow	m³/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)

Pollutant	Units	Frequency	Approved Method
Cadmium	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Mercury	mg/m^3	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^3	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m^3	Annual	TM-4
Temperature	^oC	Quarterly	TM-2
Total Solid Particles	mg/m^3	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m^3	Quarterly	TM-34
Volumetric Flowrate	m^3/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.

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.

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 7006/ORLA/01 and 02 are 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, Q2, 2019-2020

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	19/08/2019	310
9	No.2 Gluten Dryer	19/08/2019	330
10	No.3 Gluten Dryer	19/08/2019	330
11	No.4 Gluten Dryer	19/08/2019	430
12	No.1 Starch Dryer	19/08/2019	310
13	No.3 Starch Dryer	07/08/2019	860
14	No.4 Starch Dryer	19/08/2019	150
16	Carbon Dioxide Scrubber Outlet	07/08/2019	10,300
--	Carbon Dioxide Scrubber Inlet	07/08/2019	12,200
35	Combined Stack No.5 & 6 Boilers	07/08/2019	1,200
42	Boiler No.4 Outlet	07/08/2019	2,600
44	Fermenter (No. 15)	07/08/2019	7,200
45	Boiler No.2 Outlet	07/08/2019	1,200
46	DDG Pellet Plant Stack	07/08/2019	1,300
47	No.5 Starch Dryer	19/08/2019	460

Key: ou = odour units

TABLE 4-2 EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, Q2, 2019-2020

EPA ID No.	Description	Date	Odour Concentration (ou)
39	Inlet to Biofilters A & B	19/08/2019	15,500
40	Outlet of Biofilter A (east)	19/08/2019	1,400
40	Outlet of Biofilter A (west)	19/08/2019	1,200
41	Outlet of Biofilter B (east)	19/08/2019	1,500
41	Outlet of Biofilter B (west)	19/08/2019	1,500

Key: ou = odour units

5 CONCLUSIONS

SEMA completed the odour sampling and analysis at Shoalhaven Starches manufacturing facility at Bomaderry for Quarter 2, 2019 - 2020.

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. Note Starch Dryer No.3 was not available for testing.

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

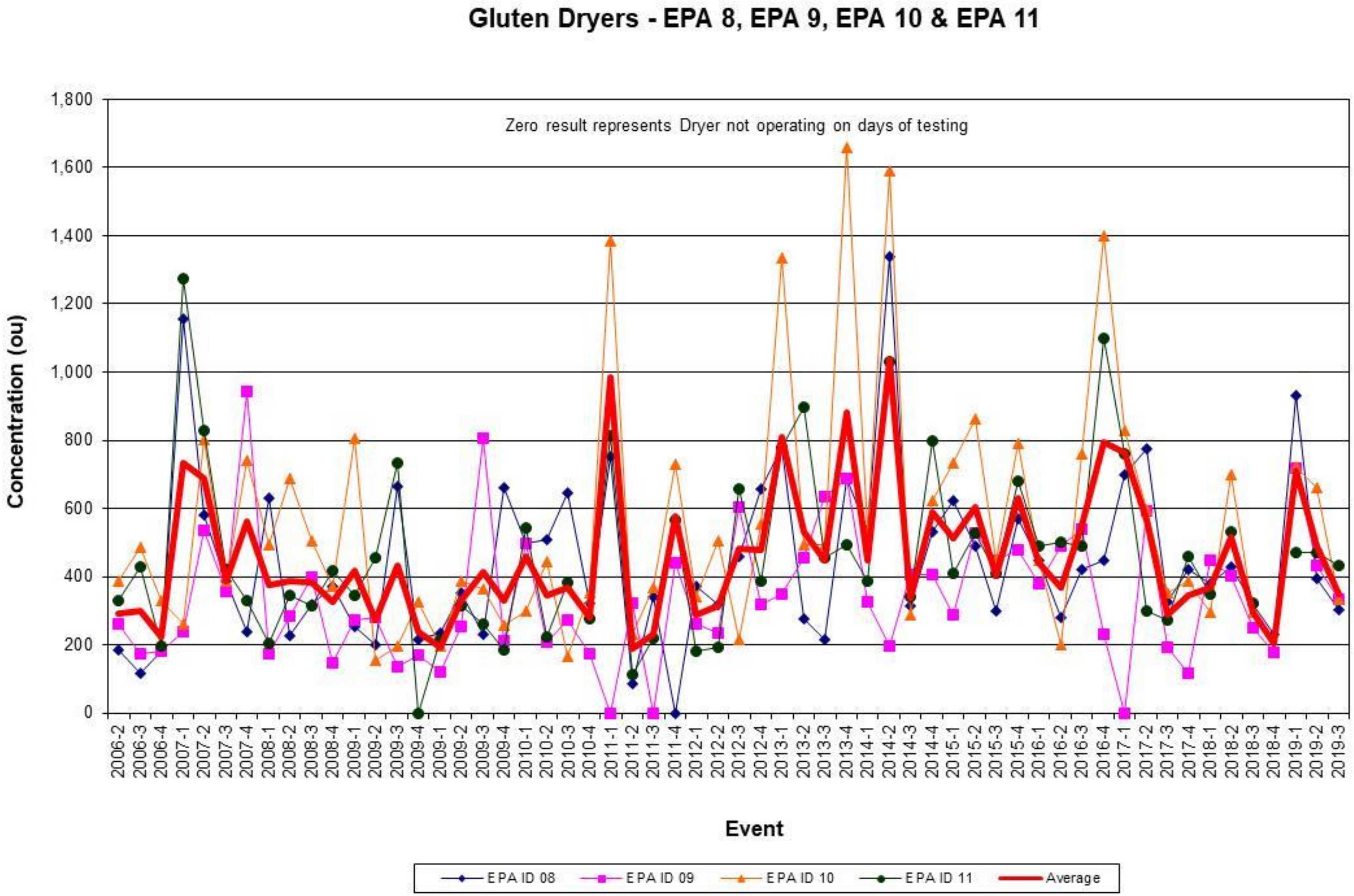


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4

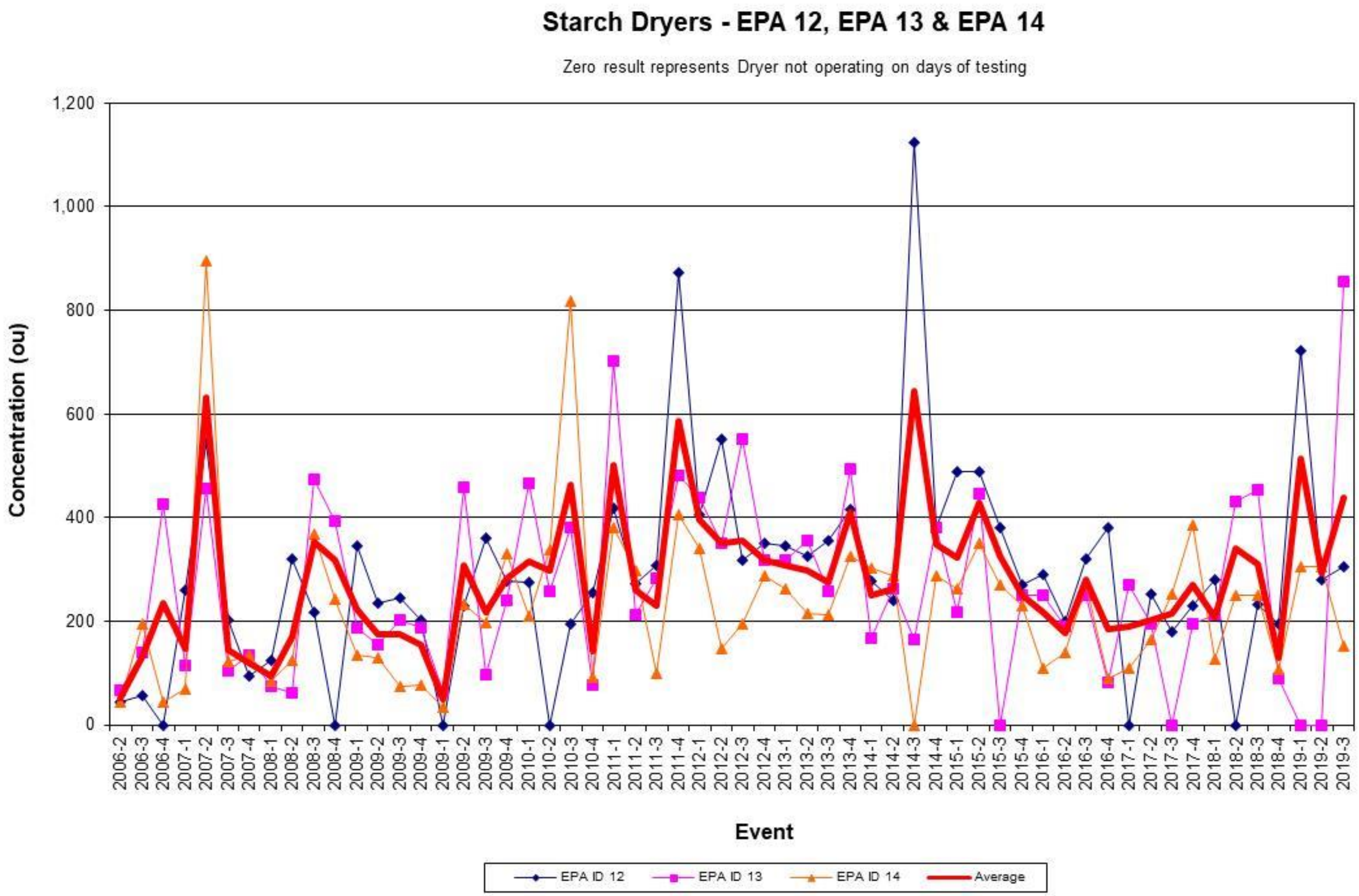


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5

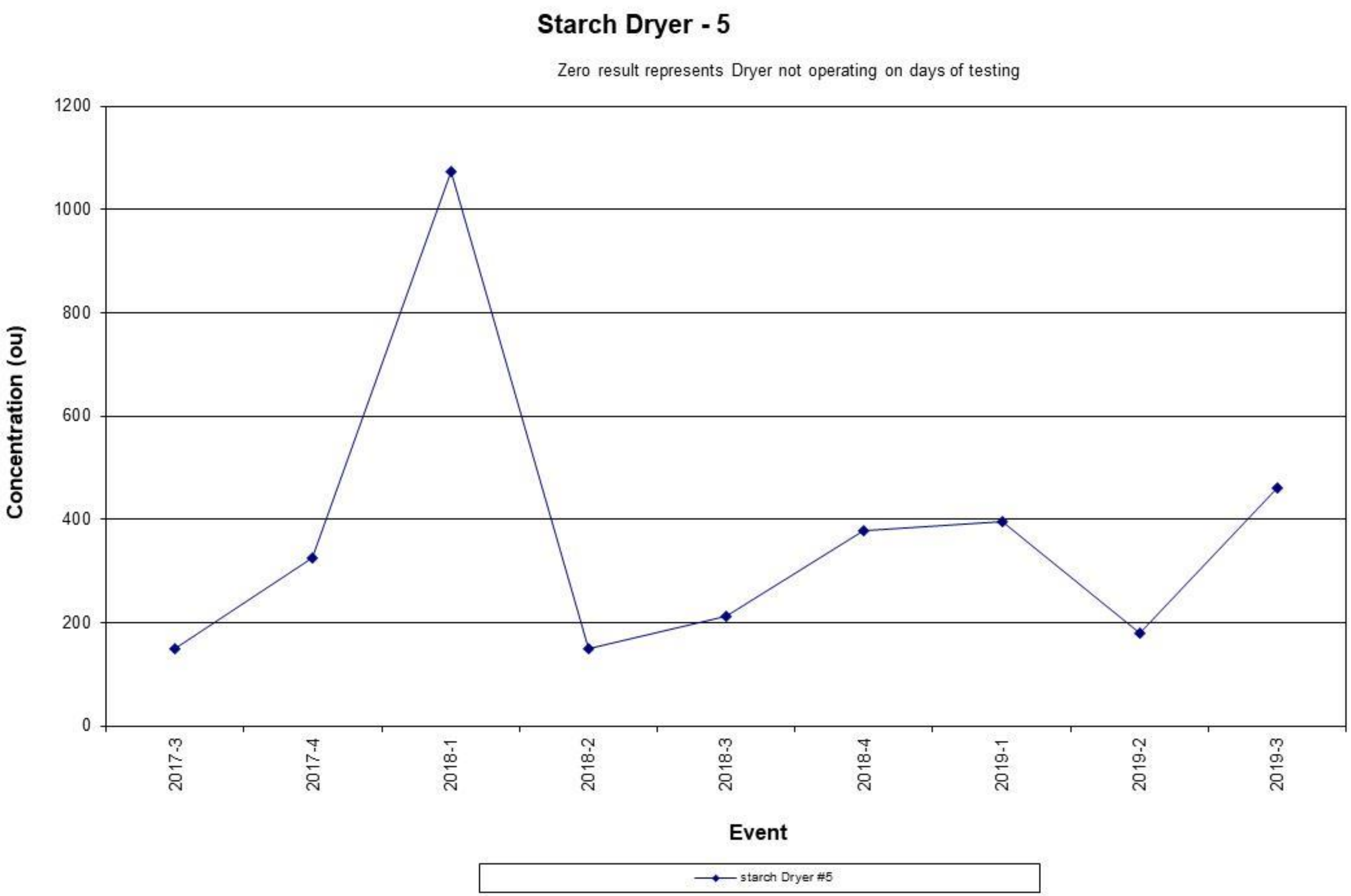


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS

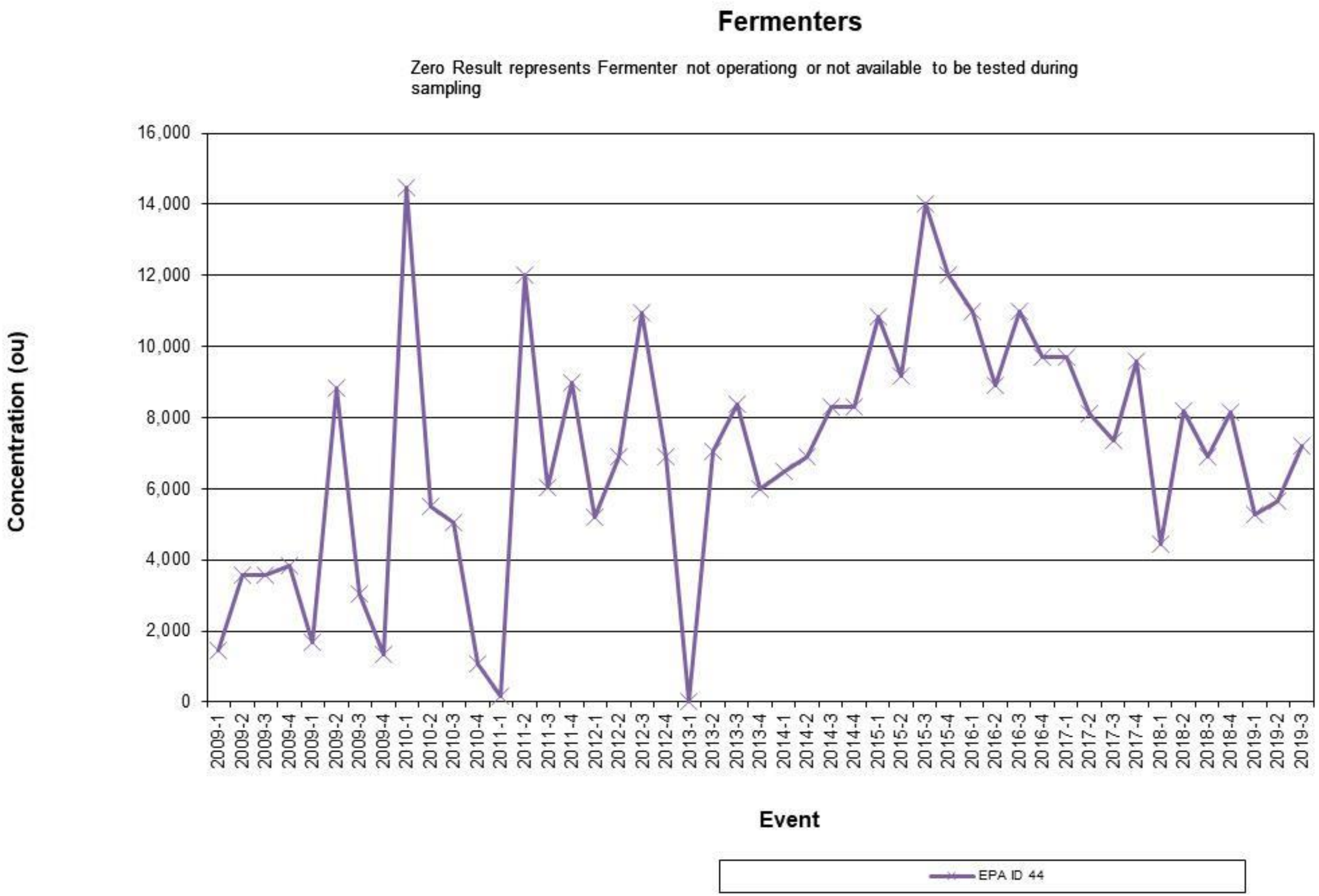


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET

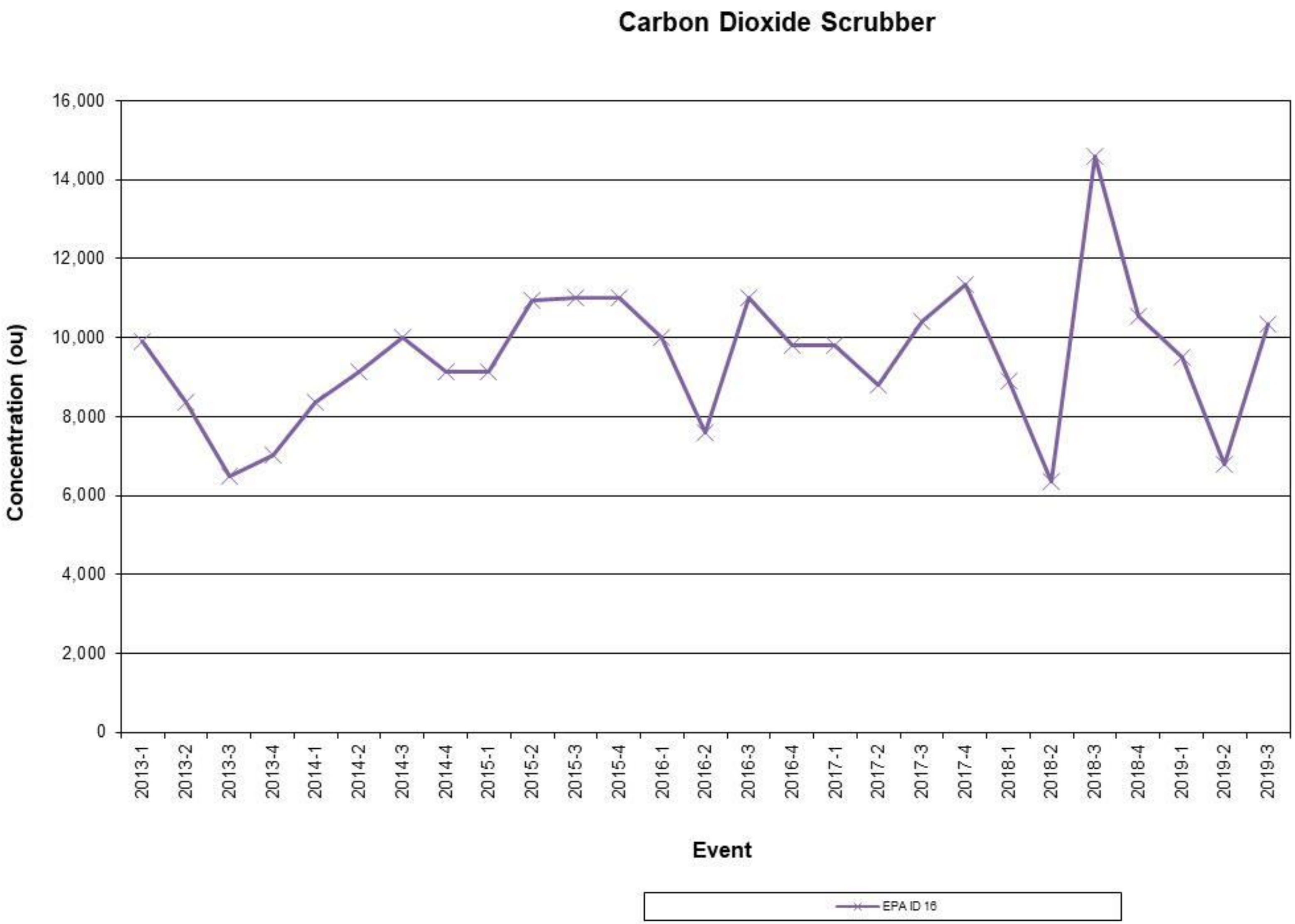


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK

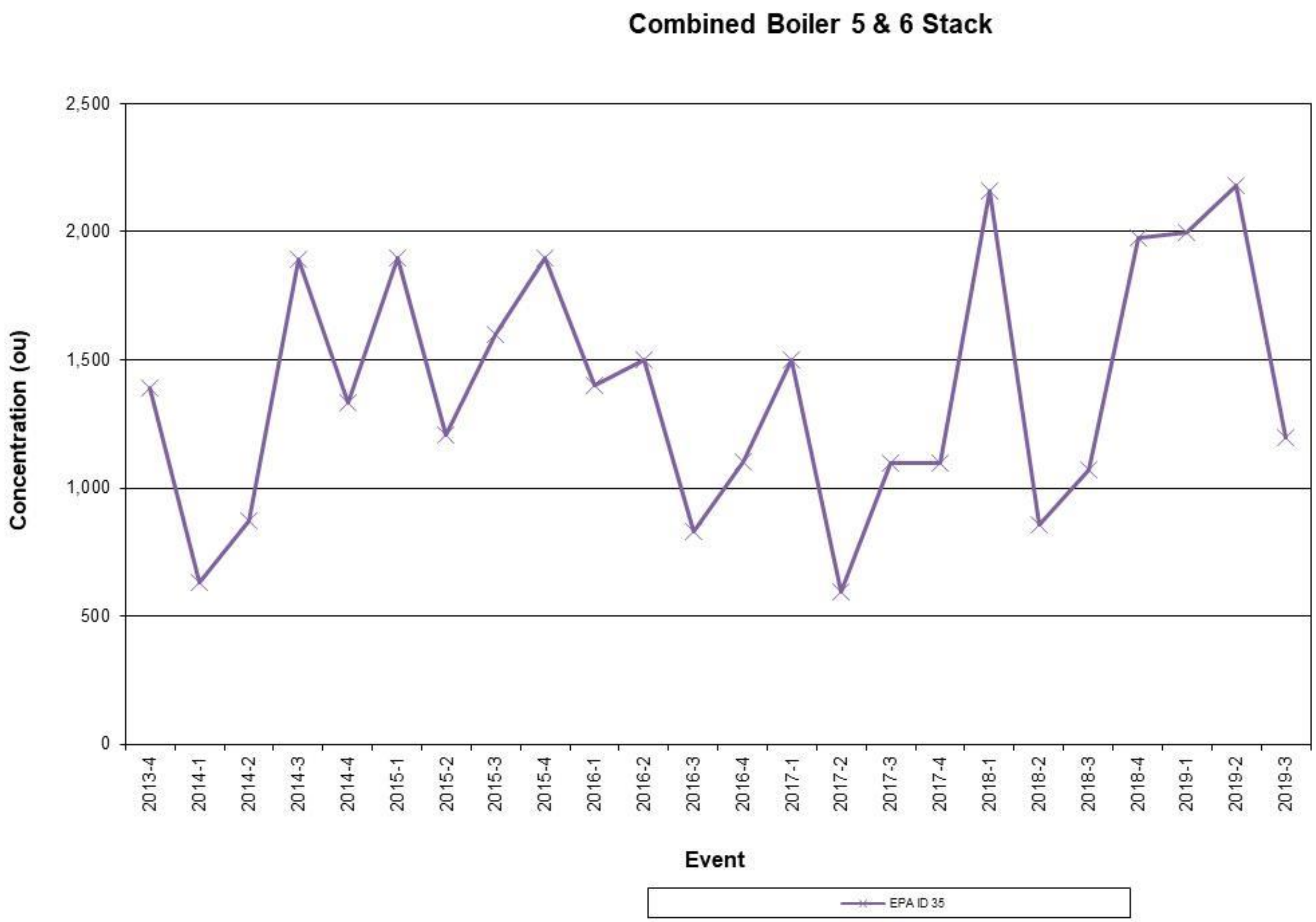


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK

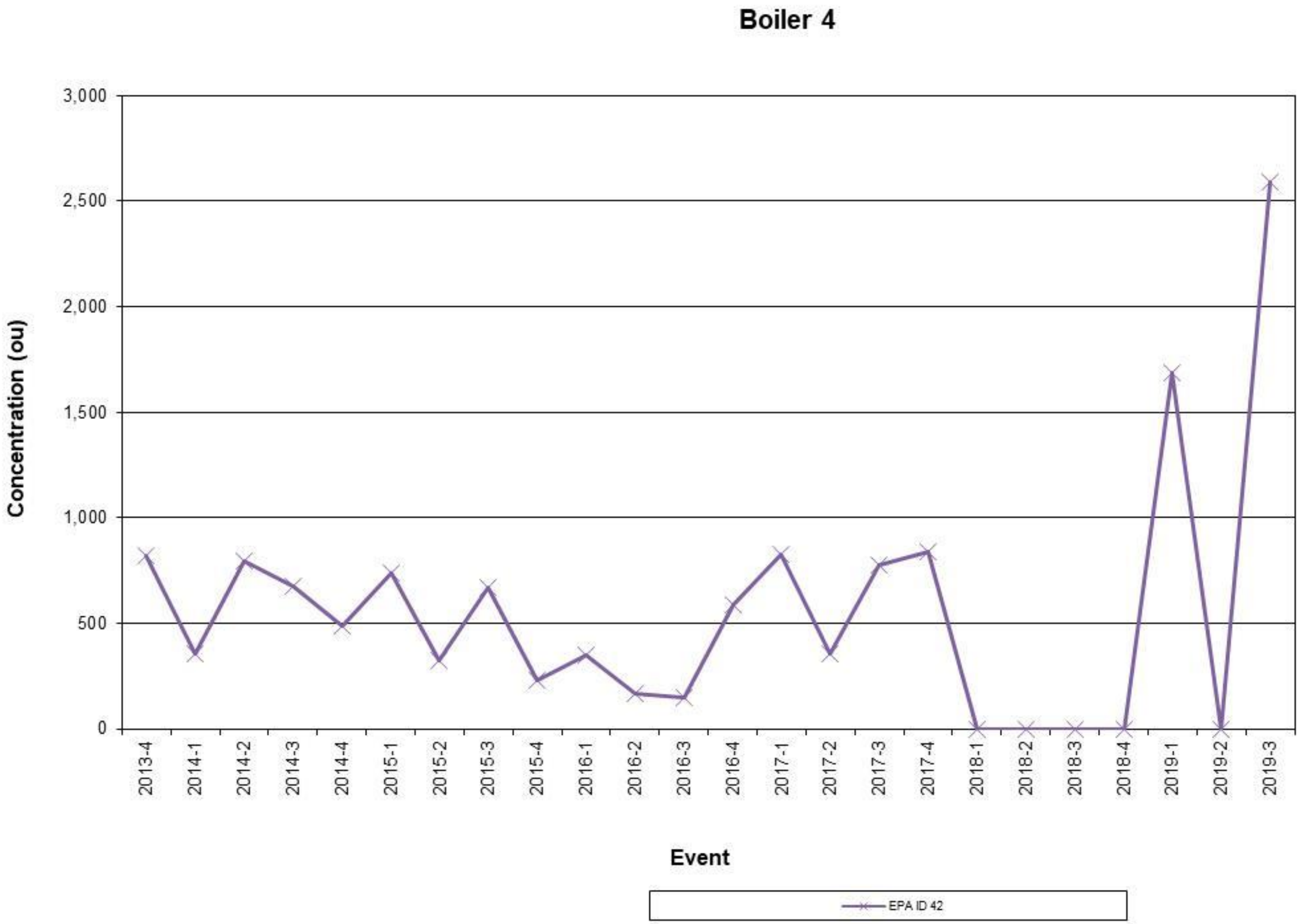


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK

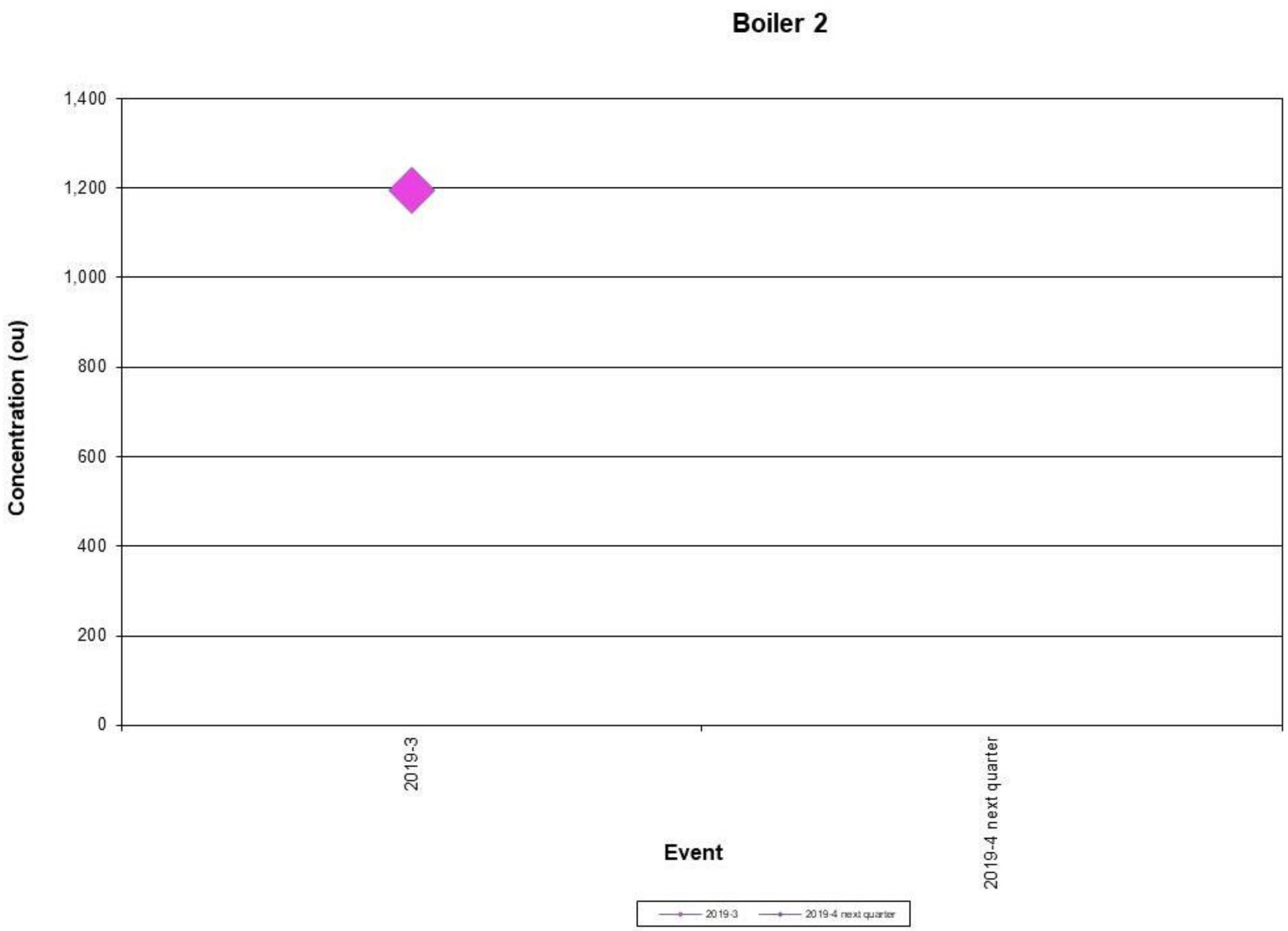


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS

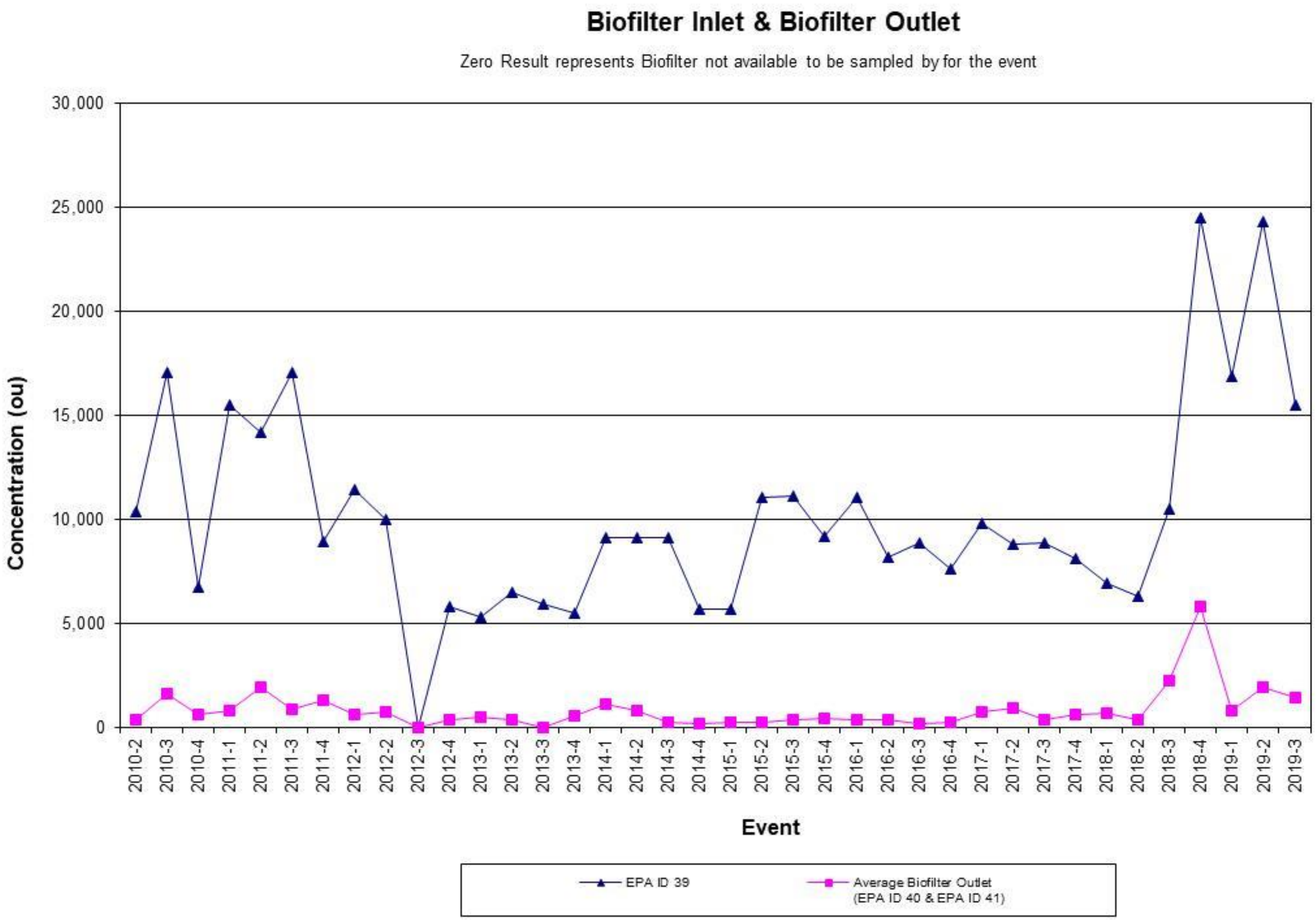
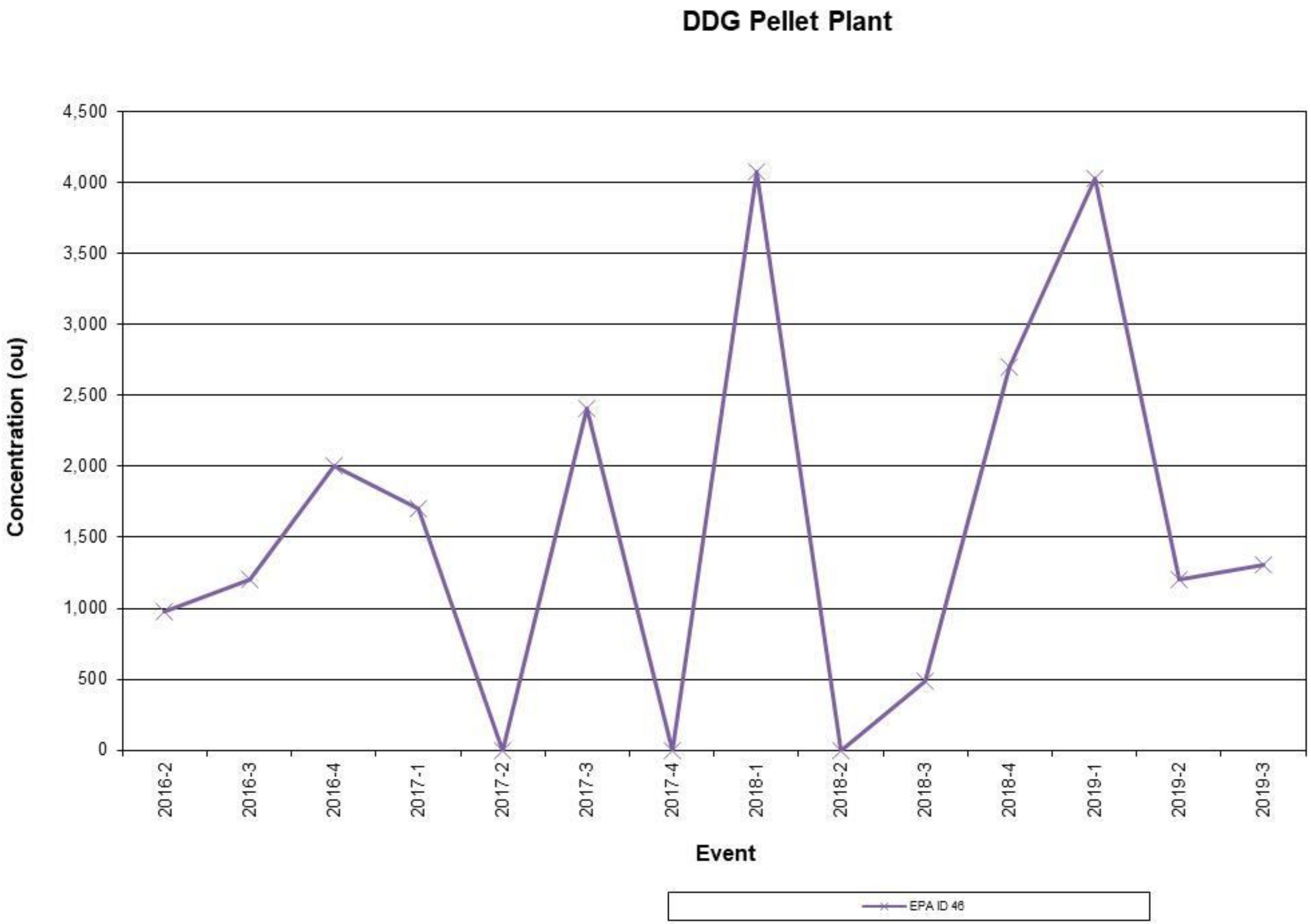


FIGURE 5-10 CONCENTRATION DDG PELLET PLANT STACK



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: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the colour, as in 'it smells like …' *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.*

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^{o}C) connected to a chromel/alumel (K-type) thermocouple probe.

6.4 OXYGEN (O_2)

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

O_2 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
^oC	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	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	7006			
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 8 Gluten Dryer No.1**	**EPA ID 9 Gluten Dryer No.2**	**EPA ID 10 Gluten Dryer No.3**	**EPA ID 11 Gluten Dryer No.4**
Date	19-August-2019	19-August-2019	19-August-2019	19-August-2019
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-1, TM-2 & TM-22			
Sample Start Time (hrs)	12:19	12:25	11:14	11:37
Sample Stop Time (hrs)	12:29	12:45	11:34	12:02
Inlet/Exhaust	Exhaust			
Stack Temperature (°C)	71.1	67	62.2	71.2
Stack Cross-Sectional area (m^2)	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	14.3	16.9*	9.0	16.8
Actual Gas Flow Volume (am^3/min)	1,227	1,108*	2,389	2,334
Total Normal Gas Flow Volume (m^3/min)	926	771*	1,866	1,776
Total Normal Gas Flow Volume (m^3/s)	15.4	12.8*	31.1	29.6
Total Stack Pressure (kPa)	101.5	93.1	101.9	101.6
Moisture Content (% by volume)	5.08	5.73	4.64	4.34
Molecular Weight Dry Stack Gas (g/gmole)	28.84	28.84	28.84	28.84
Dry Gas Density (kg/m^3)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.90	20.9	20.9
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5223	5224	5224	5226
SEMA Number	727622	727623	727624	727625
Sample Start Time (hrs)	12:19	12:35	11:24	11:52
Sample Finish Time (hrs)	12:29	12:45	11:34	12:02
Odour Concentration (As Received) (ou)	310	330	330	430
Odour Concentration (Final) (ou)	**310**	**330**	**330**	**430**
Normal MOER (As Received) (ou m^3/s)	4,700	4,300	10,400	12,800
Normal MOER (Final) (ou m^3/s)	4,700	4,300	10,400	12,800
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

Note: * flow was unable to be taken due to access to the duct no longer available for flow measurements on EPA ID 9. Thus these measurements are estimated, based on Quarter 1, 2019 results.

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

Emission Test Results				
Project Number	7006			
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 12 Starch Dryer No.1**	**EPA ID 13 Starch Dryer No.3**	**EPA ID 14 Starch Dryer No.4**	**EPA ID 47 Starch Dryer No.5**
Date	19-August-2019	07-August-2019	19-August-2019	19-August-2019
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-1,TM-2 & TM-22			
Sample Start Time (hrs)	12:57	16:07	10:44	14:25
Sample Stop Time (hrs)	13:20	16:27	11:03	15:14
Inlet/Exhaust	Exhaust			
Stack Temperature (^{o}C)	36.5	34.0	34.7	58.6
Stack Cross-Sectional area (m^2)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	7.2	21.8	21.8	15.4
Actual Gas Flow Volume (am^3/min)	966	1,307	1,310	4,194
Total Normal Gas Flow Volume (m^3/min)	817	1,110	1,093	3,333
Total Normal Gas Flow Volume (m^3/s)	13.6	18.5	18.2	55.5
Total Stack Pressure (kPa)	101.60	101.04	101.70	101.62
Moisture Content (% by volume)	4.37	4.23	6.38	3.77
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836	28.836	28.836
Dry Gas Density (kg/m^3)	1.29	1.29	1.29	1.29
Oxygen (%)	20.9	20.9	20.9	20.9
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5228	5218	5227	5230
SEMA Number	727627	727598	727626	727629
Sample Start Time (hrs)	13:10	16:17	10:53	15:04
Sample Finish Time (hrs)	13:20	16:27	11:03	15:14
Odour Concentration (As Received) (ou)	310	860	150	460
Odour Concentration (Final) (ou)	**310**	**860**	**150**	**460**
Normal MOER (As Received) (ou m^3/s)	4,200	15,800	2,800	25,700
Normal MOER (Final) (ou m^3/s)	4,200	15,800	2,800	25,700
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

TABLE A- 3 EMISSION TEST RESULTS – BOILER STACKS

Emission Test Results			
Project Number	7006	7006	7006
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 35 Boilers No.5 & 6 Combined Stack**	**EPA ID 42 Boilers No.4 Stack**	**EPA ID 45 Boilers No.2 Stack**
Date	07-August-2019	07-August-2019	07-August-2019
	Dry	Dry	Dry
Run	1	1	1
Method	TM-1 & TM-2 & TM-22		
Sample Start Time (hrs)	16:49	17:38	18:27
Sample Stop Time (hrs)	17:20	18:01	18:37
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	131.8	155.0	203.0
Stack Cross-Sectional area (m^2)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	13.6	17.9	10.8
Actual Gas Flow Volume (am^3/min)	2,564.1	1,133.3	617.3
Total Normal Gas Flow Volume (m^3/min)	1,636.5	691.6	336.0
Total Normal Gas Flow Volume (m^3/s)	27.276	11.526	5.599
Total Stack Pressure (kPa)	100.87	101.13	101.10
Moisture Content (% by volume)	4.96	4.17	4.92
Molecular Weight Dry Stack Gas (g/gmole)	30.080	29.776	30.080
Dry Gas Density (kg/m^3)	1.34	1.33	1.34
Oxygen (%)	8.4	11.2	8.4
Analysis	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5219	5220	5221
SEMA Number	727599	727600	727601
Sample Start Time (hrs)	17:10	17:51	18:27
Sample Finish Time (hrs)	17:20	18:01	18:37
Odour Concentration (As Received) (ou)	1,200	2,600	1,200
Odour Concentration (Final) (ou)	**1,200**	**2,600**	**1,200**
Normal MOER (As Received) (ou m^3/s)	32,700	29,900	6,700
Normal MOER (Final) (ou m^3/s)	32,700	29,900	6,700
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

TABLE A-4 EMISSION TEST RESULTS – CO_2 SCRUBBER OUTLET & FERMENTER 16

Emission Test Results			
Project Number	7006	7006	7006
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 16 CO_2 Scrubber Outlet**	**EPA ID 16 CO_2 Scrubber Inlet**	**EPA ID 44 Fermenter 15**
Date	07-August-2019	07-August-2019	07-August-2019
	Dry	Dry	Dry
Run	1	1	1
Method	TM-1,TM-2 & TM-22		
Sample Start Time (hrs)	15:00	15:14	14:20
Sample Stop Time (hrs)	15:22	15:19	14:28
Inlet/Exhaust	Exhaust	Inlet	Exhaust
Stack Temperature (°C)	19.8	19.8	30.8
Stack Cross-Sectional area (m^2)	0.196	Exhaust gas flow details as for outlet. Inlet sample port is not compliant with TM-1.	0.071
Average Stack Gas Velocity (m/s)	15.4		11.0
Actual Gas Flow Volume (am^3/min)	181		46.8
Total Normal Gas Flow Volume (m^3/min)	165		40.3
Total Normal Gas Flow Volume (m^3/s)	2.7		0.672
Total Stack Pressure (kPa)	100.94		101.03
Moisture Content (% by volume)	1.95		3.83
Molecular Weight Dry Stack Gas (g/gmole)	31.204		30.008
Dry Gas Density (kg/m^3)	1.39		1.34
Oxygen (%)	0.1		0.5
Analysis	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5216	5217	5215
SEMA Number	727596	727597	727595
Sample Start Time (hrs)	15:12	15:17	14:30
Sample Finish Time (hrs)	15:22	15:19	14:40
Odour Concentration (As Received) (ou)	10,300	12,200	7,200
Odour Concentration (Final) (ou)	**10,300**	**12,200**	**7,200**
Normal MOER (As Received) (ou m^3/s)	28,400	---	4,900
Normal MOER (Final) (ou m^3/s)	28,400	---	4,900
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

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

Emission Test Results		
Project Number	7006	7006
Project Name	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 46 DDG Pellet Plant Stack**	**EPA ID 39 Inlet to Biofilters A & B**
Date	07-August-2019	07-August-2019
	Dry	Dry
Run	1	1
Method	TM-1 & TM-2 & TM-22	
Sample Start Time (hrs)	13:58	14:42
Sample Stop Time (hrs)	14:25	15:05
Inlet/Exhaust	Exhaust	
Stack Temperature (^oC)	39.8	39.6
Stack Cross-Sectional area (m^2)	1.674	0.283
Average Stack Gas Velocity (m/s)	15.0	14.4
Actual Gas Flow Volume (am^3/min)	1,501.9	245
Total Normal Gas Flow Volume (m^3/min)	1,284.1	194
Total Normal Gas Flow Volume (m^3/s)	21.402	3.2
Total Stack Pressure (kPa)	100.98	97.09
Moisture Content (% by volume)	1.73	5.13
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m^3)	1.29	1.287
Oxygen (%)	20.9	20.9
Analysis	Odour	
Method	AS4323.3	
ORLA Number	5214	5229
SEMA Number	727588	727628
Sample Start Time (hrs)	14:15	14:55
Sample Finish Time (hrs)	14:25	15:05
Odour Concentration (As Received) (ou)	1,300	15,500
Odour Concentration (Final) (ou)	**1,300**	**15,500**
Normal MOER (As Received) (ou m^3/s)	27,900	50,200
Normal MOER (Final) (ou m^3/s)	27,900	50,200
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS (EPL IDS 40 & 41)

Emission Test Results				
Project Number	7006	7006	7006	7006
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPL ID 40 Biofilter A East**	**EPL ID 40 Biofilter A West**	**EPL ID 41 Biofilter B East**	**EPL ID 41 Biofilter B West**
Date	19-August-2019	19-August-2019	19-August-2019	19-August-2019
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-2 & TM-22			
Sample Start Time (hrs)	15:18	16:24	15:00	16:20
Sample Stop Time (hrs)	15:40	16:48	15:21	16:42
Inlet/Exhaust	Exhaust			
Stack Temperature (^{o}C)	31.2	28.1	34.2	30.8
Proportion of Inlet air flow	**0.28**	**0.24**	**0.24**	**0.24**
Calculated from inlet flow Actual Gas Flow Volume (am^3/min)	68.4	57.6	59.4	59.4
Calculated from inlet flow Total Normal Gas Flow Volume (m^3/min)	54.3	45.8	47.2	47.2
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5231	5233	5232	5234
SEMA Number	727630	727632	727631	727633
Sample Start Time (hrs)	15:30	16:38	15:11	16:32
Sample Finish Time (hrs)	15:40	16:48	15:21	16:42
Odour Concentration (As Received) (ou)	1,400	1,200	1,500	1,500
Odour Concentration (Final) (ou)	1,400	1,200	1,500	1,500
Normal MOER (As Received) (ou m^3/s)	1,300	900	1,200	1,200
Normal MOER (Final) (ou m^3/s)	1,300	900	1,200	1,200
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:

Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	DDG stack, Starch Dryer 3, Fermenter 15, CO_2 Scrubber outlet, CO_2 Scrubber inlet, Boiler 2, Boiler 4 &Boiler 5&6
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7006/ORLA/01
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5213 to 5221
	SEMA Sample number(s):	727594 to 727601
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	7 August 2019
	Order number:	5038
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	21 August 2019

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76{,}895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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 August 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7006/ORLA/01

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) 1 *	Sample Odour Concentration (ou) 2 *	Odour Character & Hedonic Tone ^ +
EPA 46 DDG Stack	727594	7/08/2019 14:15	5214	8/08/2019 11:18	4	8	Nil	1303	1300	Caramel liqueur, sweet vinegar, mould, cooking oil, coffee, burnt rubber (-1)^
EPA 44 No. 15 Fermenter	727595	7/08/2019 14:30	5215	8/08/2019 11:47	4	8	Nil	7189	7200	Vanilla, coconut alcohol, sweet oil, vinegar, sweet swampy, yoplait fermentation (-1)^
EPA 16 CO_2 Scrubber Outlet	727596	7/08/2019 15:12	5216	8/08/2019 12:15	4	8	Nil	10322	10300	Banana and vanilla essence, vinegar, alcohol, sickly sweet (-1)^
EPA 16 CO_2 Scrubber Inlet	727597	7/08/2019 15:19	5217	8/08/2019 12:43	4	8	Nil	12197	12200	Banana and vanilla essence, vinegar, coconut alcohol, sickly sweet , sweet plastic (-1)^
EPA 13 Starch Dryer 3	727598	7/08/2019 16:17	5218	8/08/2019 13:50	4	8	Nil	856	860	Banana essence, caramel, sharp sweet oil, vinegar, coconut water (-1)^
EPA 35 Boiler 5&6	727599	7/08/2019 17:10	5219	8/08/2019 14:19	4	8	Nil	1199	1200	Hot iron, linen, car exhaust fumes, vinegar, chalky smoke (-1)^
EPA 42 Boiler 4	727600	7/08/2019 17:51	5220	8/08/2019 14:48	4	8	Nil	2593	2600	Vinegar, smoke machine, sharp, smoke, dry cleaners, car exhaust, hot iron (-1)^
EPA 45 Boiler 2	727601	7/08/2019 18:27	5221	8/08/2019 15:17	4	8	Nil	1195	1200	Vinegar, smoke machine, dry cleaners, car exhaust, acid, sharp (-1)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7006/ORLA/01

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5213	62	1413	43.9	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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. Panellist Rolling Average: SR = 55.9, PR = 47.2, TL = 39.8, PRA = 39.8

^ 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 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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Bio inlet, Bio A outlet east & west, Bio B outlet east & west, Starch Dryers 1,4 & 5 and Gluten Dyers 1, 2,3 & 4
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7006/ORLA/02
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5223 to 5234
	SEMA Sample number(s):	727622 to 727633
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	7 August 2019
	Order number:	5038
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	21 August 2019

This report cannot be reproduced except in full

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76{,}895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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 August 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7006/ORLA/02

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone[^ +]
EPA 8 Gluten Dryer No.1	727622	19/08/2019 12:19	5223	20/08/2019 10:35	4	8	Nil	300	300	Tobacco, spice, wood oil, plastic paint, hessian, fermented hops, drain water (-2)[^]
EPA 9 Gluten Dryer No.2	727623	19/08/2019 12:35	5224	20/08/2019 11:04	4	8	Nil	333	330	Tobacco, cloves, wood oil, plastic paint, hessian, baking bread (-2)[^]
EPA 10 Gluten Dryer No.3	727624	19/08/2019 11:24	5225	20/08/2019 11:33	4	8	Nil	333	330	Tobacco, cloves, yeast, paint, plastic, wood oil, grease, hessian, wheat or grain, baking bread (-3)[^]
EPA 11 Gluten Dryer No.4	727625	19/08/2019 11:52	5226	20/08/2019 12:01	4	8	Nil	432	430	Tobacco, cloves, yeast, burnt plastic, plastic paint, hessian, drain water (-2)[^]
EPA 14 Starch Dryer No.4	727626	19/08/2019 10:53	5227	20/08/2019 12:30	4	8	Nil	152	150	Wheat, cloves, grain, coconut vegetable oil, vinegar, heated or melting plastic, soft vinyl (-2)[^]
EPA 12 Starch Dryer No.1	727627	19/08/2019 13:10	5228	20/08/2019 12:58	4	8	Nil	305	300	Wheat, grain, yeast, melted plastic, sharp vinyl, hessian, wet cardboard (-3)[^]

Odour Research Laboratories Australia

Odour Olfactometry Results – 7006/ORLA/02

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone^ +
EPA 39 Bio inlet	727628	19/08/2019 14:55	5229	20/08/2019 13:27	4	8	Nil	15488	15500	Yeast, wheat, marmite, cereal, hops, coconut vegetable oil, smoky/burnt /sour vegetables (-3)^
EPA 47 Starch Dryer No.5	727629	19/08/2019 15:04	5230	20/08/2019 14:10	4	8	Nil	462	460	Wheat, hessian, mould, grain, oil, bitter vegetables, hops (-3)^
EPA 40 Bio A outlet east	727630	19/08/2019 15:30	5231	20/08/2019 14:40	4	8	Nil	1421	1420	Yeast, wheat, marmite, grain, hessian, rotten vegetables, damp soil, vegemite, cocoa powder (-2)^
EPA 41 Bio B outlet east	727631	19/08/2019 15:11	5232	20/08/2019 15:08	4	8	Nil	1540	1540	Potato, yeast vegemite, soil, drain water, bitter, cocoa powder (-2)^
EPA 40 Bio A outlet west	727632	19/08/2019 16:38	5233	20/08/2019 15:36	4	8	Nil	1195	1200	Yeast, moist earth, vegemite, oil, varnish, bitter, cocoa powder (-2)^
EPA 41 Bio B outlet west	727633	19/08/2019 16:32	5234	20/08/2019 16:05	4	8	Nil	1544	1540	coffee, garbage, septic, damp soil, vegemite, vegetable oil, stinky socks, sewerage (-4)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7006/ORLA/02

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5222	62	1195	51.9	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] Target Range for reference gas n-butanol is $20 \le \chi \le 80$ ppb and compliance with AS/NZ4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration. Panellist Rolling Average: SR = 54.8, PR = 47.1, TL = 39.7, PRA = 39.7

^ 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 panellist 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	04-Jul-19	04-Jan-20
769	Thermocouple	04-Jul-19	04-Jan-20
919	Thermocouple	04-Jul-19	04-Jan-20
885	Digital Manometer	21-Jan-19	21-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
893	Thermocouple	04-Jul-19	04-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
858	Digital Temperature Reader	04-Jul-19	04-Jan-20
726	Pitot	23-Jul-19	23-Jul-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
947	VANE Anomometer	23-Oct-17	23-Oct-19
946	Combustion Analyzer	09-Jul-19	09-Jan-20
676	Personal Sampler	14-Mar-19	14-Mar-20
832	Personal Sampler	14-Mar-19	14-Mar-20
834	Personal Sampler	14-Mar-19	14-Mar-20

Gas Mixtures used for Analyser Span Response

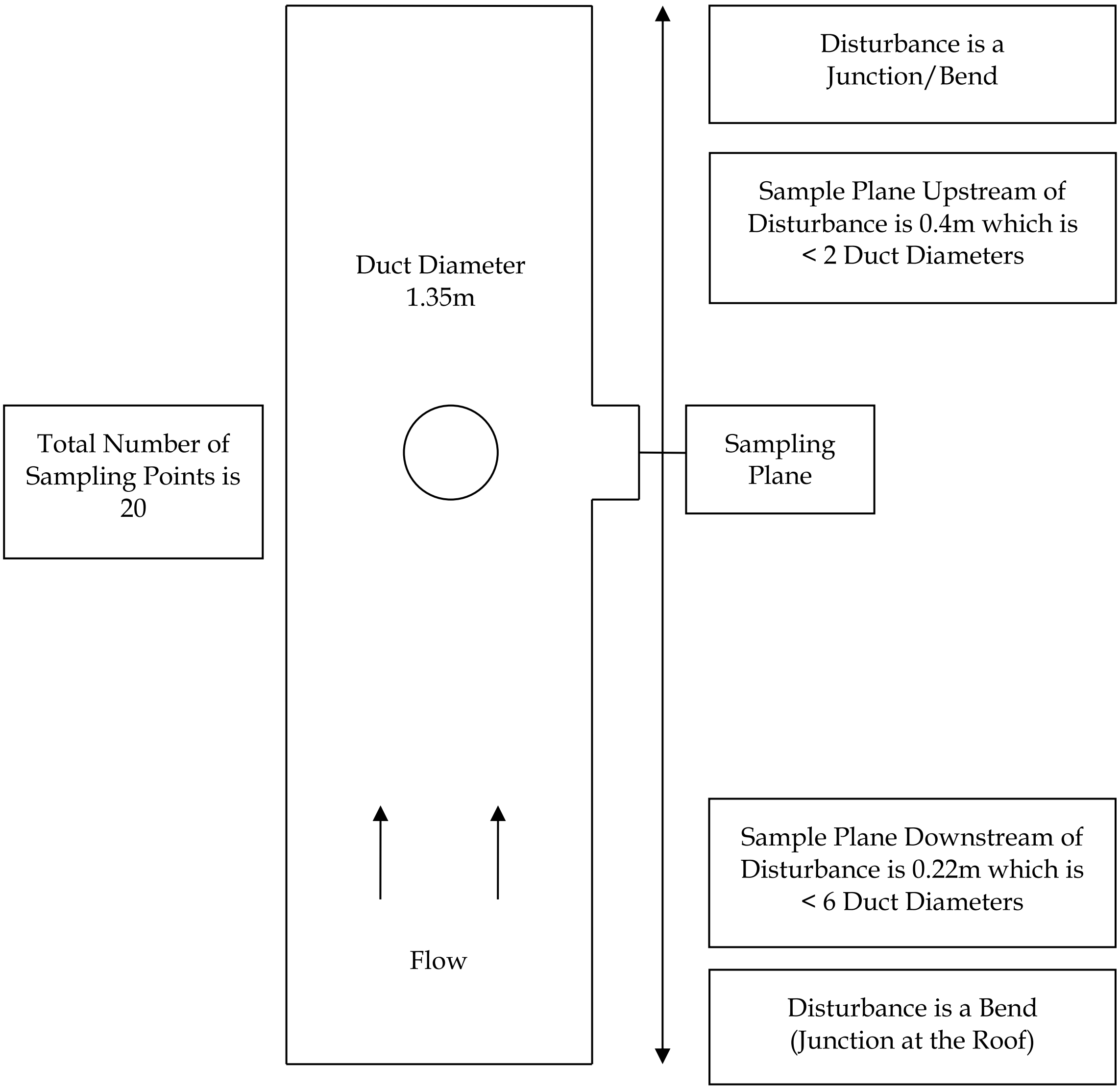
Conc.	Mixture	Cylinder No.	Expiry Date
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

TABLE C-2 INSTRUMENT CALIBRATION DETAILS DAY 2

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	04-Jul-19	04-Jan-20
769	Thermocouple	04-Jul-19	04-Jan-20
919	Thermocouple	04-Jul-19	04-Jan-20
885	Digital Manometer	21-Jan-19	21-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
893	Thermocouple	04-Jul-19	04-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
858	Digital Temperature Reader	04-Jul-19	04-Jan-20
726	Pitot	23-Jul-19	23-Jul-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
947	VANE Anomometer	23-Oct-17	23-Oct-19
946	combustion analyzer	09-Jul-19	09-Jan-20
676	Personal Sampler	14-Mar-19	14-Mar-20
832	Personal Sampler	14-Mar-19	14-Mar-20
834	Personal Sampler	14-Mar-19	14-Mar-20
Gas Mixtures used for Analyser Span Response			
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



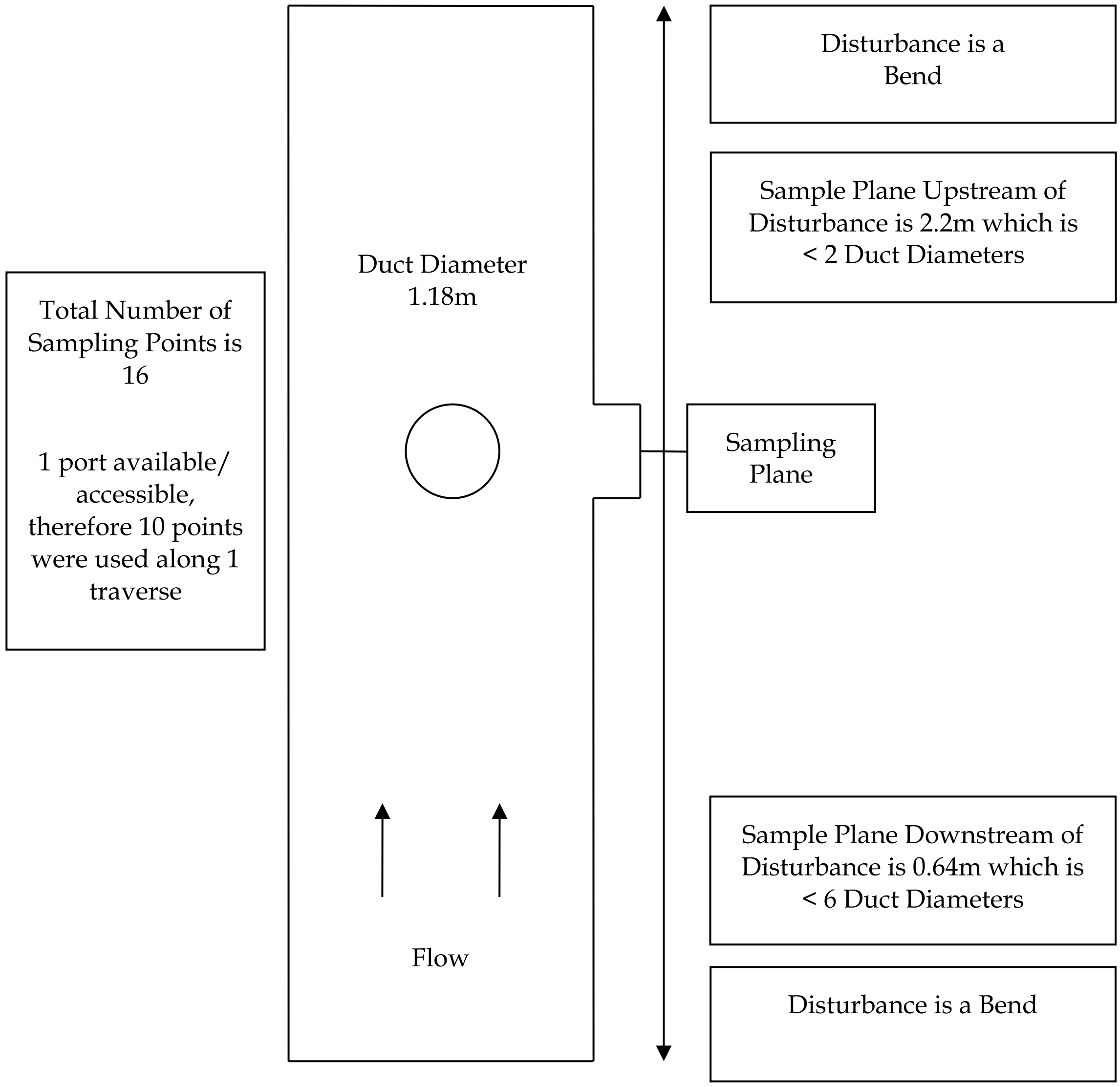
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



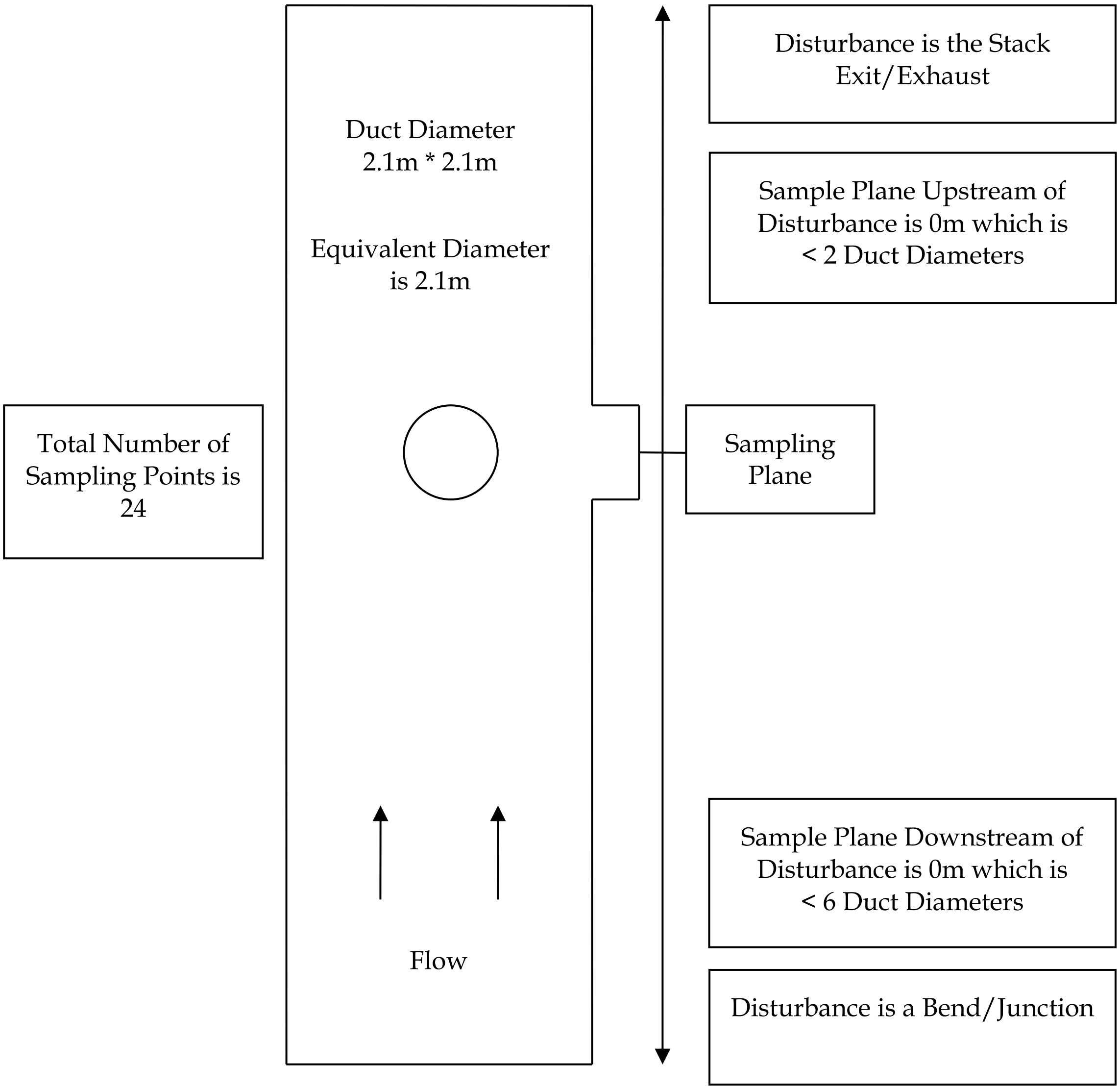
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

FIGURE D-4 GLUTEN DRYER NO. 2 – SAMPLE LOCATION

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



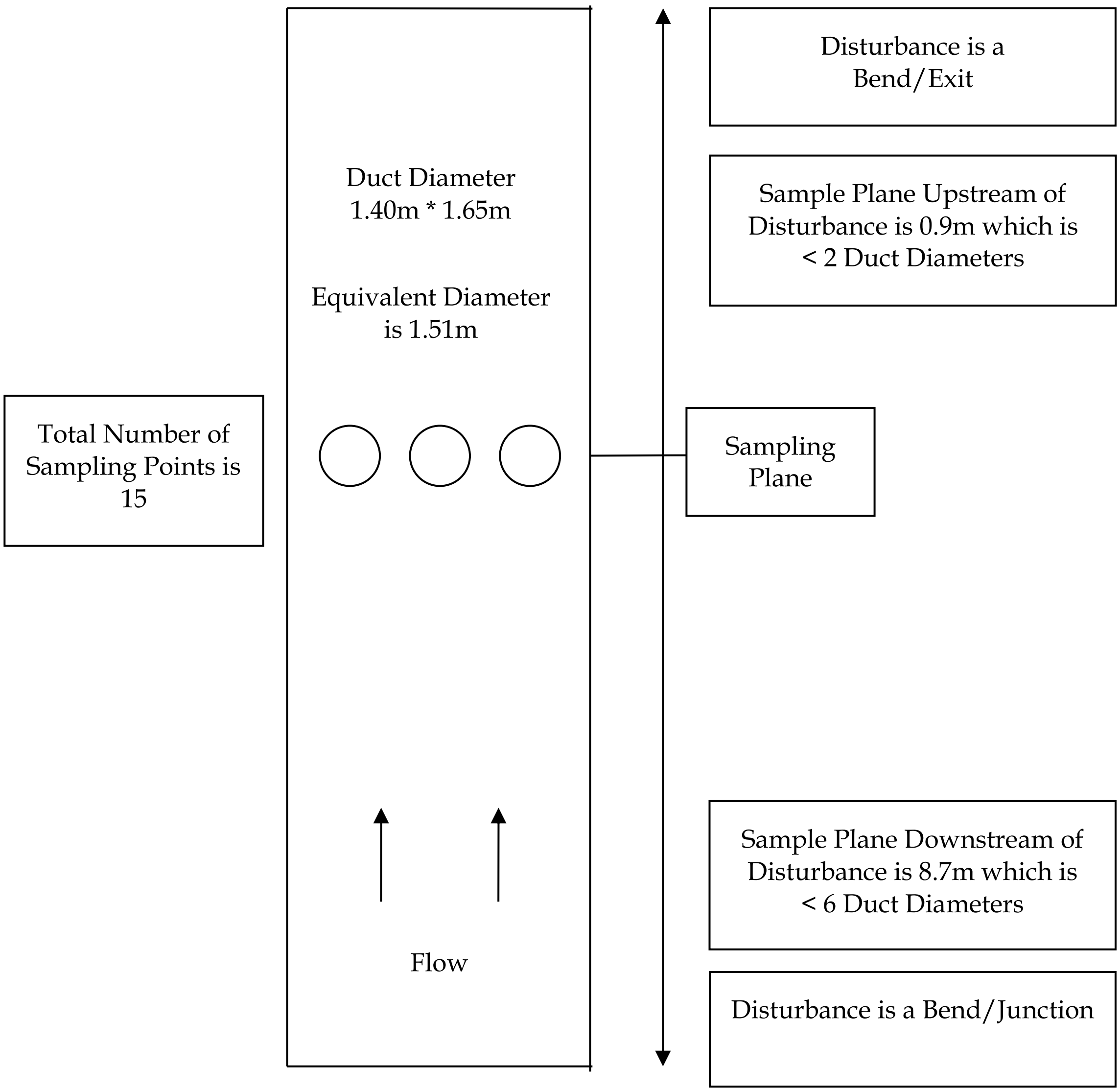
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



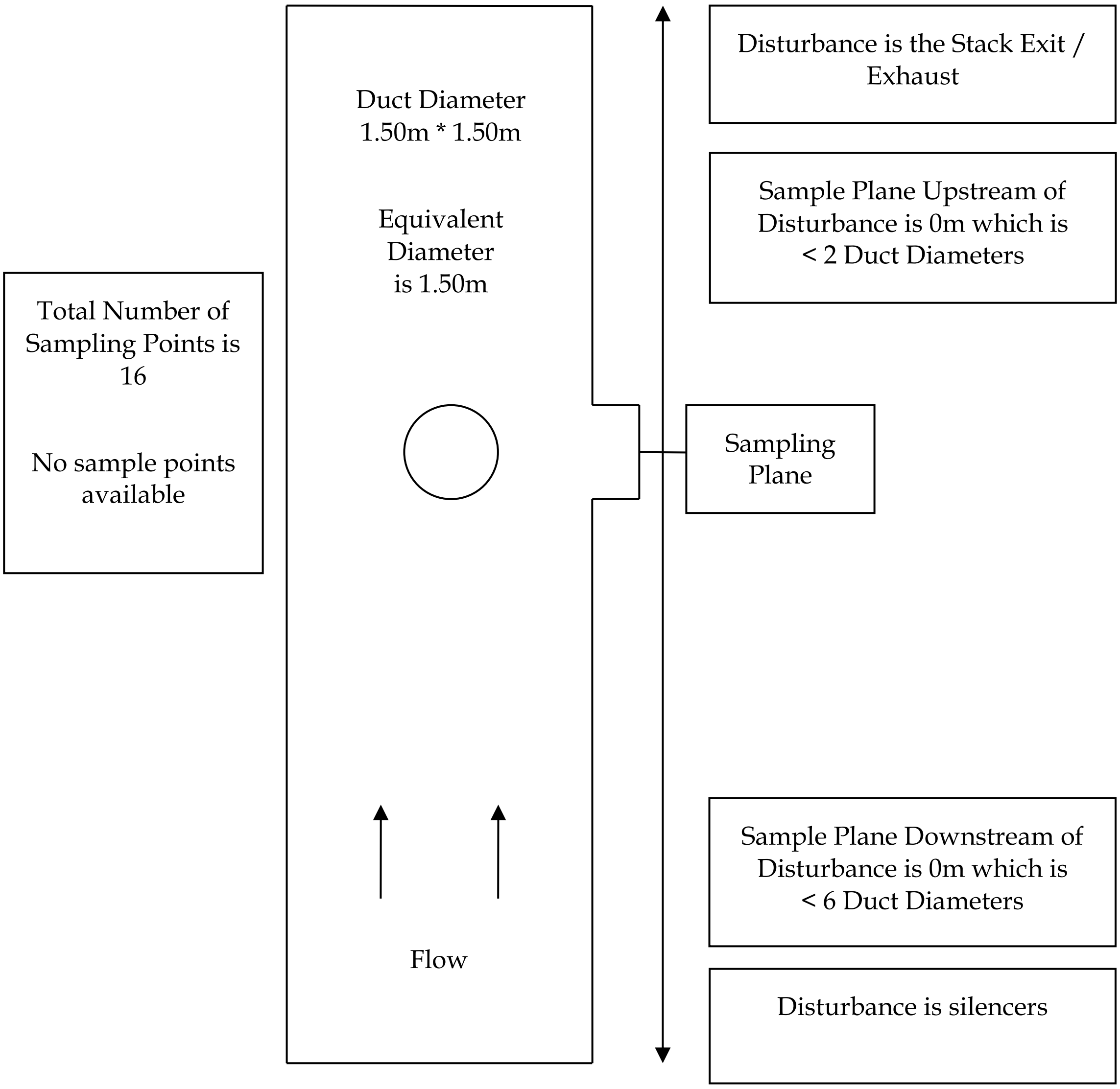
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exit 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



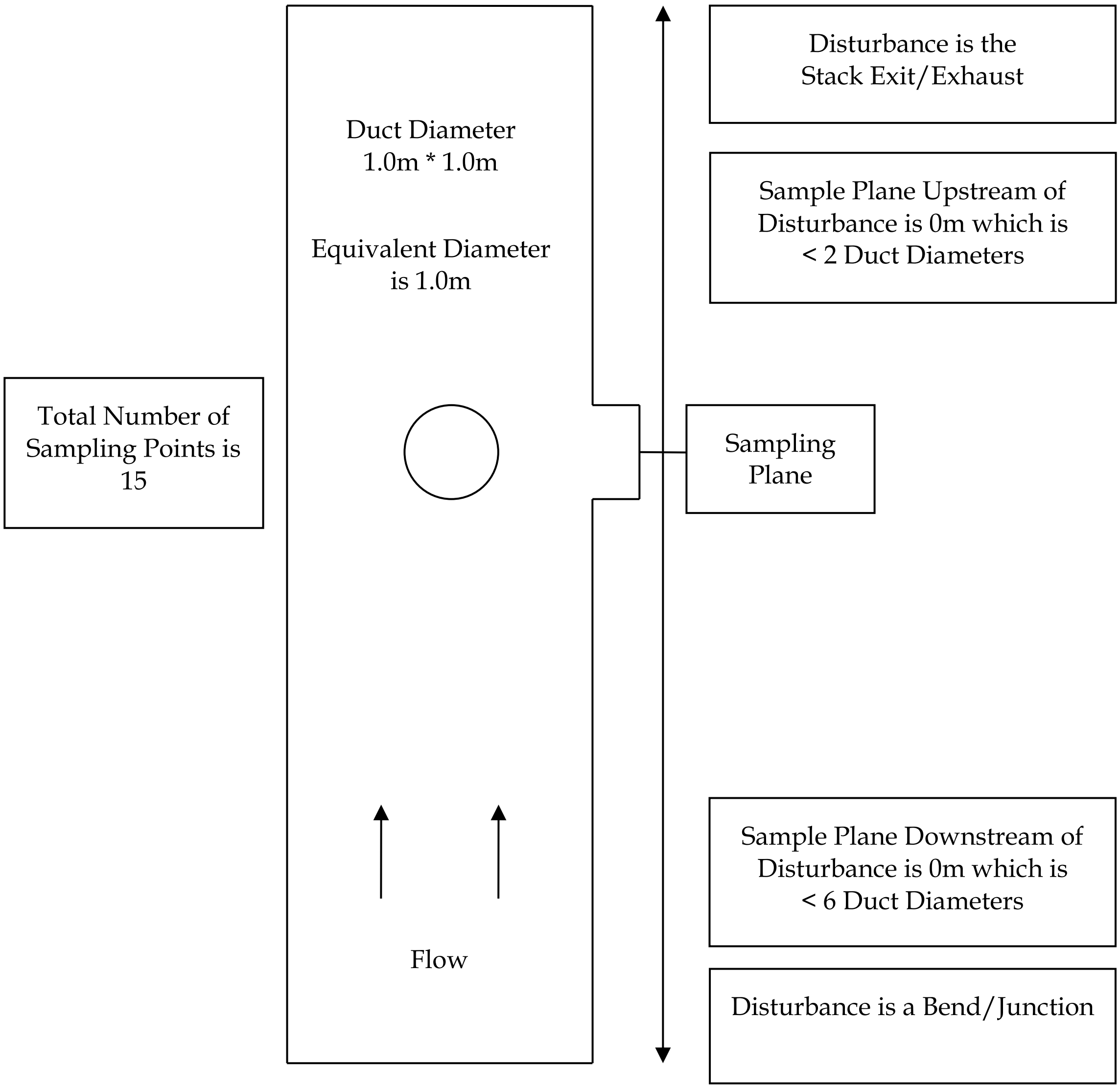
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-10 STARCH DRYER NO. 1 – SAMPLE LOCATION

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



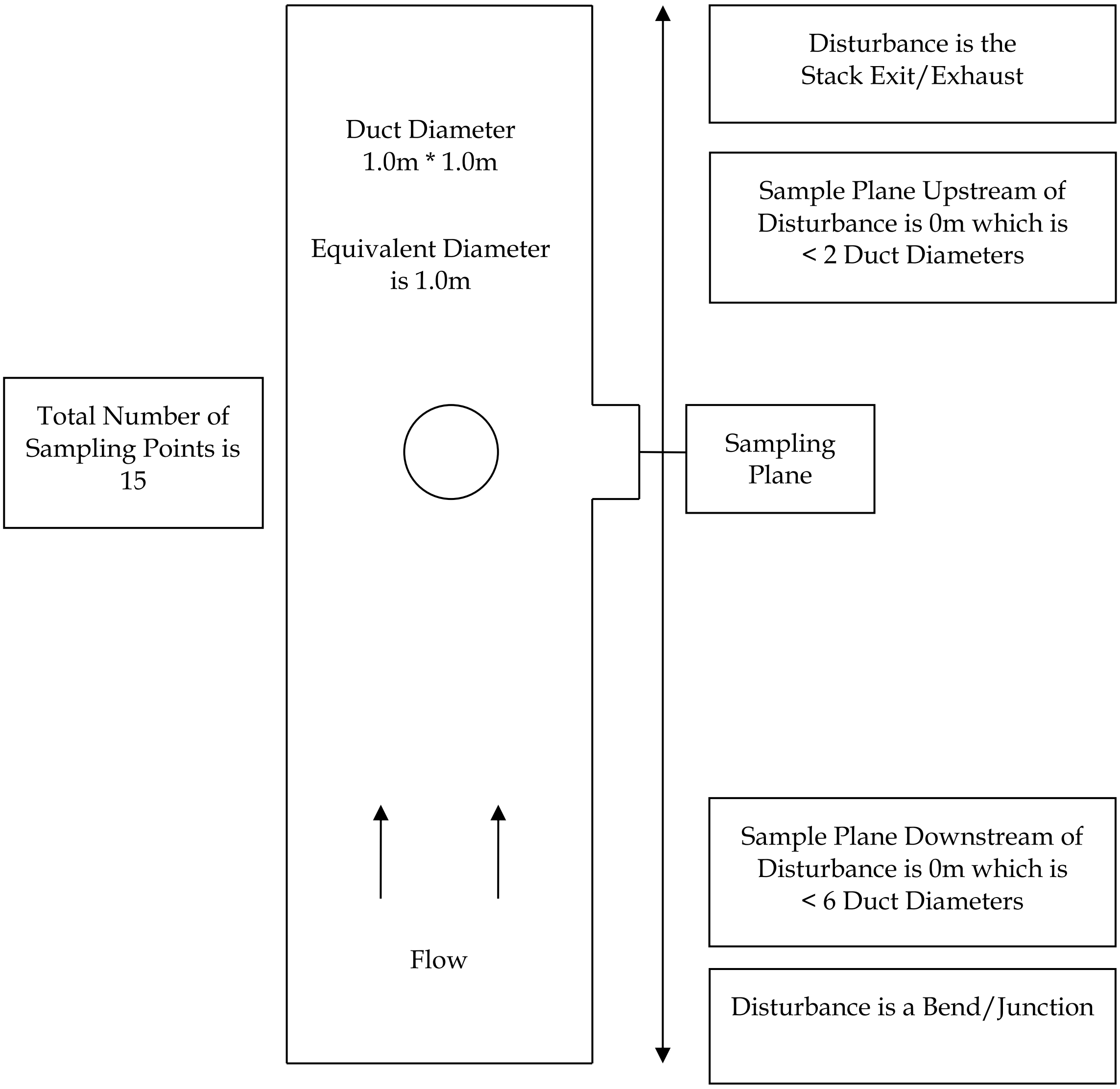
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-12 STARCH DRYER NO. 3 – SAMPLE LOCATION

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



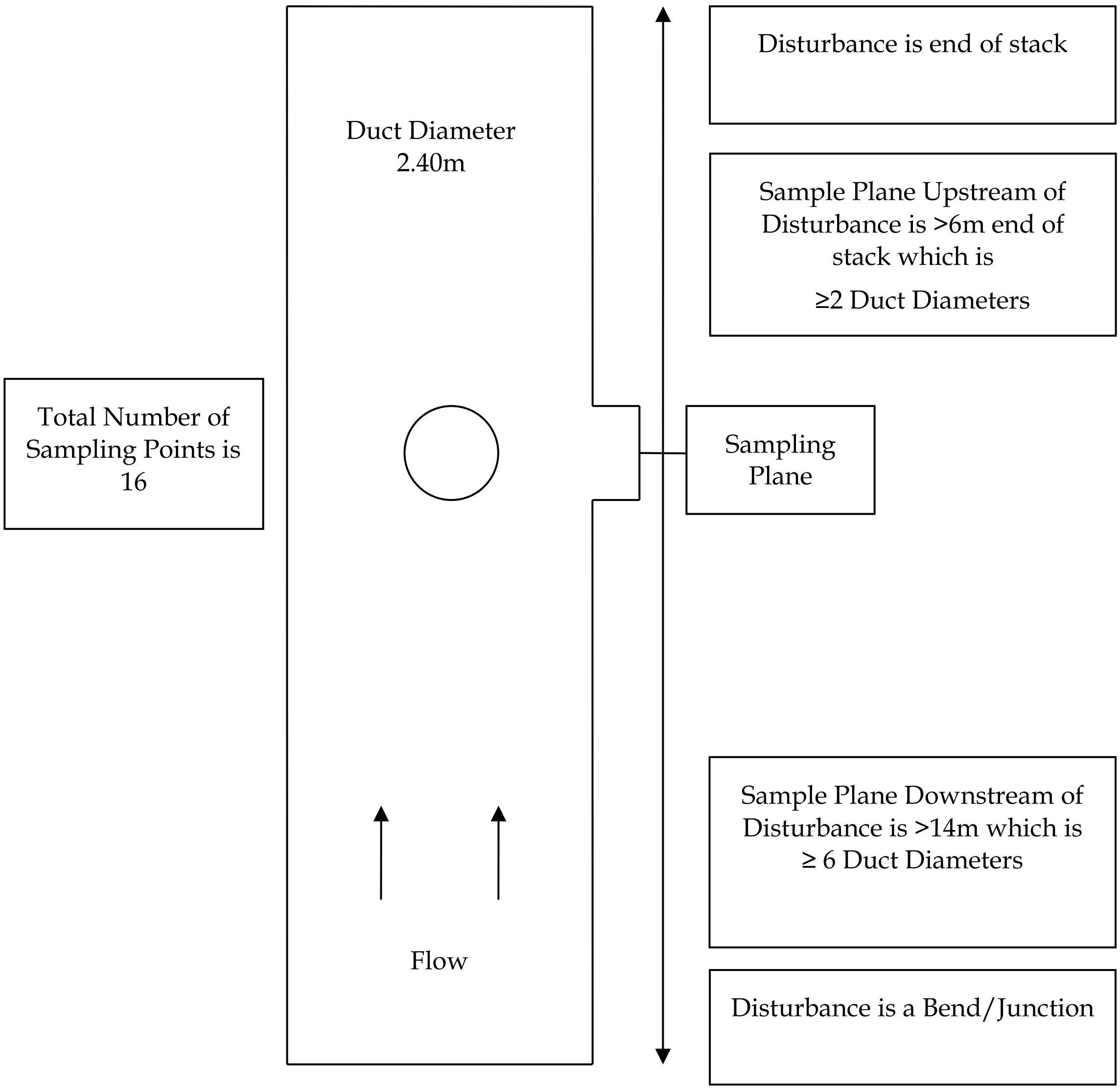
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

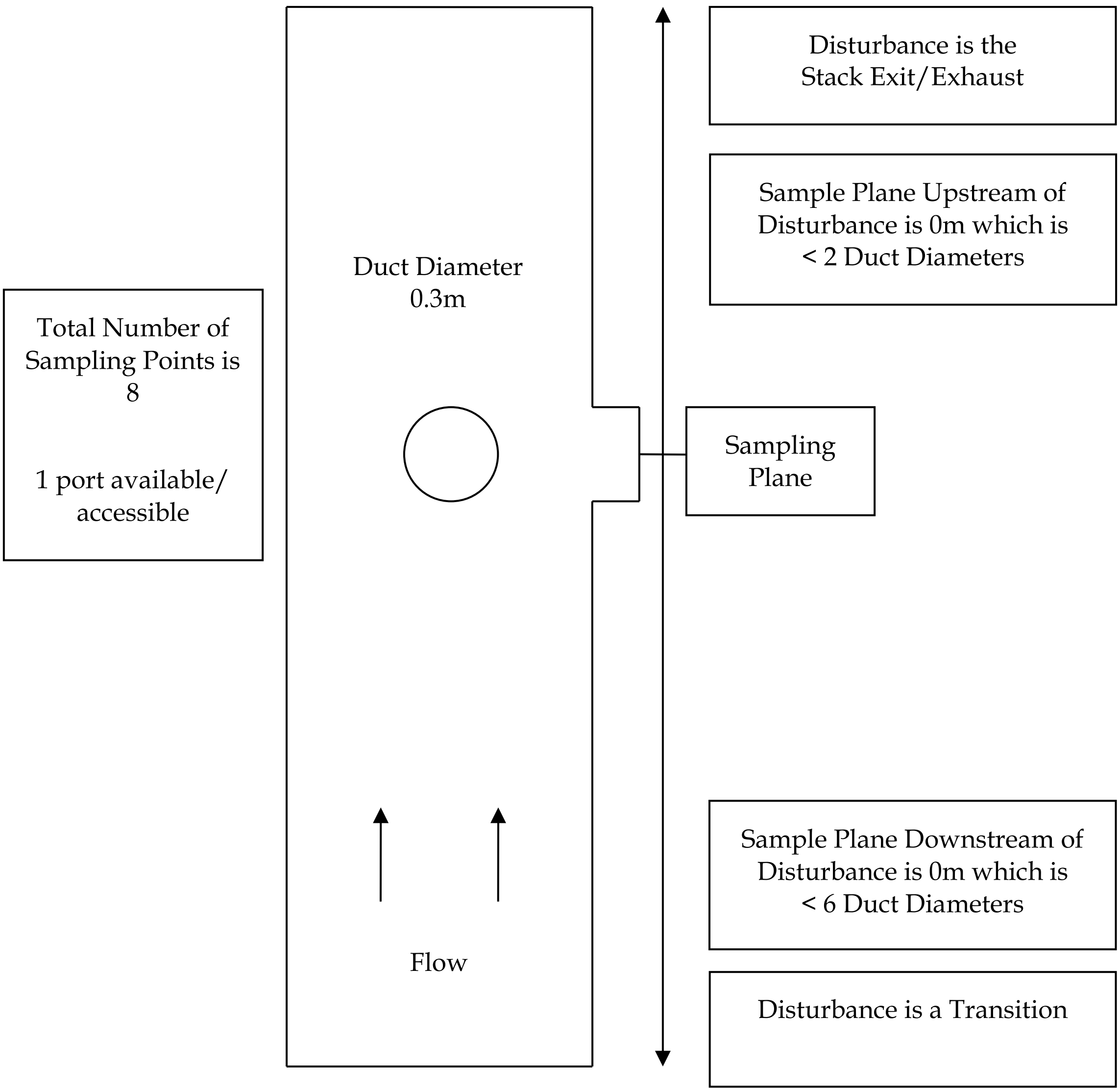


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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.

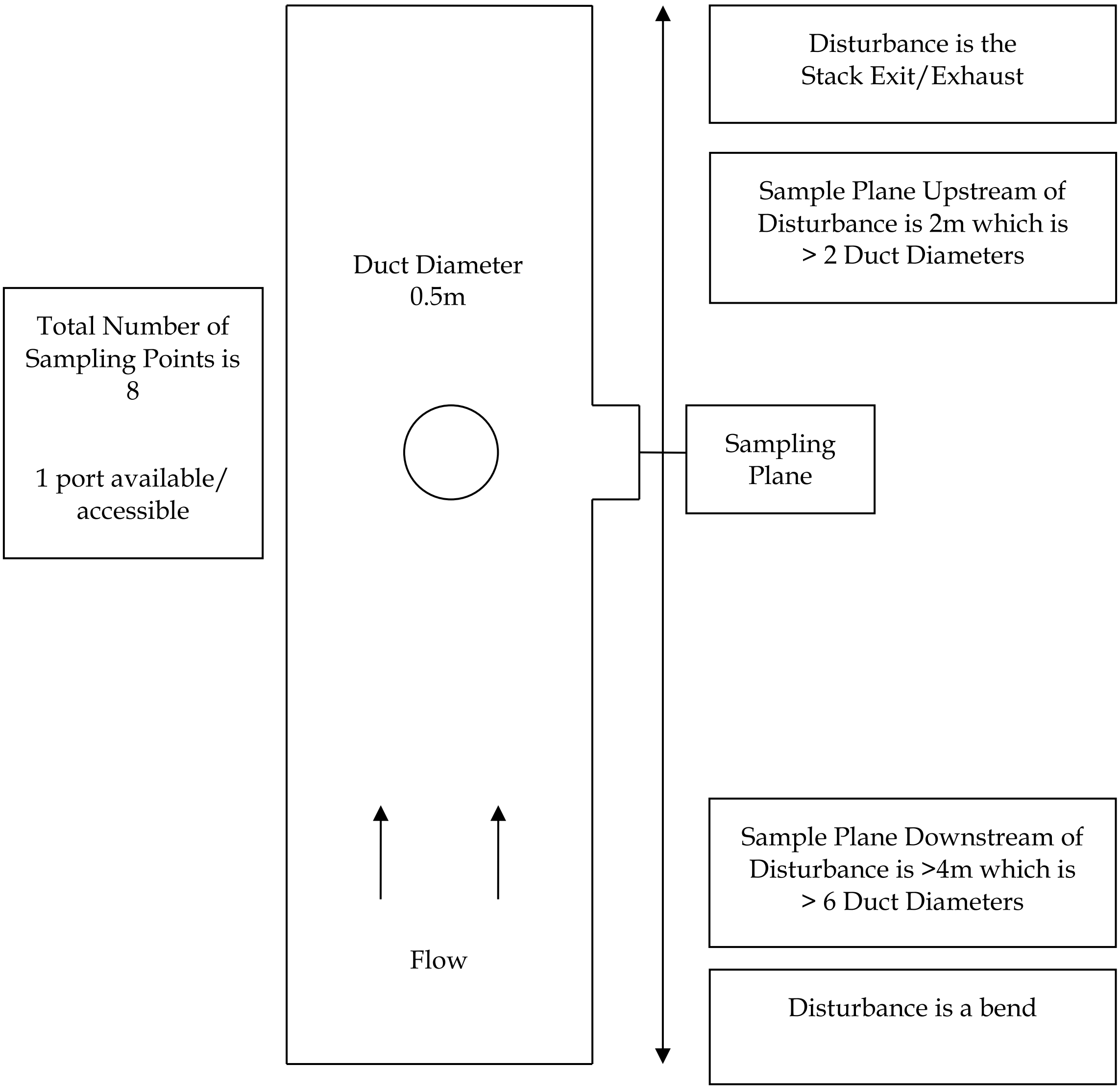
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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_2 SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC

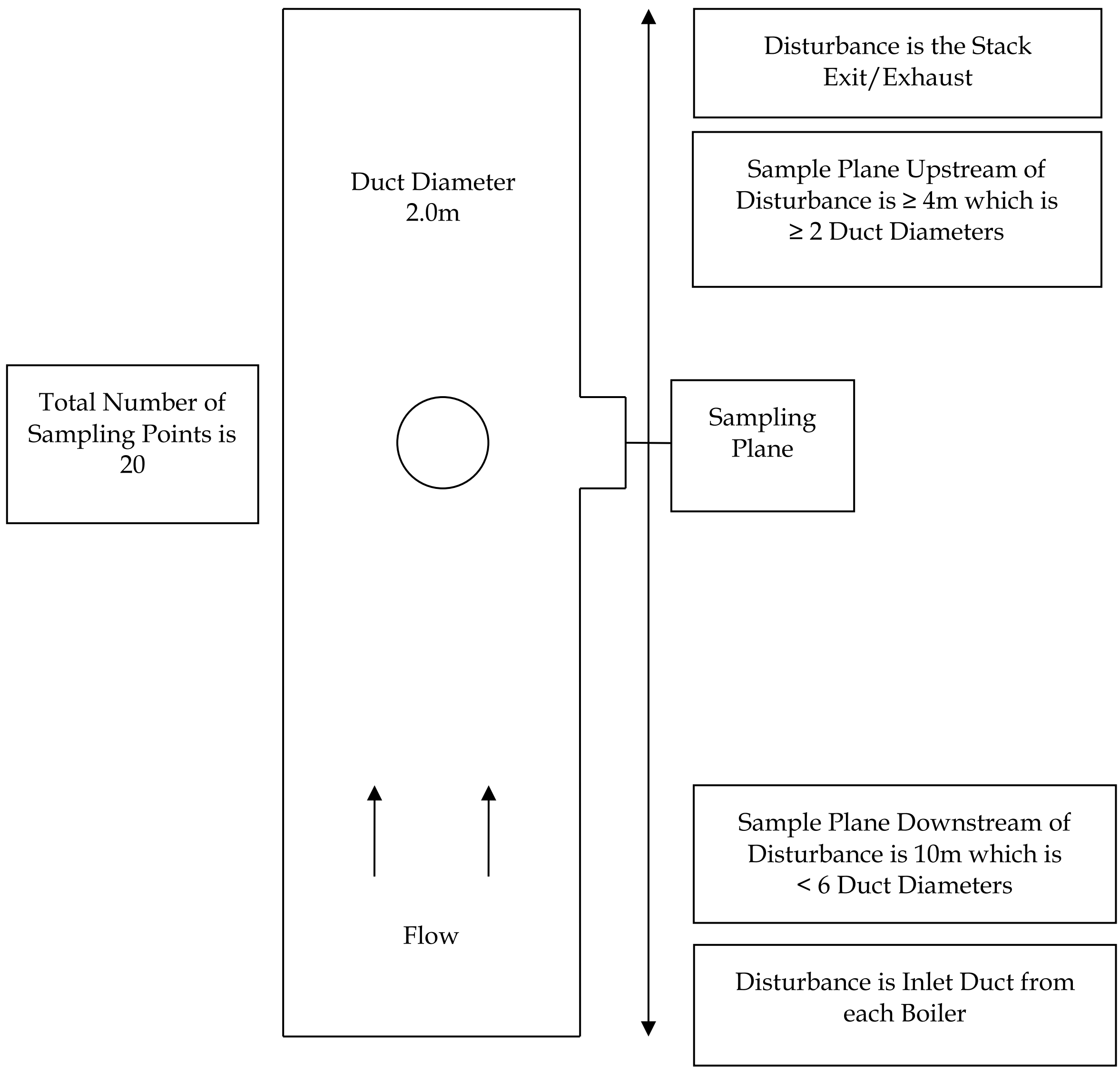


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

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



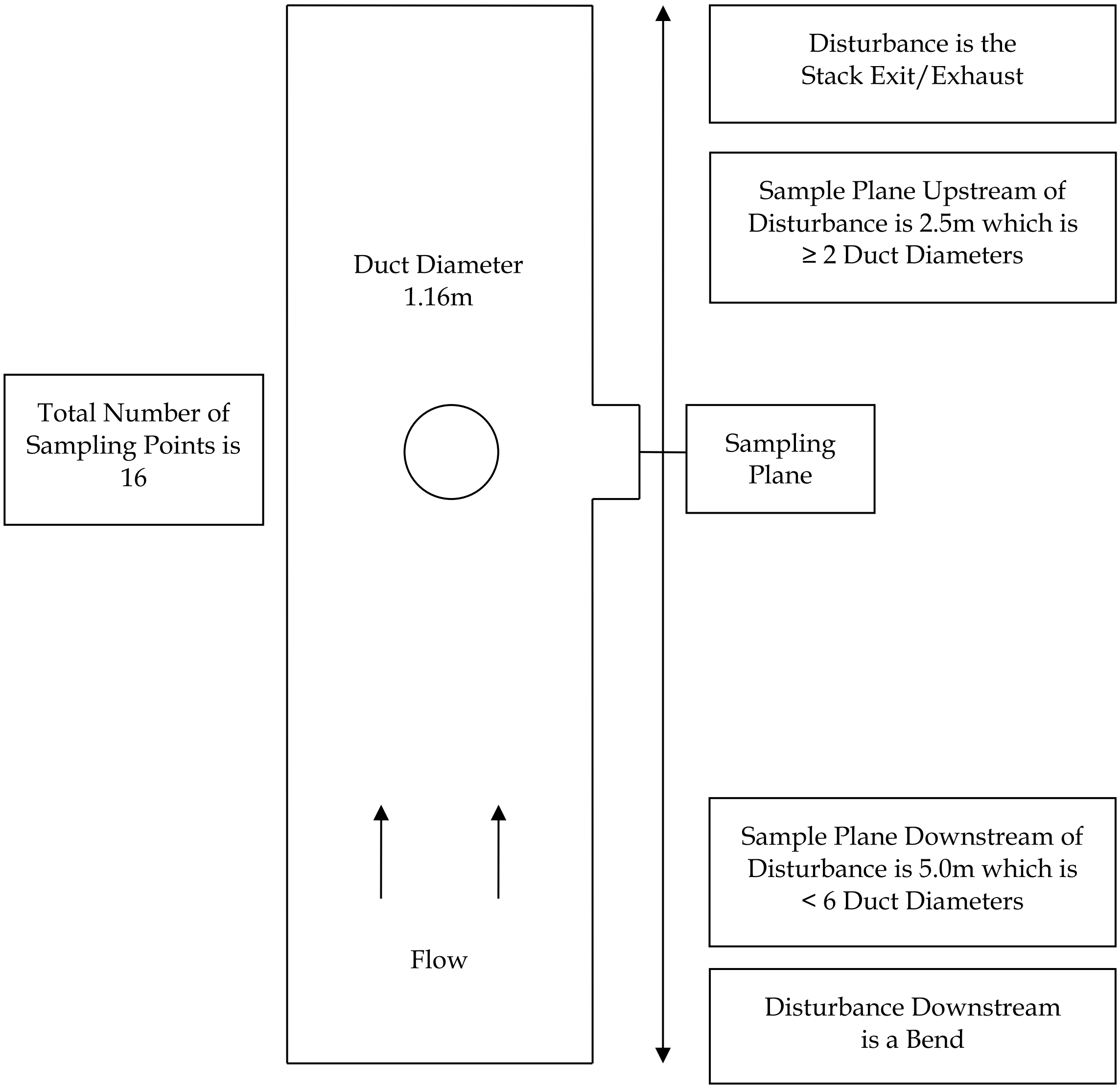
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



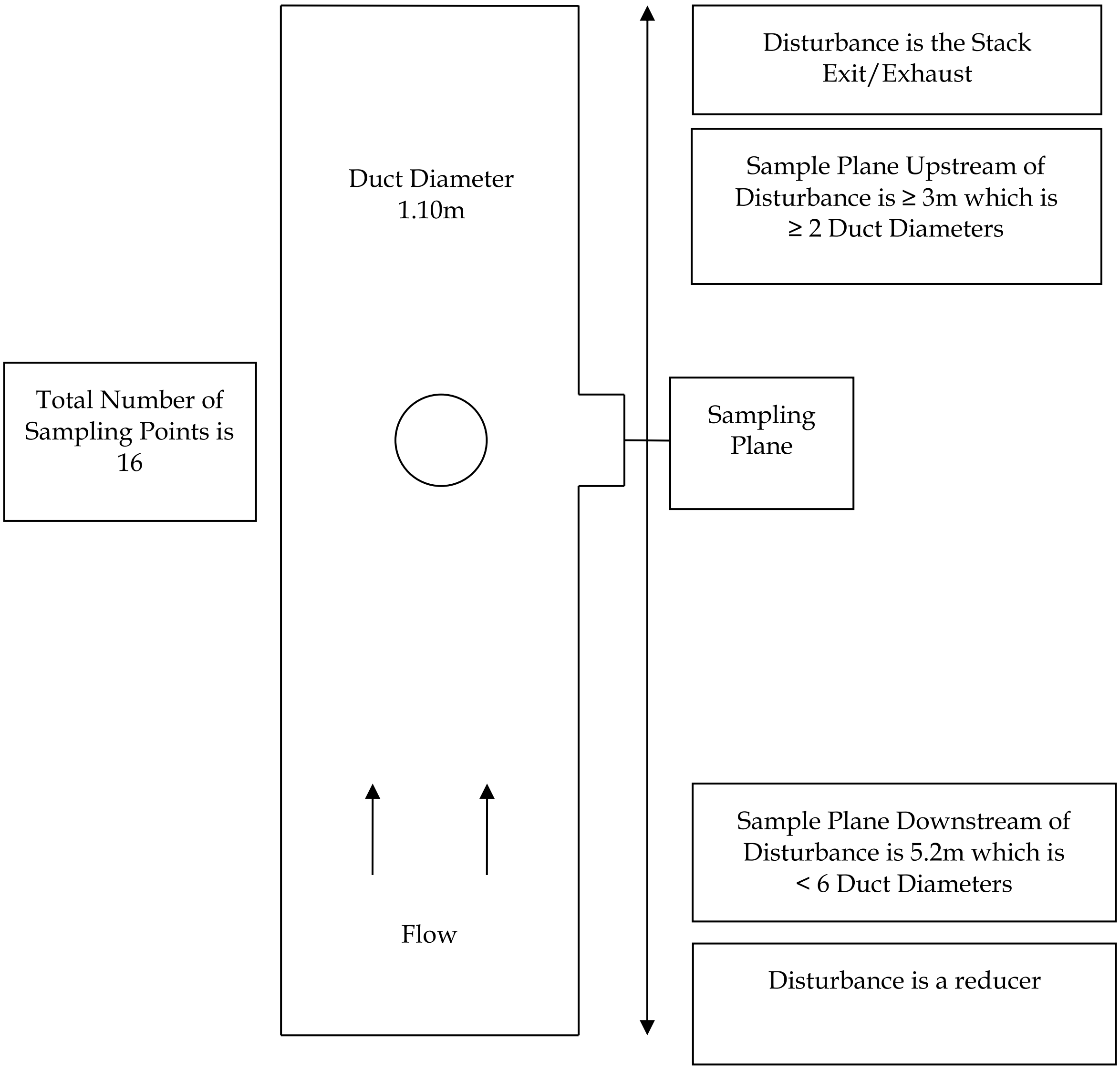
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exit 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

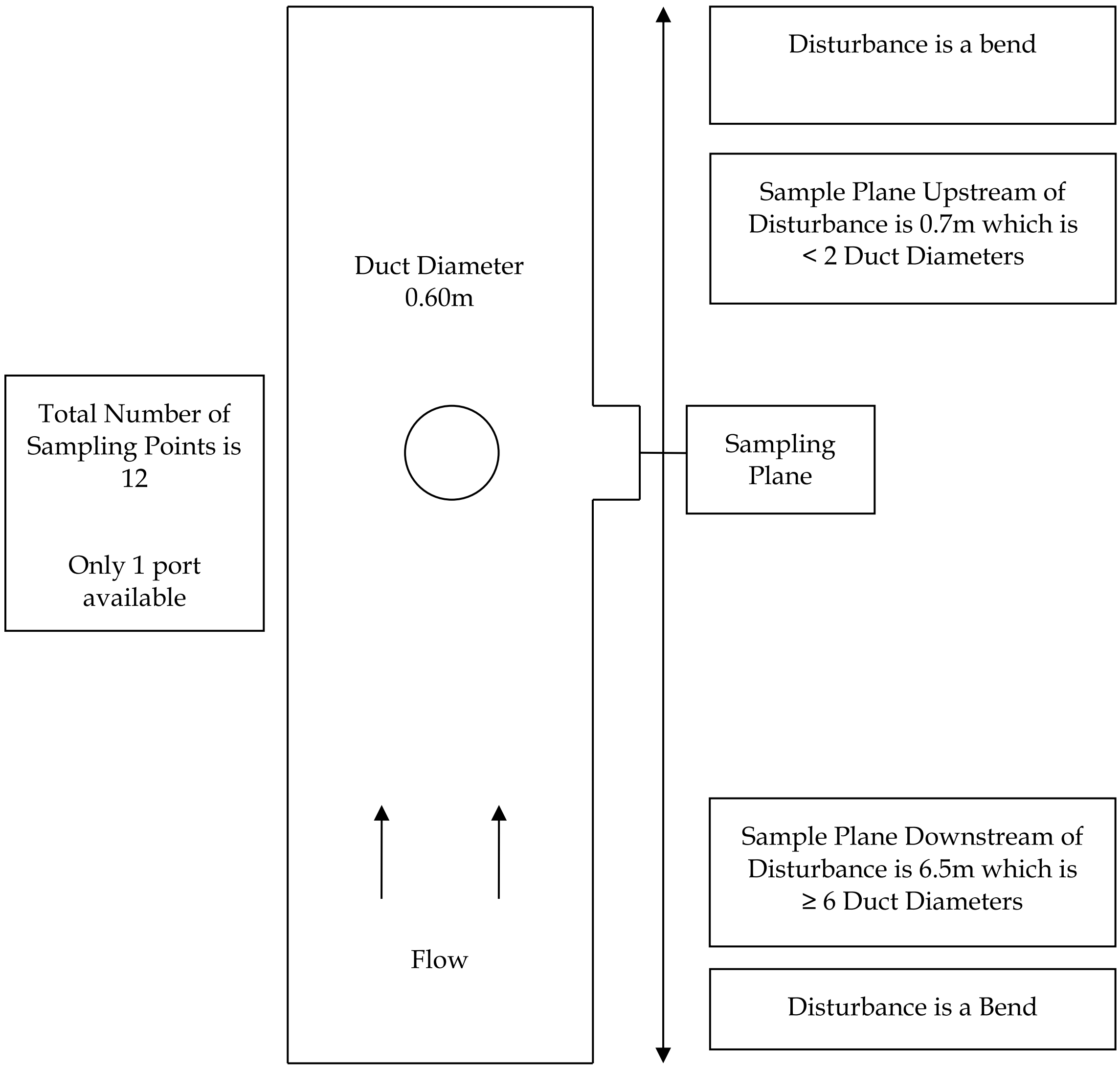


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as 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 exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

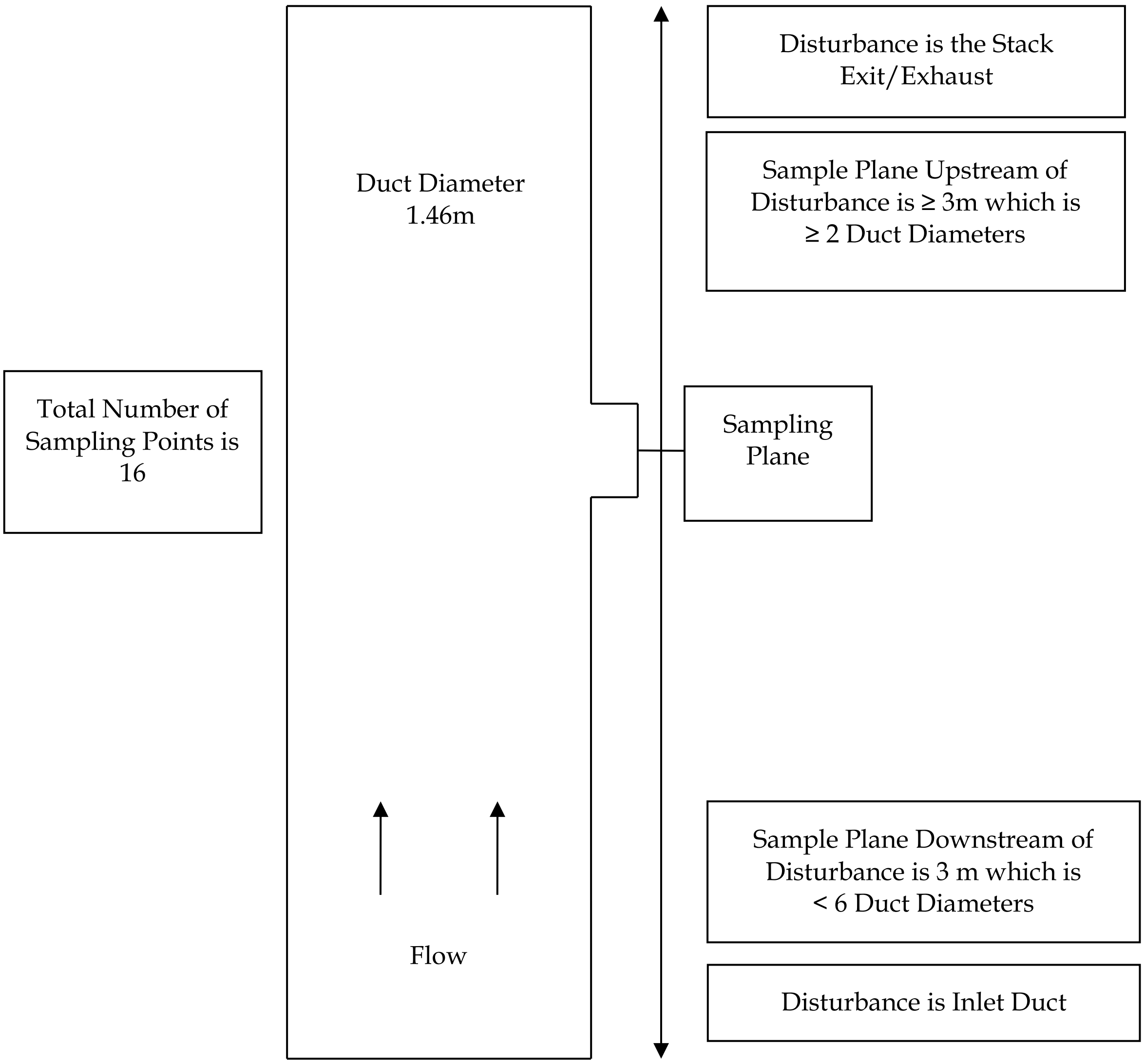
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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 3, 2019-2020

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.:	**7028/S25115B/19**
Dates of Survey:	**1 and 4 November, 2019**
Date of Issue:	**20 November, 2019**

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

EPL ODOUR EMISSION SURVEY QUARTER 3, 2019-2020

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: 7028/S25115B/19

DATES OF SURVEY: 1 AND 4 NOVEMBER, 2019

DATE OF ISSUE: 20 NOVEMBER, 2019

P W STEPHENSON

J WEBER

M KIMBER

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF TABLES – APPENDICES

TABLE OF FIGURES – APPENDICES

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_2) 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 3, 2019-2020 odour test results are presented in this report. The tests were conducted on 1st and 4th November, 2019.

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_2 Scrubber outlet	1	Quarterly
Not specified	CO_2 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
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/m³	=	kilograms per cubic metre
m/s	=	metres per second
m³/s	=	cubic metres per second
mg/m³	=	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/m³	Quarterly	TM-23
Flow	m³/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)

Pollutant	Units	Frequency	Approved Method
Cadmium	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Mercury	mg/m^3	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^3	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Quarterly	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m^3	Annual	TM-4
Temperature	^oC	Quarterly	TM-2
Total Solid Particles	mg/m^3	Quarterly	TM-15
Type 1 & Type 2 substances in aggregate	mg/m^3	Quarterly	TM-12,TM-13 & TM-14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds as n-propane equivalent	mg/m^3	Quarterly	TM-34
Volumetric Flowrate	m^3/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 Reports 7028/ORLA/01 and 02 are 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, Q3, 2019-2020

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	1.11.2019	665
9	No.2 Gluten Dryer	1.11.2019	560
10	No.3 Gluten Dryer	1.11.2019	430
11	No.4 Gluten Dryer	1.11.2019	305
12	No.1 Starch Dryer	1.11.2019	220
13	No.3 Starch Dryer	1.11.2019	200
14	No.4 Starch Dryer	4.11.2019	200
16	Carbon Dioxide Scrubber Outlet	1.11.2019	10,300
--	Carbon Dioxide Scrubber Inlet	1.11.2019	8,700
35	Combined Stack No.5 & 6 Boilers	4.11.2019	1,830
42	Boiler No.4 Outlet	4.11.2019	1,660
44	Fermenter (No. 10)	1.11.2019	7,350
45	Boiler No.2 Outlet	4.11.2019	1,540
46	DDG Pellet Plant Stack	4.11.2019	3,100
47	No.5 Starch Dryer	1.11.2019	610

Key: ou = odour units

TABLE 4-2 EMISSION CONCENTRATION TEST RESULTS DIFFUSE SOURCES, Q3, 2019-2020

EPA ID No.	**Description**	**Date**	**Odour Concentration** (ou)
39	Inlet to Biofilters A & B	4.11.2019	5,000
40	Outlet of Biofilter A (east)	4.11.2019	305
40	Outlet of Biofilter A (west)	4.11.2019	335
41	Outlet of Biofilter B (east)	4.11.2019	515
41	Outlet of Biofilter B (west)	4.11.2019	1,540

Key: ou = odour units

5 CONCLUSIONS

SEMA completed the odour sampling and analysis at Shoalhaven Starches manufacturing facility at Bomaderry for Quarter 3, 2019 - 2020.

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

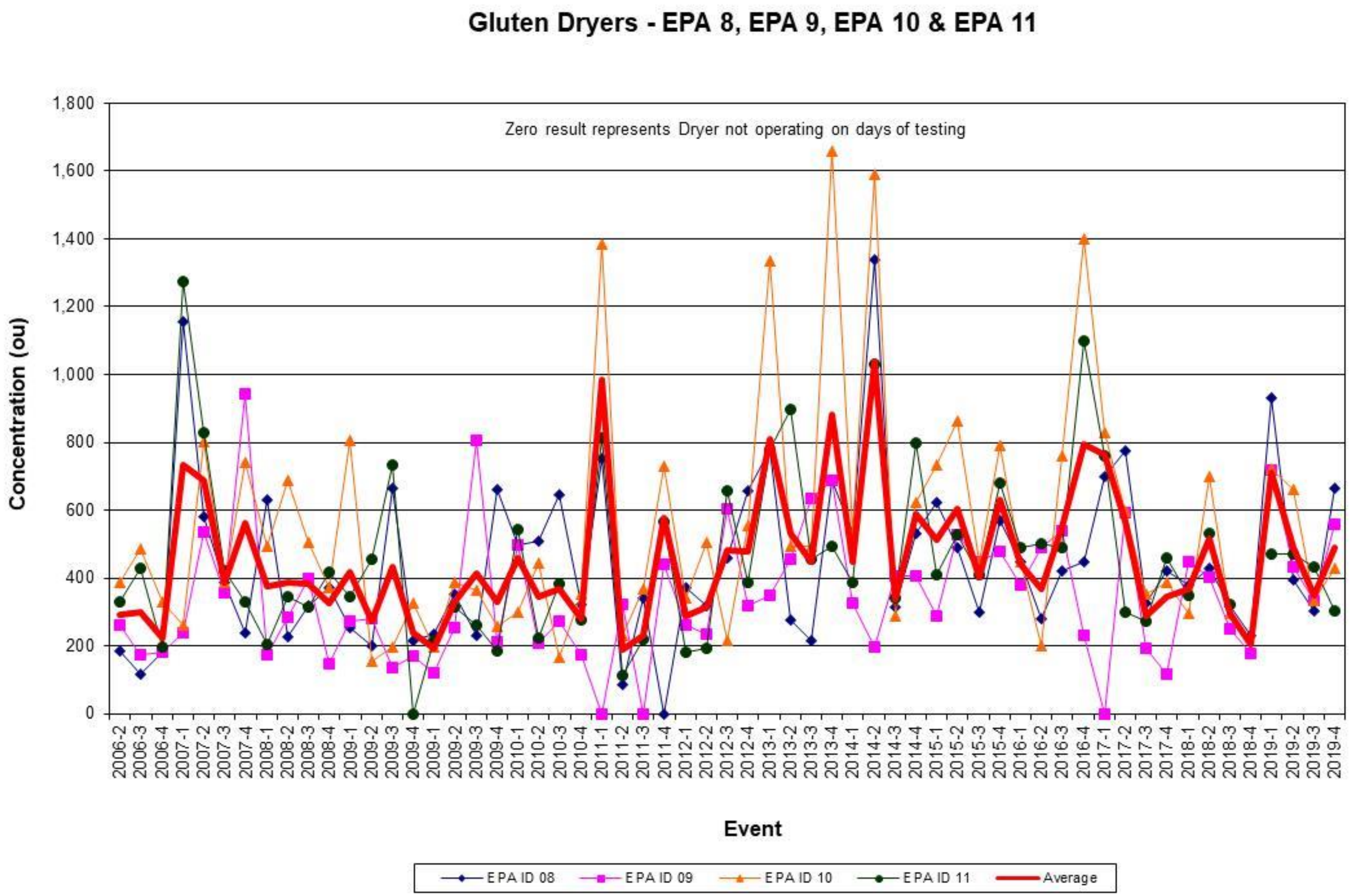


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4

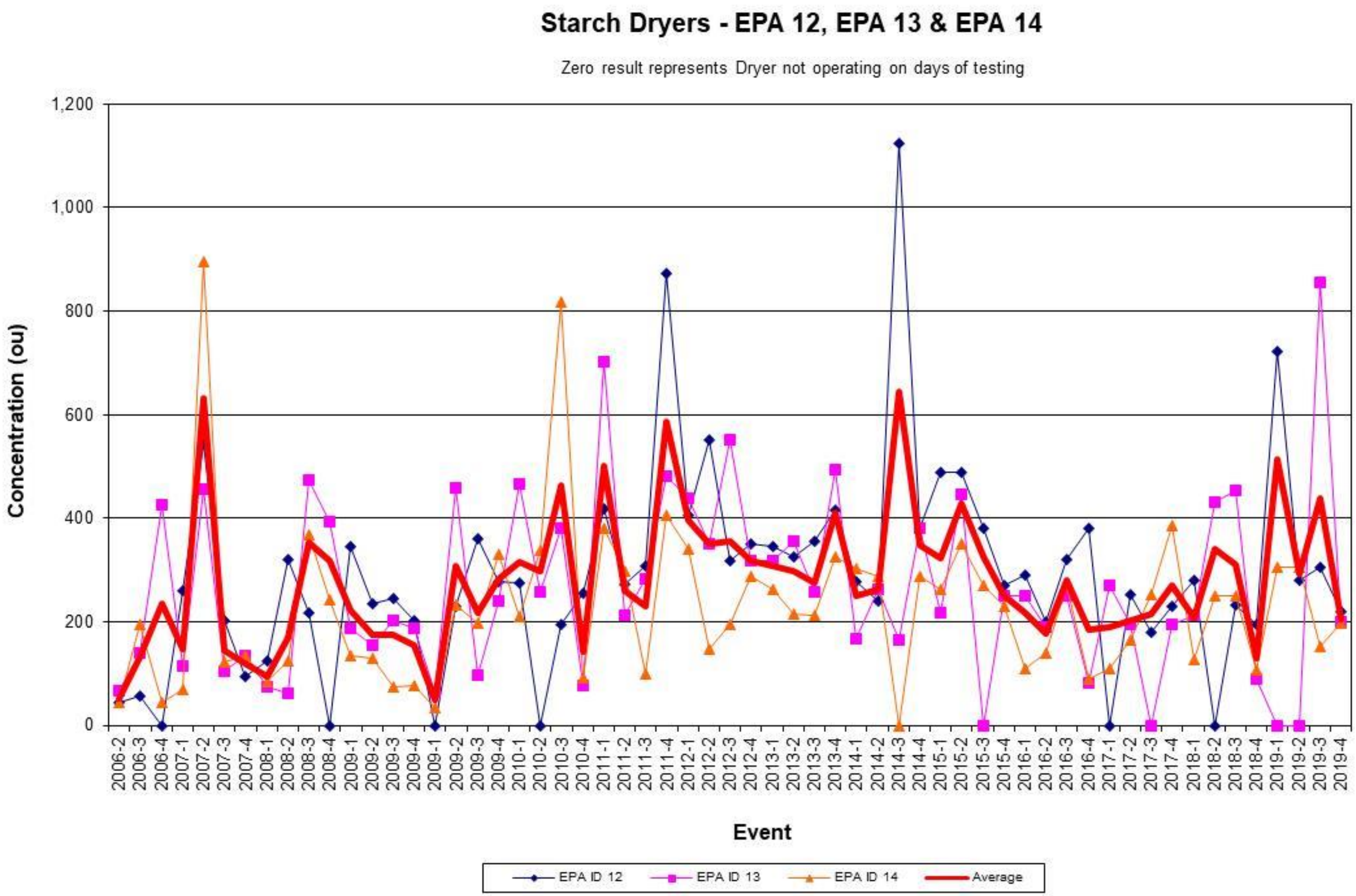


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5

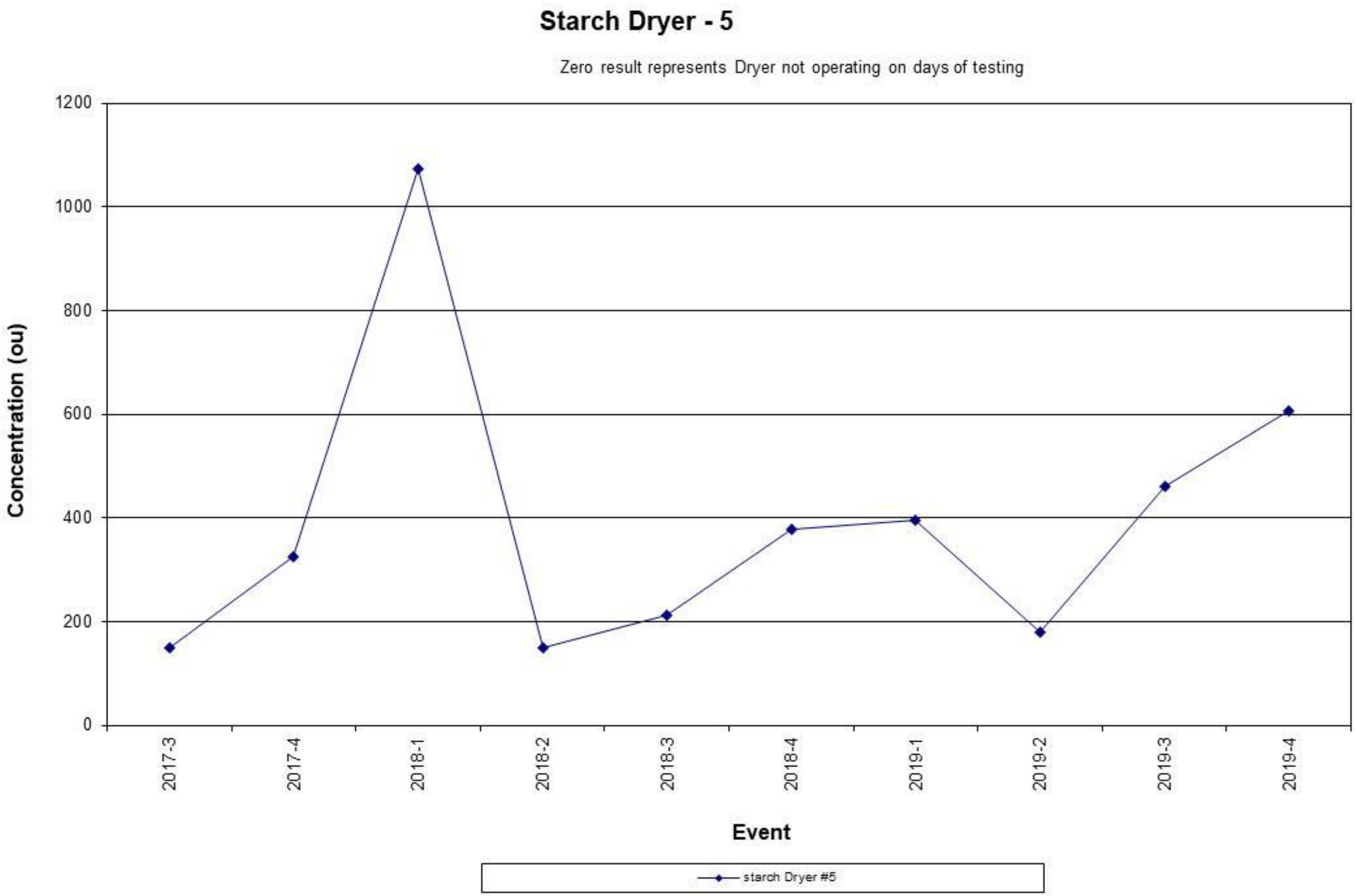


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS

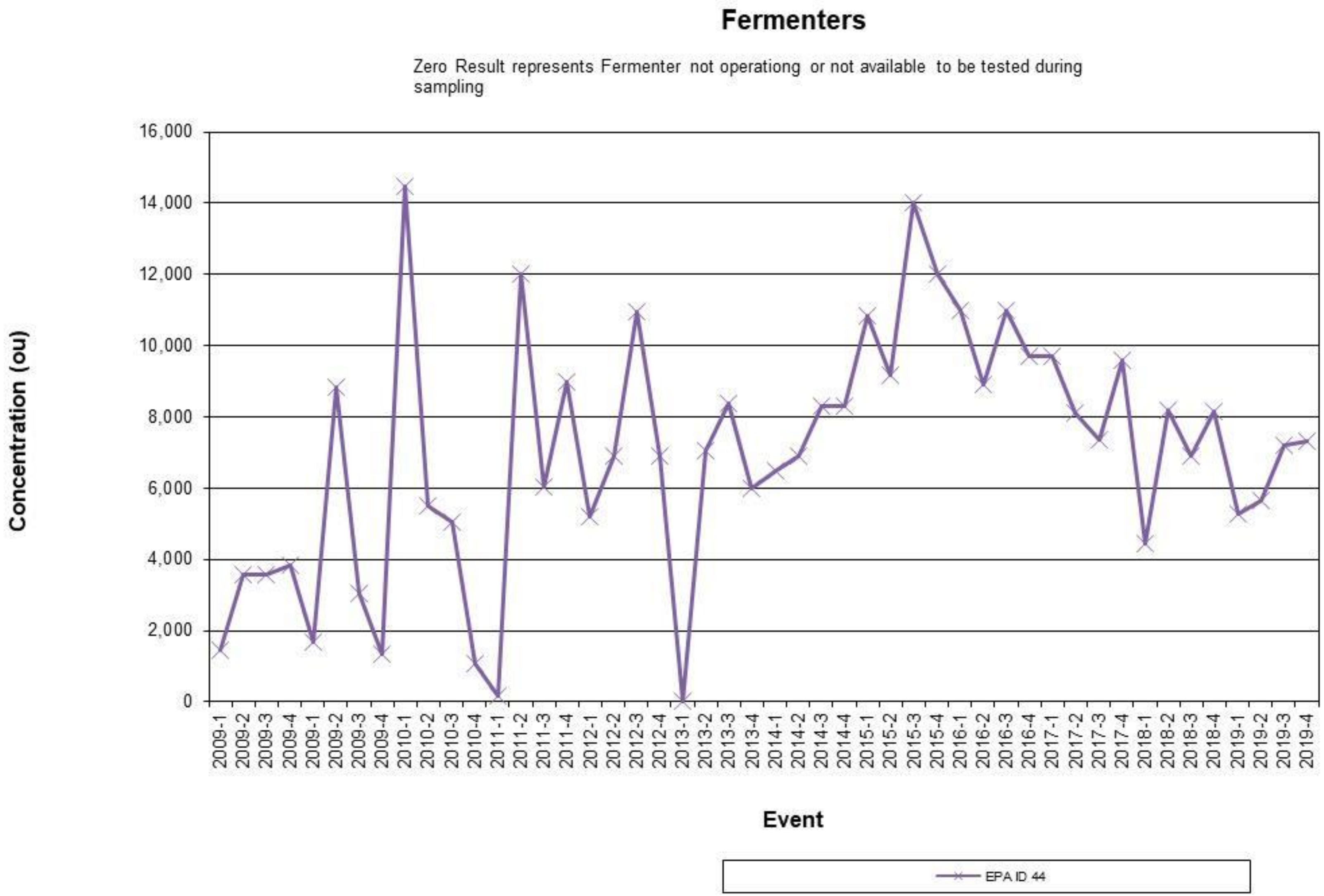


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET

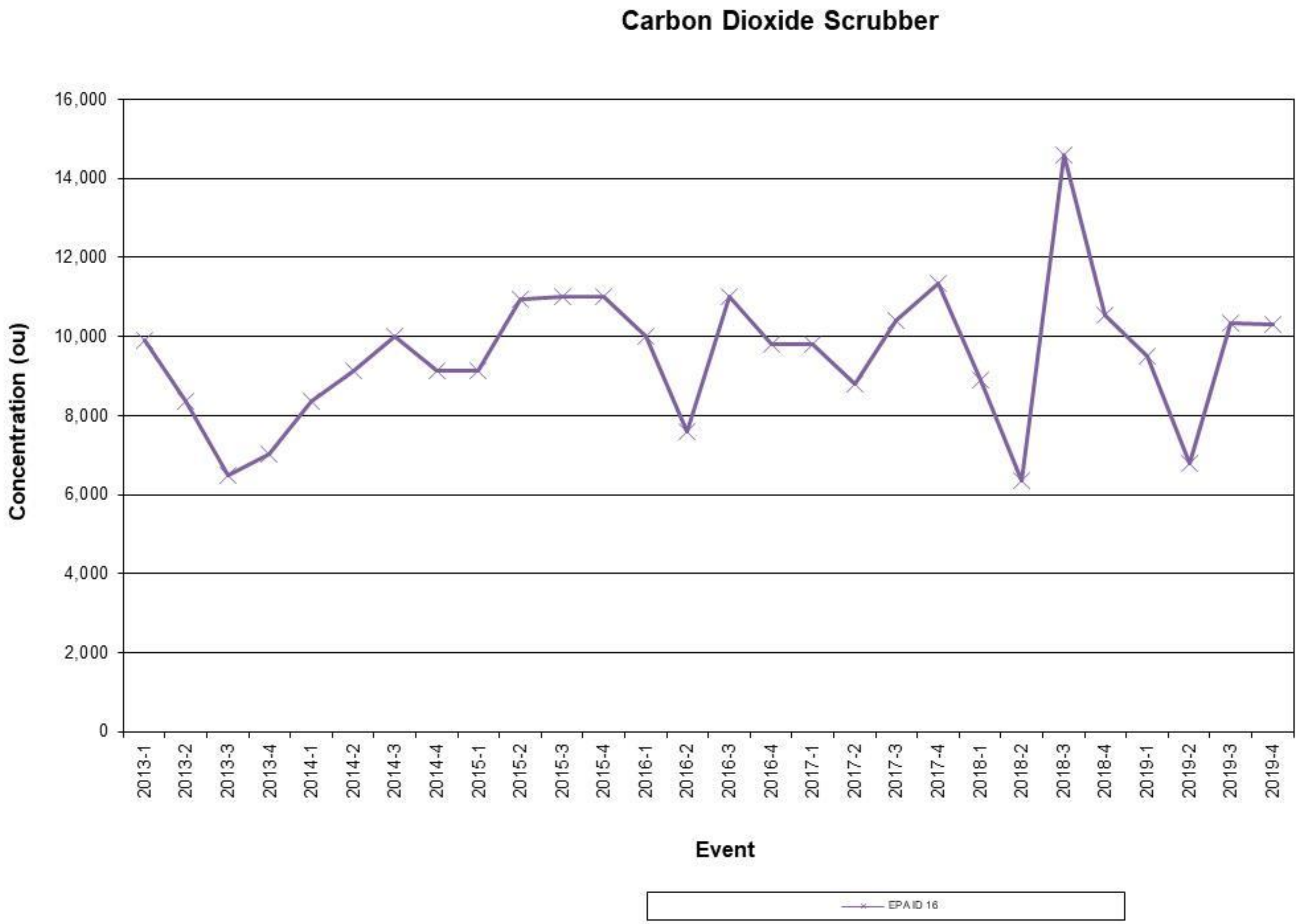


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK

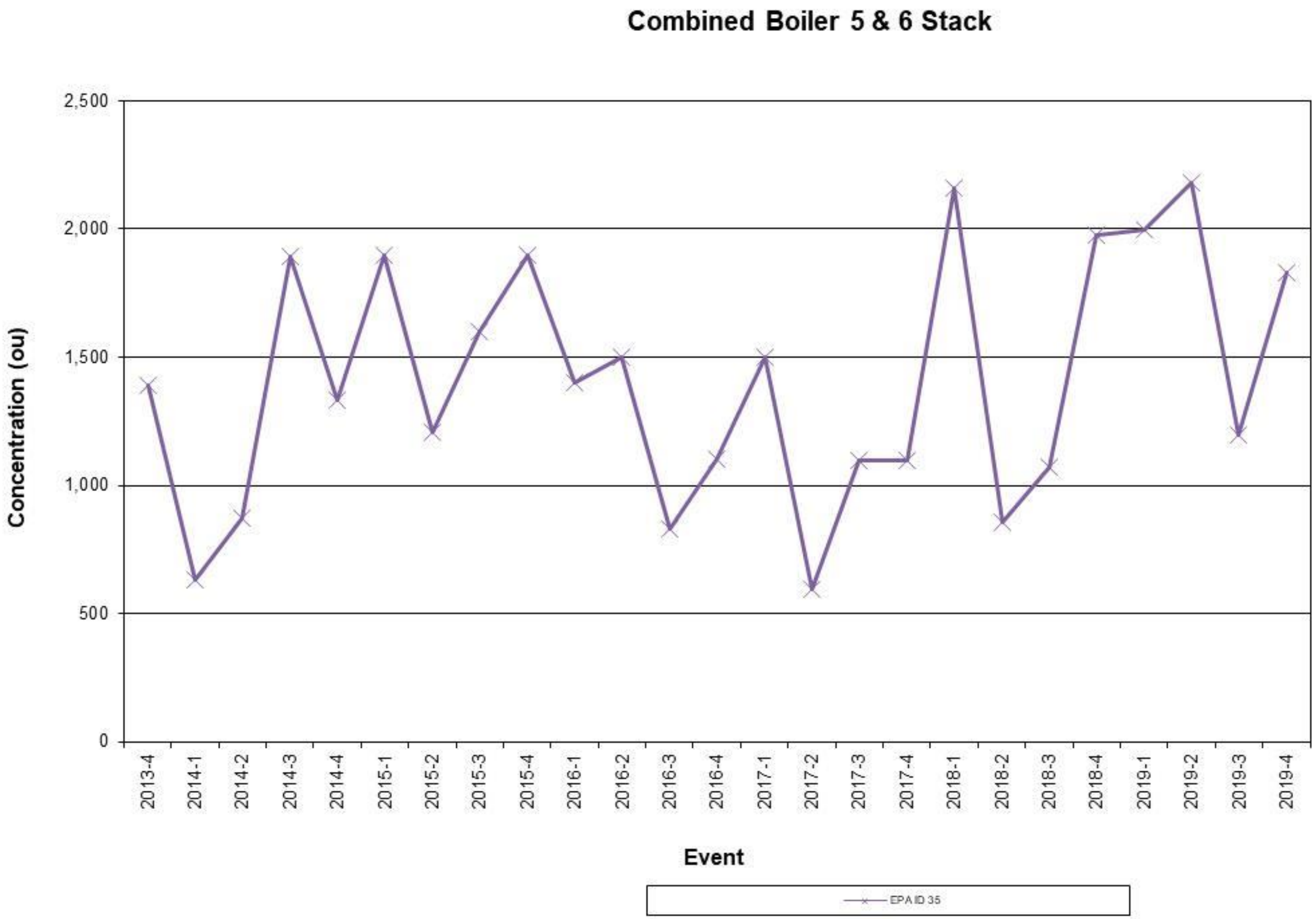


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK

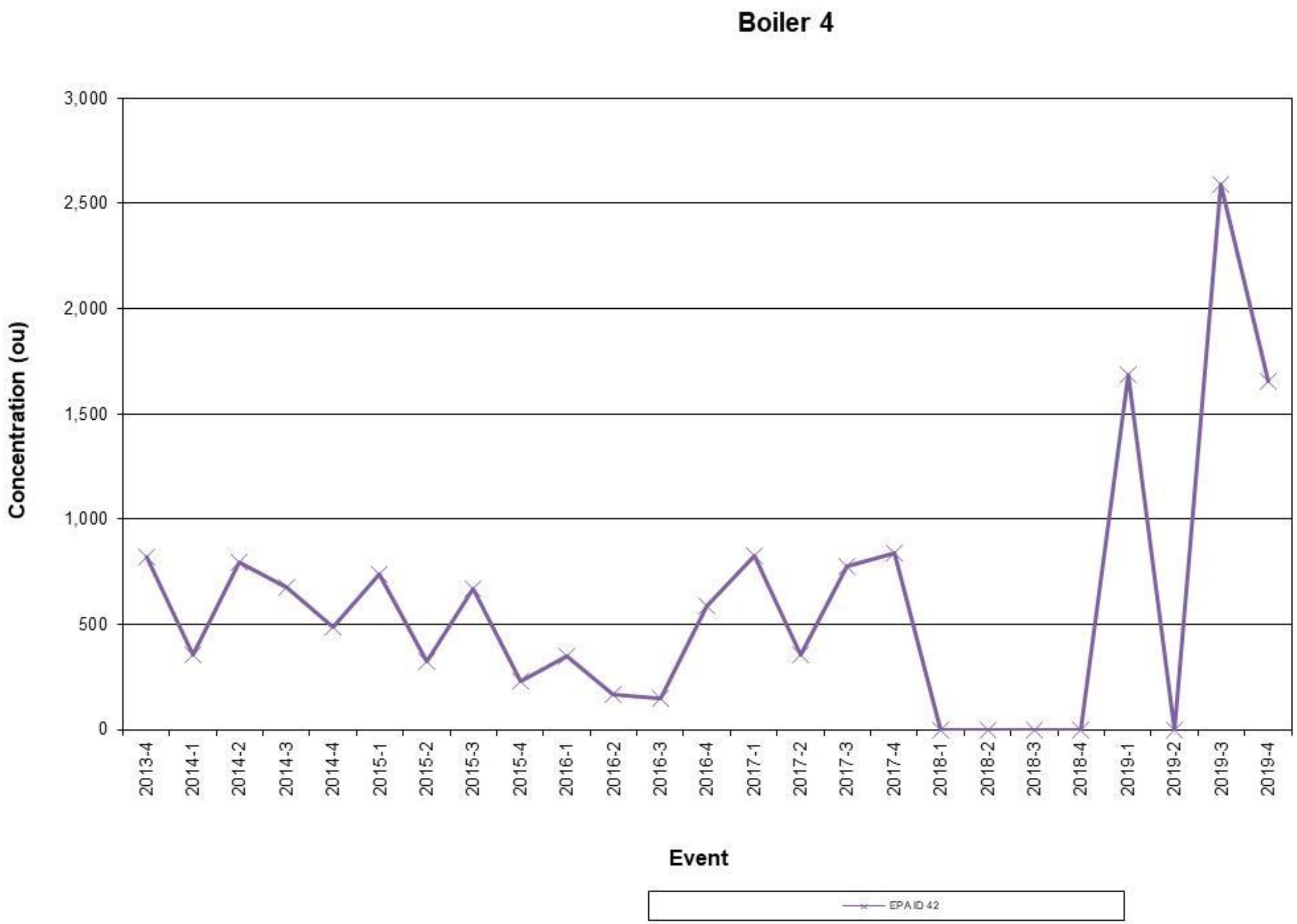


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK

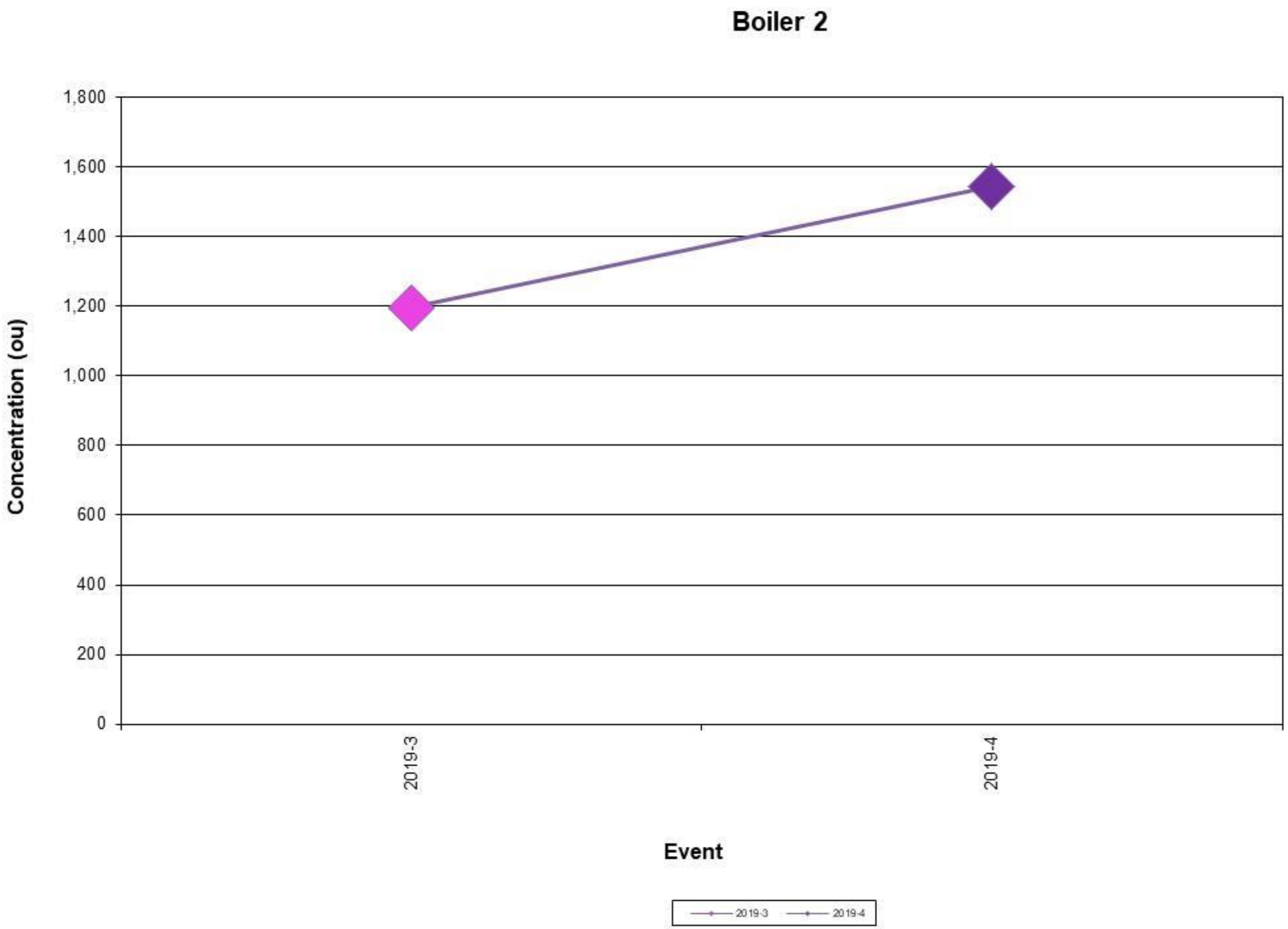


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS

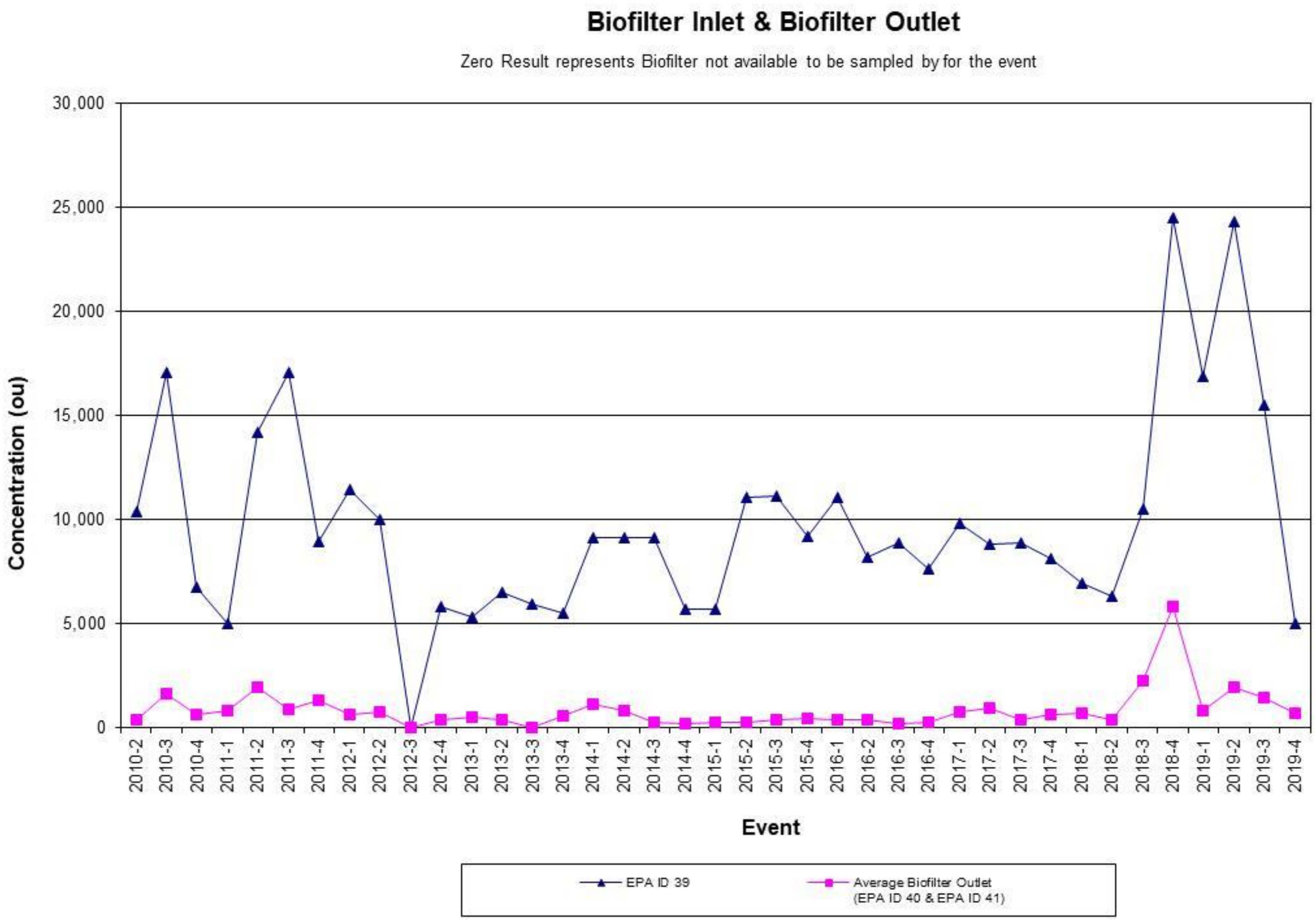
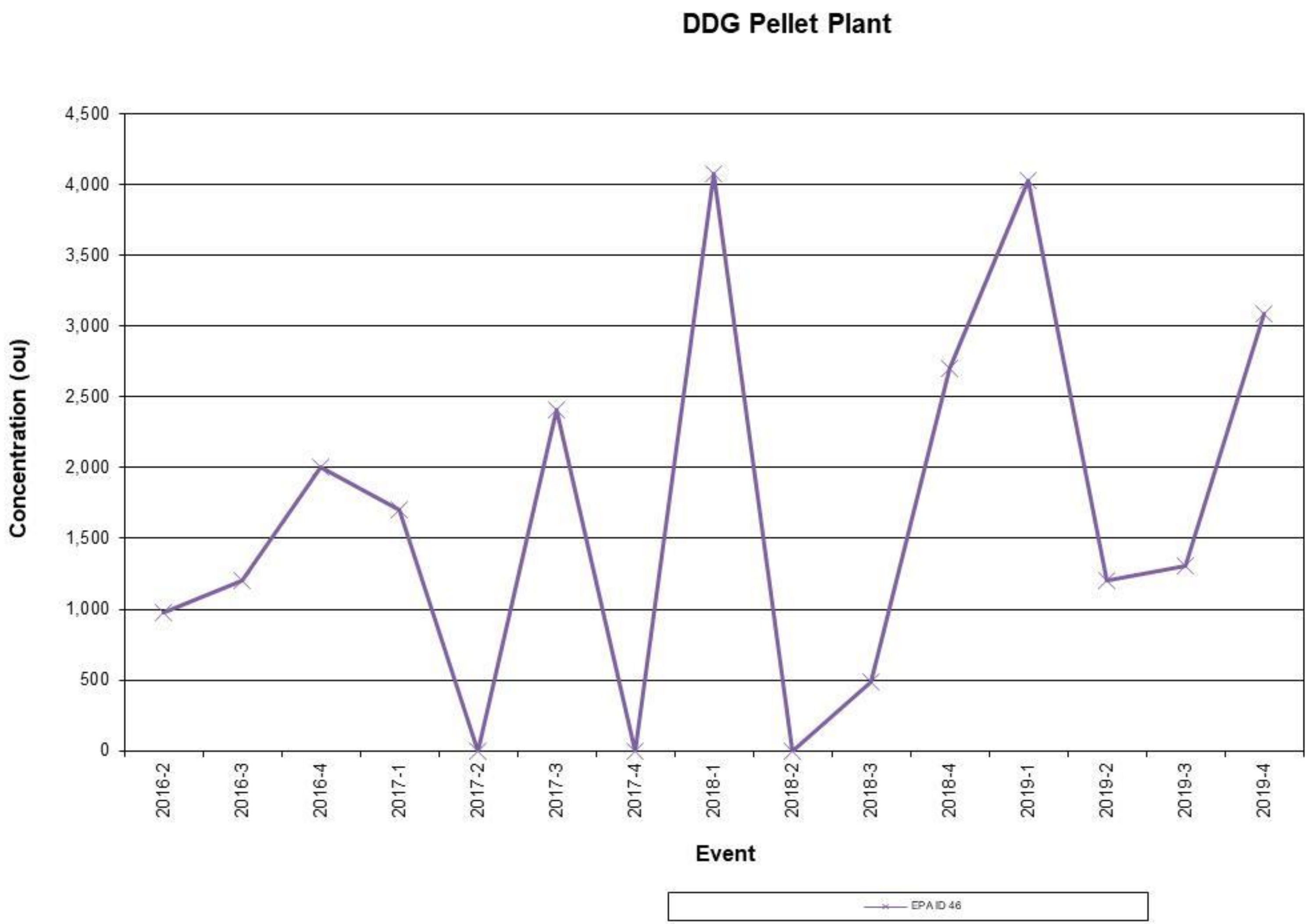


FIGURE 5-10 CONCENTRATION DDG PELLET PLANT STACK



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: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the colour, as in 'it smells like …' *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.*

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^{o}C) connected to a chromel/alumel (K-type) thermocouple probe.

6.4 OXYGEN (O_2)

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

O_2 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
^oC	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	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	7028	7028	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	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	01-Nov-19	01-Nov-19	01-Nov-19	05-Nov-19
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	12:04	14:57	11:50	14:51
Flow Stop Time (hrs)	12:18	15:17	12:12	15:17
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	72.5	67	71.4	76.5
Stack Cross-Sectional area (m^2)	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	14	17	9.2	17
Actual Gas Flow Volume (am^3/min)	1,180	1,110	2,450	2,370
Total Normal Gas Flow Volume (m^3/min)	875	770	1,768	1,754
Total Normal Gas Flow Volume (m^3/s)	14.6	12.8	29.5	29.2
Total Stack Pressure (kPa)	101.4	93.0	101.8	101.5
Moisture Content (% by volume)	6.2	5.7	9.2	5.6
Molecular Weight Dry Stack Gas (g/gmole)	28.84	28.84	28.84	28.84
Dry Gas Density (kg/m^3)	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	5231	5252	5247	5253
SEMA Number	727737	727738	727733	727739
Sample Start Time (hrs)	14:27	15:07	12:02	15:07
Sample Finish Time (hrs)	14:37	15:17	12:12	15:17
Odour Concentration (As Received) (ou)	665	558	432	305
Odour Concentration (Final) (ou)	**670**	560	**430**	**305**
Normal MOER (As Received) (ou m^3/s)	9,800	7,200	12,700	9,100
Normal MOER (Final) (ou m^3/s)	9,800	7,200	12,700	9,100
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period	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	7028	7028	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	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	01-Nov-19	01-Nov-19	01-Nov-19	01-Nov-19
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	14:12	11:30	13:10	16:11
Flow Stop Time (hrs)	14:32	11:50	13:40	16:34
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	38.2	35.7	47.0	61.9
Stack Cross-Sectional area (m^2)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	6.8	23	23	14.3
Actual Gas Flow Volume (am^3/min)	913	1,360	1,370	3,890
Total Normal Gas Flow Volume (m^3/min)	757	1,140	1,100	2,970
Total Normal Gas Flow Volume (m^3/s)	13	19	18	50
Total Stack Pressure (kPa)	101.5	101.5	101.6	101.2
Moisture Content (% by volume)	5.7	5.1	6.2	6.1
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^3)	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	5246	5245	5260	5254
SEMA Number	727732	727731	727745	727740
Sample Start Time (hrs)	14:22	11:40	13:30	16:24
Sample Finish Time (hrs)	14:32	11:50	13:40	16:34
Odour Concentration (As Received) (ou)	216	197	198	608
Odour Concentration (Final) (ou)	**220**	**200**	**200**	**610**
Normal MOER (As Received) (ou m^3/s)	2,800	3,8000	3,600	30,200
Normal MOER (Final) (ou m^3/s)	2,800	3,800	3,600	30,200
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period	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	7028	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 35 Boilers 5&6**	**EPA ID 42 Boiler 4**	**EPA ID 45 Boiler 2**
Date	04-Nov-19	04-Nov-19	04-Nov-19
	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)	11:19	11:38	12:21
Flow Stop Time (hrs)	11:39	11:59	12:43
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^{o}C)	137	162	169
Stack Cross-Sectional area (m^2)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	14.9	16.3	8.8
Actual Gas Flow Volume (am^3/min)	2,800	1,000	504
Total Normal Gas Flow Volume (m^3/min)	1,800	610	300
Total Normal Gas Flow Volume (m^3/s)	30	10	5.0
Total Stack Pressure (kPa)	101.2	101.4	101.4
Moisture Content (% by volume)	5.0	5.5	4.5
Molecular Weight Dry Stack Gas (g/gmole)	30.1	29.8	30.1
Dry Gas Density (kg/m^3)	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	5257	5258	5259
SEMA Number	727742	727743	727744
Sample Start Time (hrs)	11:29	11:49	12:33
Sample Finish Time (hrs)	11:39	11:59	12:43
Odour Concentration (As Received) (ou)	1,800	1,700	1,500
Odour Concentration (Final) (ou)	**1,800**	**1,700**	**1,500**
Normal MOER (As Received) (ou m^3/s)	54,000	17,000	7,700
Normal MOER (Final) (ou m^3/s)	54,000	17,000	7,700
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit
Sample Storage Period	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 10 & CO_2 SCRUBBER OUTLET

Emission Test Results		
Project Number	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 44 Fermenter 10**	**EPA ID 16 CO_2 Scrubber outlet**
Date	01-Nov-19	01-Nov-19
	Dry	Dry
Run	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	12:43	12:43
Flow Stop Time (hrs)	13:04	13:05
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	33.0	29.2
Stack Cross-Sectional area (m^2)	0.071	0.196
Average Stack Gas Velocity (m/s)	5.7	11.4
Actual Gas Flow Volume (am^3/min)	24.0	134
Total Normal Gas Flow Volume (m^3/min)	20.7	117
Total Normal Gas Flow Volume (m^3/s)	0.35	2.0
Total Stack Pressure (kPa)	101.5	101.5
Moisture Content (% by volume)	3.79	3.39
Molecular Weight Dry Stack Gas (g/gmole)	29.6	31.2
Dry Gas Density (kg/m^3)	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5248	5249
SEMA Number	727734	727735
Sample Start Time (hrs)	12:54	12:55
Sample Finish Time (hrs)	13:04	13:05
Odour Concentration (As Received) (ou)	7349	10322
Odour Concentration (Final) (ou)	**7300**	**10300**
Normal MOER (As Received) (ou m^3/s)	2,500	20,100
Normal MOER (Final) (ou m^3/s)	2,500	20,100
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample Storage Period	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

Emission Test Results		
Project Number	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 46 DDG Pellet Plant Stack**	**EPA ID 39 Biofilter Inlet**
Date	04-Nov-19	04-Nov-19
	Dry	Dry
Run	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	10:18	14:32
Flow Stop Time (hrs)	10:44	14:42
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	48.6	43.2
Stack Cross-Sectional area (m^2)	1.674	0.283
Average Stack Gas Velocity (m/s)	15.7	14.7
Actual Gas Flow Volume (am^3/min)	1,580	249
Total Normal Gas Flow Volume (m^3/min)	1,300	192
Total Normal Gas Flow Volume (m^3/s)	21.674	3.2
Total Stack Pressure (kPa)	101.23	96.70
Moisture Content (% by volume)	2.99	6.39
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m^3)	1.29	1.287
Oxygen (%)	20.9	20.9
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5256	5261
SEMA Number	727741	727746
Sample Start Time (hrs)	10:29	14:38
Sample Finish Time (hrs)	10:44	14:42
Odour Concentration (As Received) (ou)	3,100	5,000
Odour Concentration (Final) (ou)	**3,100**	**5,000**
Normal MOER (As Received) (ou m^3/s)	67,000	16,000
Normal MOER (Final) (ou m^3/s)	67,000	16,000
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample Storage Period	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS

Emission Test Results				
Project Number	7028	7028	7028	7028
Project Name	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches	Shoalhaven Starches
Test Location	**EPA ID 40 Biofilter A East**	**EPA ID 40 Biofilter A West**	**EPA ID 41 Biofilter B East**	**EPA ID 41 Biofilter B West**
Date	4-11-2019	4-11-2019	4-11-2019	4-11-2019
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)	15:10	15:36	15:11	15:34
Sample & Flow Stop Time (hrs)	15:30	15:56	14:31	15:54
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	39.5	40.6	39.2	39.8
Proportion of Inlet air flow	**24%**	**25%**	**27%**	**24%**
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	5262	5263	5264	5265
SEMA Number	727747	727748	727749	727750
Odour Concentration (As Received) (ou)	300	340	520	1,500
Odour Concentration (Final) (ou)	300	340	520	1,500
Normal MOER (As Received) (ou m^3/s)	230	270	450	1,200
Normal MOER (Final) (ou m^3/s)	230	270	450	1,200
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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Starch Dryers 1, 3 & 5, Gluten Dyers 1, 2, 3 & 4, Fermenter 15, CO_2 Scrubber outlet and CO_2 Scrubber inlet
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7028/ORLA/01
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5244 to 5254
	SEMA Sample number(s):	727731 to 727740
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	31 October 2019
	Order number:	5069
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	18 November 2019

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76{,}895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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 November 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7028/ORLA/01

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone [^] [+]
EPA 13 Starch Dryer No.3	727731	1/11/2019 11:40	5245	2/11/2019 11:45	4	8	Nil	197	200	Cucumber, cloves, fruity, sweet oil, sweet, hessian, hops, cereal, grassy and vinegary at end (0)[^]
EPA 12 Starch Dryer No.1	727732	1/11/2019 14:22	5246	2/11/2019 12:15	4	8	Nil	216	220	Blood and bone, dirty, corn, nutty, slight yeast, coffee, plastic, paint and polyfilla (0)[^]
EPA 10 Gluten Dryer No.3	727733	1/11/2019 12:02	5247	2/11/2019 12:44	4	8	Nil	432	430	Rotting vegetables, banana essence, ester, garbage, smelly shoes, paint and plastic (-3)[^]
EPA 44 No.10 Fermenter	727734	1/11/2019 12:54	5248	2/11/2019 13:13	4	8	Nil	7349	7300	Ink, car oil, car exhaust, varnish, mothballs, vinegar sharp tangy and sour cherry fruit (-3)[^]
EPA 16 CO_2 Scrubber Outlet	727735	1/11/2019 13:00	5249	2/11/2019 13:42	4	8	Nil	10322	10300	Ink, car oil, vinegar, mothballs, fermentation, banana essence and banana (-3)[^]

Odour Research Laboratories Australia

Odour Olfactometry Results – 7028/ORLA/01

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone [^ +]
EPA 16 CO_2 Scrubber Inlet	727736	1/11/2019 13:00	5250	2/11/2019 14:12	4	8	Nil	8735	8700	Ink, car oil, vinegar, mothballs, fermentation, sweet, tangy, banana and banana essence (-4)^
EPA 8 Gluten Dryer No.1	727737	1/11/2019 14:17	5251	2/11/2019 14:42	4	8	Nil	665	670	Garbage, fermentation, vinegar, slight sweet and slight tangy, hessian, sweet oil, slight mothballs and ink (-3)^
EPA 9 Gluten Dryer No.2	727738	1/11/2019 15:07	5252	2/11/2019 15:12	4	8	Nil	558	560	Rotting vegetables, garbage, smelly shoes, sweet vinegar and ink (-2)^
EPA 11 Gluten Dryer No.4	727739	1/11/2019 15:07	5253	2/11/2019 15:43	4	8	Nil	305	310	Initially plastic, sulfur, cereal, hessian, smelly shoes, banana and slight sour cherry (-3)^
EPA 47 Starch Dryer No.5	727740	1/11/2019 16:24	5254	2/11/2019 16:14	4	8	Nil	608	610	Cooked vegetables, sour fruit, sweet vinegar, hessian and slight paint/hard plastic (-2)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7028/ORLA/01

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5244	62	1413	43.9	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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. Panellist Rolling Average: SR = 51.8, PR = 46.9, TL = 42.4, PRA = 39.6

^ 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 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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	DDG stack, Boiler 2, Boiler 4 & Boiler 5&6, Bio inlet, Bio A outlet east & west, Bio B outlet east & west and Starch Dryer 4
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7028/ORLA/02
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5255 to 5265
	SEMA Sample number(s):	727741 to 727750
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	31 October 2019
	Order number:	5069
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	18 November 2019

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 $12 \leq \chi \leq 76,895$ 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 ± 3°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: $r = 0.0056$ (February 2019) 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: $A = 0.050$ (February 2019) 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 November 2019

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7028/ORLA/02

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone [^] [+]
EPA 46 DDG pellet Stack	727741	4/11/2019 10:29	5256	5/11/2019 10:43	4	8	Nil	3090	3100	Bitter coffee, caramel, cloves, brandy, hops, slight vomit odour at end (-0)[^]
EPA 35 Boiler 5&6	727742	4/11/2019 11:29	5257	5/11/2019 11:12	4	8	Nil	1830	1800	Kerosene, petroleum, acid, plastic, paint, sour vegetables, grain and grass (-1)[^]
EPA 42 Boiler 4	727743	4/11/2019 11:49	5258	5/11/2019 11:41	4	8	Nil	1655	1700	Sharp fuel odour, sulfur, ash, yeast, onion and vegetable soup (-3)[^]
EPA 45 Boiler 2	727744	4/11/2019 12:33	5259	5/11/2019 12:30	4	8	Nil	1544	1500	Grease, car exhaust, fuel, smoke, burnt (-2)[^]
EPA 14 Starch Dryer No.4	727745	4/11/2019 13:20	5260	5/11/2019 12:59	4	8	Nil	198	200	Dank, metallic, sweet, plastic, cooked onions, hessian (-3)[^]

Odour Research Laboratories Australia

Odour Olfactometry Results – 7028/ORLA/02

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone [^] [+]
EPA 39 Bio inlet	727746	4/11/2019 14:38	5261	5/11/2019 13:29	4	8	Nil	4989	5000	Yeast, damp, bitter, vomit, plastic, coconut, coffee, caramel, nutty (-1)[^]
EPA 40 Bio A outlet east	727747	4/11/2019 15:10	5262	5/11/2019 14:03	4	8	Nil	305	305	Sharp alcoholic vanilla, vinegar, methylated spirits, solvent, glue, garbage, musty, ashes, peat (-3)[^]
EPA 40 Bio A outlet west	727748	4/11/2019 15:36	5263	5/11/2019 14:32	4	8	Nil	333	335	Tannin, tea-like, methylated spirits, varnish, glue, sulphur, garbage, resin, musty, burnt wood, floral (-2)[^]
EPA 41 Bio B outlet east	727749	4/11/2019 15:11	5264	5/11/2019 15:01	4	8	Nil	513	515	Off milk but not sour yet, musty, earth, grains, vegetation/onions, vegemite, soil, drain water, burnt wood ashes, compost (-4)[^]
EPA 41 Bio B outlet west	727750	4/11/2019 15:34	5265	5/11/2019 15:30	4	8	Nil	1540	1540	Off milk, swampy, moist earth, sewage, oil, garbage, menthol, smelly sandshoes, damp burnt wood ashes (-3)[^]

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7028/ORLA/02

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5255	62	1299	47.7	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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. Panellist Rolling Average: SR = 51.8, PR = 48.5, TL = 43.9, JW 61.9

^ 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 panellist 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

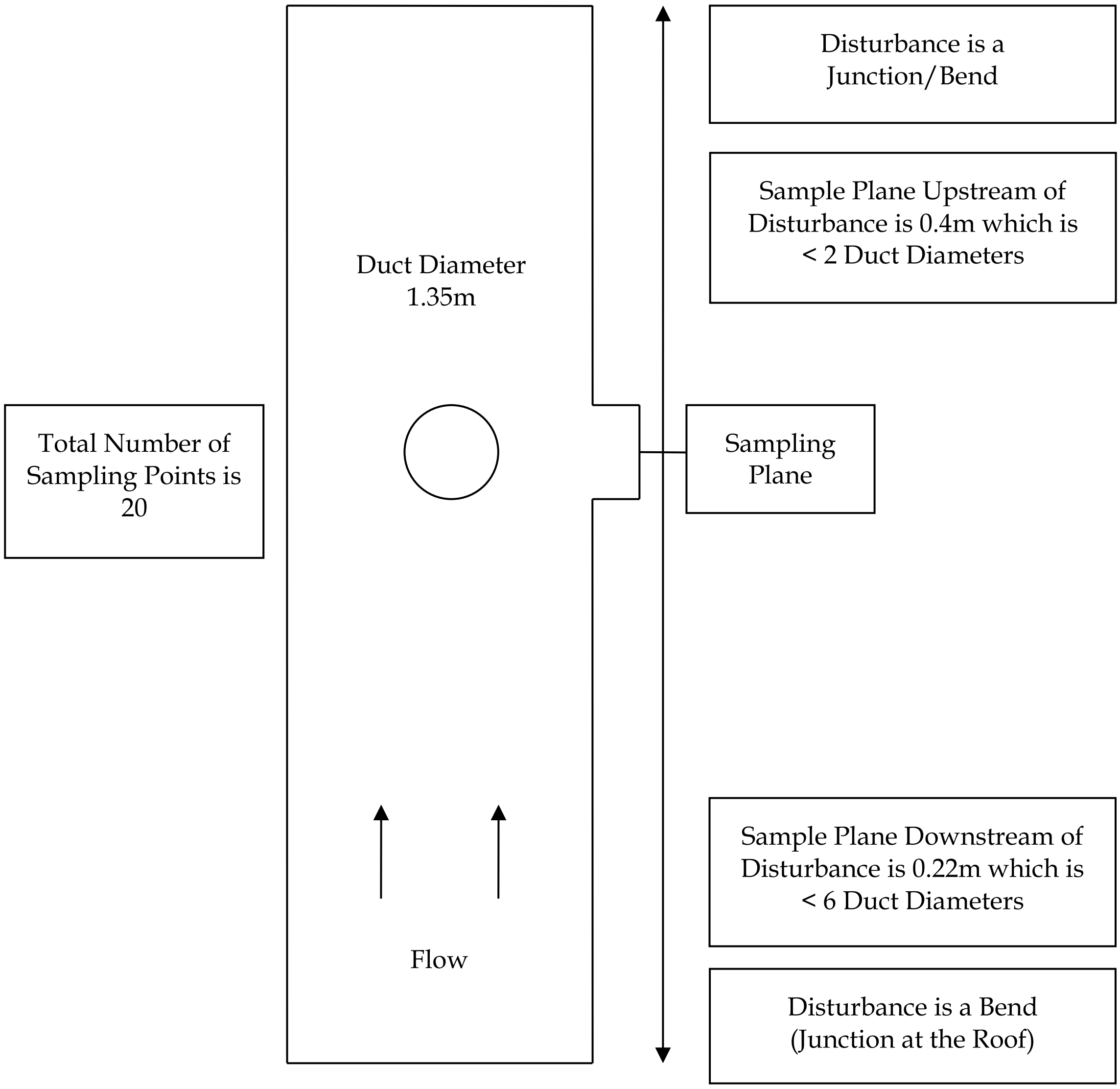
SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	04-Jul-19	04-Jan-20
769	Thermocouple	04-Jul-19	04-Jan-20
768	Thermocouple	04-Jul-19	04-Jan-20
885	Digital Manometer	21-Jan-19	21-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
893	Thermocouple	04-Jul-19	04-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
858	Digital Temperature Reader	04-Jul-19	04-Jan-20
726	Pitot	23-Jul-19	23-Jul-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
946	Combustion Analyzer	09-Jul-19	09-Jan-20
24	Personal Sampler	09-Apr-19	09-Apr-20
678	Personal Sampler	09-Apr-19	09-Apr-20
675	Personal Sampler	09-Apr-19	09-Apr-20
Gas Mixtures used for Analyser Span Response			
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	04-Jul-19	04-Jan-20
769	Thermocouple	04-Jul-19	04-Jan-20
768	Thermocouple	04-Jul-19	04-Jan-20
885	Digital Manometer	21-Jan-19	21-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
920	Thermocouple	04-Jul-19	04-Jan-20
815	Digital Manometer	21-Jan-19	21-Jan-20
858	Digital Temperature Reader	04-Jul-19	04-Jan-20
726	Pitot	23-Jul-19	23-Jul-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
946	Combustion Analyzer	09-Jul-19	09-Jan-20
832	Personal Sampler	14-Mar-19	14-Mar-20
24	Personal Sampler	09-Apr-19	09-Apr-20
675	Personal Sampler	09-Apr-19	09-Apr-20
Gas Mixtures used for Analyser Span Response			
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



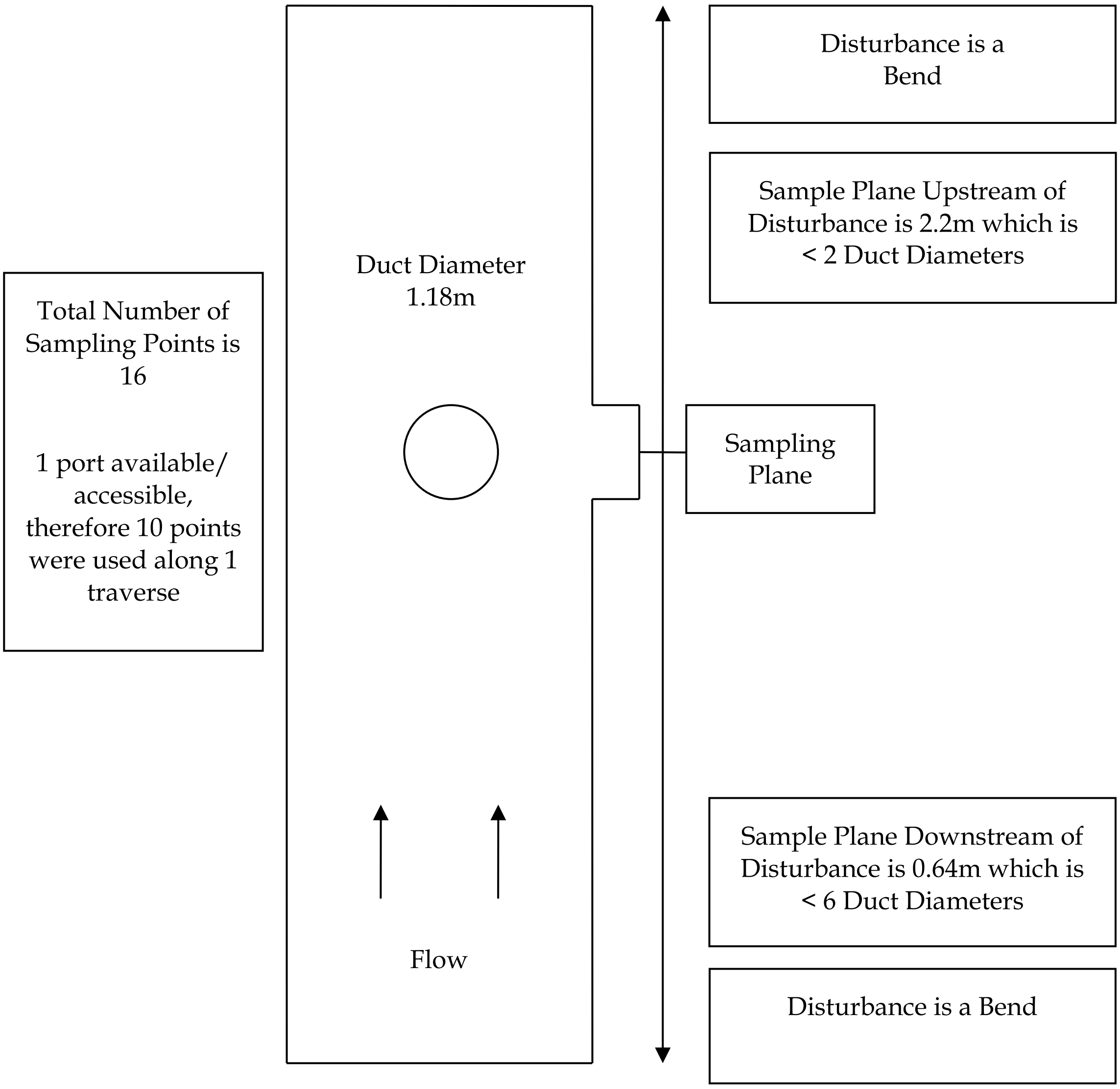
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



Gluten Dryer 2 monitoring point has been quarantined by roof re-alignment. Access is now prohibited to exhaust duct. Sampling point at exit only suitable for odour and temperature and not flow and velocity.

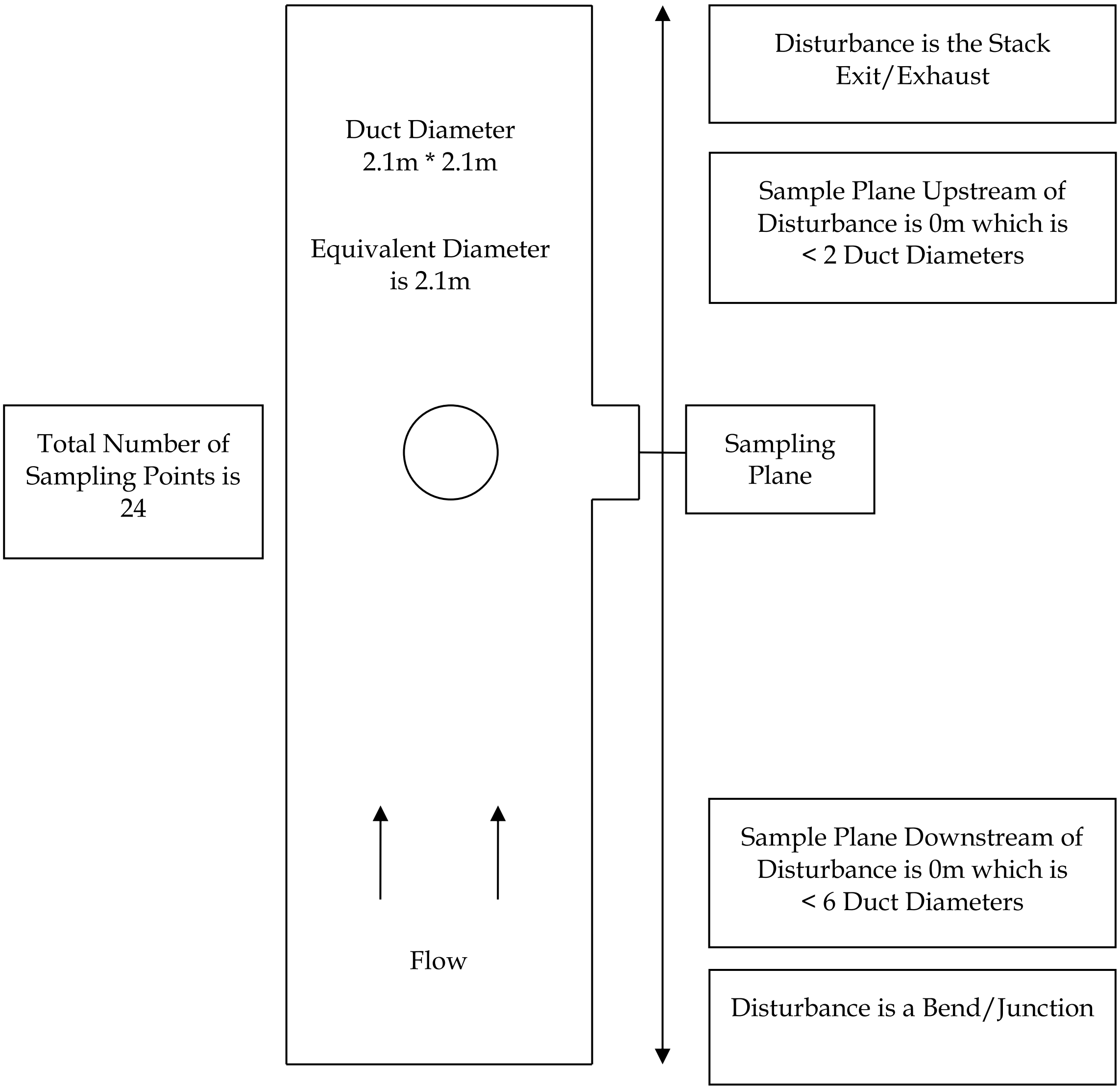
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



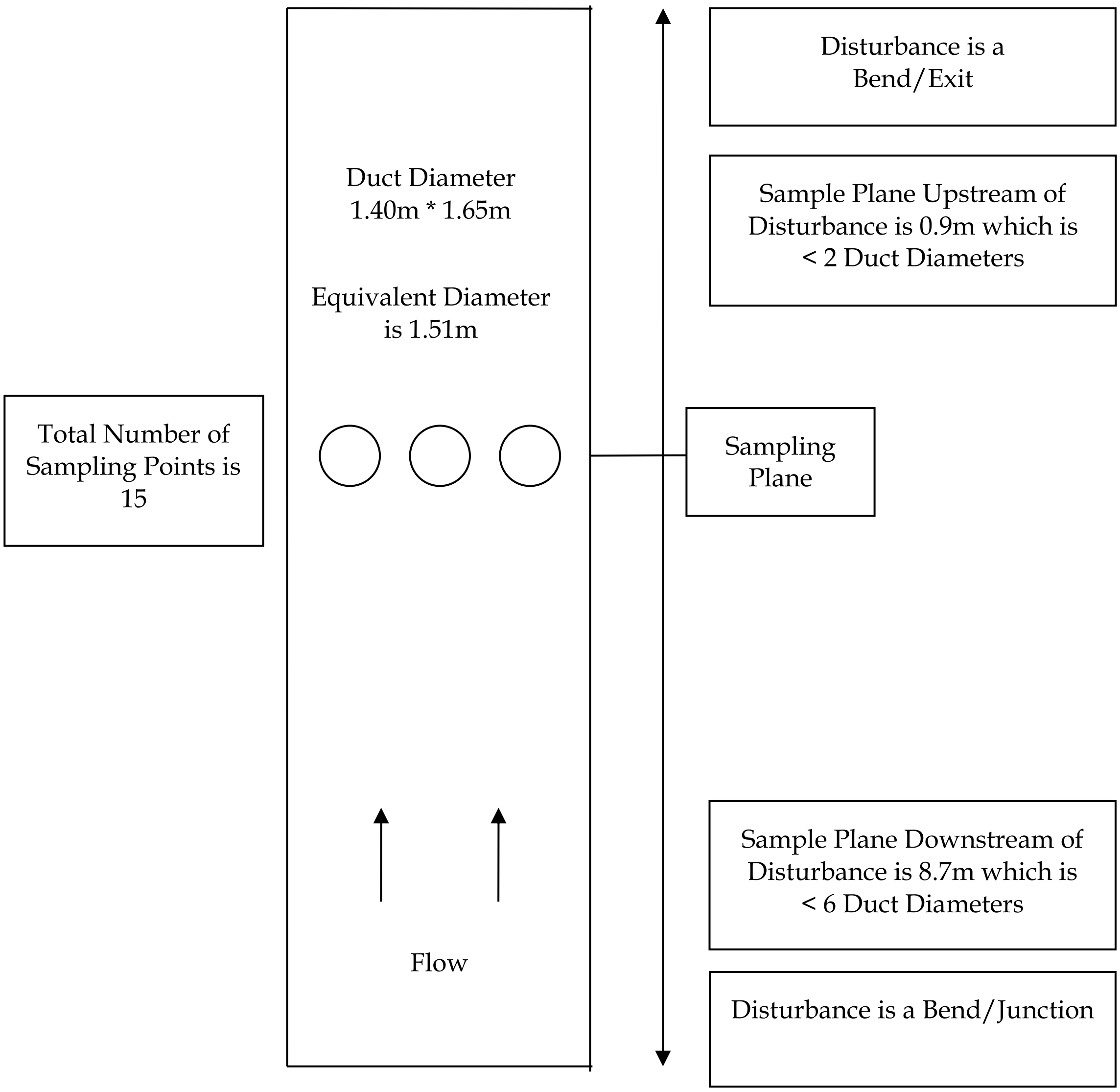
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



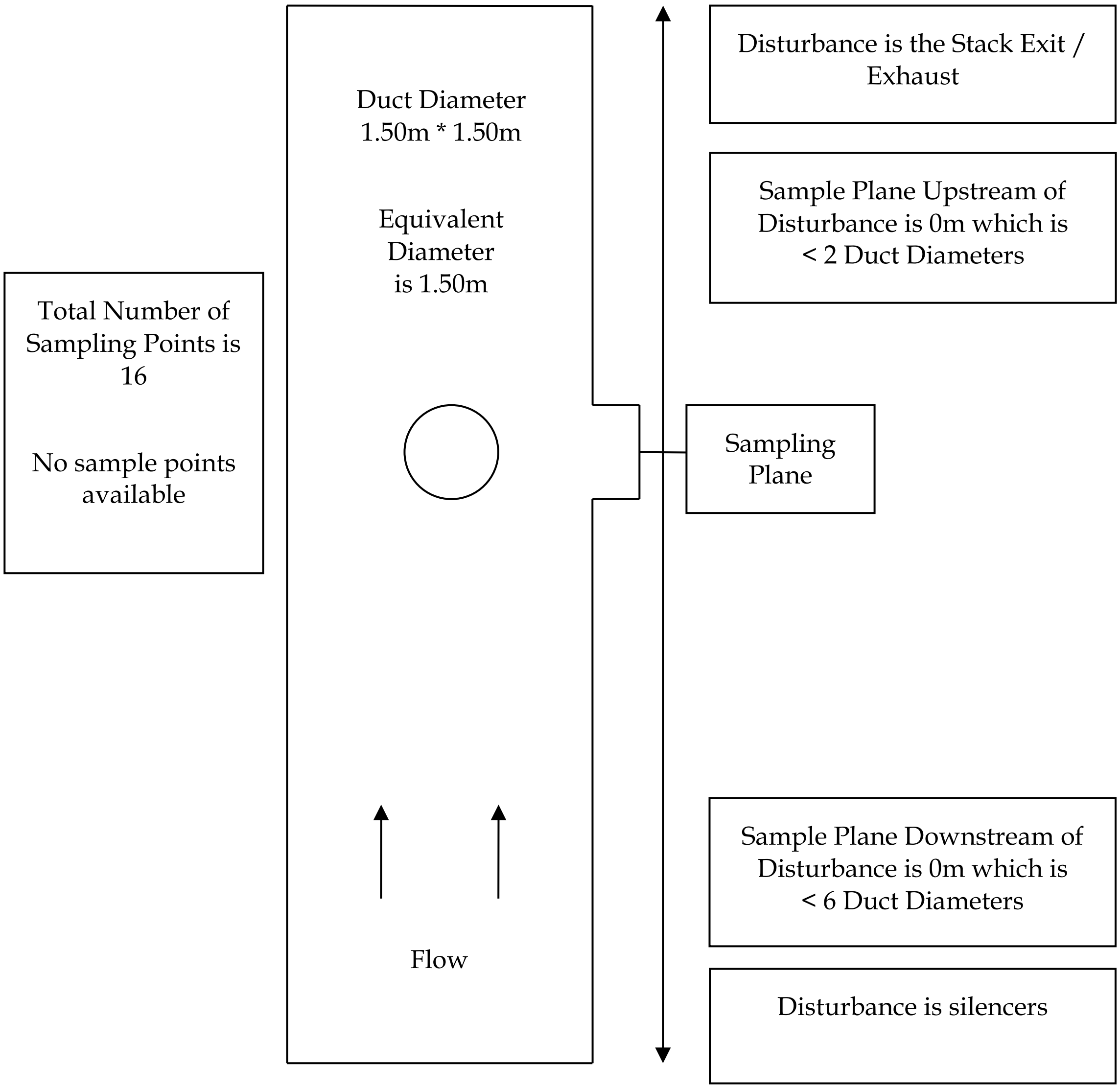
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exit 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



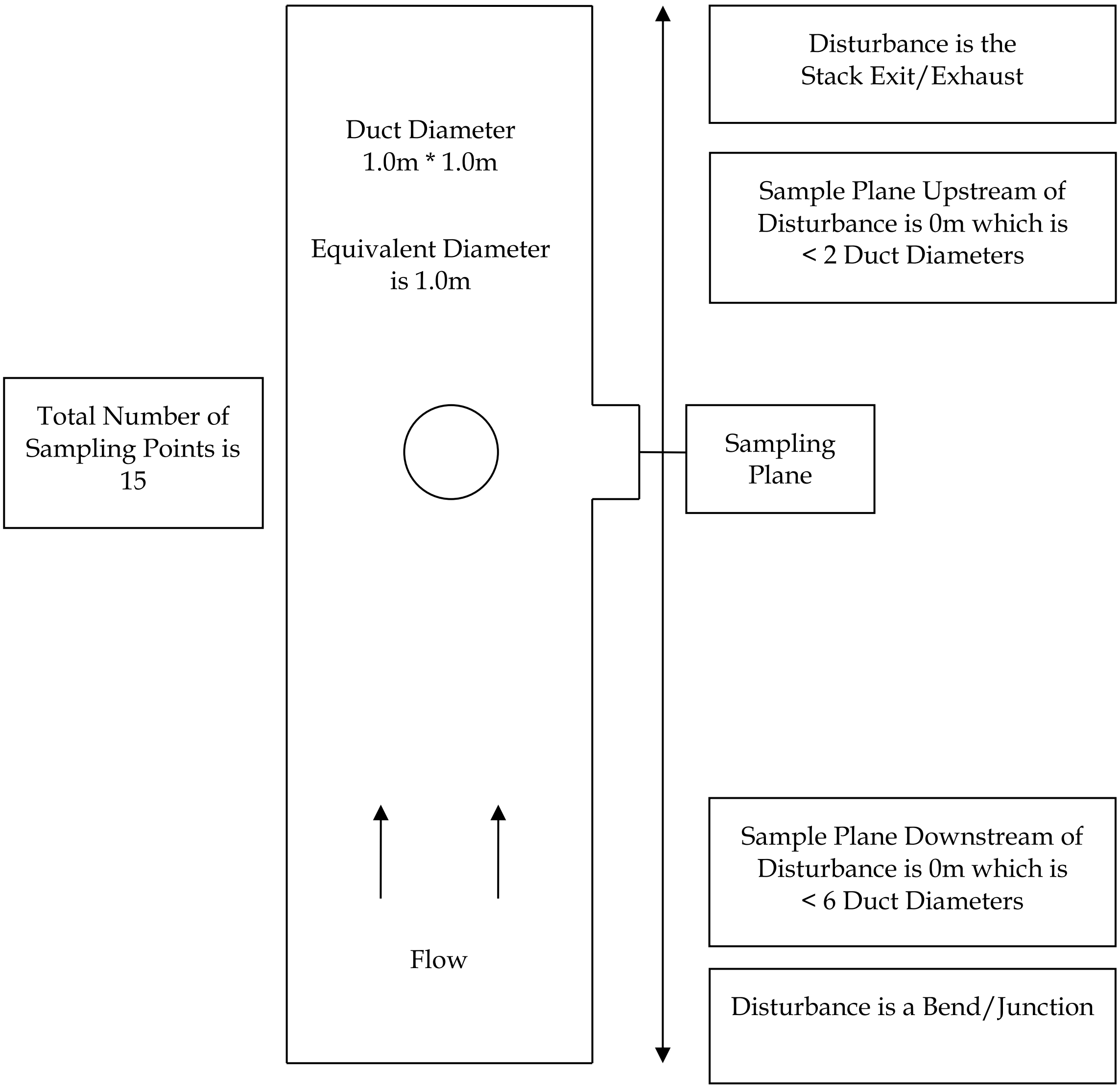
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-10 STARCH DRYER NO. 1 – SAMPLE LOCATION

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



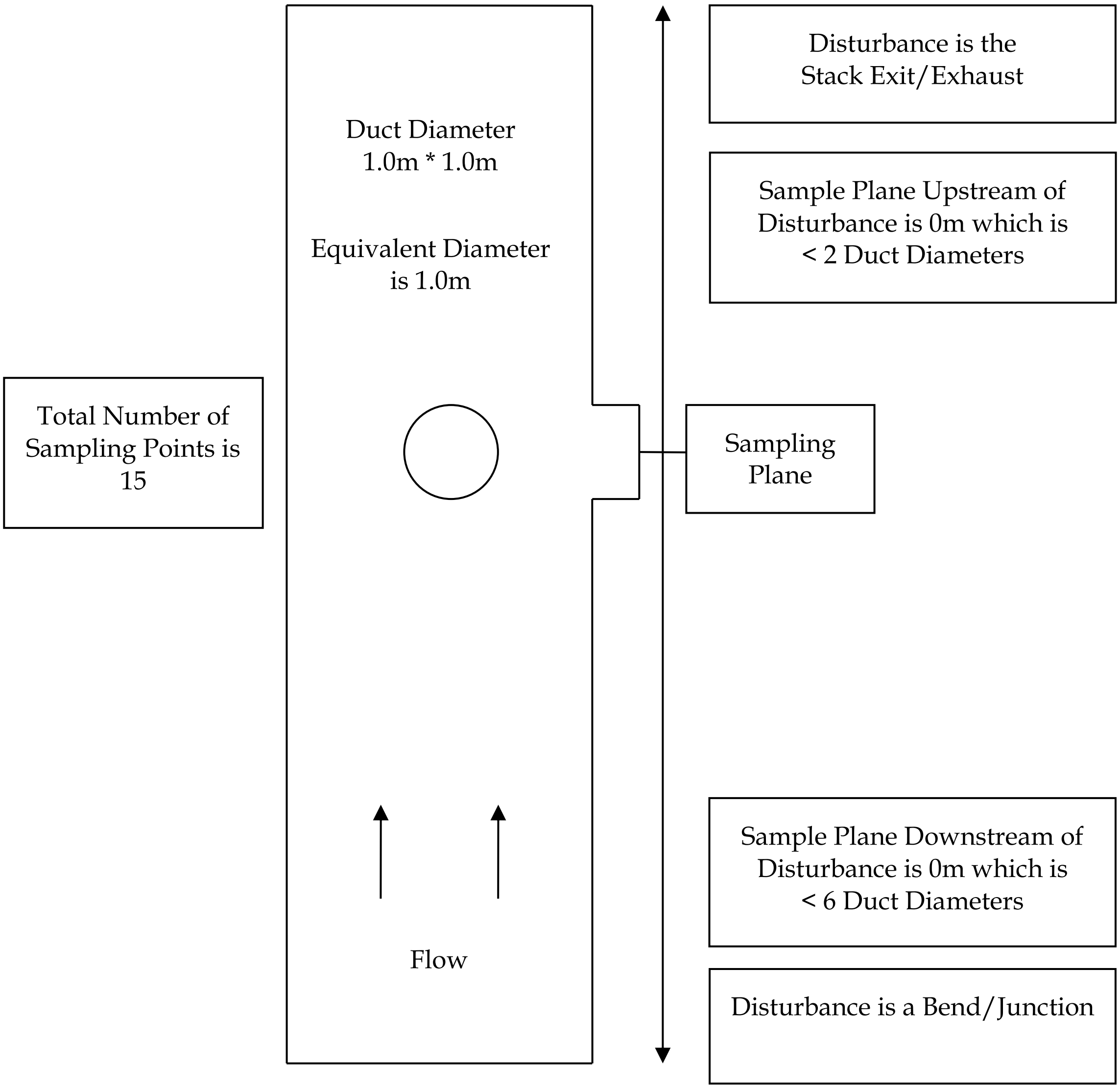
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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 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-12 STARCH DRYER NO. 3 – SAMPLE LOCATION

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



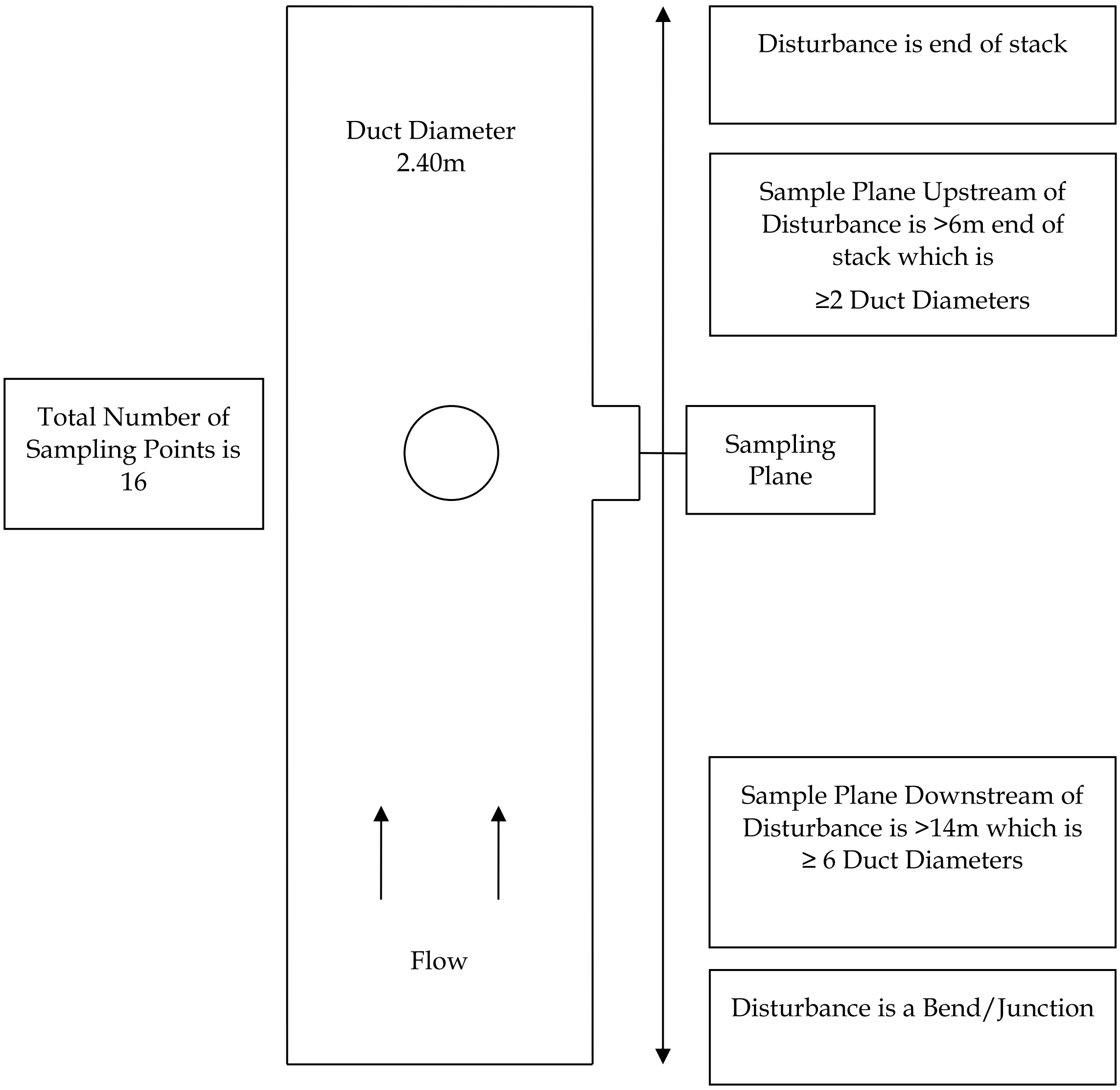
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

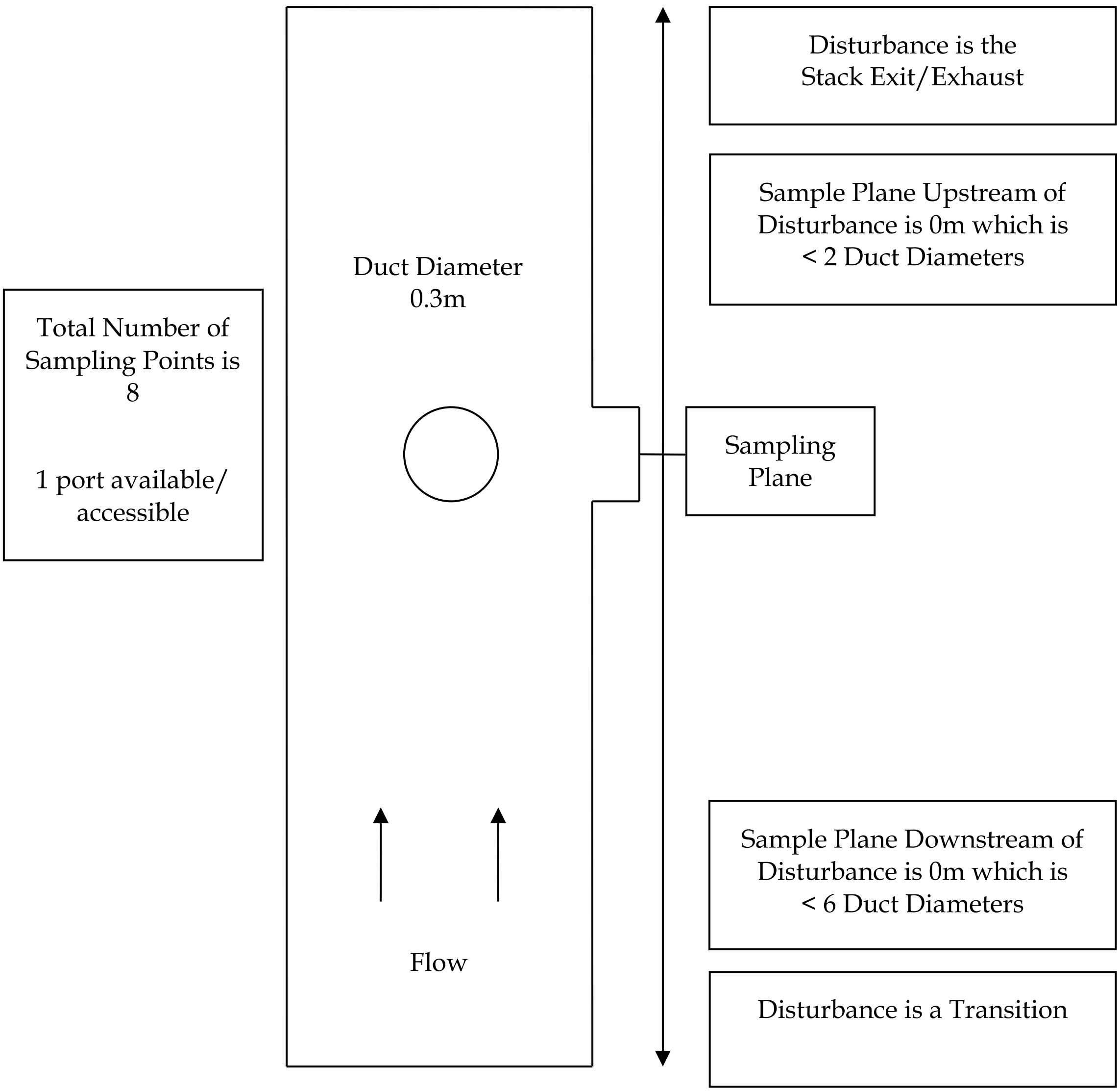


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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.

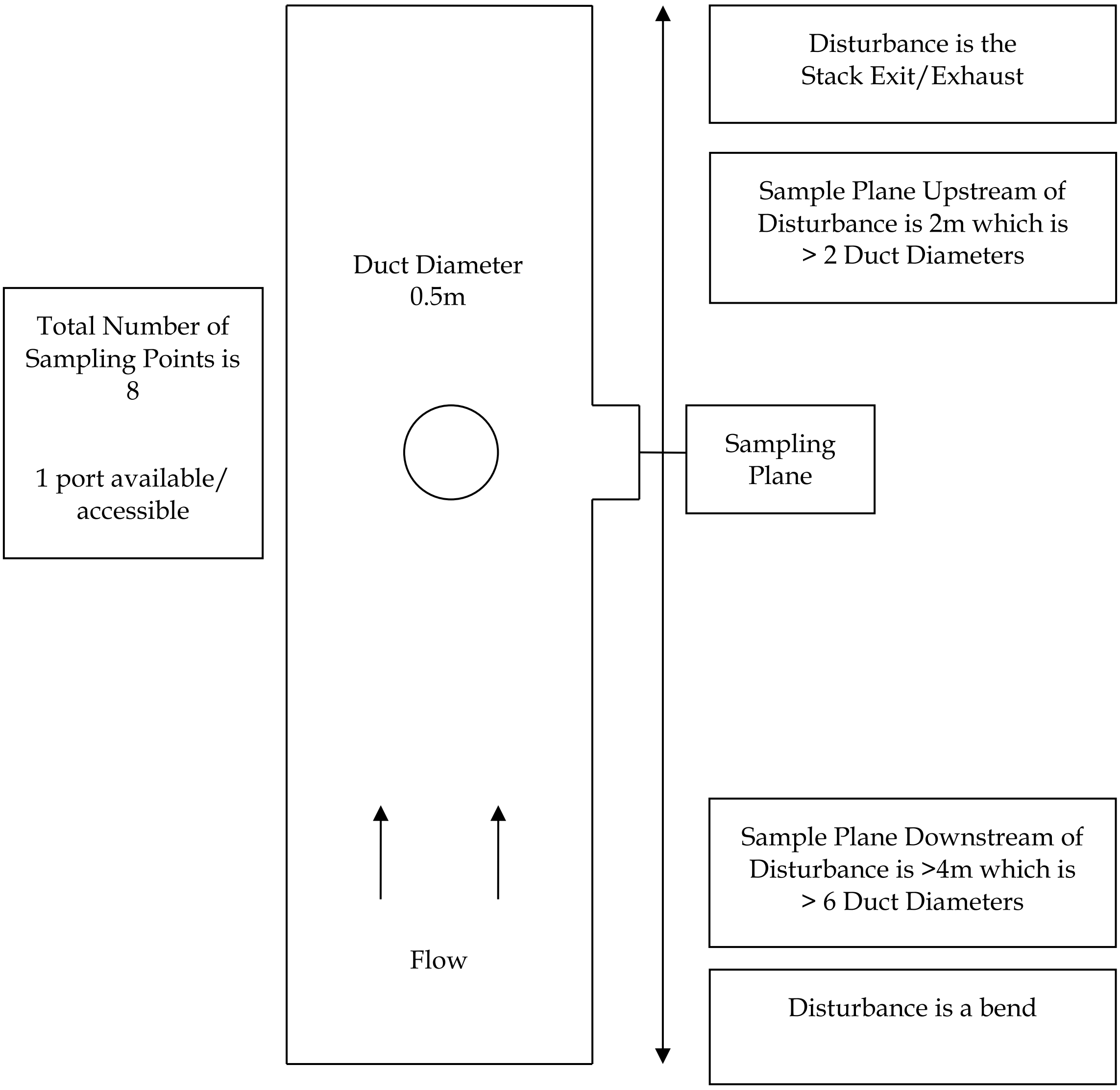
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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_2 SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC

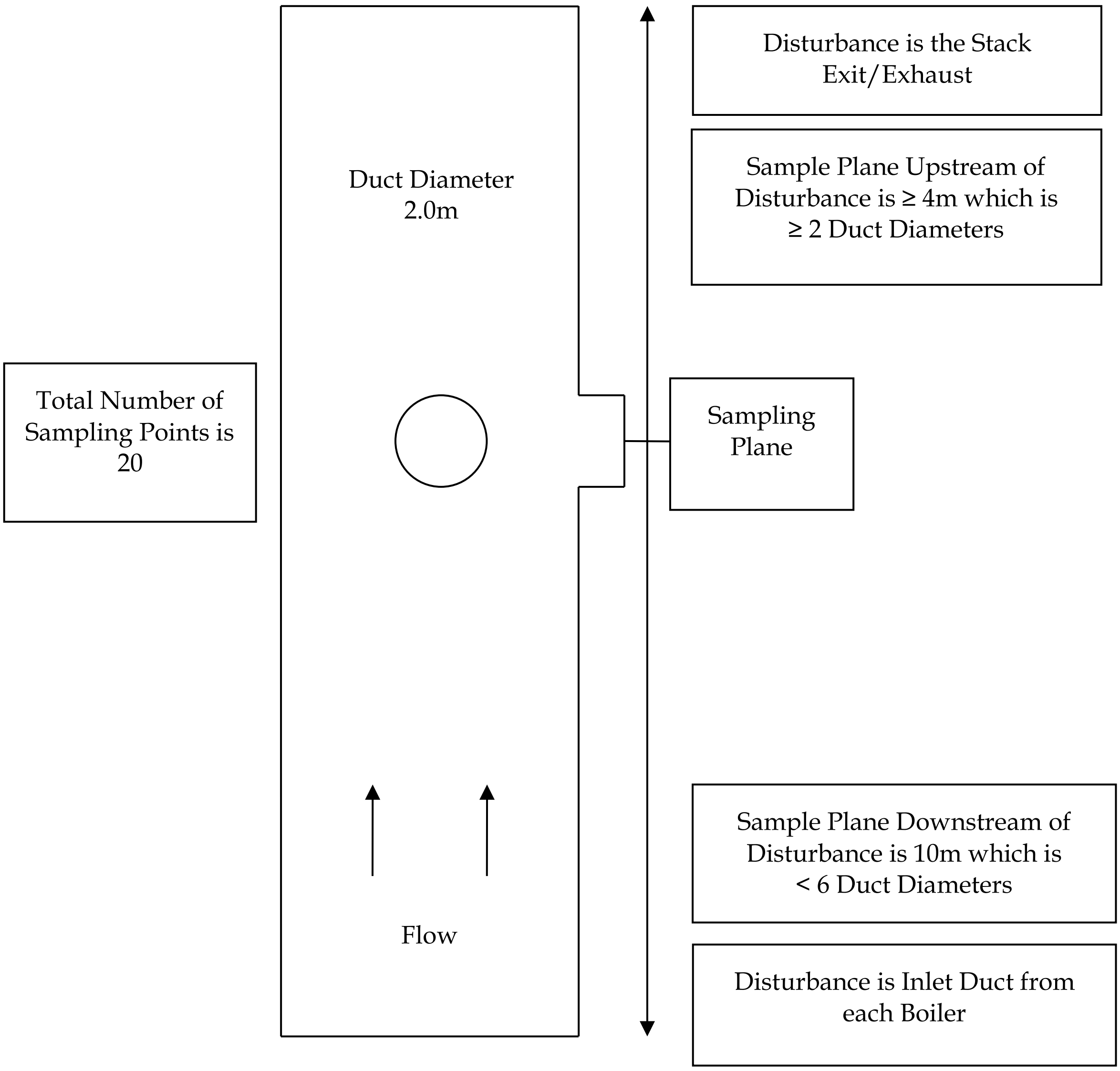


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

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



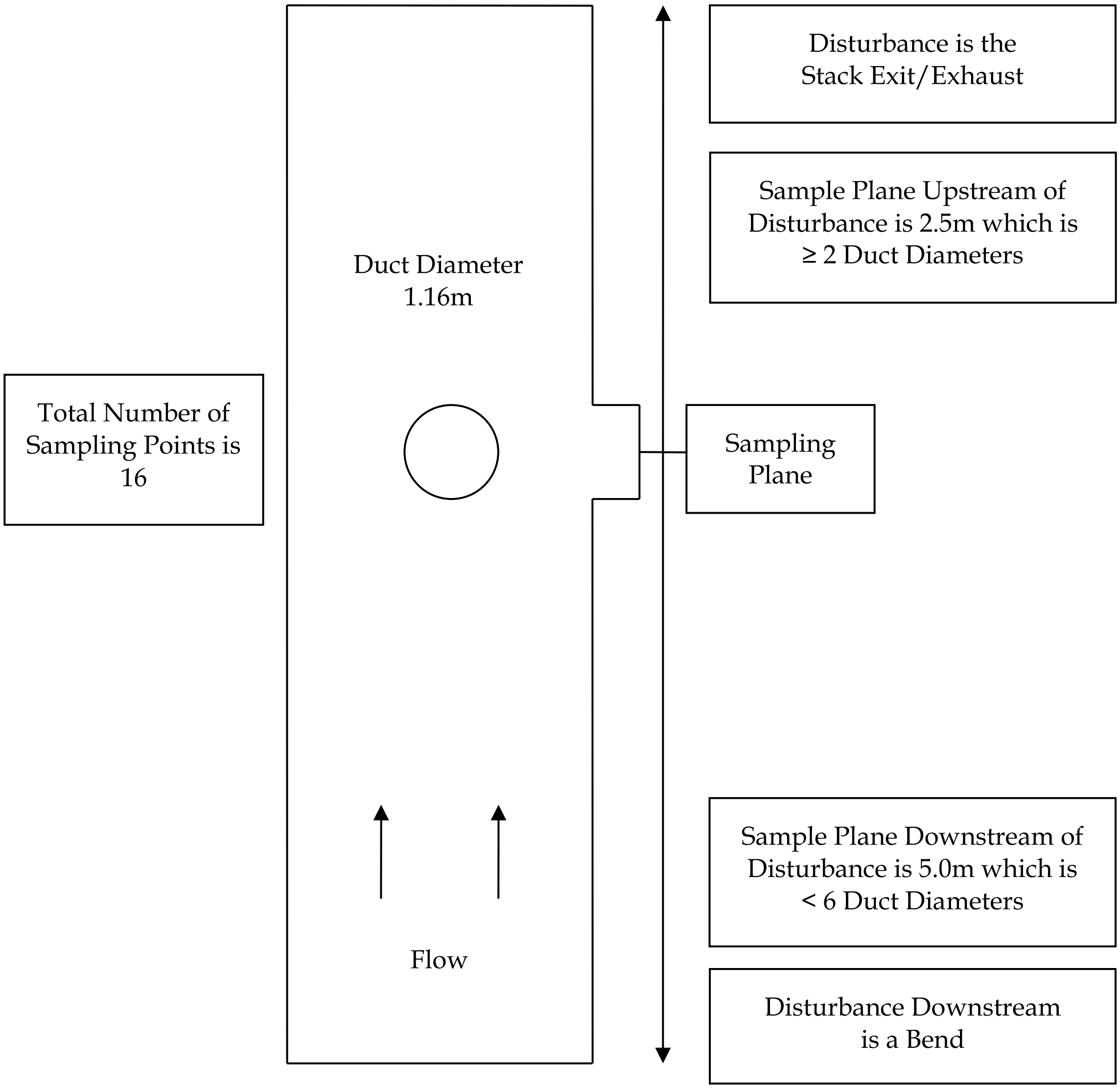
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



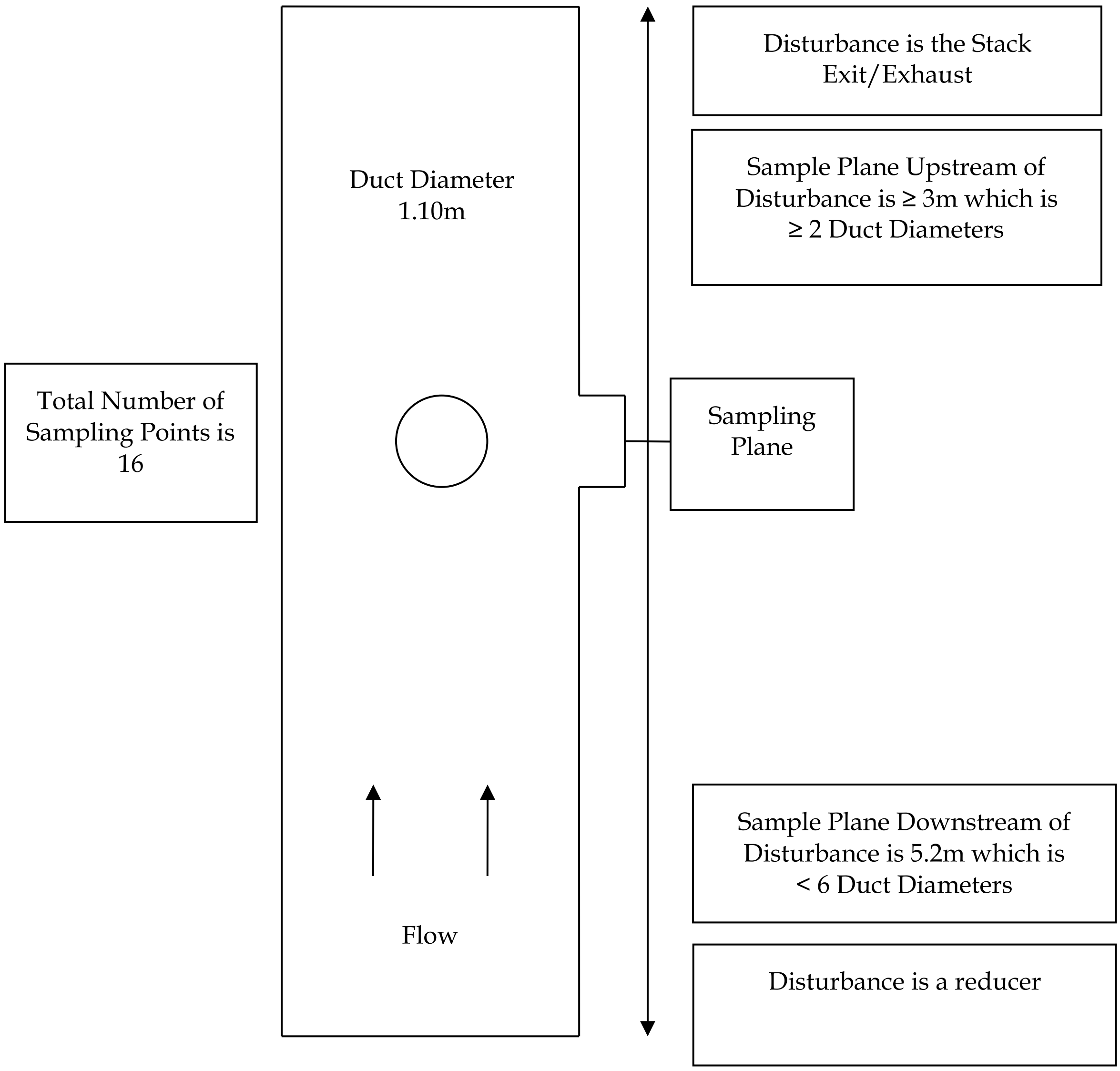
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exit 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

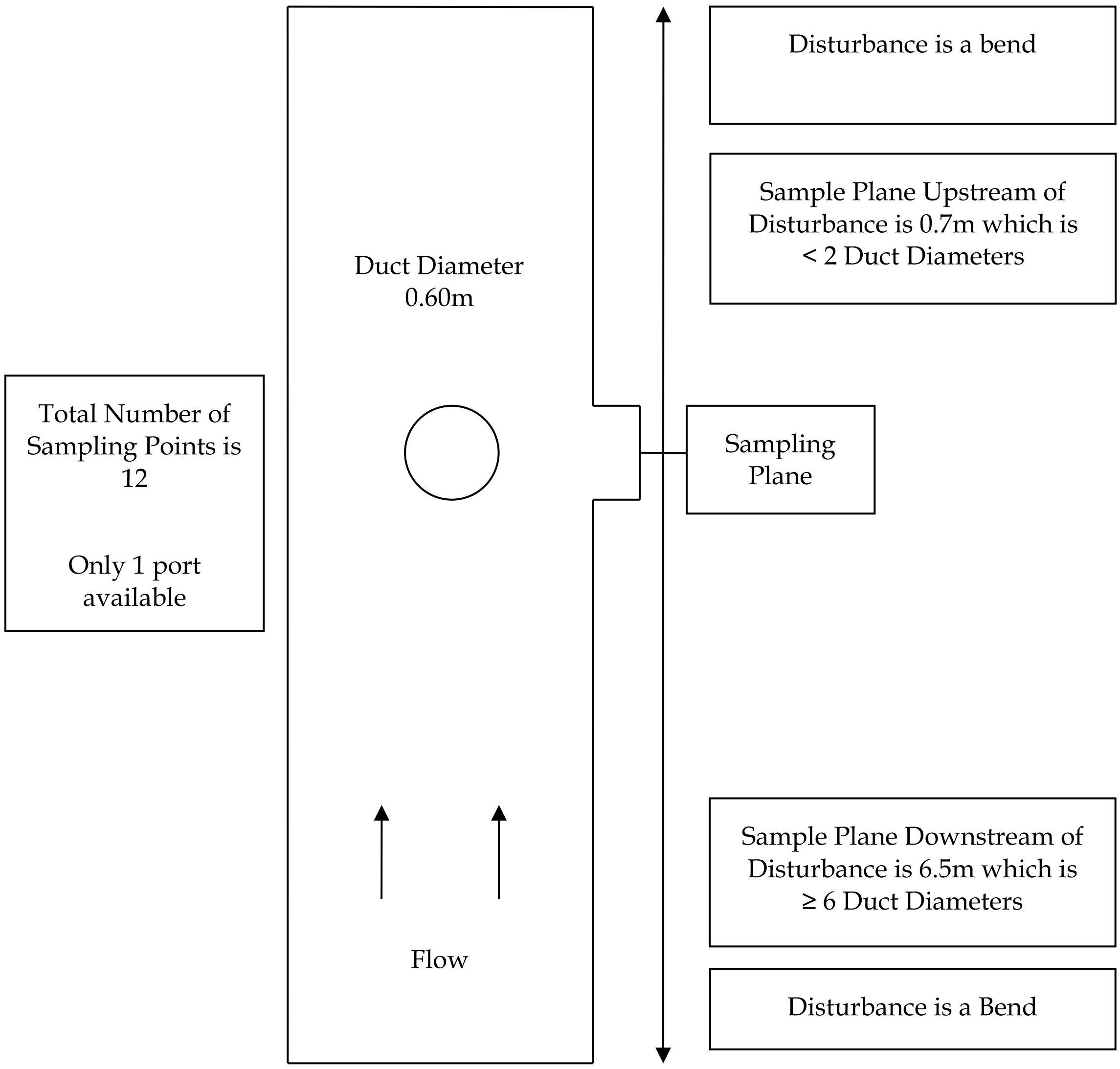


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as 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 exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

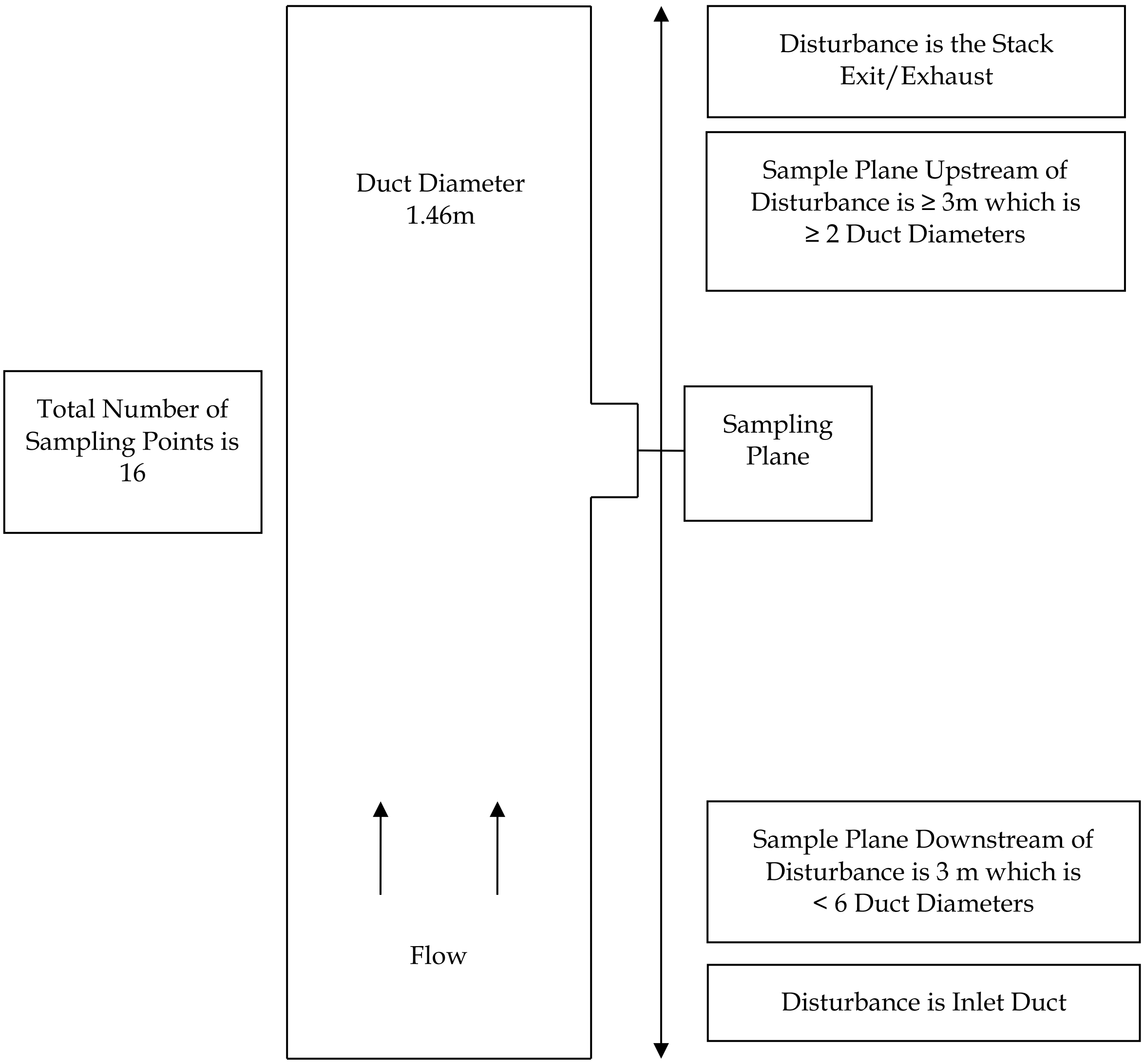
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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 4, 2019-2020

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.:	**7052A/S25548/20**
Dates of Survey:	**21 & 27 February & 02 March, 2020**
Date of Issue:	**7 May, 2020**
Date of Re-issue	**24 June, 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

EPL ODOUR EMISSION SURVEY ANNUAL & QUARTER 4, 2019-2020

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.:	**7052A/S25548/20**
DATE OF SURVEY:	**21 & 27 FEBRUARY & 02 MARCH, 2020**
DATE OF ISSUE:	**7 MAY, 2020**
DATE OF RE-ISSUE	**24 JUNE, 2020**

P W STEPHENSON

J WEBER

M KIMBER

NOTE:
Report 7052 re-issued as 7052A with correction to typographical error in Table A-4. An incorrect stack diameter had been entered into calculation spreadsheet for CO_2 Scrubber outlet causing flow rate to be significantly reduced.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF TABLES – APPENDICES

TABLE OF FIGURES – APPENDICES

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_2) Scrubber Inlet sampling point, which currently is not listed in EPL 883 and therefore does not have EPA Identification No., was also sampled.

The EPL No.883 annual monitoring is undertaken in the period from May 1 to April 30 each the year. In addition Quarterly monitoring is conducted in the following periods:
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 2019-2020 Annual and Quarter 4 odour test results are presented in this report. These tests were conducted on 21 and 27 February, and 3 March 2020.

2 MONITORING REQUIREMENTS

2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 20 JUNE 2018)

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_2 Scrubber outlet	1	Quarterly
Not specified	CO_2 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
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 - REQUIREMENT TO MONITOR CONCENTRATION OF POLLUTANTS DISCHARGED

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 other columns.*

TABLE 2-2 SAMPLING AND ANALYSIS OF POINT SOURCES (POINTS 8-14, 16 & 47)

Pollutant	Units	Frequency	Approved Method
Dry Gas Density	kg/m^3	Quarterly	TM-23
Flow	m^3/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	^{o}C	Quarterly	TM-2
Velocity	m/s	Quarterly	TM-2

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

Pollutant	Units	Frequency	Approved Method
Odour	ou	Yearly	OM-7

TABLE 2-4 SAMPLING AND ANALYSIS OF POINT SOURCE (POINTS 35, 42 & 45)

Pollutant	Units	Frequency	Approved Method
Cadmium	mg/m^3	Quarterly	TM -12, 13 & 14
Mercury	mg/m^3	Quarterly	TM -12, 13 & 14
Moisture	%	Quarterly	TM-22
Nitrogen Dioxide	mg/m^3	Quarterly	TM-11
Odour	ou	Quarterly	OM-7
Opacity	%	Continuous	CEM-1
Oxygen	%	Quarterly	TM-25
Sulphur Dioxide	mg/m^3	Yearly	TM-4
Temperature	^{o}C	Quarterly	TM-2
Total Solid Particles	mg/m^3	Quarterly	TM-15
Type 1 and 2 substances in aggregate	mg/m^3	Quarterly	TM -12, 13 & 14
Velocity	m/s	Quarterly	TM-2
Volatile Organic Compounds	mg/m^3	Quarterly	TM-34
Volumetric Flowrate	m^3/s	Quarterly	TM-2

TABLE 2-5 SAMPLING AND ANALYSIS OF SOURCES (POINTS 39-41, 44 & 46)

Pollutant	Units	Frequency	Approved Method
Odour	ou	Quarterly	OM-7

Key to Tables 2.2 to 2.5:

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

3 PRODUCTION CONDITIONS

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

EPA ID No.46 DDG Pellet plant exhaust was not available for odour emission monitoring during the period of days that the odour emission survey was undertaken.

All other sources were monitored as per the EPL including the emission from the new DDG Dryer No. 4 which is an additional inlet stream to the Biofilter.

4 ODOUR EMISSION TEST RESULTS

SEMA performed odour emission sampling and odour analysis was performed by Odour Research Laboratories Australia (ORLA), which are both NATA accredited (No.15043) facilities to ISO 17025 for this.
Refer Appendix B for NATA accredited ORLA Olfactometry Test Reports 7052/ORLA/01, 02 and 03. Refer Appendix A for exhaust gas flow and emission tests results from point sources, Appendix C for details calibration of instruments used to take measurements and Appendix D for sample locations.

Table 4-1 summarises the odour emission concentrations from all sources.

TABLE 4-1 ODOUR EMISSION CONCENTRATION TEST RESULTS - Q4 & ANNUAL, 2019-2020

EPA ID No.	Description	Date	Odour Concentration (ou)
8	No.1 Gluten Dryer	20.02.2020	360
9	No.2 Gluten Dryer	20.02.2020	610
10	No.3 Gluten Dryer	20.02.2020	560
11	No.4 Gluten Dryer	20.02.2020	360
12	No.1 Starch Dryer	27.02.2020	120
13	No.3 Starch Dryer	20.02.2020	510
14	No.4 Starch Dryer	20.02.2020	783
16	Carbon Dioxide Scrubber Outlet	20.02.2020	8,700
--	Carbon Dioxide Scrubber Inlet	20.02.2020	7,400
19	Effluent Storage Dam 1	02.03.2020	560
20	Effluent Storage Dam 2	02.03.2020	510
21	Effluent Storage Dam 3	02.03.2020	510
23	Effluent Storage Dam 5	02.03.2020	330
24	Effluent Storage Dam 6	02.03.2020	82
25	Sulphur Oxidation Pond	02.03.2020	250
35	Combined Stack No. 5 & 6 Boilers	27.02.2020	2000
39	Inlet Pipe from DDG Dryers 1,2&3 to Biofilters A & B	27.02.2020	25,000
39A	Inlet Pipe from DDG Dryer #4 to Biofilters A & B	27.02.2020	23,000
40	Outlet of Biofilter A (east&west)	27.02.2020	790 & 1200
41	Outlet of Biofilter B (east&west)	27.02.2020	850 & 2400
42	Boiler No. 4	27.02.2020	2,000
44	Fermenter No. 12	20.02.2020	5,200
45	Boiler No. 2	27.02.2020	1,500
46	DDG Pellet Plant Stack		n/a - Not available
47	No.5 Starch Dryer	20.02.2020	430

Key: ou = odour units
n/a = nil sample , not operating on any of sampling days

5 CONCLUSIONS

SEMA completed the odour sampling and analysis at Shoalhaven Starches manufacturing facility at Bomaderry for the 2019–2020 Quarter 4 and Annual monitoring.

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

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

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

Figure 5-4 graphically shows the Fermenter odour 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 odour emission concentrations since summer 2013-2014 respectively.

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

Figure 5-9 graphically shows the Bio-filter odour emission concentrations since autumn 2010 and inlet to biofilter odour concentrations from DDG Dryer Nos. 1, 2 & 3. In addition, this quarter includes the odour emission from DDG Dryer No. 4 which has similar odour concentration as the other DDG dryers.

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

Figures 5-11 to 5-15 show Effluent Pond 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

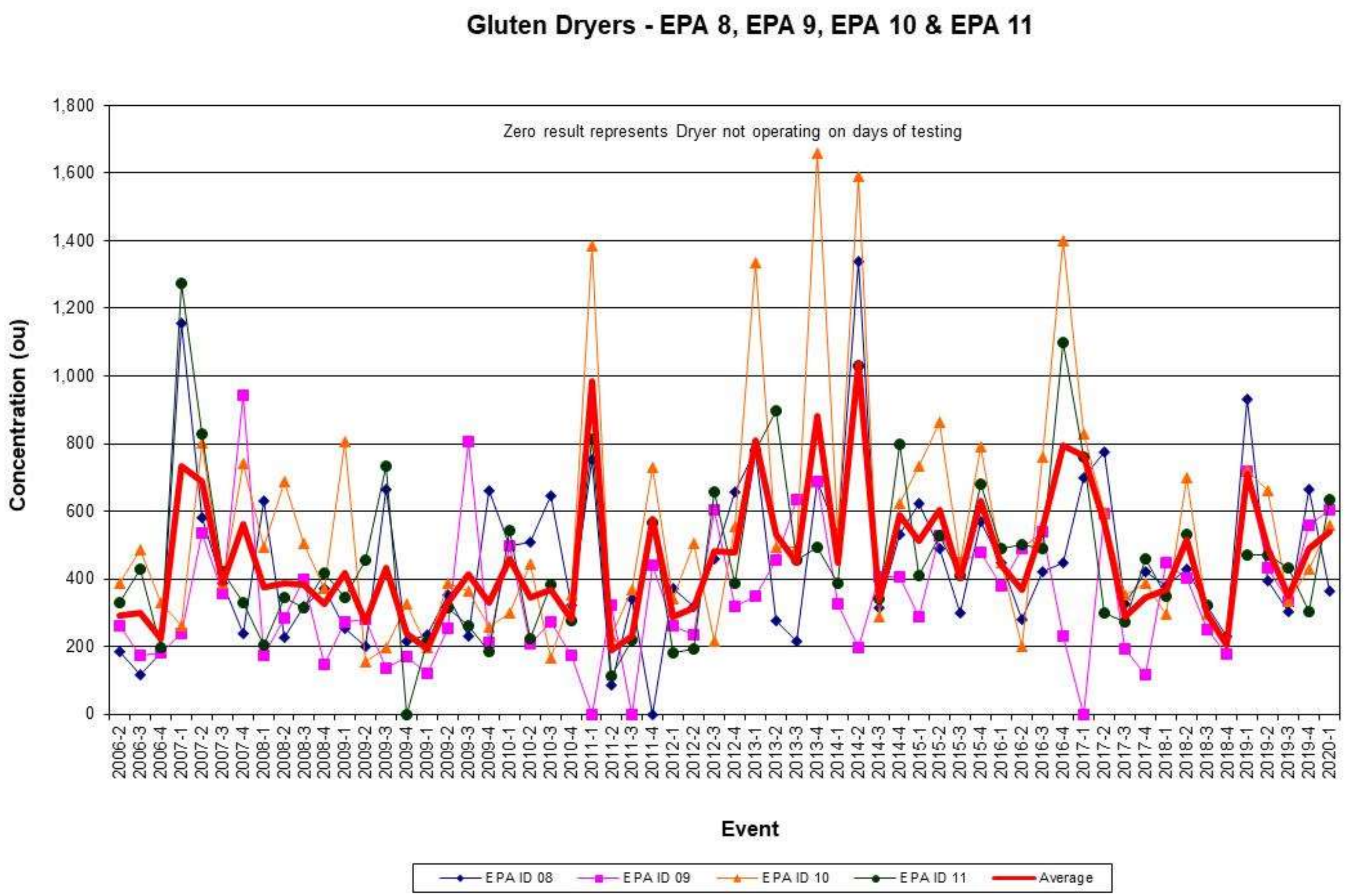


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4

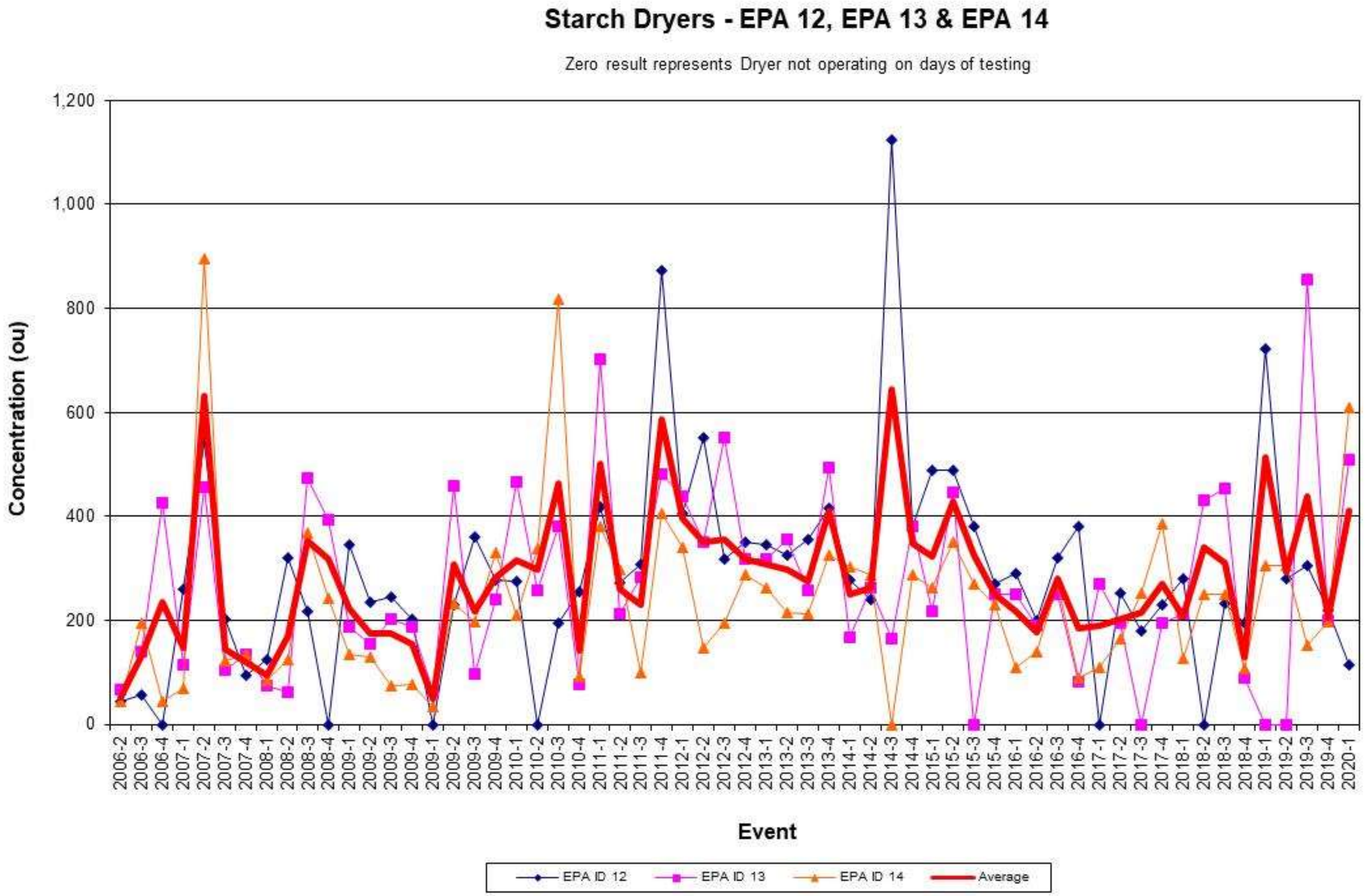


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5

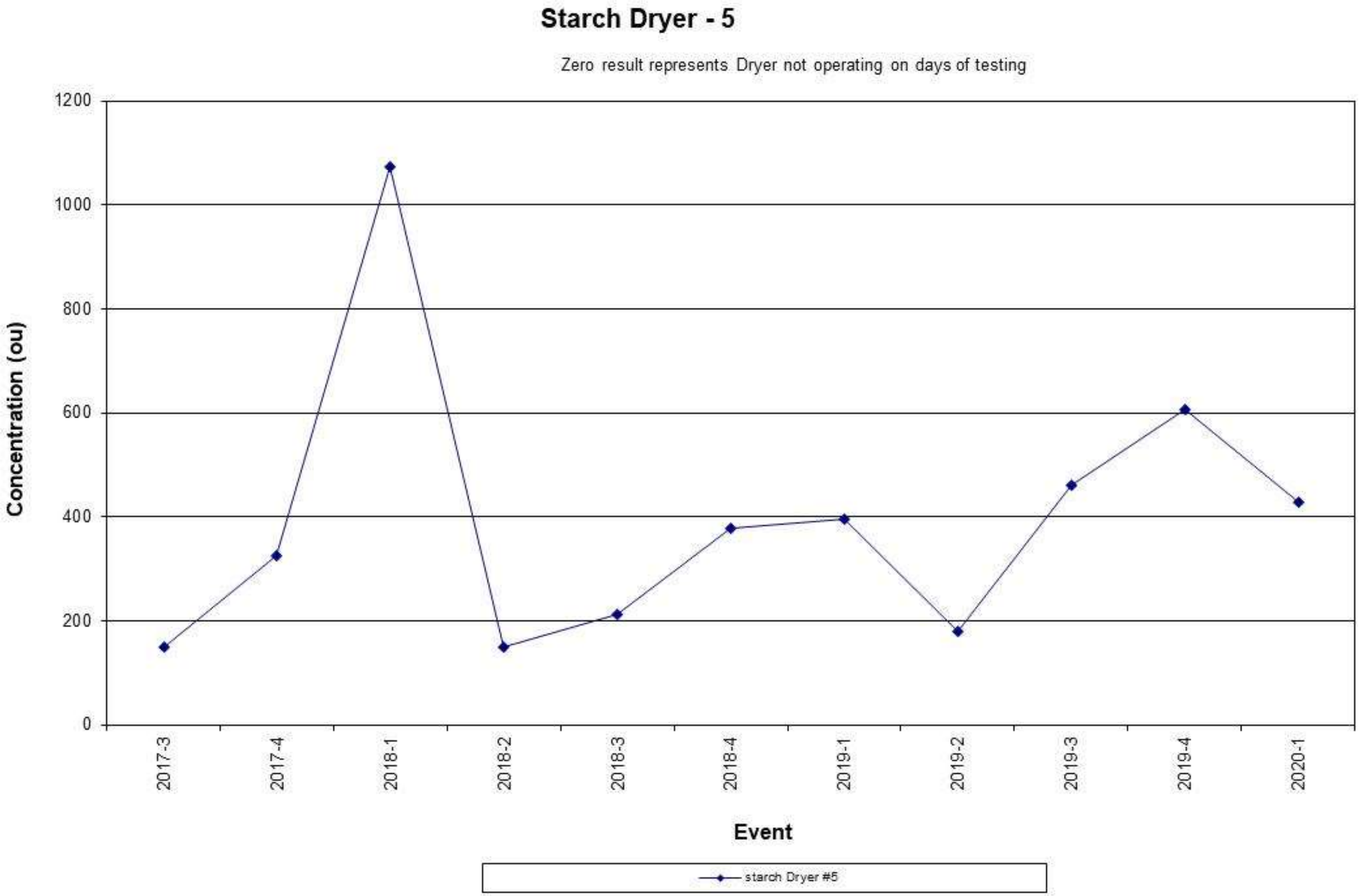


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS

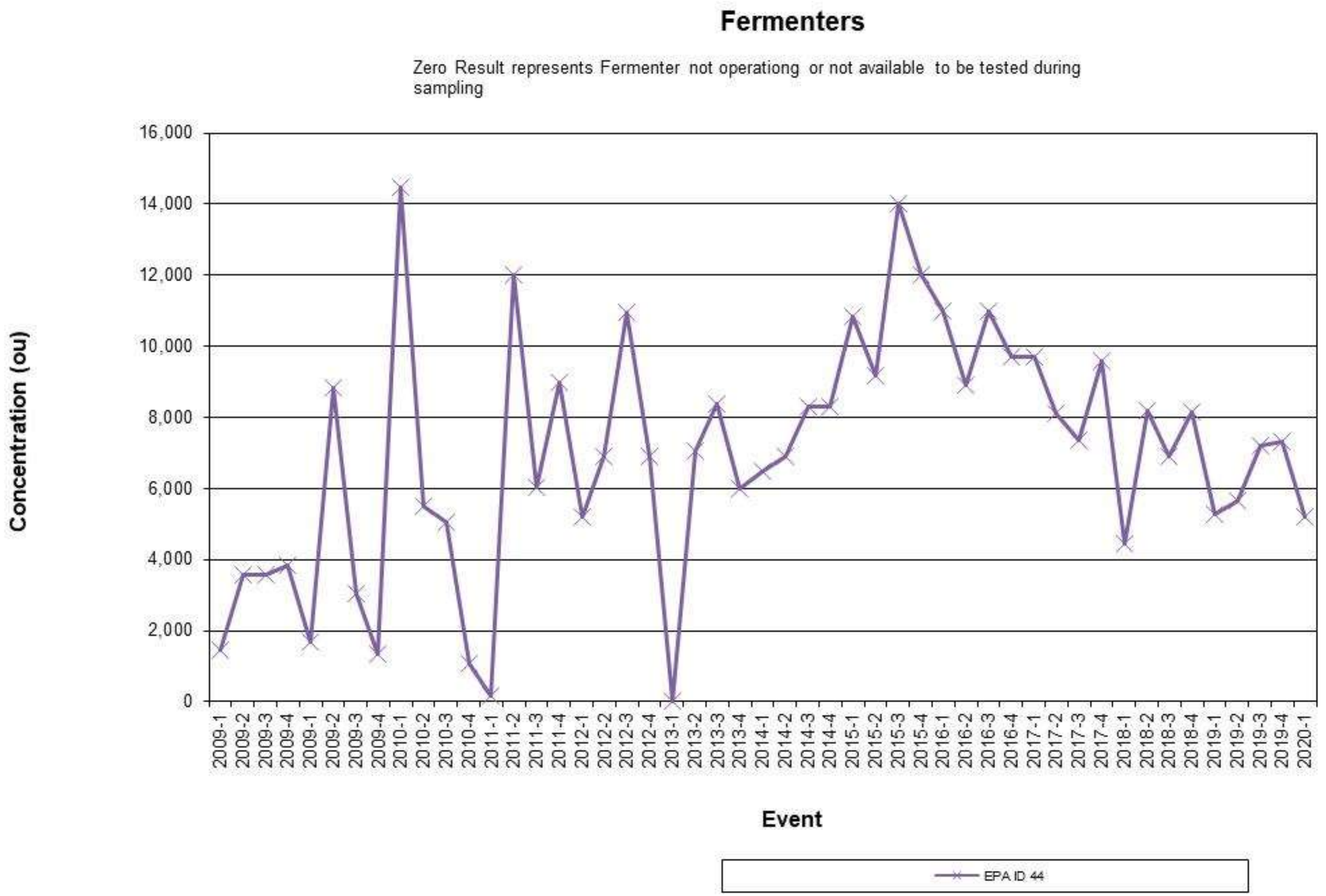


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET

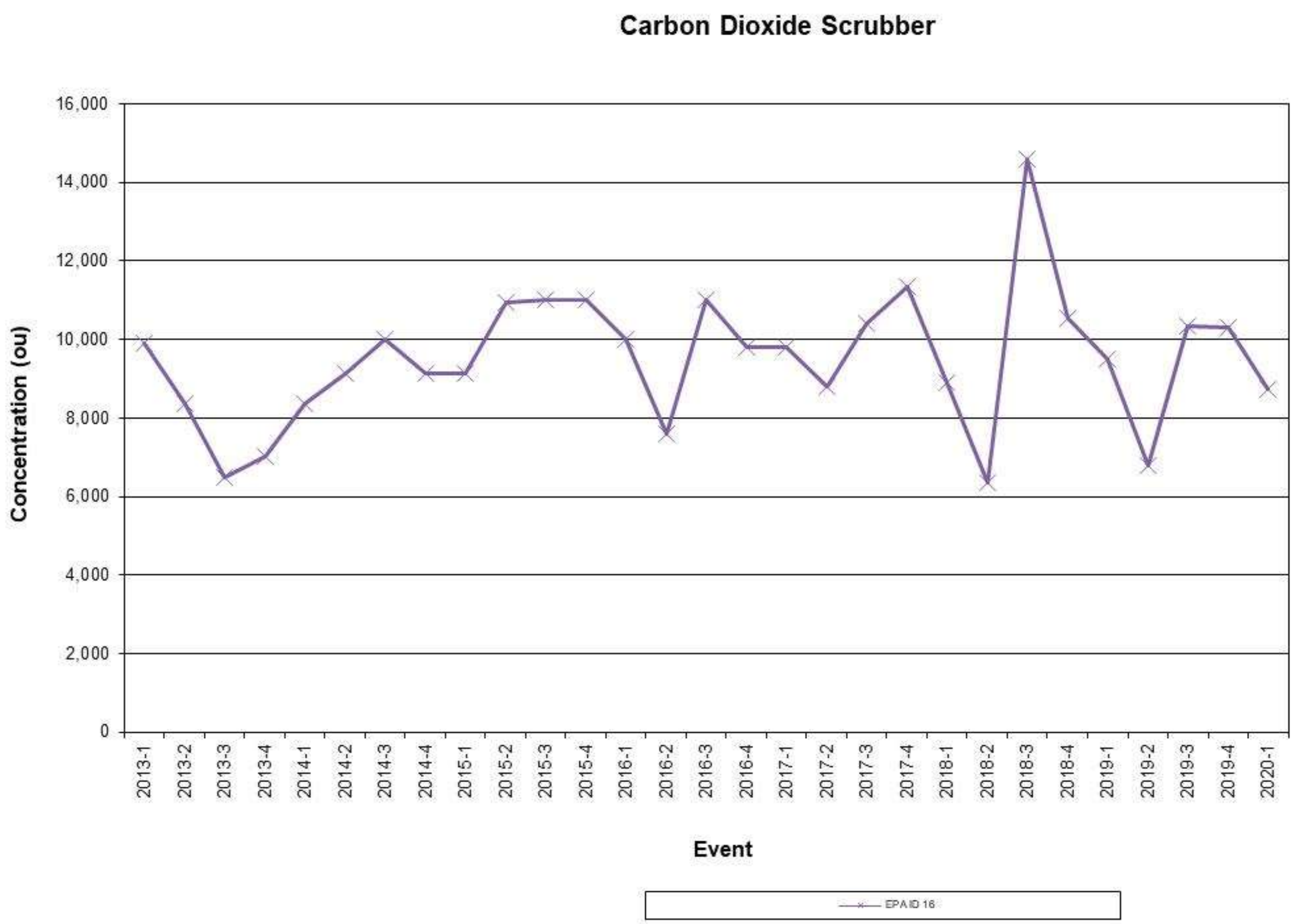


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 AND 6 STACK

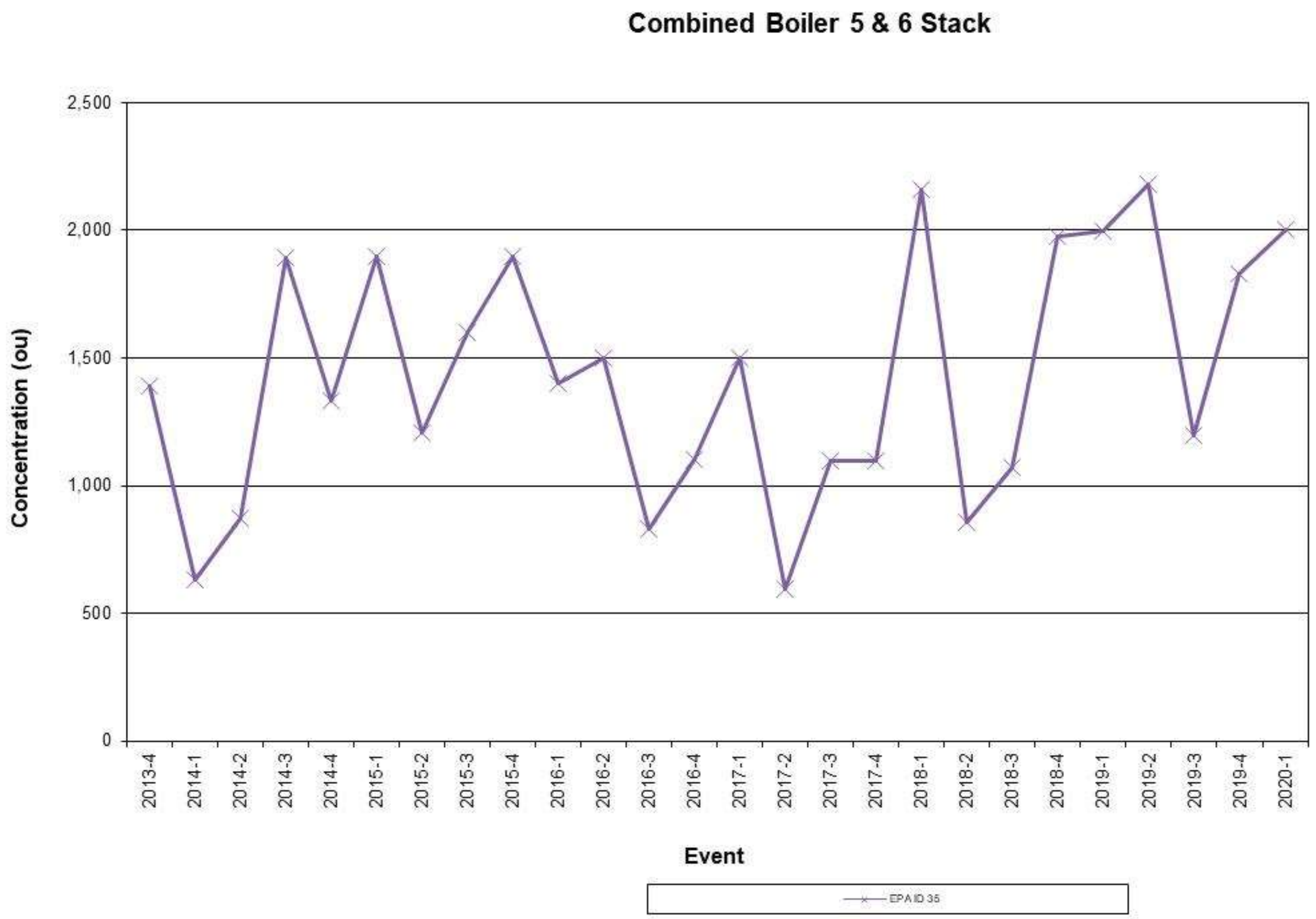


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK

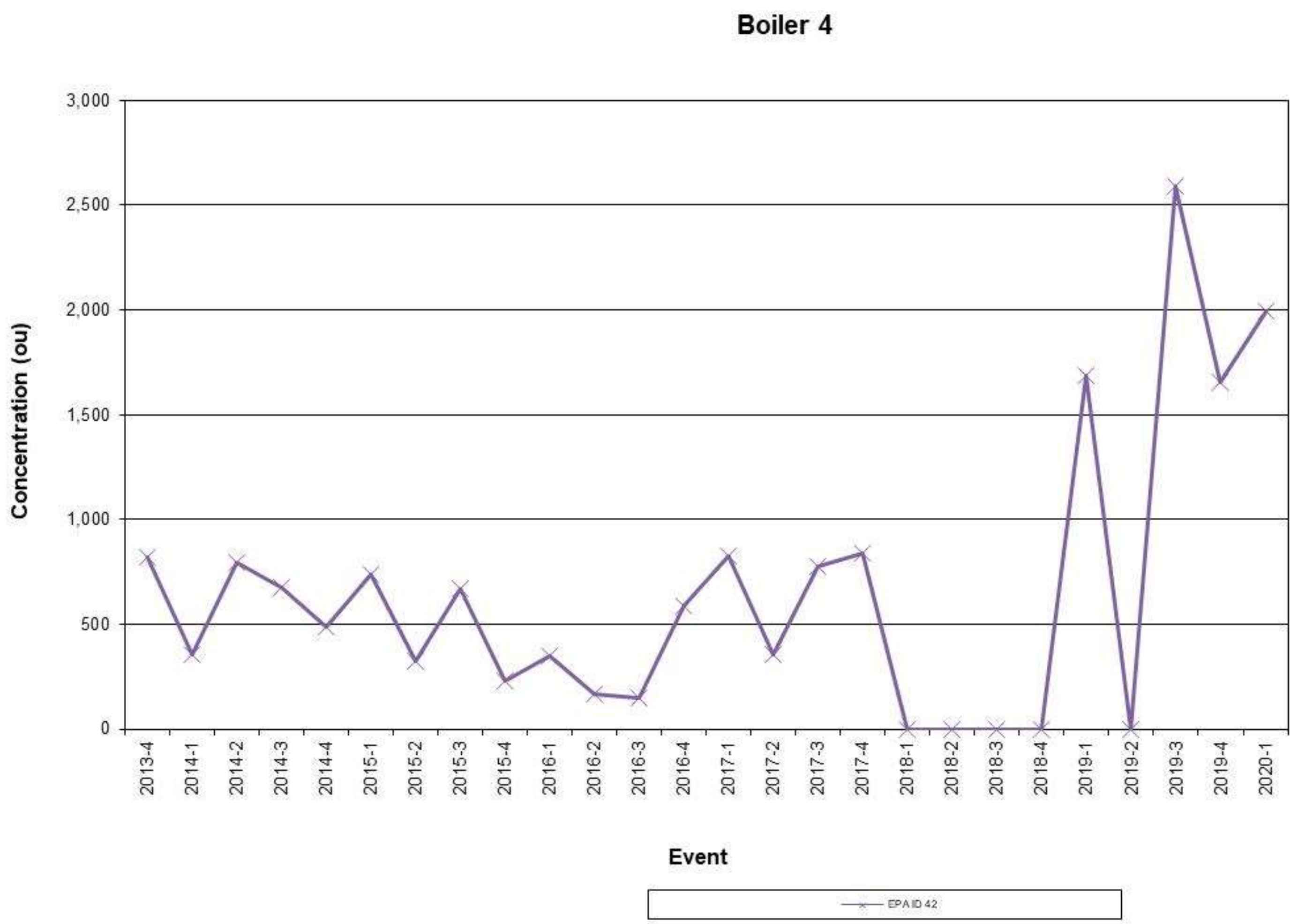


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK

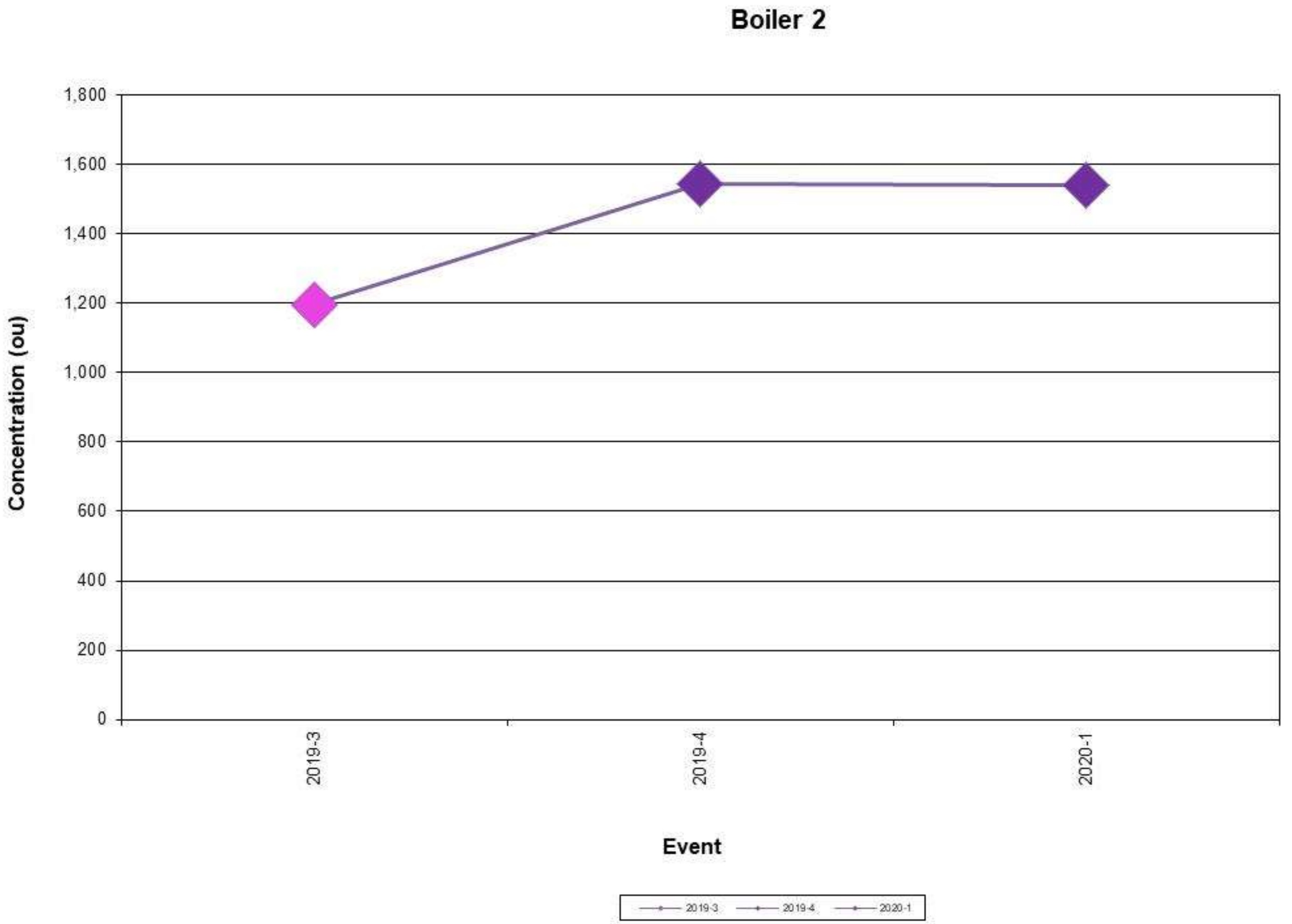


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS

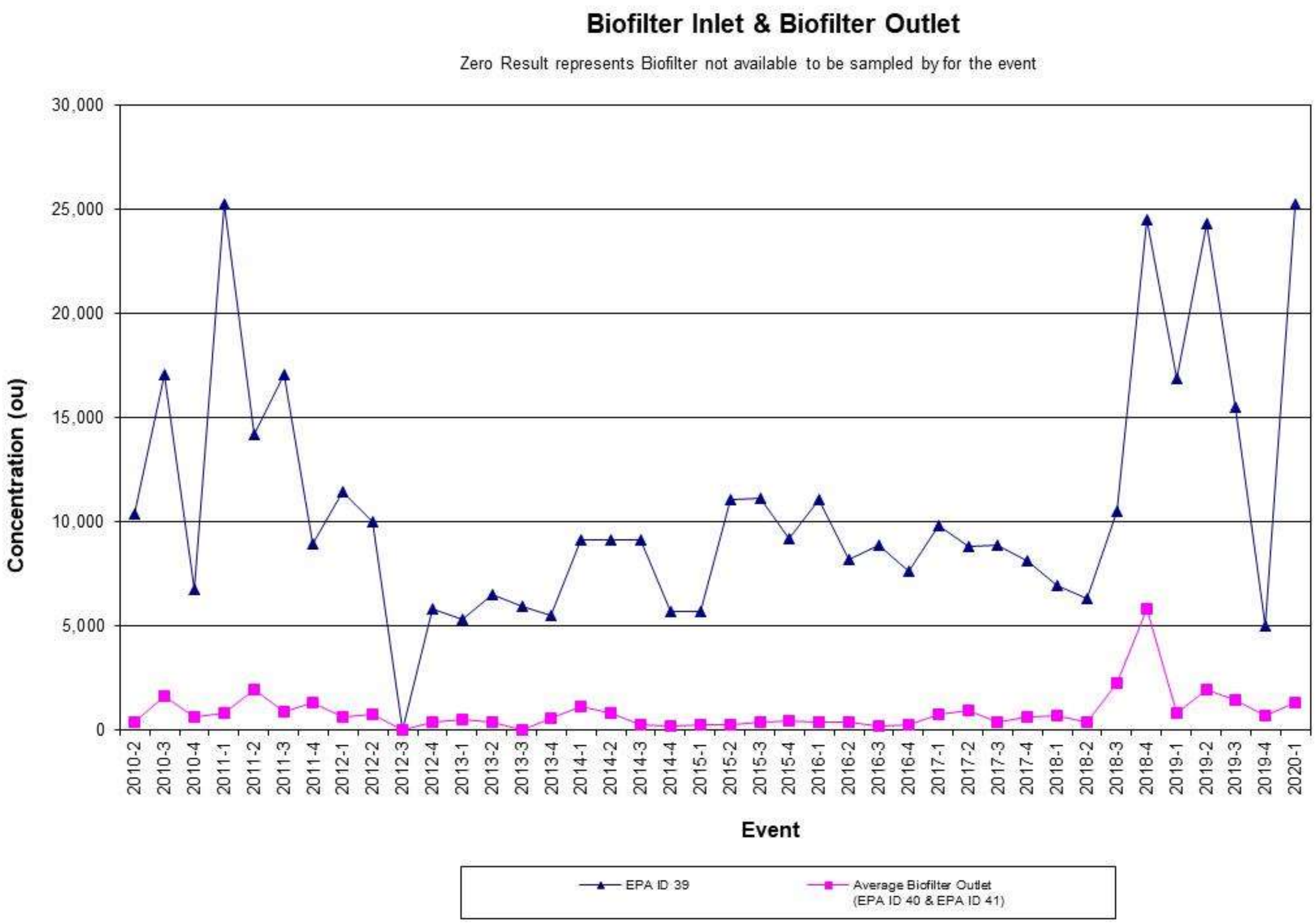


FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT STACK

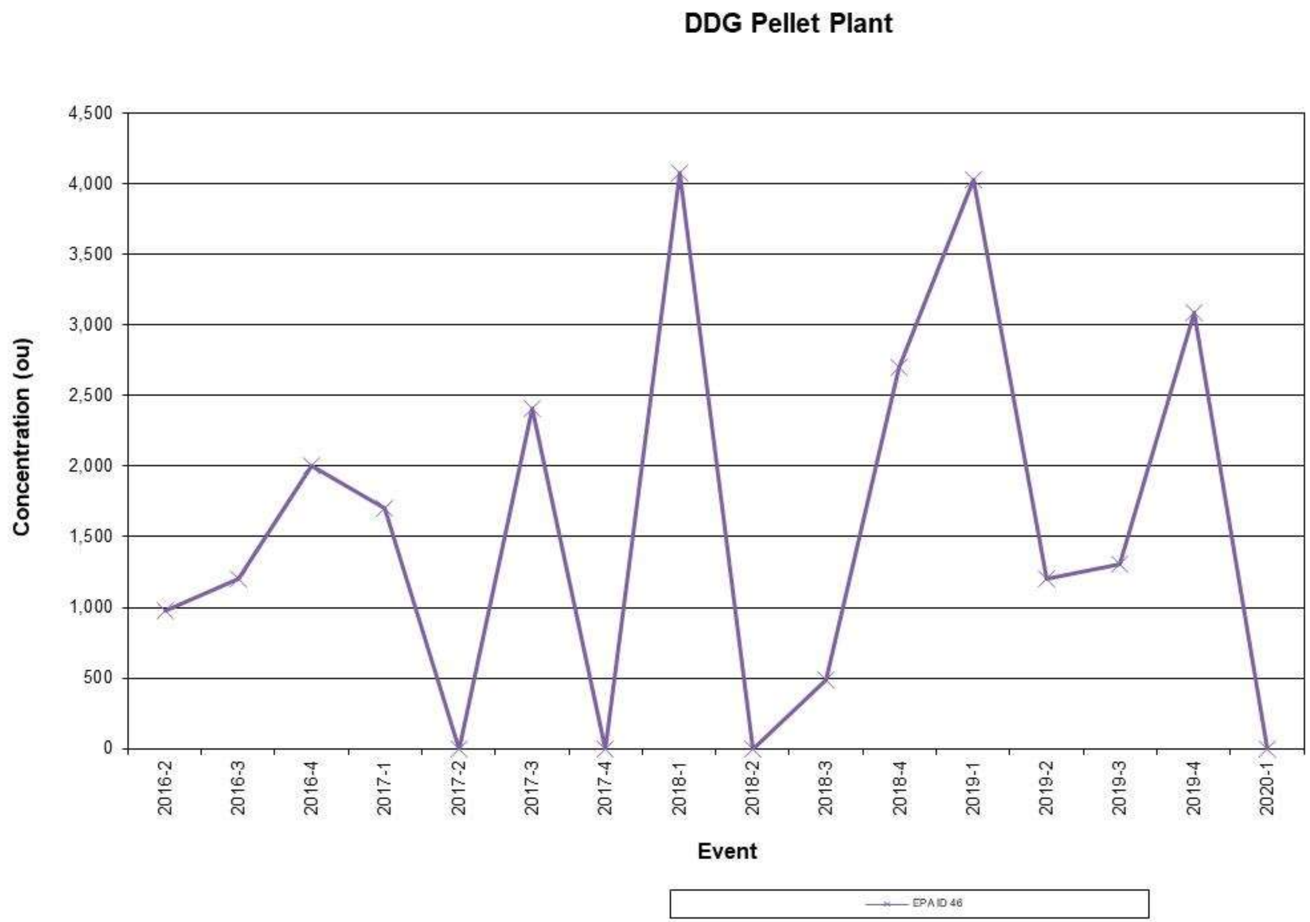


FIGURE 5-11 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 1

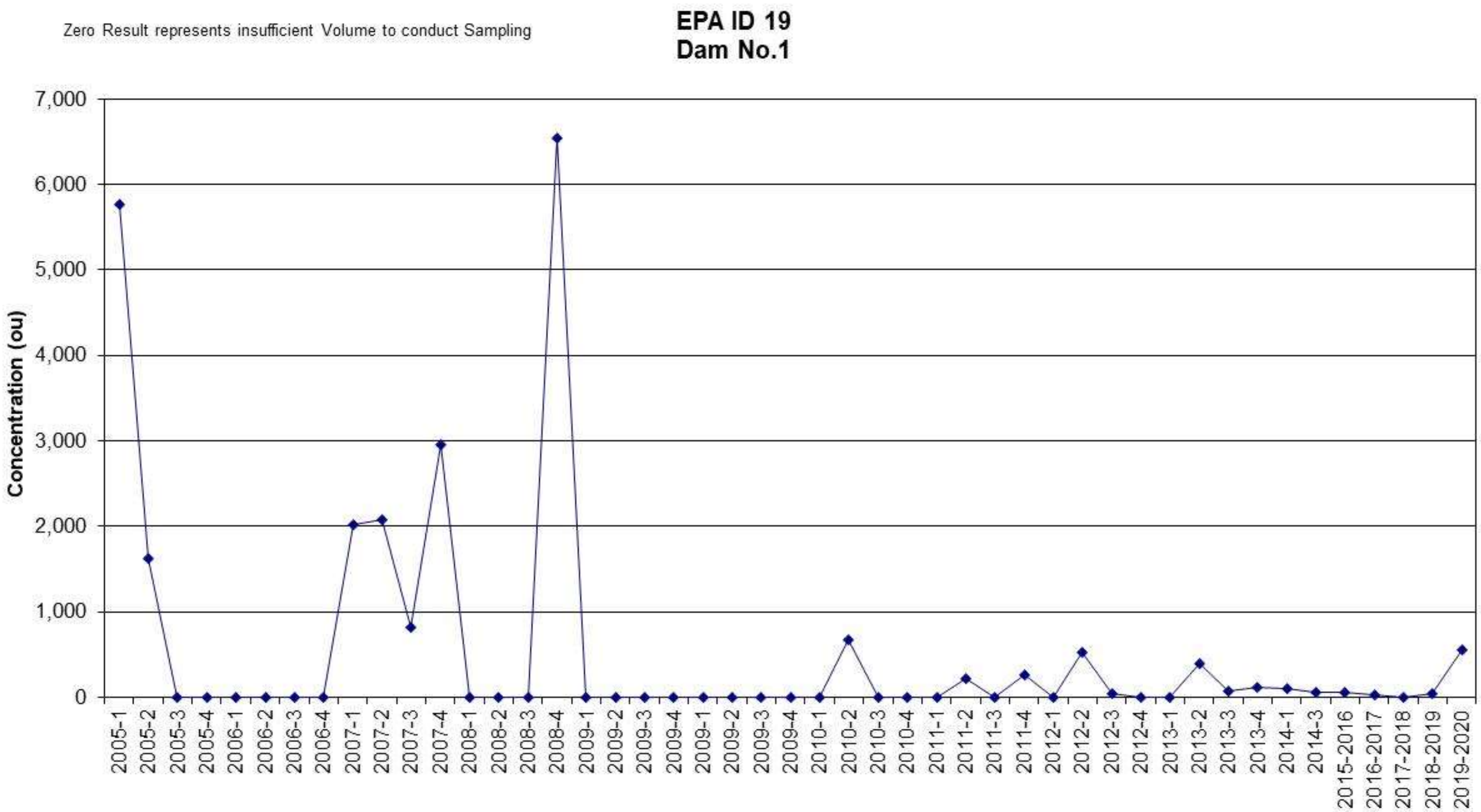


FIGURE 5-12 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 2

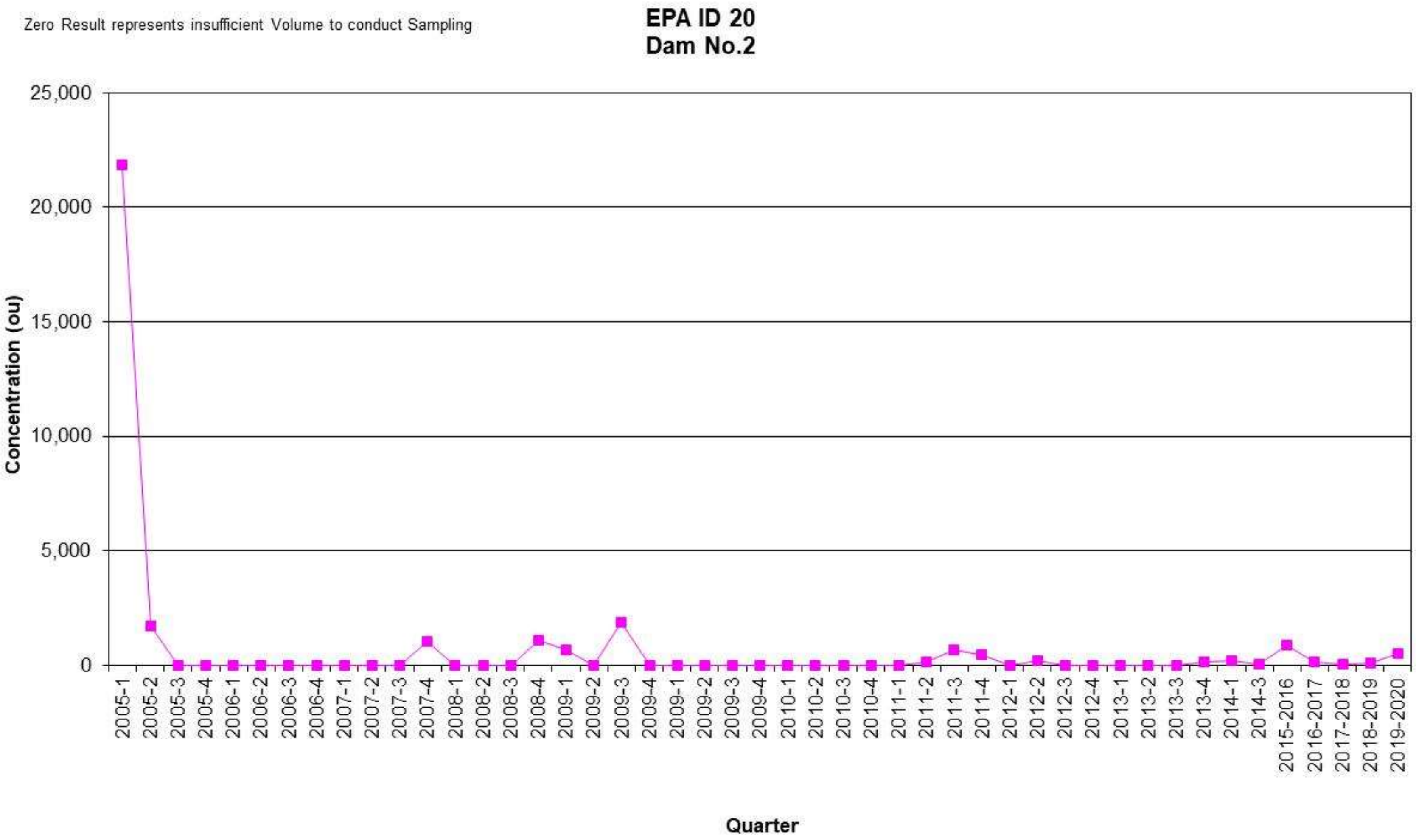


FIGURE 5-13 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 3

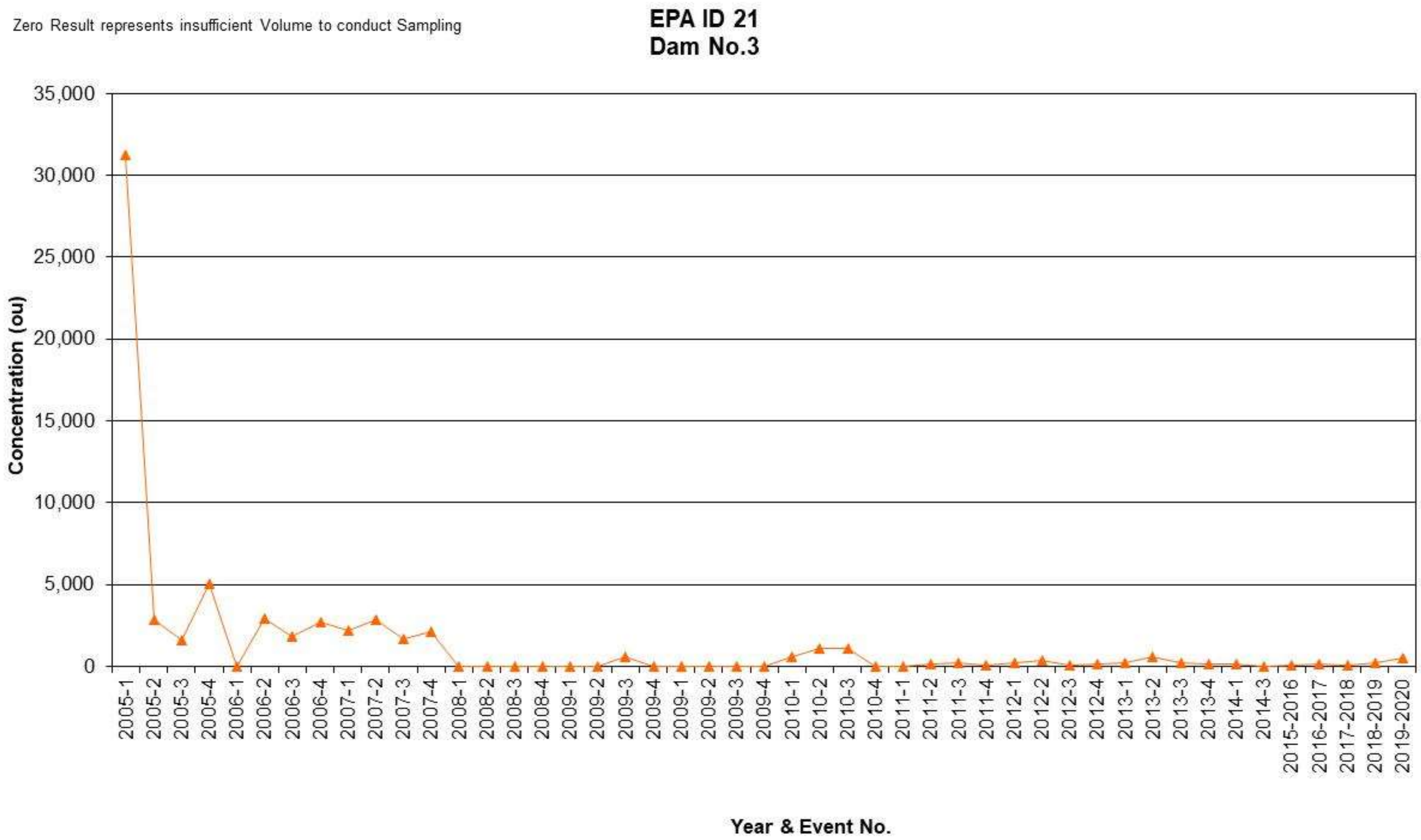


FIGURE 5-14 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 5

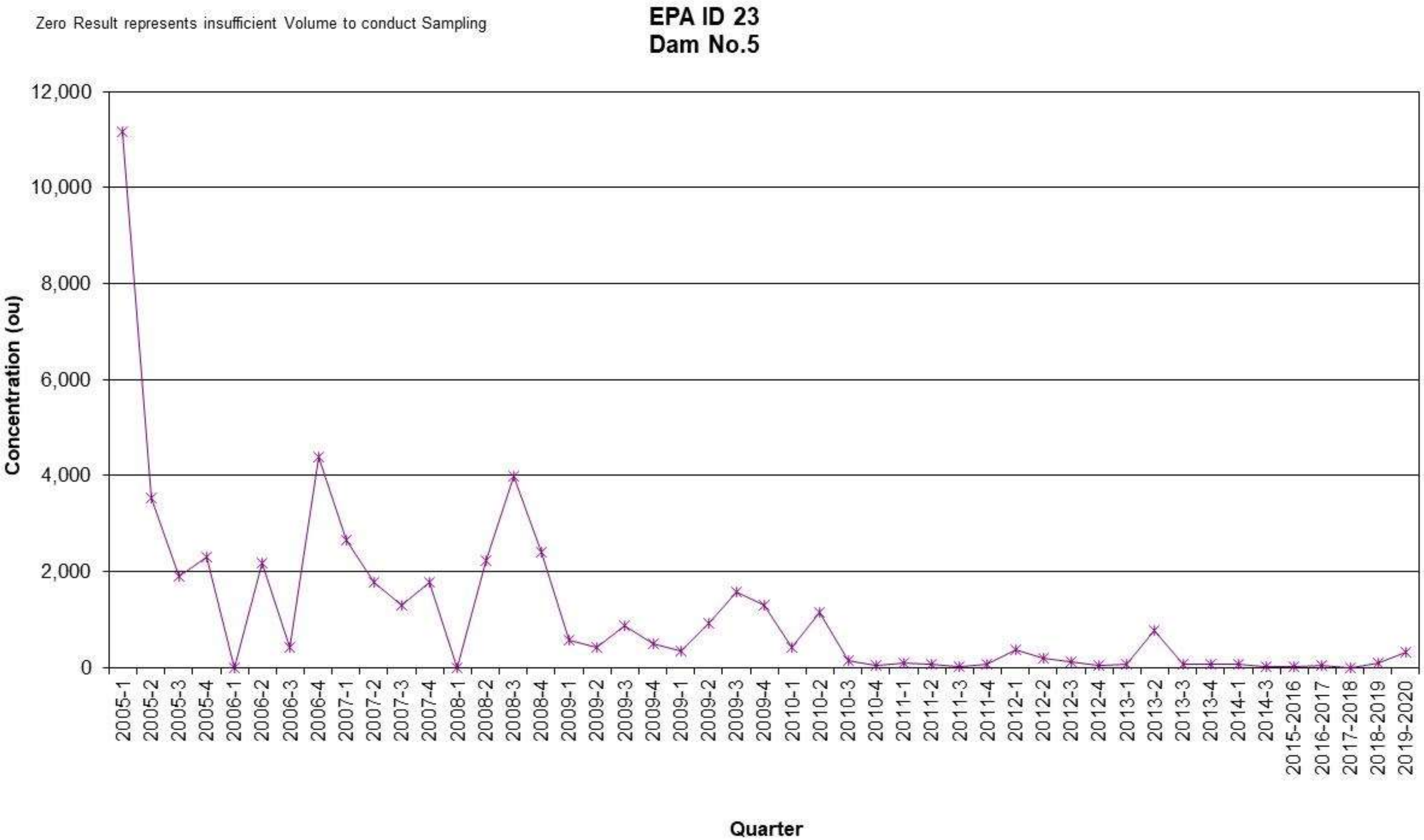


FIGURE 5-15 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 6

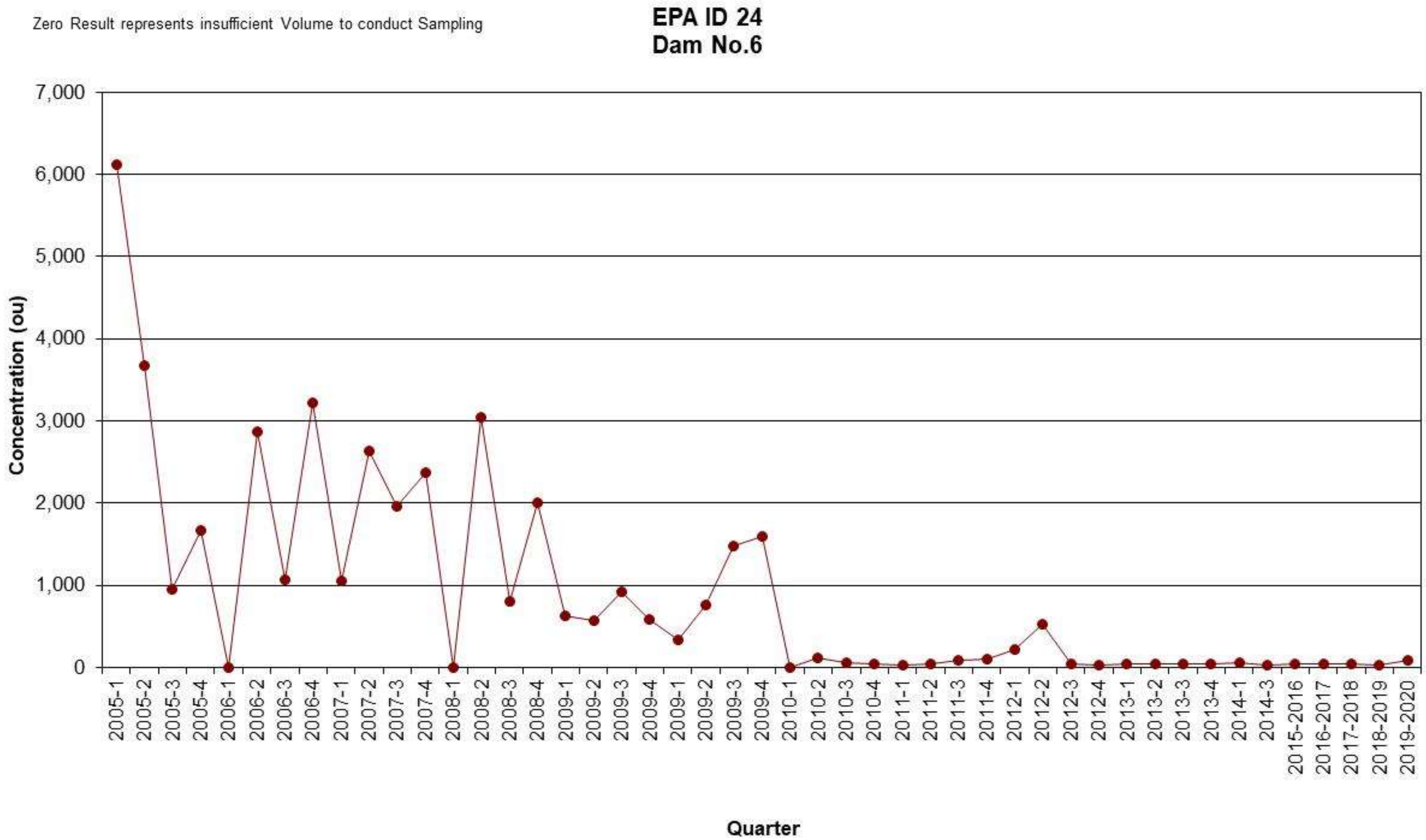
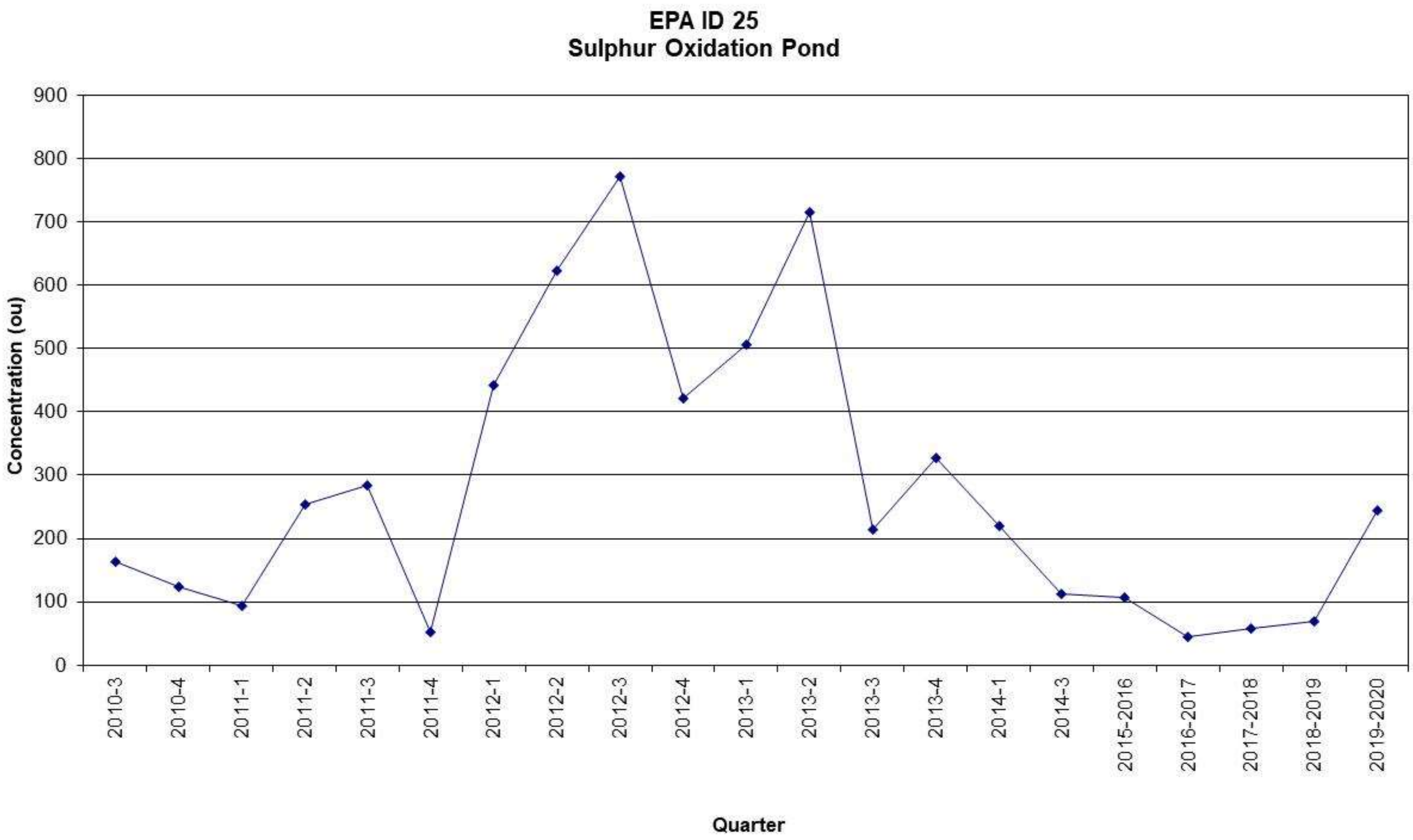


FIGURE 5-16 ODOUR EMISSION CONCENTRATIONS, SULPHUR OXIDATION POND



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: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the colour, as in 'it smells like …' *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.*

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_2)

(OEH NSW TM-25 and USEPA Method 3A)

O_2 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
^oC	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	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 1, 2, 3 & 4

Emission Test Results	Velocity & Flow / Moisture			
Project Number	7052			
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	20.02.2020	20.02.2020	20.02.2020	20.02.2020
	Dry			
Run	1			
Method	TM-1 & TM-2 & TM-22			
Sample Start Time (hrs)	11:36	12:00	11:05	12:17
Sample Stop Time (hrs)	11:57	12:18	11:31	12:38
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	71.7	70	73.6	74.5
Stack Cross-Sectional area (m^2)	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	13.5	17.0	9.9	17.1
Actual Gas Flow Volume (am^3/min)	1,157	1,114	2,628	2,365
Total Normal Gas Flow Volume (m^3/min)	856	772	1,927	1,736
Total Normal Gas Flow Volume (m^3/s)	14.3	12.9	32.1	28.9
Total Stack Pressure (kPa)	101.0	92.6	101.4	101.1
Moisture Content (% by volume)	6.4	4.7	7.1	6.4
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^3)	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	5284	5283	5282	5285
SEMA Number	727830	727829	727828	727831
Odour Concentration (As Received) (ou)	360	600	560	360
Odour Concentration (Final) (ou)	**360**	600	**560**	**360**
Normal MOER (As Received) (ou m^3/s)	5,200	7,800	18,000	10,500
Normal MOER (Final) (ou m^3/s)	5,200	7,800	18,000	10,500
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period	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 1, 3, 4 & 5

Emission Test Results	Velocity & Flow / Moisture			
Project Number	7052			
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	27.02.2020	20.02.2020	20.02.2020	20.02.2020
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Sample Start Time (hrs)	11:59	10:28	10:28	13:20
Sample Stop Time (hrs)	12:20	10:50	10:49	13:40
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	40.4	32.5	40.1	68.0
Stack Cross-Sectional area (m^2)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	6.6	20.7	21.2	14.5
Actual Gas Flow Volume (am^3/min)	896	1,241	1,272	3,935
Total Normal Gas Flow Volume (m^3/min)	735	1,052	1,037	2,942
Total Normal Gas Flow Volume (m^3/s)	12.3	17.5	17.3	49.0
Total Stack Pressure (kPa)	101.2	101.1	101.2	101.0
Moisture Content (% by volume)	5.8	5.0	6.4	6.3
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^3)	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	5291	5280	5281	5286
SEMA Number	727836	727826	727827	727832
Odour Concentration (As Received) (ou)	116	510	783	430
Odour Concentration (Final) (ou)	**116**	**510**	**783**	**430**
Normal MOER (As Received) (ou m^3/s)	1,421	8938	13,538	21,083
Normal MOER (Final) (ou m^3/s)	1,421	8938	13,538	21,083
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample Storage Period	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	Velocity & Flow / Moisture		
Project Number	7052		
Project Name	Shoalhaven Starches		
Test Location	**EPA ID 35 Boilers 5&6**	**EPA ID 42 Boiler 4**	**EPA ID 45 Boiler 2**
Date	27.02.2020	27.02.2020	27.02.2020
	Dry		
Run	1		
Method	TM-1, TM-2 & TM-22		
Sample Start Time (hrs)	10:06	10:43	11:14
Sample Stop Time (hrs)	10:27	11:04	11:35
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	139	162	217
Stack Cross-Sectional area (m^2)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	14.8	19.4	9.2
Actual Gas Flow Volume (am^3/min)	2,794	1,228	523
Total Normal Gas Flow Volume (m^3/min)	1,755	729	278
Total Normal Gas Flow Volume (m^3/s)	29.26	12.15	4.64
Total Stack Pressure (kPa)	101.1	101.2	101.3
Moisture Content (% by volume)	5.0	5.4	4.5
Molecular Weight Dry Stack Gas (g/gmole)	30.1	29.8	30.1
Dry Gas Density (kg/m^3)	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	5288	5289	5290
SEMA Number	727833	727834	727835
Odour Concentration (As Received) (ou)	2,000	2,000	1,500
Odour Concentration (Final) (ou)	**2,000**	**2,000**	**1,500**
Normal MOER (As Received) (ou m^3/s)	58,500	24,000	7,100
Normal MOER (Final) (ou m^3/s)	58,500	24,000	7,100
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit
Sample Storage Period	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 15 & CO_2 SCRUBBER OUTLET

Emission Test Results	Velocity & Flow / Moisture	
Project Number	7052A (table amended)	
Project Name	Shoalhaven Starches	
Test Location	**EPA ID 44 Fermenter 15**	**EPA ID 16 CO_2 Scrubber outlet**
Date	20.02.2020	20.02.2020
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Sample Start Time (hrs)	12:43	8:52
Sample Stop Time (hrs)	12:43	9:13
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	30.3	28.9
Stack Cross-Sectional area (m^2)	0.071	0.196
Average Stack Gas Velocity (m/s)	1.7	8.5
Actual Gas Flow Volume (am^3/min)	7.3	100
Total Normal Gas Flow Volume (m^3/min)	6.3	87
Total Normal Gas Flow Volume (m^3/s)	0.106	1.453
Total Stack Pressure (kPa)	101.5	101.1
Moisture Content (% by volume)	3.7	3.5
Molecular Weight Dry Stack Gas (g/gmole)	29.6	31.2
Dry Gas Density (kg/m^3)	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5277	5278
SEMA Number	727823	727824
Odour Concentration (As Received) (ou)	5,200	8,700
Odour Concentration (Final) (ou)	**5,200**	**8,700**
Normal MOER (As Received) (ou m^3/s)	548	12,700
Normal MOER (Final) (ou m^3/s)	548	12,700
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample Storage Period	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-5 EMISSION TEST RESULTS – BIOFILTER INLETS

Emission Test Results	Velocity & Flow / Moisture	
Project Number	7052	
Project Name	Shoalhaven Starches	
Test Location	**EPA ID 39 Biofilter Inlet from DDG Dryers 1, 2 & 3**	**EPA ID 39 Biofilter Inlet from DDG Dryer# 4**
Date	27.02.2020	27.02.2020
	Dry	
Run	1	
Method	TM-1, TM-2 & TM-22	
Sample Start Time (hrs)	13:08	13:25
Sample Stop Time (hrs)	13:20	13:46
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	43.4	29.4
Stack Cross-Sectional area (m^2)	0.283	0.049
Average Stack Gas Velocity (m/s)	15.0	8.6
Actual Gas Flow Volume (am^3/min)	255	25
Total Normal Gas Flow Volume (m^3/min)	195	22
Total Normal Gas Flow Volume (m^3/s)	3.2	0.4
Total Stack Pressure (kPa)	96.6	101.6
Moisture Content (% by volume)	7.2	3.6
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8
Dry Gas Density (kg/m^3)	1.29	1.29
Oxygen (%)	20.9	20.9
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5297	5296
SEMA Number	727842	727841
Odour Concentration (As Received) (ou)	25,300	23,200
Odour Concentration (Final) (ou)	**25,300**	**23,200**
Normal MOER (As Received) (ou m^3/s)	82,000	8,500
Normal MOER (Final) (ou m^3/s)	82,000	8,500
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample Storage Period	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-6 EMISSION TEST RESULTS – BIOFILTER OUTLETS

Emission Test Results	Biofilter Exhaust Airflow and Odour Concentration			
Project Number	7052			
Project Name	Shoalhaven Starches			
Test Location	**EPA ID 40 Biofilter A East**	**EPA ID 40 Biofilter A West**	**EPA ID 41 Biofilter B East**	**EPA ID 41 Biofilter B West**
Date	27.02.2020	27.02.2020	27.02.2020	27.02.2020
Run	1			
Method	TM-2 & TM-22			
Sample & Flow Start Time (hrs)	14:14	14:41	14:07	14:47
Sample & Flow Stop Time (hrs)	14:33	15:03	14:40	15:10
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	39.9	39.6	40.5	38.0
Proportion of Inlet air flow	**0.25**	**0.25**	**0.25**	**0.25**
Analysis	**Odour**	**Odour**	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**	**AS4323.3**	**AS4323.3**
ORLA Number	5292	5293	5294	5295
SEMA Number	727837	727838	727839	727840
Odour Concentration (as received) (ou)	790	1,240	850	2,400
Odour Concentration (Final) (ou)	790	1,240	850	2,400
Normal MOER (as received) (ou m^3/s)	720	1,100	790	2,000
Normal MOER (Final) (ou m^3/s)	720	1,100	790	2,000
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:	
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	Ponds 1, 2, 3, 5 & 6, SO Basin Pond, Starch Dryers 1, 4 & 5, Gluten Dryers 1, 2, 3 & 4, Boiler 5&6, Boiler 4, Biofilter A east & west outlets, Biofilter B east & west outlets, Biofilter inlet, CO_2 Scrubber inlet & outlet, Fermenter. DDG Pellet Plant stack (not accessible this survey).
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7052/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5277 to 5304
	SEMA Sample number(s):	727823 to 727848
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	21 February 2020
	Order number:	5094
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	23 April 2020

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

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 ± 3°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.

23 April, 2020

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7052/ORLA/01

Sample				Analysis Date & Time	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone^ +
Location	ID No.	Date/Time	ORLA No.	(Completed)				(ou) 1*	(ou) 2*	
Sample ID: F15	727823	20/2/2020 09:06	5277	21/2/2020 10:20	4	8	Nil	5188	5188	Mild fruity yoghurt (non-acidic), wine, coconut oil, caramel liqueur, alcohol, sweet & vinegary, plastic, ink pad (-2)^
Sample ID: CO_2 outlet	727824	20/2/2020 09:03	5278	21/2/2020 10:48	4	8	Nil	8735	8735	Vinegar, coconut oil, alcohol, vanilla yoghurt (non-acidic), caramel liqueur, ink pad (-2)
Sample ID: CO_2 inlet	727825	20/2/2020 09:03	5279	21/2/2020 11:18	4	8	Nil	7392	7392	Fruit, bakery, winery, acidic orange yoghurt, caramel liqueur, alcohol, banana essence, vinegar, ink pad (-2)^
Sample ID: Starch Dryer 3	727826	20/2/2020 10:40	5280	21/2/2020 11:46	4	8	Nil	511	510	Acidic fruit yoghurt, wine, vinegar, coconut oil, sharp (-2)^
Sample ID: Starch Dryer 4	727827	20/2/2020 10:39	5281	21/2/2020 12:24	4	8	Nil	608	610	Smoke, acidic fruit yoghurt, wine, almond oil, sharp, bitter coffee (-2)^
Sample ID: Gluten Dryer 3	727828	20/2/2020 11:21	5282	21/2/2020 12:52	4	8	Nil	558	558	Wine, vinegar, smelly sandshoes, garbage, fruity yoghurt (non-acidic), earth, swampy, plastic (-2)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7052/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) 1 *	(ou) 2 *	
Sample ID: Gluten Dryer 2	727829	20/2/2020 12:08	5283	21/2/2020 14:07	4	8	Nil	606	606	Mangrove, mild swamp, wine, wet timber, plastic, yeast, coconut oil, mould (-2)^
Sample ID: Gluten Dryer 1	727830	20/2/2020 11:47	5284	21/2/2020 14:35	4	8	Nil	363	363	Hessian bags, wet timber, pesticide oil, plastic, yeast, cereal, grains (-2)^
Sample ID: Gluten Dryer 4	727831	20/2/2020 12:28	5285	21/2/2020 15:04	4	8	Nil	363	363	Grease, timber, pesticide oil, hessian, hard plastic, cereal (-2)^
Sample ID: Starch Dryer 5	727832	20/2/2020 13:30	5286	21/2/2020 15:32	4	8	Nil	430	430	Mangrove, mild swamp, wine, fruit, sour milk, cereal, plastic (-2)^
Sample ID: Boiler 5&6	727833	27/2/2020 10:17	5288	28/2/2020 10:10	4	8	Nil	2001	2001	Lime, acid, citrus, household gas, woody, tobacco, earthy, plastic, paint, smoky, smoke machine, vinegar (-2)^
Sample ID: Boiler 4	727834	27/2/2020 10:54	5289	28/2/2020 10:38	4	8	Nil	1995	1995	Acid, nutty, potato, household gas, hard plastic, smoke machine, vinegar (-2)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7052/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) 1 *	(ou) 2 *	
Sample ID: Boiler 2	727835	27/2/2020 11:27	5290	28/2/2020 11:07	4	8	Nil	1540	1540	Chlorine, cooked onion, acid, gas & slight acetylene gas, plastic, smoke machine, tobacco, earth, vinegar, sharp (-2)^
Sample ID: Starch Dryer 1	727836	27/2/2020 12:10	5291	28/2/2020 11:37	4	8	Nil	116	116	Hessian, old mushrooms, wheat, mould, cereal, grain, sharp, methylated spirits, oil/grease (-2)^
Sample ID: Biofilter A East outlet	727837	27/2/2020 14:23	5292	28/2/2020 12:06	4	8	Nil	785	785	Shoe polish, fresh garbage, vomit, old food, chocolate, burnt rubber, bitter, garbage (-2)^
Sample ID: Biofilter A West outlet	727838	27/2/2020 14:52	5293	28/2/2020 12:35	4	8	X6	1239	1239	Smelly sandshoes, garbage, decay, sour milk, chocolate, cocoa powder, sickly sweet, very strong bitter coffee, dirty, burnt, bitter (-2)^
Sample ID: Biofilter B East outlet	727839	27/2/2020 14:30	5294	28/2/2020 13:04	4	8	Nil	854	854	Garbage, boiled cooked vegetables, smelly sandshoes, burnt rubber, cocoa powder (not sweet), dirt-road works, burnt paper or garbage, bitter (-2)^
Sample ID: Biofilter B West outlet	727840	27/2/2020 15:00	5295	28/2/2020 13:32	4	8	Nil	2378	2378	Garbage, boiled cooked vegetables, smelly sandshoes, cocoa powder, bitter, dirt, burnt plastic/oil (-2)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7052/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) 1 *	(ou) 2 *	
Sample ID: Biofilter inlet- DDG	727841	27/3/2020 13:36	5296	28/2/2020 14:01	4	8	Nil	23241	23241	Caramel, alcohol, coffee, grain, dirt, hops or cereal, rubbery, grease, burning engine oil, marmite (-2)^
Sample ID: Biofilter inlet DDG 1,2 & 3	727842	27/2/2020 13:10	5297	28/2/2020 14:01	4	8	Nil	25264	25264	Sawdust, caramel, alcohol, coffee, grain, hops or cereal, earth, dirt, burnt toast, grease, vegemite, marmite, pest control oil (-2)^
Sample ID: Pond 1	727843	2/3/2020 11:01	5299	3/3/2020 10:20	4	8	Nil	558	558	Musty, peat-like, swampy, yeast, wood, mild vegemite, bonox (-1)^
Sample ID: Pond 2	727844	2/3/2020 11:42	5300	3/3/2020 10:48	4	8	Nil	511	511	Earthy, musty, musty cardboard, wood smoke, grain, compost, swamp (-1)^
Sample ID: Pond 3	727845	2/3/2020 12:35	5301	3/3/2020 11:17	4	8	Nil	511	511	Decay, yeasty, earthy, musty, swamp, grass, stale water (-2)^
Sample ID: Pond 5	727846	2/3/2020 11:42	5302	3/3/2020 11:46	4	8	Nil	333	333	Sewer, mould, swamp, musty, floral, sweet, hessian, grain, earthy (-1)^
Sample ID: Pond 6	727847	2/3/2020 11:42	5303	3/3/2020 13:15	4	8	Nil	82	82	Mould, organic, swamp, musty, earth, grease, varnish, compost, grass, oil (0)^
Sample ID: SO Basin	727848	2/3/2020 11:42	5304	3/3/2020 13:44	4	8	Nil	245	245	Burnt paper or wood, woody, bonox, vegemite, peat-like, furniture cleaner, swampy, fermented organic matter, tannic acid (-1)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7052/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5276	21/02/2020	62.0	1622	38.2	Yes
n-butanol	5287	28/02/2020	62.0	1419	43.7	Yes
n-butanol	5298	03/03/2020	62.0	1419	43.7	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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.

Panellist Rolling Average:

21/02/2020: SR =50.1, PR = 50.2, TL = 43.9, PRA = 41.9

28/02/2020: SR = 47.9, PR = 52.4, TL = 41.9, PRA = 41.9, JW = 60.5

03/03/2020: PR = 52.4, TL = 41.9, PRA = 40.9, JW = 58.4

^ 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 panellist responses at the recognition threshold.

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

--END OF TEST REPORT--

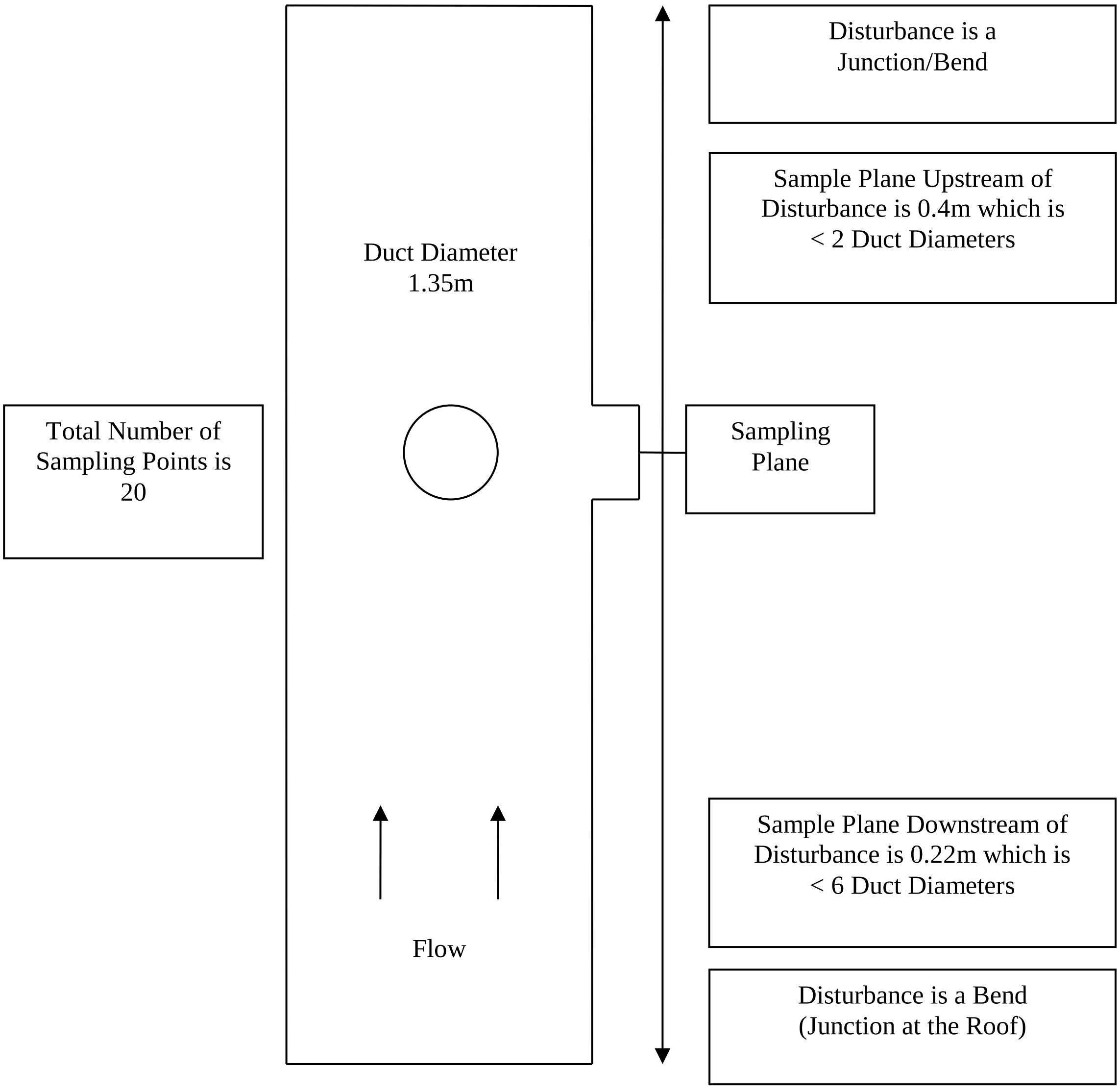
APPENDIX C – DETAILS OF INSTRUMENT CALIBRATION

TABLE C-1 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
769	Thermocouple	02-Dec-19	02-Jun-20
768	Thermocouple	02-Dec-19	02-Jun-20
885	Digital Manometer	06-Dec-19	06-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
893	Thermocouple	02-Dec-19	02-Jun-20
726	Pitot	23-Jul-19	23-Jul-2020 Visually inspected On-Site before use
183	Pitot	17-Apr-19	17-Apr-2020 Visually inspected On-Site before use
946	combustion analyzer	09-Dec-19	09-Jun-20
675	Personal Sampler	09-Apr-19	09-Apr-20
832	Personal Sampler	26-Feb-20	26-Feb-21
934	Personal Sampler	26-Aug-19	26-Aug-20
753	Personal Sampler	09-Apr-19	09-Apr-20
907	Gas Meter	06-Jun-19	06-Jun-20
Gas Mixtures used for Analyser Span Response			
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



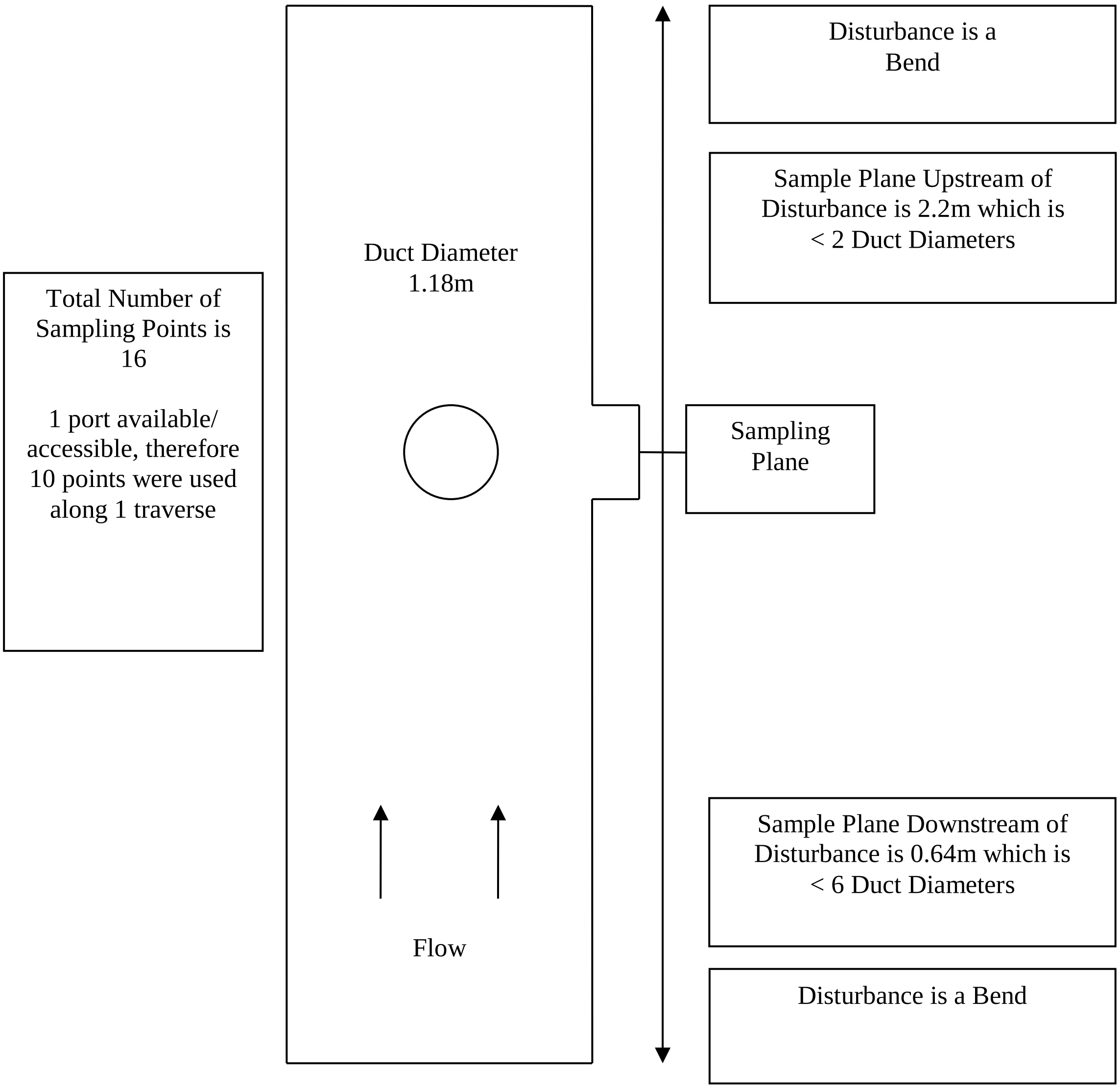
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



Gluten Dryer 2 monitoring point has been quarantined by roof re-alignment. Access is now prohibited to exhaust duct. Sampling point at exit only suitable for odour and temperature and not flow and velocity

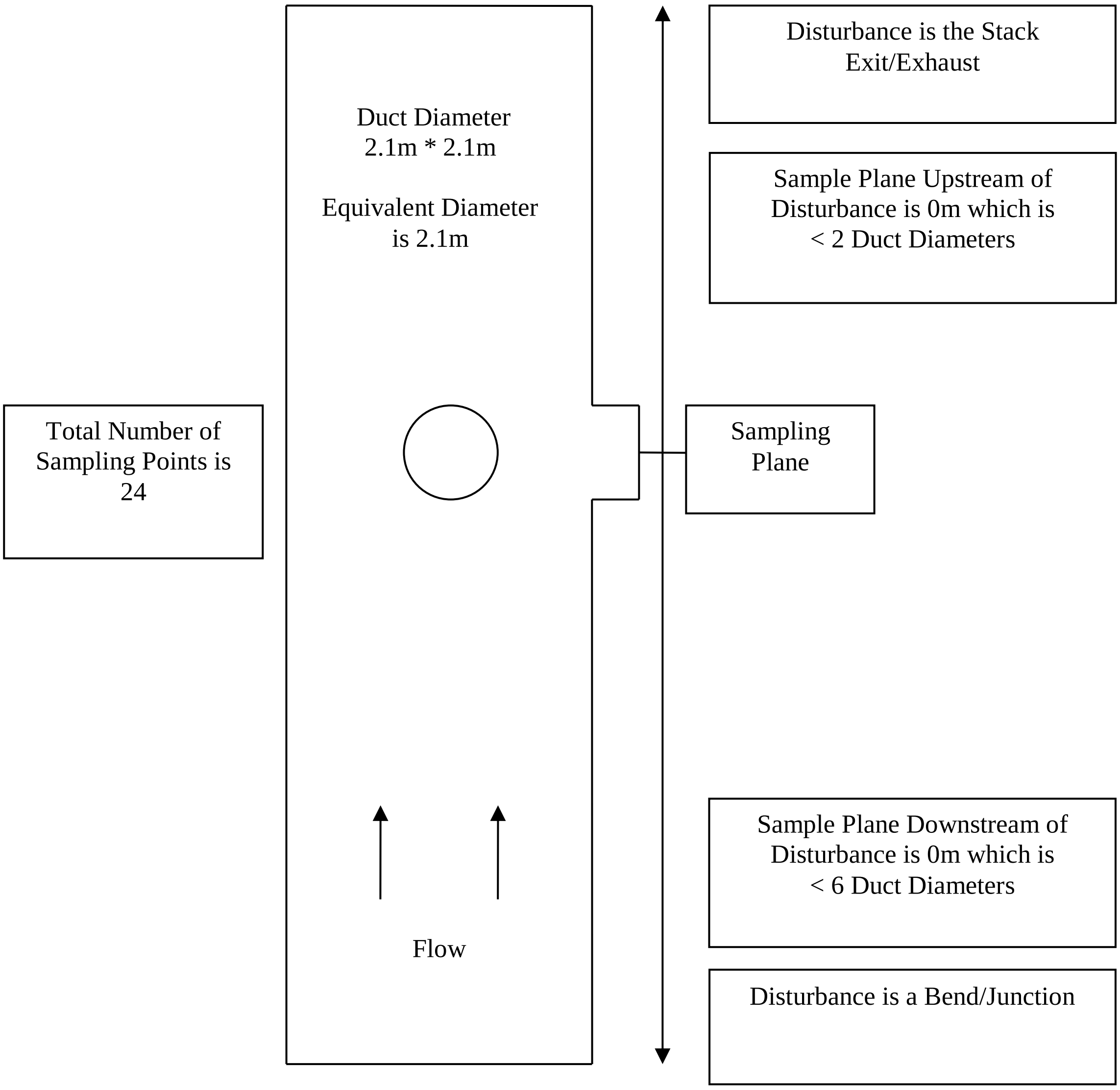
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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-4 GLUTEN DRYER NO. 2 – SAMPLE LOCATION

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



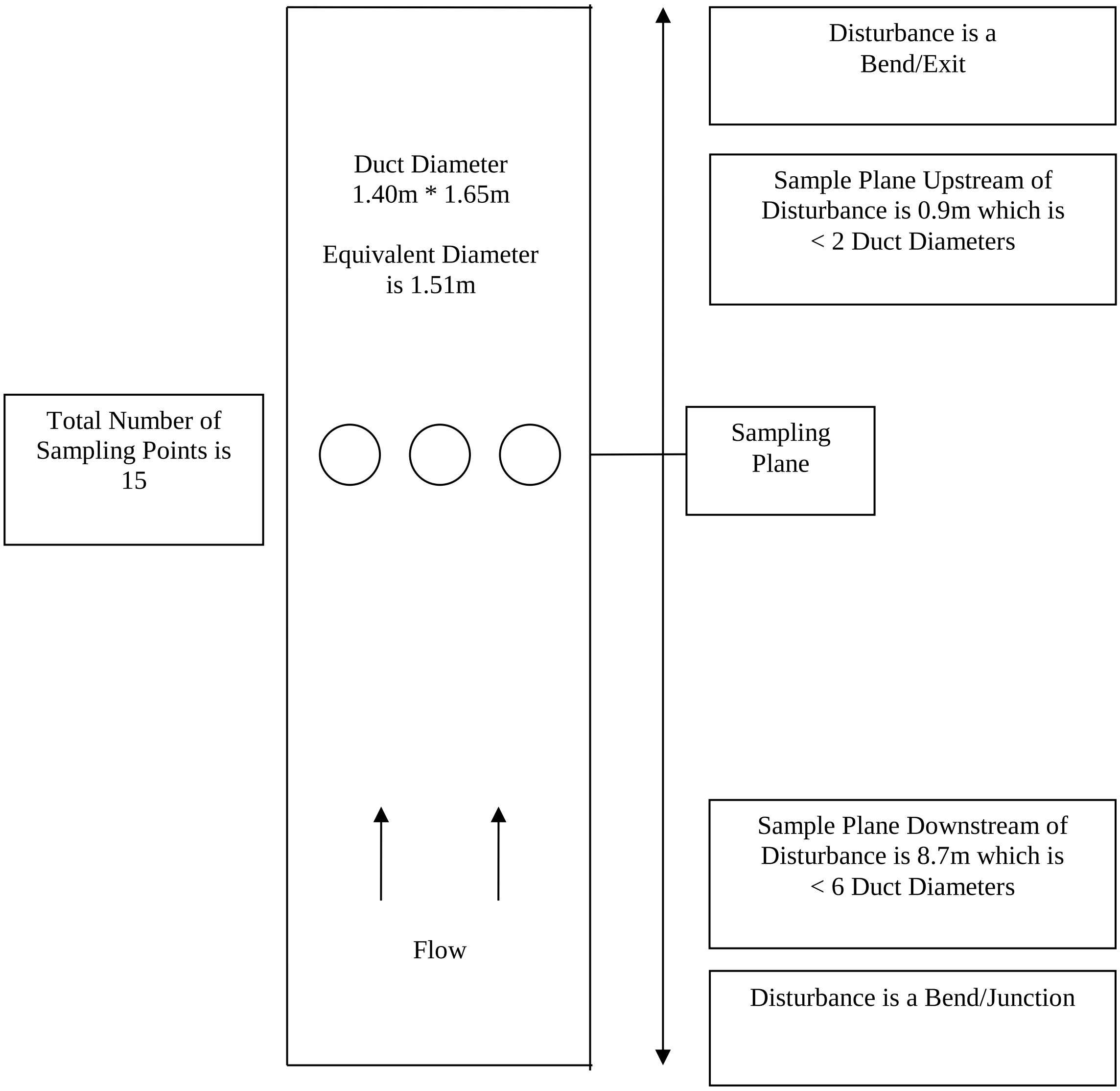
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



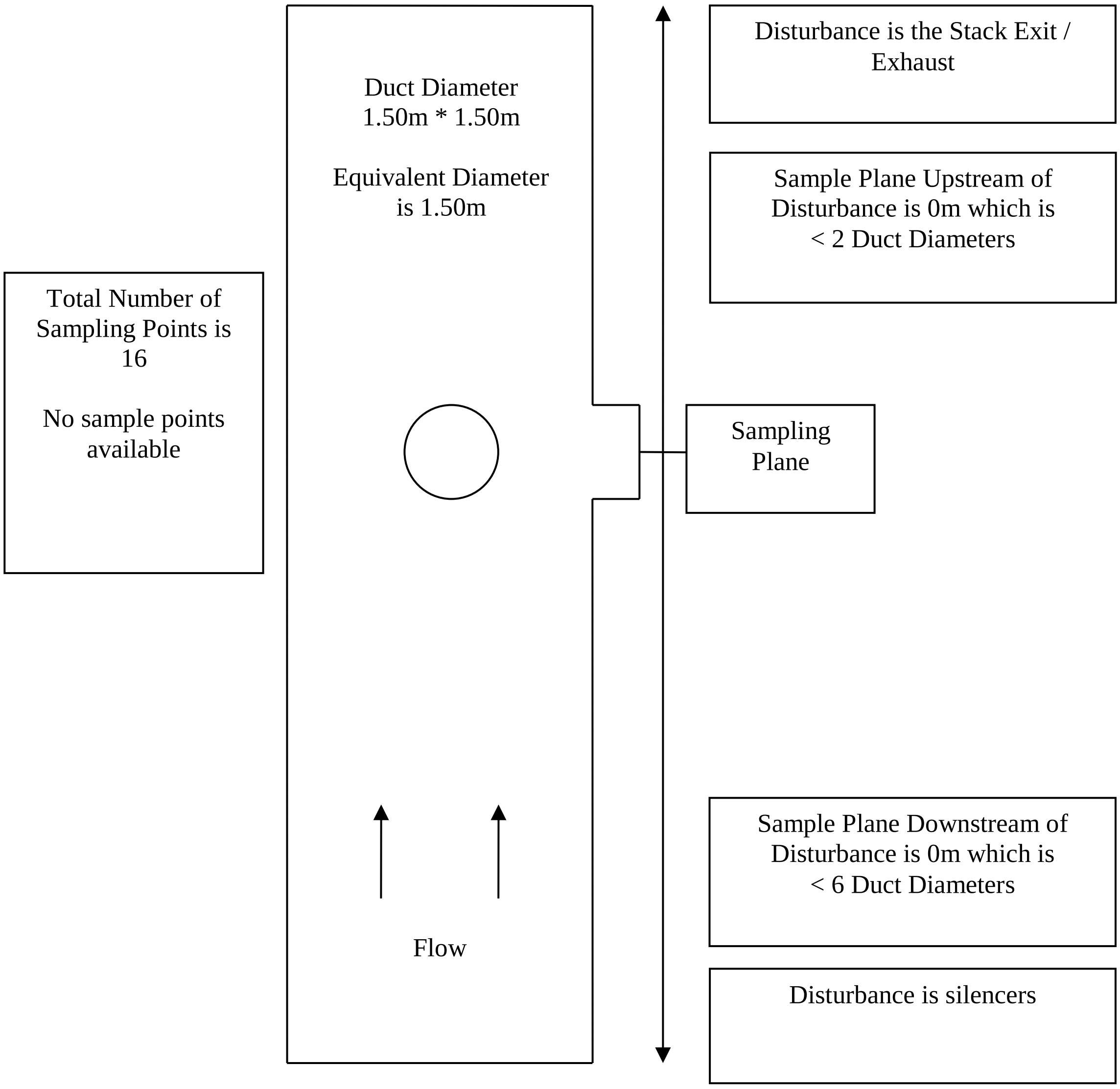
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

However the sample plane does meet the minimum sampling plane position; sampling plane position will be found to exit 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 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-10 STARCH DRYER NO. 1 – SAMPLE LOCATION

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

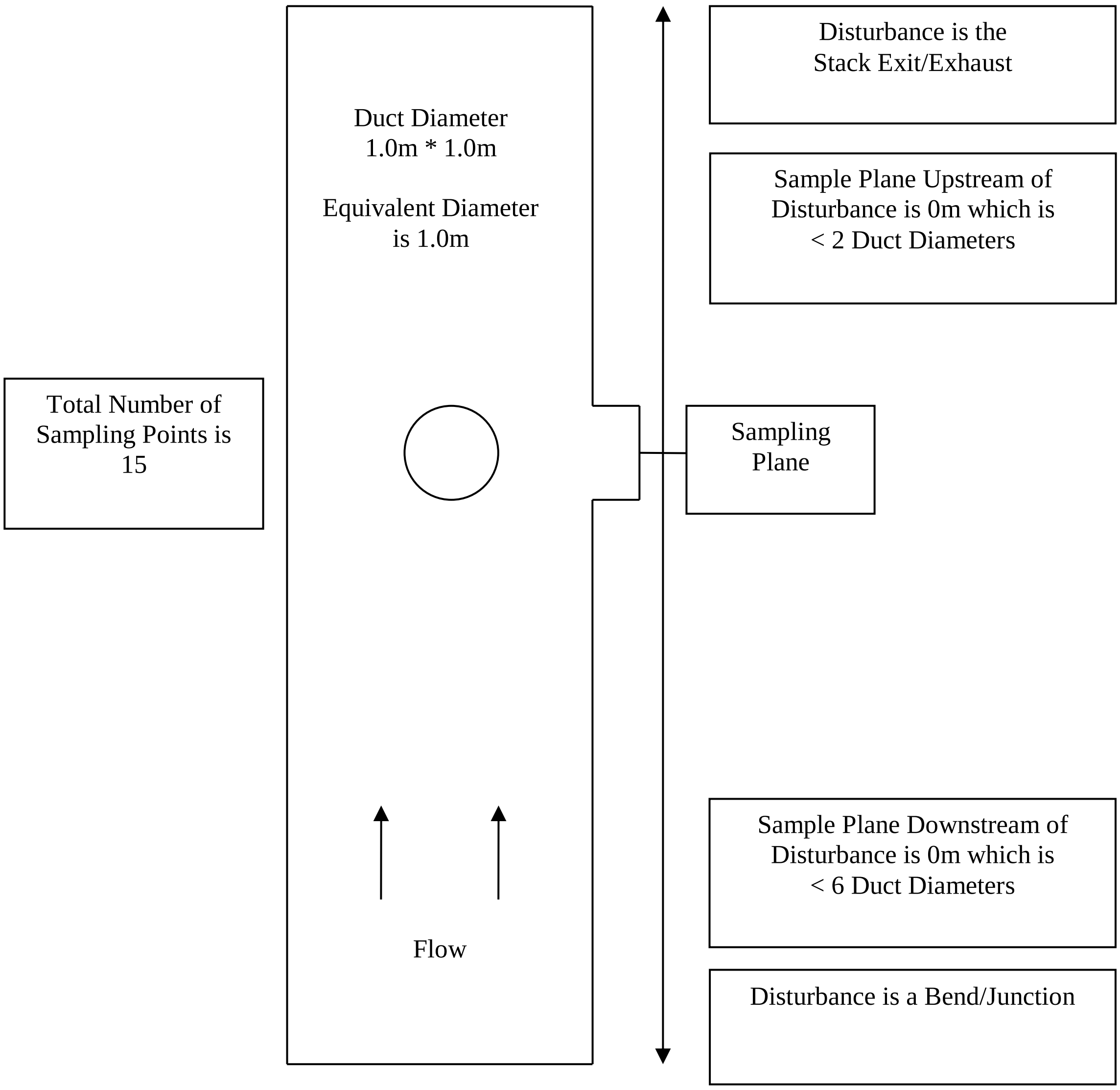
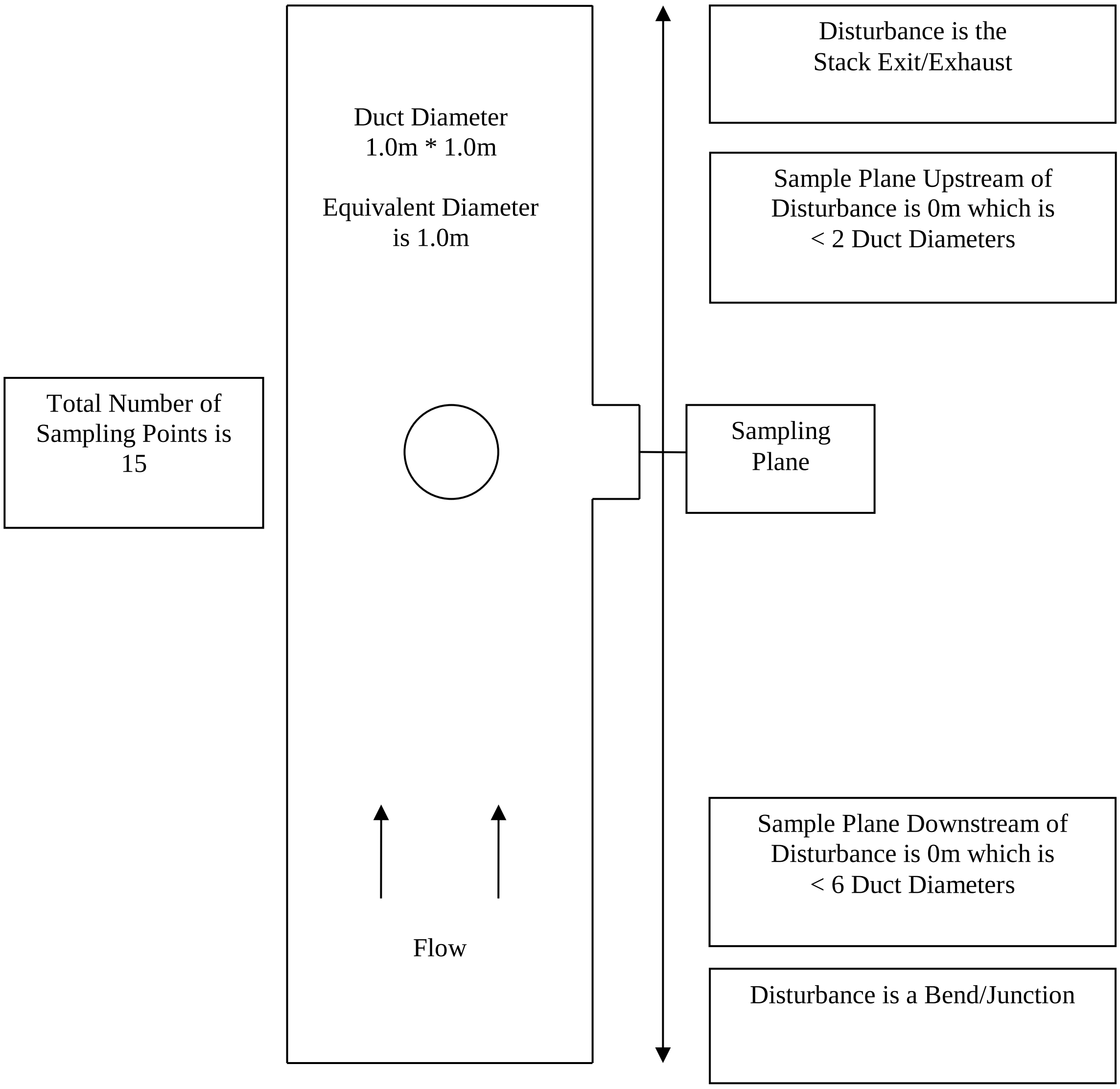


FIGURE D- 12 STARCH DRYER NO. 3 – SAMPLE LOCATION

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



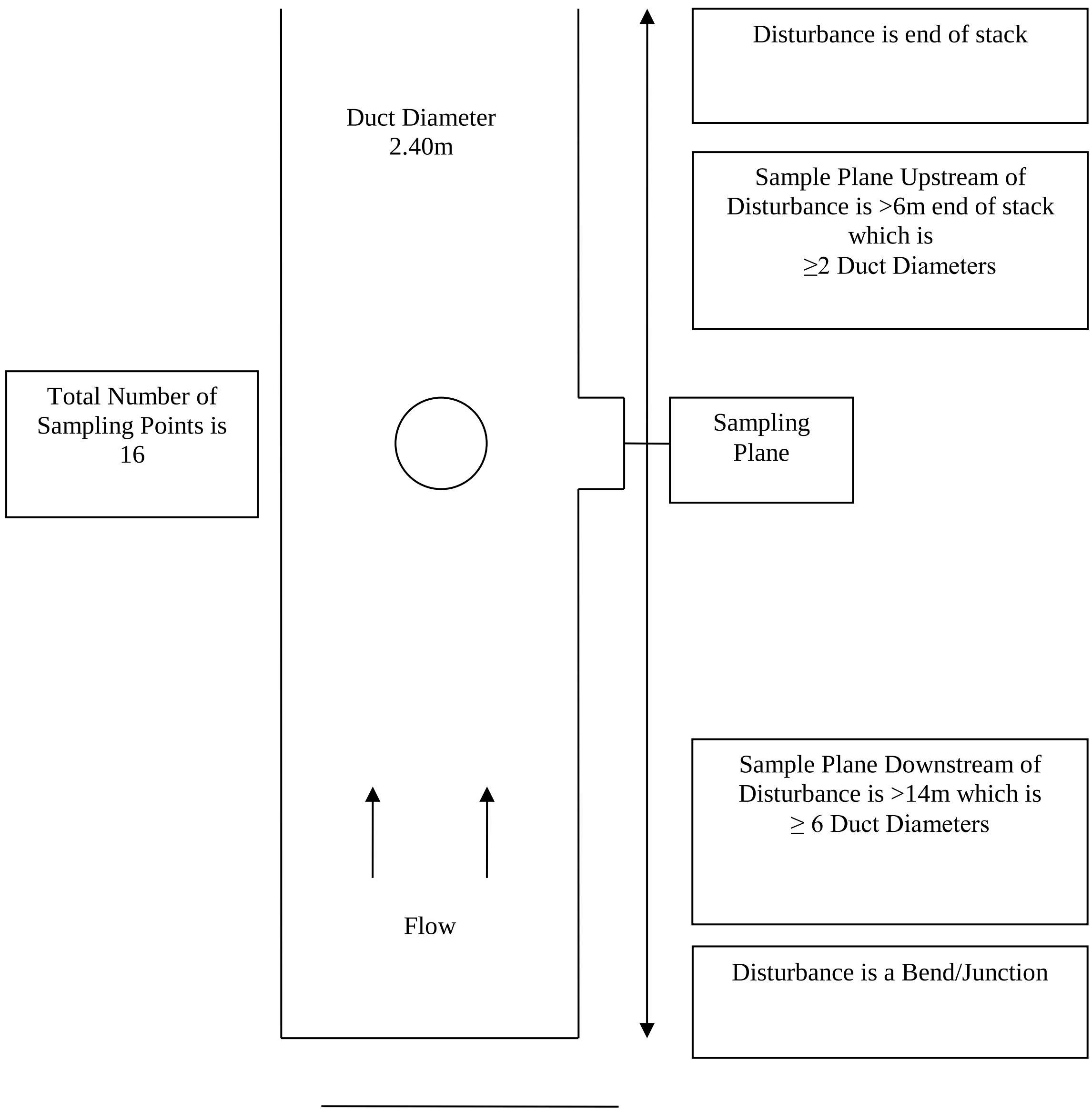
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

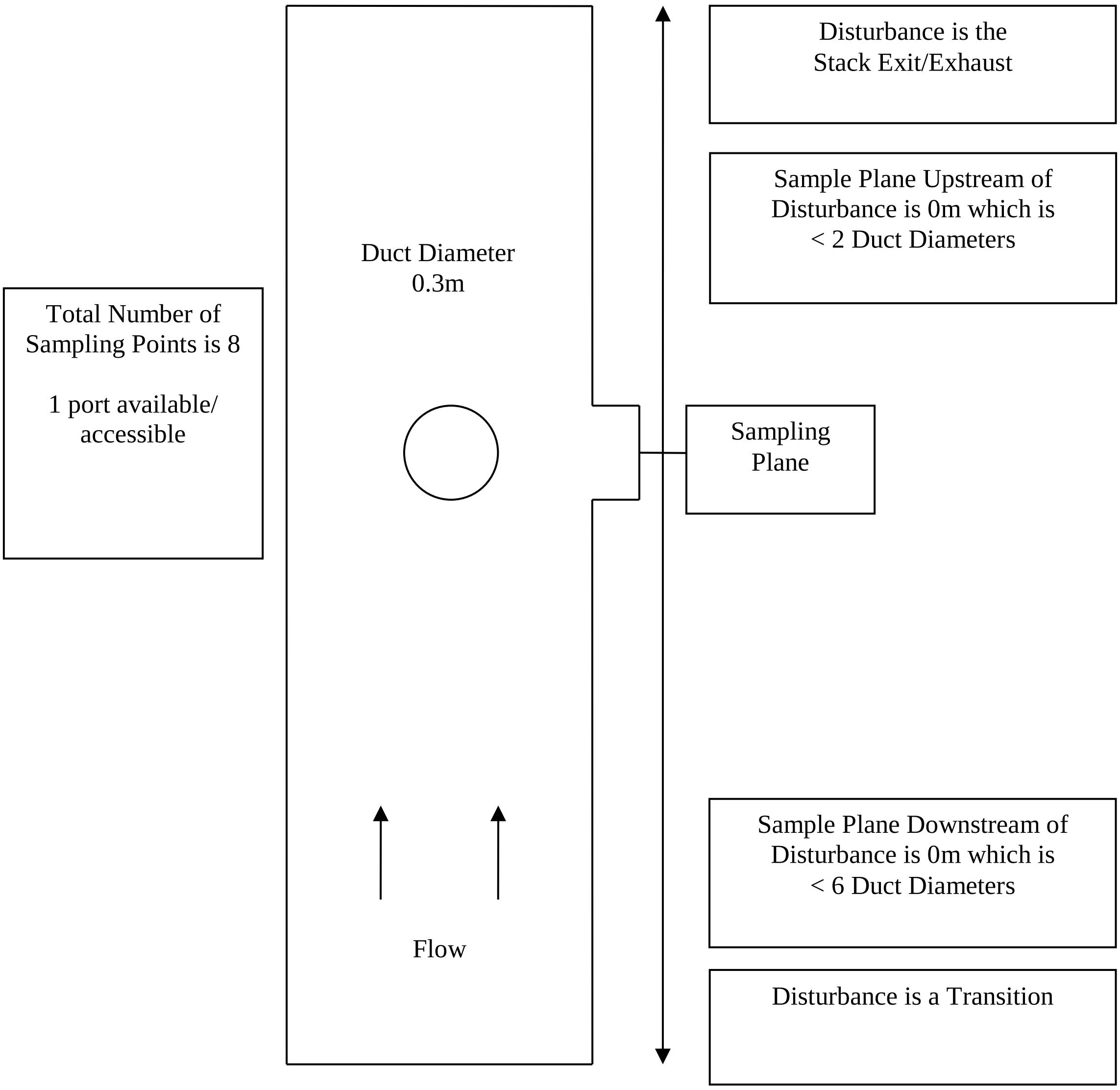


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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



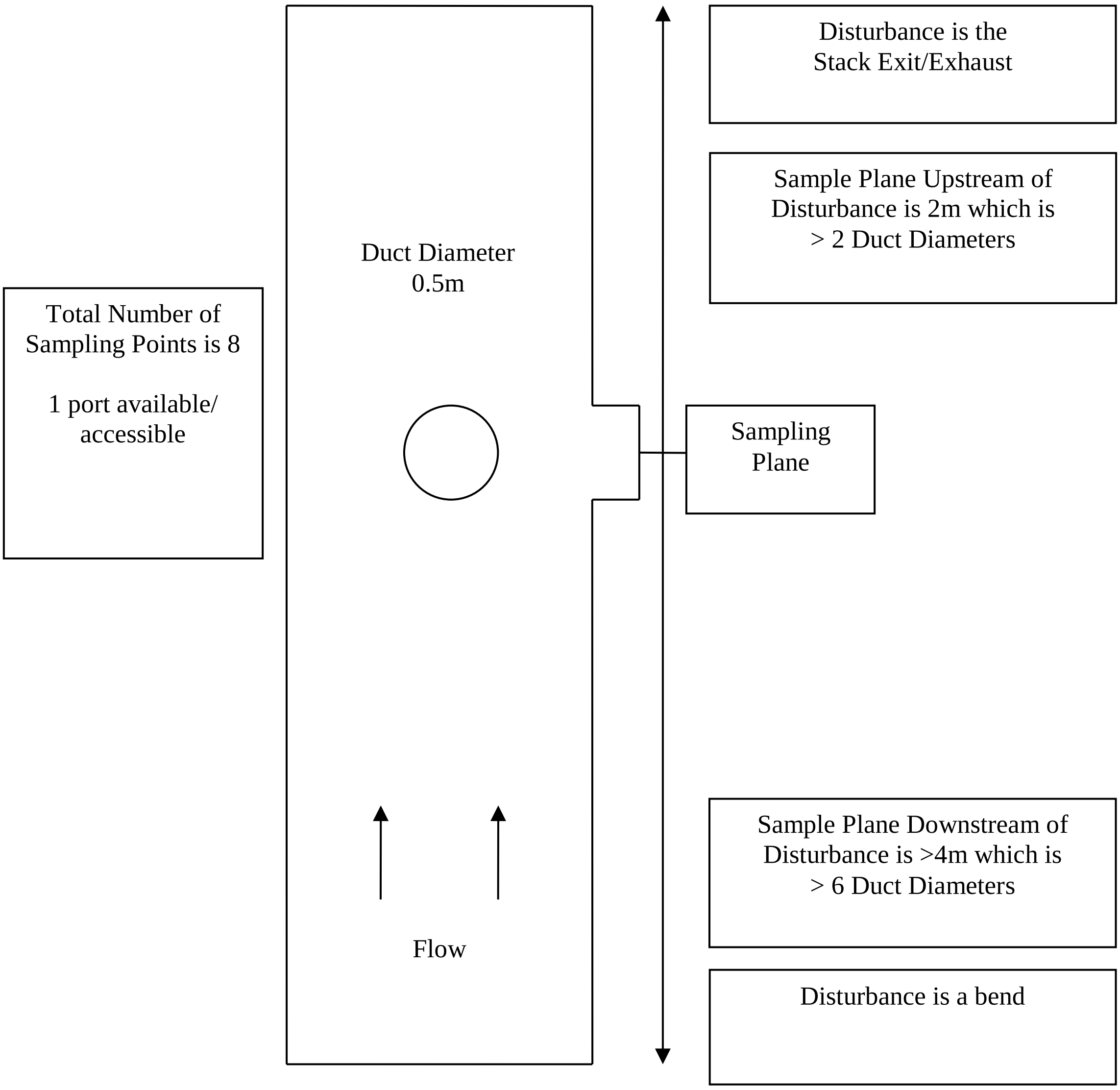
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

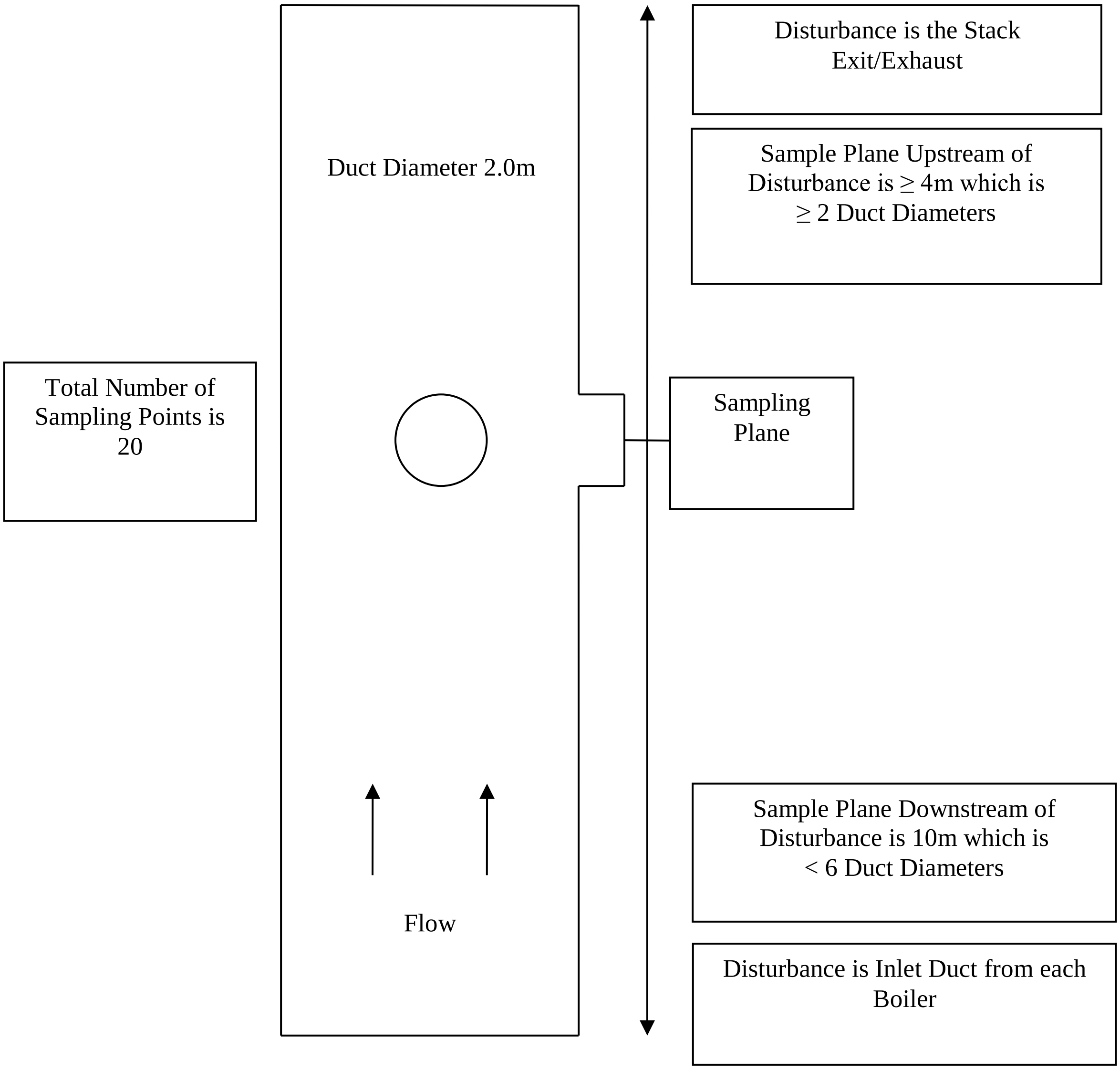
FIGURE D-19 CO_2 SCRUBBER OUTLET – SAMPLE LOCATION SCHEMATIC



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



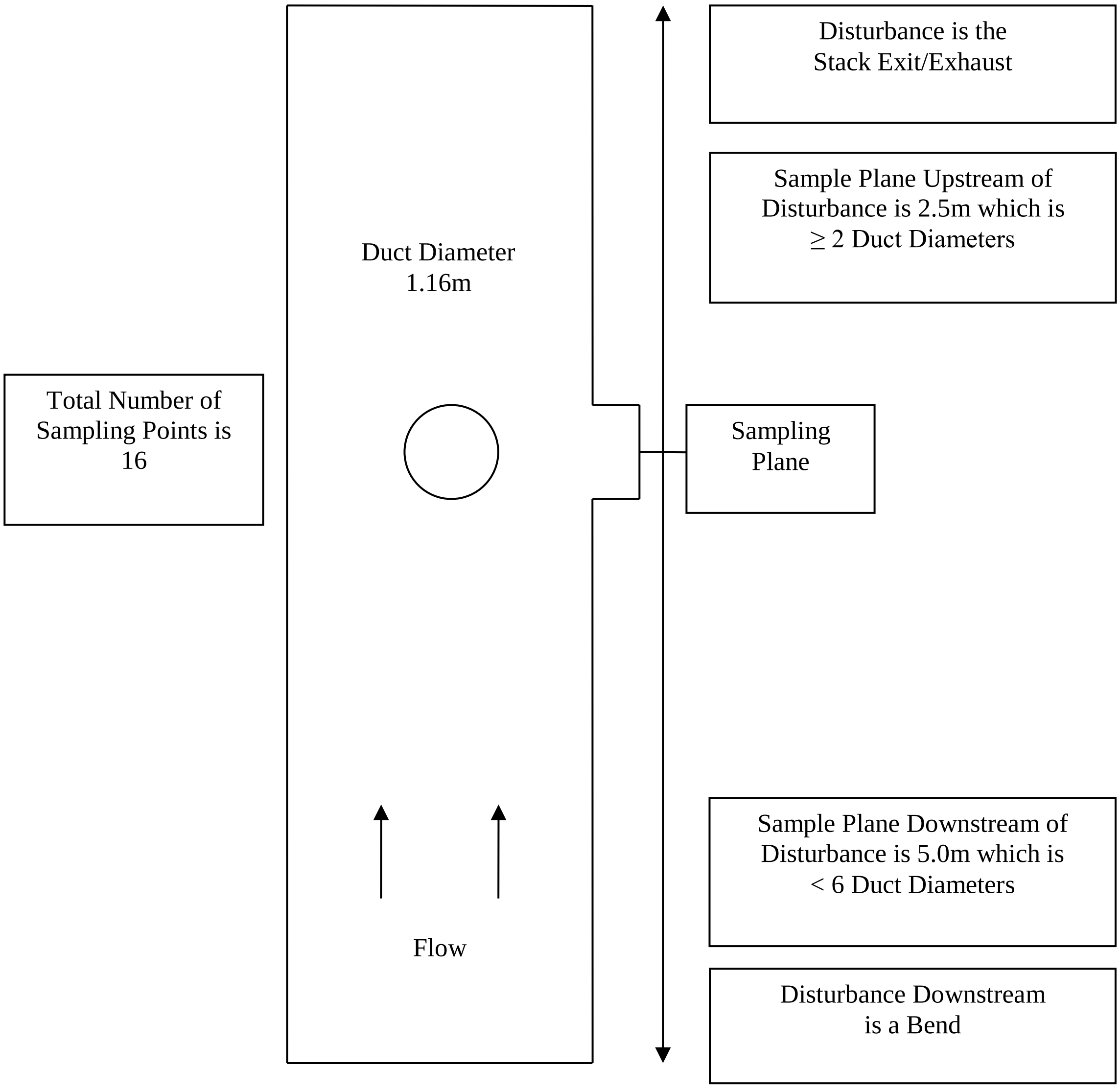
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



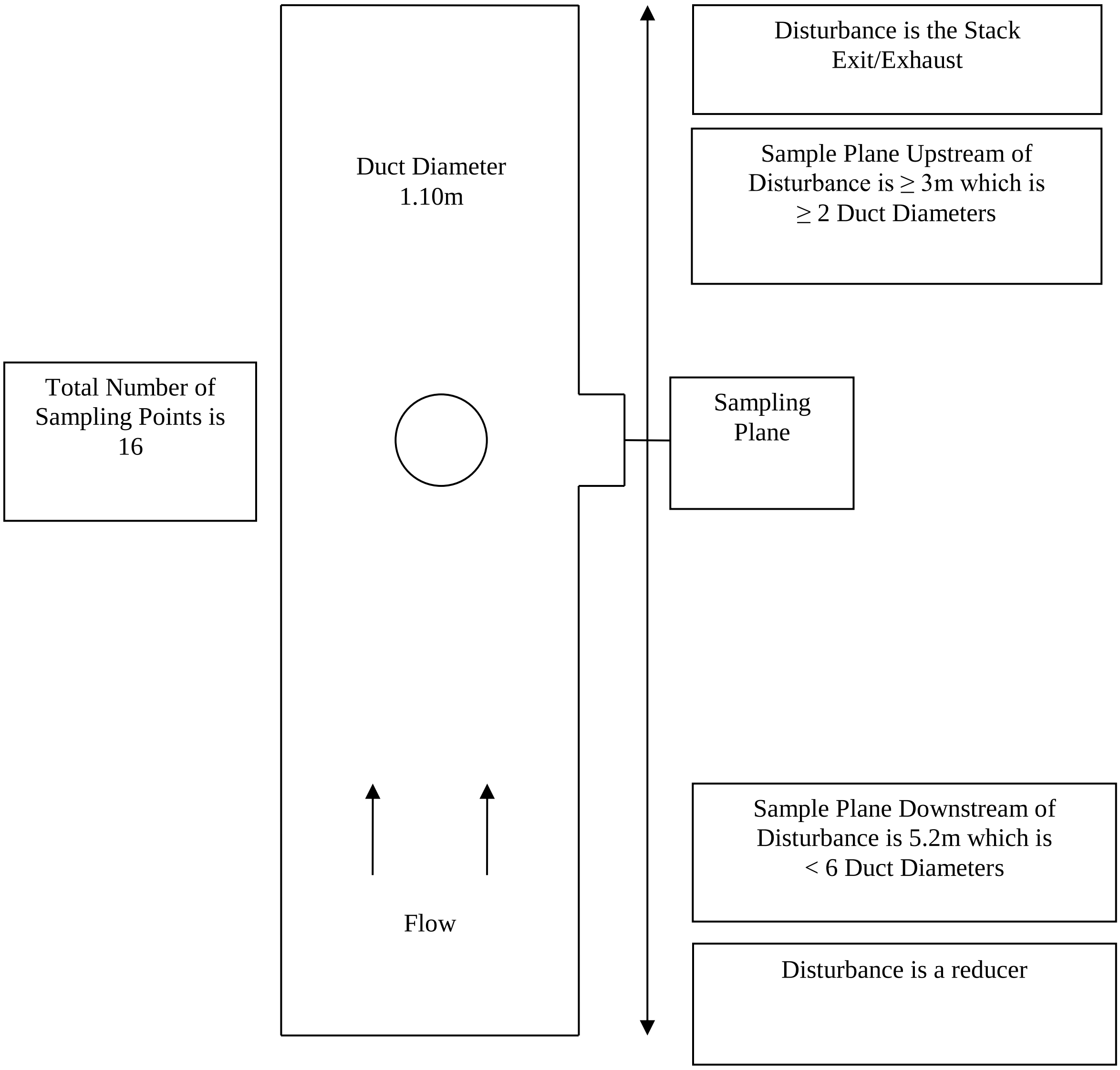
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

The sample plane however does meet the minimum sampling plane conditions; sampling plane conditions will be found to exit 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

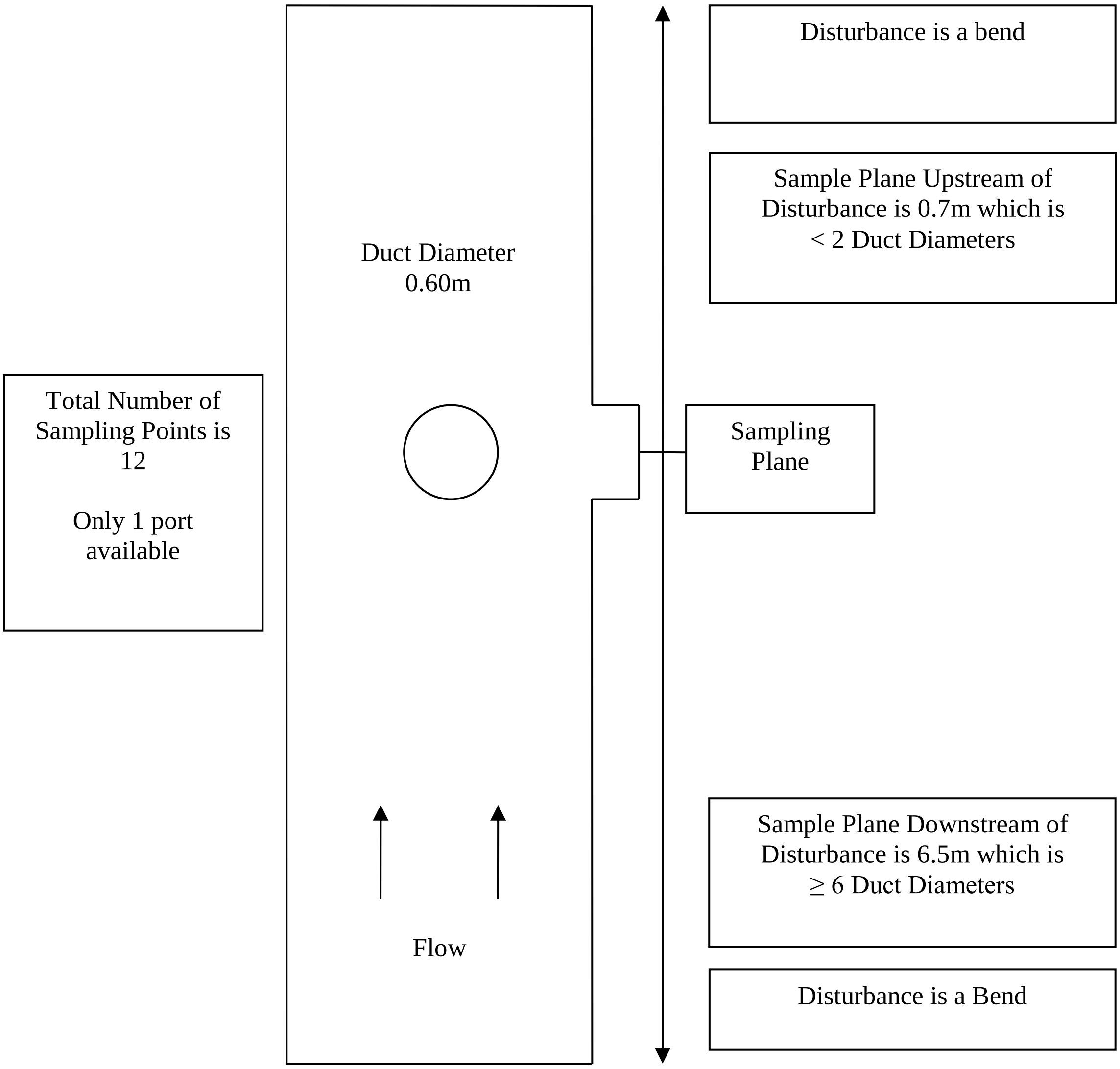


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as 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 exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

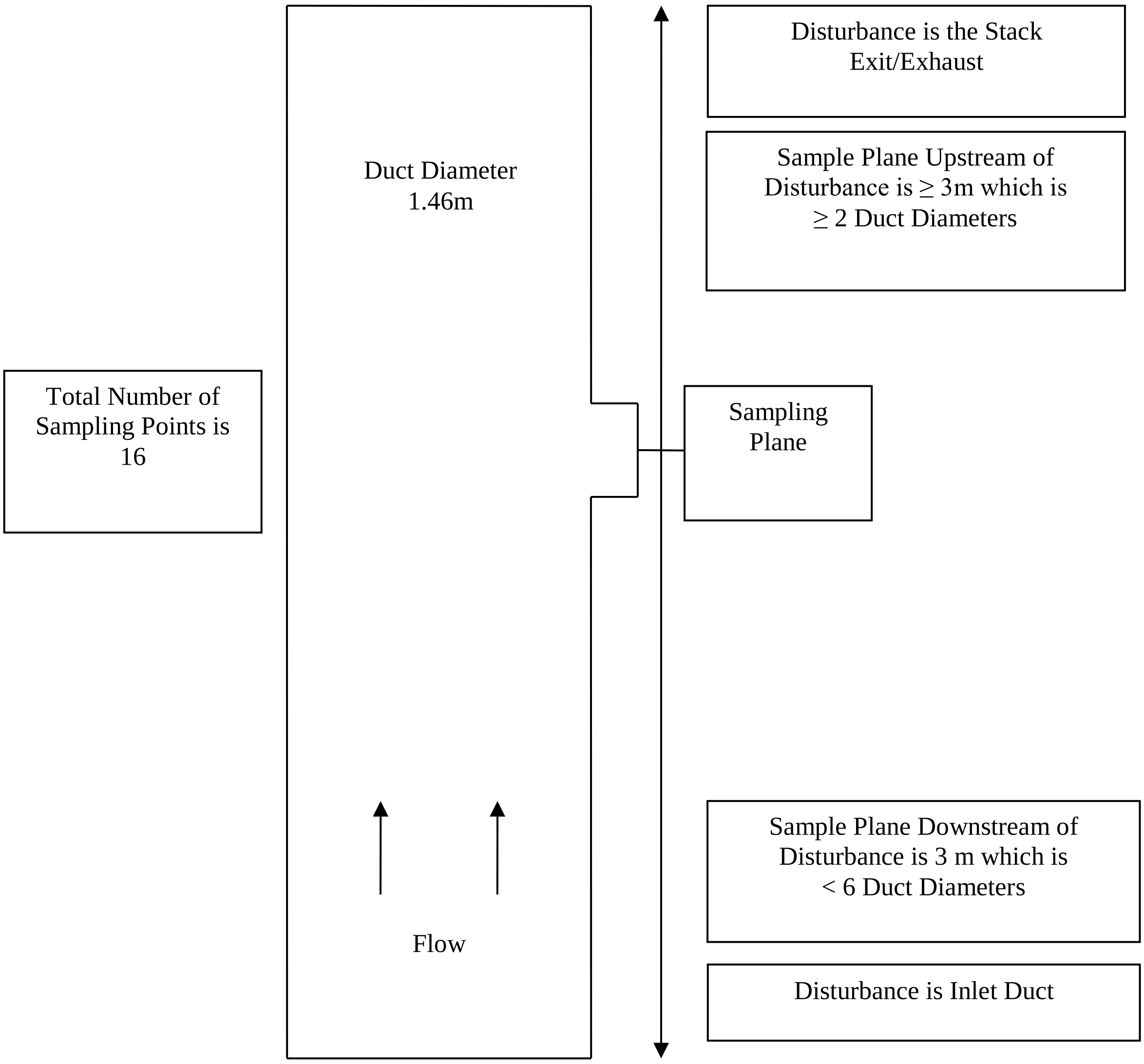
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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 – 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

Manildra Group

Manildra Modification 19 Air Quality Assessment

August 2020

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Introduction

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 19). 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 and 17 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)

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	• Reducing the number of approved DDGS Dryers from six to four. • A minor modification to the footprint of the four DDG dryers. • Relocation of the cooling towers in the DDG Plant. • A Mill Feed Silo and structure to feed DDG dryers. • Expanded use of the existing coal and woodchip storage area within the SS Environmental farm. • The addition of two biofilters to cope with the increased number of DDG Dryers. • A forklift maintenance building adjacent to the relocated DDG dryers, along with a container preparation area adjacent to the relocated DDG Dryers.
Modification 12	Modifications to the existing Ethanol Distillery Plant to: • 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 • modify the type and location of the Water Balance Recovery Evaporator that has been previously approved under MOD 2 adjacent to the Ethanol Plant.
Modification 13	• Modification of boilers 2 and 4, with the conversion of boiler 4 from gas fired to coal fired. • Installation of an additional baghouse on boiler 6.
Modification 14	• Modifications to the former paper mill site.
Modification 15	• Construction of the SupaGas CO2 plant at the former Dairy Farmers factory site.
Modification 16	Modification 16 comprised of the following: • Installation of a third flour mill C within the existing flour mill B building • Undertaking modifications to flour mills A and B • The construction of a new industrial building adjoining the Starch Dryer No. 5 building containing:

Modification	Summary of changes
	• The new product dryer • Plant and equipment associated with the processing of specialised speciality products. • Addition to Starch Dryer No 5 building to house a bag house for this dryer • Conversion of two existing gluten dryers (1 and 2) to starch dryers • Additional sifter for the interim packing plant • 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) • 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 • Relocation of the existing boiler No. 7 to the northern side of the overall boiler house complex • Construction of an indoor electrical substation on the northern side of Bolong Road • Construction of an additional rail intake pit for the unloading of rail wagons • Extension of the existing electrical substation located within the main factory area.
Modification 17/18	Modification 17 comprised of the following: • 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. • Use of sawmilling residue (woodchips) for boiler fuel by blending woodchip with coal in Boilers 2 & 4 • Installation of a new product dryer (No. 9) within the footprint of the speciality products building as approved under Mod 16. • 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 • 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 • Amendment to design specifications for silencers to exhaust fans for Flour Mill B • Extension of the approved footprint for the product dryer building. The building will need to be wider than the one that has been approved

Modification	Summary of changes
	• Installation of a wet end processing plant within the product dryer building • Extension of speciality products building to the north to provide bulk chemical storage to the south of the product dryer building • Demolition of existing stores and maintenance offices building • Repurposing the existing maintenance building • Changes to car parking arrangements.

1.3 Current proposal: Modification 19

Manildra continue to explore alternative markets for products used in the manufacture of ethanol. In line with this, modifications are proposed to the existing Ethanol Distillery Plant to increase the production of ‘beverage’ grade ethanol on site. The modification will enable increased flexibility in terms of the range of types of ethanol produced at the site to meet market demands.

The modification proposal will enable an increase in production of up to 100 ML of beverage grade ethanol per annum. The proposal will not however involve an increase in the overall ethanol production at the site above the current approved 300 ML per year. With current capacity of 110 ML of beverage grade ethanol, the proposal will allow production of up to 210 ML of ‘beverage’ grade ethanol per annum to meet increased market demand for these higher quality ethanol products. There will be no increase in the overall ethanol production above the current approved 300 ML per annum.

To increase the proportion of beverage grade ethanol production on site, Shoalhaven Starches propose to undertake the following modifications (Mod 19):

- 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.
- An additional three (3) ethanol storage tanks within the existing ethanol storage tank area.
- 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.
- 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.
- 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.

- The construction of an additional ethanol loadout immediately adjacent to and to the north of the existing loadout facility.
- Installation of additional cooling towers within the eastern part of the site
- The construction of a cable stay pipe bridge across Abernethy's Creek to supply power and product to these buildings.
- The relocation of the extension of the existing electrical substation located on the eastern side of Abernethy's Creek
- 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

The relocation of the existing ethanol distillery control room from its current position adjacent the existing ethanol plant, to the old fire pump station building which is located adjacent to the Bolong Road frontage of the site. This use was originally approved as part of Mod 15.

The changes are shown in Figure 1.

This Air Quality Impact Assessment addresses those components of Mod 19 that have potential air quality impacts, namely the installation of distillation columns and associated processing equipment immediately to the west of the existing Ethanol Distillery Plant and the construction of three (3) product silos above the existing interim packing plant.

1.4 Scope

The proposed changes (Mod 19) 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 non-odorous 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). 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 19 model setup
- Presents the results of odour dispersion modelling for the proposed (Mod 19) scenario using CALPUFF
- Characterises non-odour sources at the plant
- Presents the results of air quality dispersion modelling for the proposed (Mod 19) 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 Manildra Group and may only be used and relied on by Manildra Group for the purpose agreed between GHD and the Manildra Group as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Manildra Group 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.

GHD has not been involved in the preparation of the planning submission and has had no contribution to, or review of the submission. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the submission.

The opinions, conclusions and any recommendations in this report are based on explicit assumptions made by GHD, described in section 1.5 and throughout the body of this document, and limitations of the modelling software CALPUFF. GHD disclaims liability arising from any of the assumptions being incorrect. GHD has prepared this report on the basis of information provided by Manildra Group and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

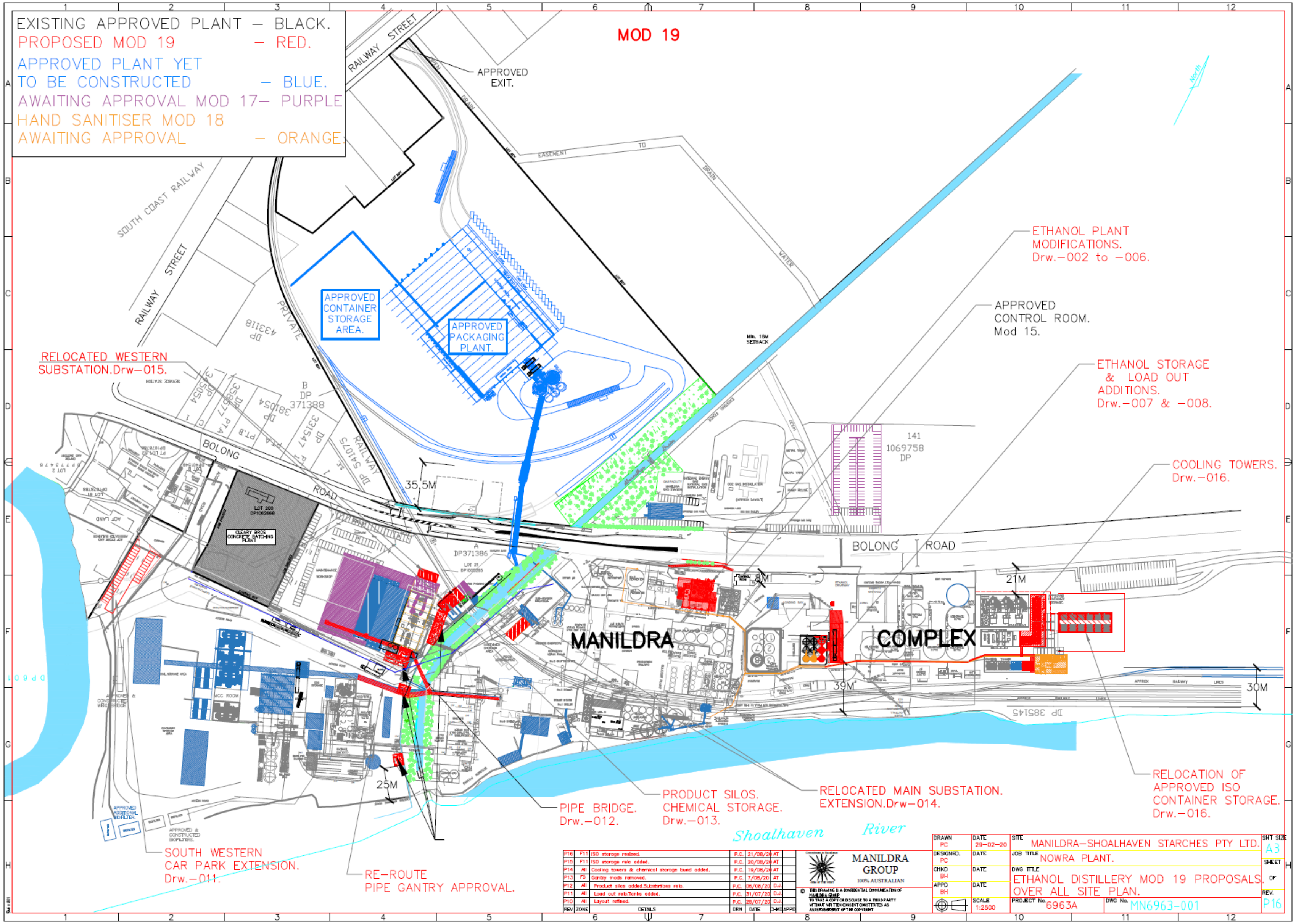


Figure 1 Proposed modification 19 changes (Source: Manildra)

2. Site location and context

2.1 Site description

Figure 2 shows the location and layout 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.

2.1.1 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 3.

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 A4

0 15 30 60 90 120

Metres

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

N

LEGEND

- Identified sensitive receptors
- Shoalhaven Starches Factory
- Packing plant (proposed)

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-27188
Revision	A
Date	12 Dec 2018

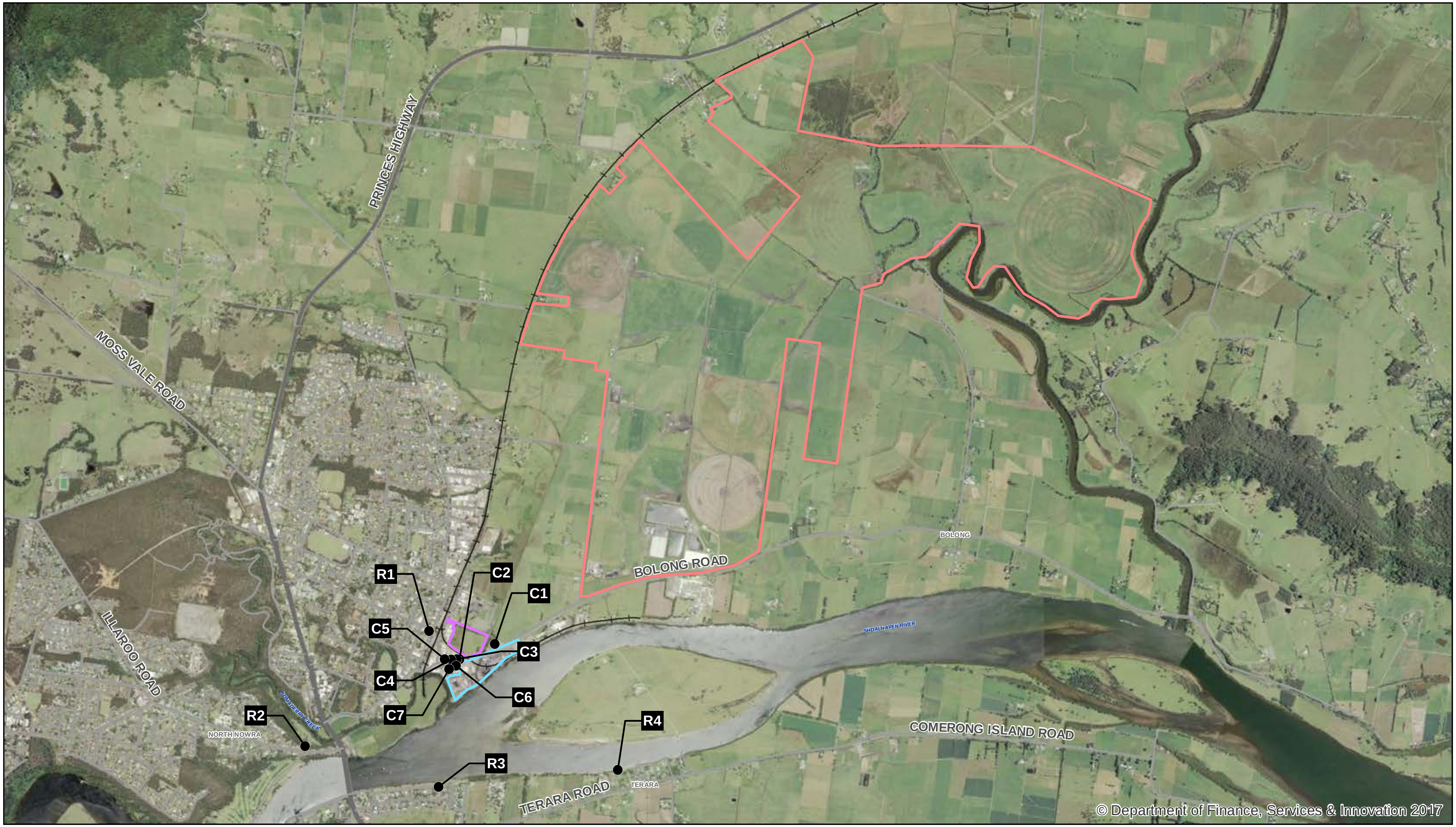
Site location and layout

Figure 2

G:\21\27188\GIS\Maps\Deliverables\21_27188_SiteLocation.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:afoddy



Paper Size A4

0 140 280 560 840 1,120

Metres

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

N

LEGEND

- Identified sensitive receptors
- Shoalhaven Starches Factory
- Packing plant (proposed)
- Environmental farm boundary

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-27188
Revision	A
Date	12 Dec 2018

Site context

Figure 3

G:\21\27188\GIS\Maps\Deliverables\21_27188_SiteContext.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia **T** 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com **W** www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:afoddy

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 4 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 4). 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^2, 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 4). 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 odour level of the matrix is typically in the range of 250 to 500 OU, and it is this ‘background’ level that limits the efficiency of a soil-bed biofilter.

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 and 17

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).

3.11.2 Mod 19

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.

Paper Size A4

0 5 10 20 30 40

Metres

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

N

LEGEND

- Odour sources
- Shoalhaven Starches Factory
- Packing plant (proposed)
- Environmental farm boundary
- Boiler house
- DDG Plant
- Ethanol recovery and storage area
- Fermenters
- Flour Mill
- Starch plant

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-27188
Revision	B
Date	26 Aug 2020

Site layout and
major odour sources

Figure 4

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z001_SiteLayout.mxd

180 Lonsdale Street Melbourne VIC 3000 Australia T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:eibbertson

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.

$$\mathrm{C} = [\log \mathrm{P}\text{-}4.5] \div \text{-}0.6 \qquad \text{Equation 1}$$

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 99th percentile)
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 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[1]. This is reproduced in Figure 5.

Table 6.1: Factors for estimating peak concentrations in flat terrain (Katestone 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 5 Extract from NSW Approved Methods

[1] Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005).

4.2 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_{10})
- Fine particulate matter less than 2.5 micron equivalent aerodynamic diameter ($PM_{2.5}$)
- Products of combustion including carbon monoxide, oxides of nitrogen (NOx), sulfur dioxide (SO_2), hydrogen chloride (HCL), heavy metals (Type I & II), total volatile organic compounds (VOC), polycyclic aromatic hydrocarbons (PAHs) and hydrogen fluoride (HF).

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	Criterion
Particulate Matter PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
Particulate Matter $PM_{2.5}$	24 hours	25 µg/m^3
	Annual	8 µg/m^3
TSP	Annual	90 µg/m^3
Carbon monoxide (CO)	15 minutes	100 mg/m^3
	1 hour	30 mg/m^3
	8 hours	10 mg/m^3
Sulfur dioxide (SO_2)	10 minutes	712 µg/m^3
	1 hour	570 µg/m^3
	24 hours	228 µg/m^3
Nitrogen dioxide (NO_2)	1 hour	246 µg/m^3
	Annual	62 µg/m^3
Hydrogen fluoride (HF)	90 days	0.25 µg/m^3
	30 days	0.4 µg/m^3
	7 days	0.8 µg/m^3
	24 hours	1.5 µg/m^3
Hydrogen Chloride (HCL)	1 hour	0.14 mg/m^3
Polycyclic aromatic hydrocarbon (PAH)	1 hour	0.0004 mg/m^3
Type 1 metals		
Antimony	1 hour	0.009 mg/m^3
Arsenic	1 hour	0.00009 mg/m^3
Cadmium	1 hour	0.000018 mg/m^3
Lead	Annual	0.5 µg/m^3
Mercury	1 hour	0.0018 mg/m^3
Type 2 metals		
Beryllium	1 hour	0.000004 mg/m^3

Pollutant	Averaging period	Criterion
Chromium	1 hour	0.00009 mg/m^3
Manganese	1 hour	0.018 mg/ m^3
Nickel	1 hour	0.00018 mg/ m^3

5. Meteorological data

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.

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 6 to show the wind field at the factory. The following trends are evident from Figure 6:

- 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.

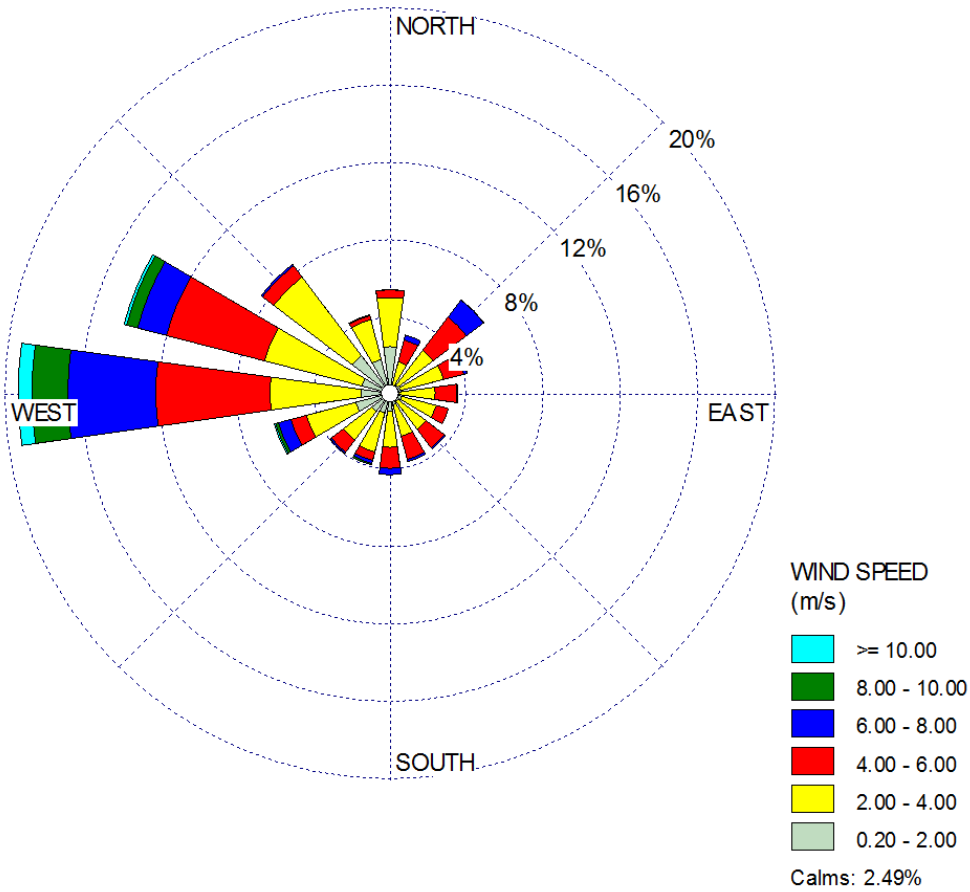


Figure 6 CALMET wind rose for the factory

6. Background air quality

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

Background levels of pollutants used in the assessment are provided in Table 6-1, with the exception of $PM_{2.5}$ and PM_{10}, which is based on 2004 data from Wollongong. This is because the nearest monitoring station that operated in 2004 with both $PM_{2.5}$ and PM_{10} data is the Wollongong site, approximately 20 km to the north of Albion Park. Wollongong generally experiences elevated particulate levels compared to Albion Park South due to the greater presence of emissions from urban and industrial sources (refer to Table 6-1).

Highest measured levels of particulate for the year 2004 at Wollongong are shown in the contemporaneous assessment in Section 8.

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

Table 6-1 Background Air Quality Data – Albion Park South (2016)

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

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

The contemporaneous particulate assessment was undertaken using data from Wollongong in 2004. A review of particulate levels at Wollongong and Albion Park is provided in Table 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.

Table 6-2 Review of particulate monitoring at Albion Park South and Wollongong, µg/m³

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

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

- SO_2 – 10.2 µg/m³
- NO_2 – 54.5 µg/m³
- PM_{10} – 28.1 µg/m³

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

7. Odour assessment

7.1 Emissions inventory

7.1.1 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[2] 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.

7.1.2 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 17. 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 a 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 3, 2019 (November 2019)
- 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 Mod 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) 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

[2] Based on VOC speciation data for selected sources in the DDG plant: DDG dryers, palmer cooler and condensate tanks.

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 current 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 MOD19 emissions inventory based on improvements at the site and subsequently being removed as a EPL odour sampling point
- Odour emission rates were assumed to be unchanged for the other emission sources.

7.1.3 Source summary and comparison

Modelling for the proposed Mod 19 scenario comprised the following sources:

- 67 point sources in total throughout the site;
    - 64 point sources with constant emissions
    - Three 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 and the current modification is also provided in Table 7-1. This shows that the total odour levels increase by approximately 13.5% between the previous (Mod 17) and current modifications (Mod 19).

This increase is primarily due to the highest quarterly results displaying significantly higher source emissions for the following three sources (compared to Mod 17):

- Boiler no 5 & 6: Increase from an MOER of 68,610 to 88,902
- Ethanol recovery scrubber: Increase from an MOER of 15,405 to 33,091
- Environmental farm after WWTP (including biofilters, effluent storage dams, sulphur oxidation basin and membrane bio-reactor): Increased from an MOER of 9,671 to 21,557.

Table 7-1 Comparison of odour emissions from previous mods to current mod

Source	Model Reference	MOER OU.m^3/s (Mod 13)	MOER OU.m^3/s (Mod 16)	Modelled Mod 17 MOER OU.m^3/s	Modelled Mod 19 MOER OU.m^3/s
Boilerhouse					
Boiler no 2	BOILR2	-	-	-	12,677
Boiler no 4	BOILR4	3,171	5,666	22,077	27,988
Boiler no 5 & 6	BOILR5	38,463	43,711	68,610	88,902
Sub total MOER		**41,634**	**49,377**	**90,687**	**129,567**
% of total MOER		**15.0%**	**18.3%**	**23.8%**	**29.9%**
DDG Plant					
Condenser drain	VCD	31	31	31	4,419
DDG tent storage area	DDG36	1,929	1,929	1,929	1,929
Product storage sheds	DDG34	1,023	1,023	1,023	1,023
Light phase tank	DDG19	20	20	20	74
Cooling towers	DDG46	172	172	172	0
DDG Loadout Shed Awning	DDG35	923	923	923	923
Pellet exhaust stack	PPES	38,240	31,544	88,073	67,000
Pellet silo	S12	350	350	350	350
Stillage surge tank	SST	149	149	149	173
Pellet plant fugitives (non-DDG sources)	PPF	5,771	5,771	5,771	5,771
Additional Cooling towers	CTP	172	172	172	0
Sub total MOER		**48,780**	**42,084**	**98,613**	**81,661**
% of total MOER		**17.5%**	**15.6%**	**25.9%**	**18.9%**
Ethanol Plant					
Yeast Propagators - tanks 4 and 5	YP45	820	820	820	820
Grain retention tank	GRT	3,250	3,250	3,250	4,535
Ethanol recovery scrubber	ERESC	3,132	10,660	15,405	33,091
Fermenters 10-16	FERM	2,668	3,298	795	2,500

Source	Model Reference	MOER OU.m^3/s (Mod 13)	MOER OU.m^3/s (Mod 16)	Modelled Mod 17 MOER OU.m^3/s	Modelled Mod 19 MOER OU.m^3/s
Jet cooker 1 retention tank	E13	1,067	1,067	1,067	1,067
Jet cooker 2/4 grain retention	E7	567	567	567	567
Feed to distillery	E22	83	83	83	83
Sub total MOER		**11,587**	**19,745**	**21,987**	**42,663**
% of total MOER		**4.2%**	**7.3%**	**5.8%**	**9.9%**
Distillery					
Incondensable gases vent	D6	558	558	558	558
Molec. sieve vacuum drum	D2	1,350	1,350	1,350	1,350
Column Washing Vent	CWV	23	25	27	1,399
Distillation plant Column Washing Vent (proposed as part of Mod 19)	CWV2				1,399
Sub total MOER		**1,931**	**1,933**	**1,935**	**4,707**
% of total MOER		**0.7%**	**0.7%**	**0.5%**	**1.1%**
Starch and Glucose					
Flour mill A Exhaust	A4	679	679	679	679
Flour mill A Exhaust	A5	96	96	96	96
Flour mill A Exhaust	A6	449	449	449	449
Flour mill A Exhaust	A7	932	932	932	932
Drum vac receiver	C4	1,400	1,400	1,400	1,400
Dry gluten roof bin	S07	4,500	4,500	4,500	4,500
Enzyme tanks	B7	2,042	2,042	2,042	2,042
Flash vessel jet cooker	C1	970	970	970	970
Flour bin aspirator	S13A	500	500	500	500
Flourbin aspirator	S13B	500	500	500	500
Flourbin motor drive	S06	283	283	283	283
Flour mill aspiration (Mod 8)	FMP1	266	205	205	205

Source	Model Reference	MOER OU.m^3/s (Mod 13)	MOER OU.m^3/s (Mod 16)	Modelled Mod 17 MOER OU.m^3/s	Modelled Mod 19 MOER OU.m^3/s
Flour mill aspiration (Mod 8)	FMP2	205	266	266	266
High protein dust collector	S08	600	600	600	600
Ion exchange effluent tank	C18	250	250	250	250
No 1 gluten dryer baghouse	S02	5,925	5,166	5,166	9,800
No 1 starch dryer	S01	5,193	5,193	11,316	2,800
No 2 gluten/starch dryer	S04	2,354	5,166	5,166	7,200
No 3 gluten dryer baghouse	S03	58,917	29,036	21,696	12,700
No 3 starch dryer	S18	1,663	5,166	5,166	3,800
No 4 gluten dryer baghouse	S05	31,222	22,433	13,693	9,100
No 4 starch dryer	S19	1,824	4,008	5,020	3,600
No 5 ring dryer gluten/starch	SDR5	4,817	4,817	4,817	4,350
No 5 starch dryer (existing)	SD5C	6,800	6,800	3,393	4,931
No 5 starch dryer (new stack)	SD5N			17,387	25,269
No 6 gluten dryer	GD6	12,568	12,568	12,568	12,568
No 7 gluten dryer	GD7	9,553	9,553	9,553	9,553
Spray dryer	S20	738	738	738	738
Starch factory rejects	E10	183	183	183	183
Farm tank	F18	3,834	3,834	3,834	3,833
Pellet mill silo	PMFS	173	173	173	173
Flour Mill B Exhaust	FMBA to FMBM	5,637	4,621	4,621	3,621
Flour Mill C Exhaust	FMC1 to FMC3	n/a	1,658	1,658	1,560
Gluten dryer No.8	GD8	n/a	12,568	12,568	12,568
Product dryer 9	PD9	n/a	n/a	5,166	9,800

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
Sub total MOER		**165,073**	**147,353**	**157,553**	**151,819**
% of total MOER		**59.3%**	**54.7%**	**41.3%**	**35.1%**
Packing Plant (Not constructed)					
Starch silo 1	PPL1	86	86	86	86
Starch silo 2	PPL2	86	86	86	86
Gluten silo 1	PPM1	173	173	173	173
Gluten silo 2	PPM2	173	173	173	173
Gluten silo 3	PPM3	173	173	173	173
Small gluten silo	PPS1	92	92	92	92
Small starch silo	PPS2	35	35	35	35
Sub total MOER		**818**	**818**	**818**	**818**
% of total MOER		**0.3%**	**0.3%**	**0.2%**	**0.2%**
Area sources: Env farm after WWTP					
Biofilter A	BIO1	440	1,408	1,386	502
Biofilter B	BIO2	330	803	1,111	1,648
Biofilter C	BIO3	1,089	1,089	1,089	1,089
Biofilter D	BIO4	1,280	1,280	1,280	1,280
Storage dam 1	PO1	148	71	119	1,475
Storage dam 2	PO2	1,656	248	143	973
Storage dam 3	PO3	192	569	1,231	2,962
Storage dam 5	PO5	515	971	1,922	6,538
Storage dam 6	PO6	1,775	1,435	793	3,097
Sulfur oxidisation basin	SOBAS	830	349	535	1,939
Membrane bio-reactor	MBR	62	62	62	54
Sub total MOER		**8,317**	**8,286**	**9,671**	**21,557**
% of total MOER		**3.0%**	**3.1%**	**2.5%**	**5.0%**
Total (Mod 11 and Mod 12)		278,140			
Total (Mod 16)			269,595		
Total (Mod 17)				381,265	

Source	Model Reference	MOER OU.m^3/s (Mod 13)	MOER OU.m^3/s (Mod 16)	Modelled Mod 17 MOER OU.m^3/s	Modelled Mod 19 MOER OU.m^3/s
Total (Mod 19)					432,792

7.2 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.

7.3 Predicted odour impacts

Figure 7 shows the predicted 99th percentile odour impacts (one minute nose-response time) for the proposed Mod 19 operations and the previous modifications.

Table 7-2 shows the predicted odour levels for the proposal (Mod 19). Table 7-2 also shows the previous modification results.

The predicted odour levels are generally equivalent to those predicted for Modification 17, with the exception of an increase at commercial receptors C2, C3, C4, C6 and C7. The increase is primarily attributed to higher quarterly sampling results particularly at the boiler house.

The results show that the impact assessment odour criteria are achieved at all residential sensitive receptors.

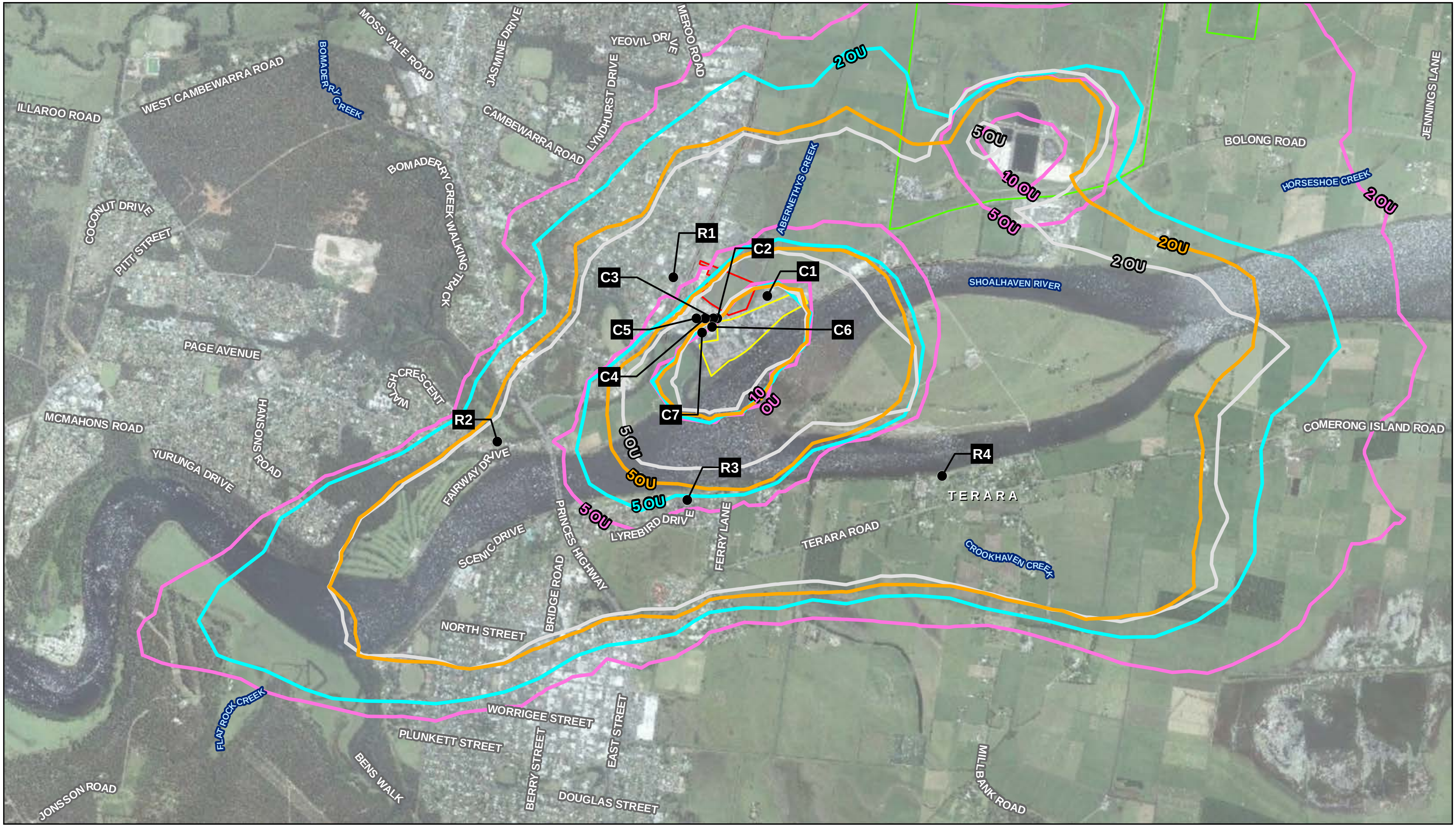
Seven commercial/industrial receptors are included in the assessment. These are all located within approximately 125 m of the site. One hour, 99th percentile odour impacts have been predicted based on the hours of operation of the receptors as per Section 2.1.1 (i.e. predicted odour impacts when the sites are not operational have been excluded from the assessment). Commercial/industrial receptors C4, C5, and C7 marginally exceed the criteria of 6 OU (assumed the same criteria as R1) due to the higher quarterly results.

Commercial receptor C1 is located approximately 45 m from the site and is the BOC CO2 Plant. Given the industrial nature of C1, and its existing proximity to the site no significant odour impacts are anticipated from the proposal.

One odour complaint (in July 2020) 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, 99th percentile, nose-response time			
					Mod 13	*Mod 16*	*Mod 17 (rounded as per EPA advice)*	*Mod 19*
R1 Bomaderry	150	Packing Plant	W	6	3.3	3.5	4	4
R2 North Nowra	1300	Factory	SW	3	2.5	2.6	3	3
R3 Nowra	700	Factory	S	5	4	4.6	5	5
R4 Terara	1300	Factory	SE	5	3.7	3.7	4	4
C1	45	Factory	N	n/a	n/a	10.3	12	12
C2	20	Factory	N	n/a	n/a	5.8	8	10
C3	30	Factory	N	n/a	n/a	5.3	7	9
C4	75	Factory	NW	n/a	n/a	4.4	6	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10
C7	55	Factory	NW	n/a	n/a	4.8	7	8



Paper Size A4

0 200 400 800

Metres

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

N

LEGEND
- Identified sensitive receptors
- Mod 16 odour unit contour
- Mod 13 odour unit contour (with mitigation)
- Mod 17 odour unit contour
- Mod 19 odour unit contour
- Shoalhaven Starches Factory
- Environmental farm boundary
- Packing plant (proposed)

GHD

Manildra Ground Pty Ltd
Shoalhaven Starches

Job Number 21-12534209
Revision B
Date 26 Aug 2020

Odour impacts, 99th percentile, one-second average, Modification 19, OU

Figure 7

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z002_Odour_Mod17.mxd

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

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012. Created by:eibbertson

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 19 includes all existing air emissions sources and those proposed in previous Modifications (up to and including Modification 17). Emission rates were estimated for a factory throughput of 300 Mega litres per annum (maximum approved throughput).

One new emission source, the three new product silos, is proposed as part of Modification 19. The operation of these silo's has the potential to emit particulate matter. The silos are not a source of products of combustion or PAH, VOC's and metals.

Generally the emissions estimation methodology adopted for Modification 19 was consistent with that of Modification 17. Modification 19 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. If monitoring data was not available, National Pollutant Inventory emissions factors (NPI factors) were used. 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 19 fuel usage	Emission estimation methodology[3]
Boiler 1	Gas fuelled	71.5 GJ/hour	NPI factors
Boiler 2	75% coal, 25% woodchips	Coal: 1.17 t/hr Woodchips: 0.62 t/hr	Coal: SEMA (2020) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 2 - Report No. 7050 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		

[3] 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 19 fuel usage	Emission estimation methodology[3]
Boiler 4	84% coal, 16% woodchips	Coal: 2.43 t/hr Woodchips: 0.74 t/hr	SEMA (2020) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 4 - Report No. 7051A Woodchips: NPI factors
Boiler 5/6	Coal	12.2 t/hr	SEMA (2020) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 5&6 - Report No. 7049
Boiler 7	Standby boiler, operation not proposed and therefore not included in this assessment		
Boiler 8	Coal	8.3 t/hr	Scaled off boiler 5/6 emission rates based on proposed fuel usage rates

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:

- Emissions rates were updated based on recent sampling including:
  - NO_x emissions from starch dryers 2, 4 and 5 and gluten dryers 1, 2, 3 and 4 were updated based on the measured NO_x concentrations and flowrates provided in SEMA (2020) Starch and Gluten Dryers NO_x Emission Test Report No. 7093. NOx emissions from Starch dryer 3 were scaled off starch dryer 4 based on flowrate. NO_x emissions from starch dryer 5 and gluten dryers 6, 7 and 8 were calculated using NPI factors
  - Particulate matter emissions from starch dryers 1 and 4 and the spray dryer were updated based on SEMA (2020) Stack Emission Survey - Particulate Matter - Starch Dryer 1, 4 and Spray Dryer - Report No. 7071
- All other dryer emissions sources are as per Mod 17.

8.1.3 Other emission sources

Other emissions sources, including the two gas turbines, would remain unchanged from previous assessments.

It should be noted that the gas turbines were assessed as part of the 2008 air quality assessment (GHD, 2008) and have been approved by EPA. However, the gas turbines have not yet been constructed.

The gas turbines would be installed as part of a gas-fired co-generation plant, which would be used to supply electricity and steam to the factory.

The turbines have been included as part of the cumulative assessment. The modelled emission rates from turbines are summarised in Table 8-2 and Table 8-3.

Table 8-2 Emission inventory – Particulate matter

Discharge Point	Model ID	EPA ID	Emission control	TSP (g/s)	PM_{10} (g/s)
Boiler No. 1	BOILR1		Gas-fired	0.072	0.072
Boiler No. 2	BOILR2	45	Cyclone and fabric filter	0.072	0.06
Boiler No. 4	BOILR4	42	Cyclone and fabric filter	0.14	0.053
Boiler No. 5/6	BOILR5	35	Fabric filter	0.19	0.088
Boiler No. 8 (Proposed)	BOILR8		Cyclone and fabric filter	0.13	0.06
Gluten dryer No. 1	S02	8	Fabric filter	0.015	0.0003
Gluten dryer No. 2	S04	9	Fabric filter	0.015	0.001
Gluten dryer No. 3	S03	10	Fabric filter	0.02	0.02
Gluten dryer No. 4	S05	11	Fabric filter	0.02	0.02
Ring Dryer No.5	SDR5		Fabric filter	0.012	0.012
Gluten dryer No. 6	GD6		Fabric filter	0.02	0.02
Gluten Dryer No.7	GD7		Fabric filter	0.035	0.035
Gluten Dryer No.8	GD8		Fabric filter	0.02	0.02
Starch dryer No. 1	S01	12	Wet-scrubber	0.044	0.033
Starch dryer No. 3	S18	13	Wet-scrubber	0.04	0.013
Starch dryer No. 4	S19	14	Wet-scrubber	0.057	0.029
Starch dryer No. 5 (Existing)	SD5C	47	Cyclone	0.065	0.065
No. 5 Starch Dryer (new - SD5 was split into 2 stacks)	SD5N		Cyclone	0.33	0.33
Spray dryer 5	S20		Fabric filter	0.0028	0.0019
Flour Mill	FMP1, FMP2		Fabric filter	0.0005	0.0005
New Flour Mill B (MOD 10)	FMBA-FMBM		Fabric filter	0.0037	0.0037
Flour Mill C (new)	FMC1-FMC3		Fabric filter	0.0013	0.0013
DDG Pellet Plant (MOD 4 & MOD 5)	PPF		Fabric filter	0.25	0.25
Packing Plant (MOD 9 approved)	PPL1-2, PPM1-3, PPS1-2		Fabric filter	0.016	0.016
Co-generator turbine No. 1 (proposed)	TURB1		Gas-fired	0.15	0.15

Discharge Point	Model ID	EPA ID	Emission control	TSP (g/s)	PM_{10} (g/s)
Co-generator turbine No. 2 (proposed)	TURB2		Gas-fired	0.15	0.15
Silo source 1 (combined stack for 3 silos)	SILO1		Fabric filter	0.0042	0.0042
Silo source 2 (combined stack for 6 silos)	SILO2		Fabric filter	0.0042	0.0042
Silo source 3 (combined stack for 2 silos)	SILO3		Fabric filter	0.017	0.017
Silo source 4 (combined stack for 6 silos)	SILO4		Fabric filter	0.0042	0.0042
Silo source 5 (combined stack for 3 silos) (proposed as part of Mod 19)	SILO5		Fabric filter	0.013	0.013
Product dryer 9	PD9		Fabric filter	0.015	0.0003

Table 8-3 Emission inventory – Products of combustion

Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 8	S02	S04	S03	S05	GD6	GD7	S19	SD5C	SD5N	Turbine No. 1 & 2 (Combined)
Fuel type	Natural gas and biogas	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
Status / details	Existing, No change		Existing, changing from gas to coal-fired		Existing, changing from gas to coal-fired		Existing, coal consumption increasing		New proposed boiler		Natural gas is fed through to the dryers for combustion. The majority of the gas is fed to gluten dryers 6 and 7 and starch dryer 5.				Approved, yet to be constructed
Stack height (m)	25	40	41	54	54	25.5	27	21	30	35	29	20	33.5	30	30
Exhaust temp. (K)	453	442	435	410	410	346	340	344	350	346	341	320	335	335	160
Stack diameter (m)	0.9	0.65	0.9	2.05	2	3.2	3.2	2.5	2.7	1.7	1.8	1.2	2.35	2.35	0.5
Exhaust velocity (m/s)	25.0	25.3	24.3	14.1	11.5	14.0	17.0	9.2	17.0	19.1	19.3	23.0	14.3	14.3	25
Oxygen (%)	ND	ND	11.2	8.7	ND	20.9	20.9	20.9	20.9	ND	ND	20.9	ND	ND	ND
Moisture (%)	ND	ND	4	5.2	ND	6.2	5.7	9.2	5.6	ND	ND	6.2	ND	ND	ND
Exhaust Flow rate, actual (m^3/s)	ND	10.1	18.8	53.5	36.4	1,180	1110	2450	2370	ND	ND	1370	ND	ND	ND
Ratio (Actual to normalised flow)	ND	1.7	1.7	1.6	1.6	1.3	1.4	1.4	1.4	ND	ND	1.2	ND	ND	ND
Emission rate (g/s)															
CO	0.23	0.33	0.50	8.5	5.8	-	-	-	-	0.17	0.13	-	0.06	0.33	0.92
SO_2	0.011	2.2	3.5	20.2	14	-	-	-	-	0.0025	0.0019	-	0.0010	0.0050	0.023
NO_2	1.6	1.5	4.1	16.9	12	0.12	0.024	0.43	0.060	0.39	0.29	0.036	0.016	0.082	6.64
VOC	0.053	0.031	0.041	0.20	0.14	-	-	-	-	-	-	-	-		-
Antimony (Sb) Type I	-	2.1E-05	7.6E-05	1.7E-04	1.2E-04	-	-	-	-	-	-	-	-		-
Arsenic (As) Type I	1.9E-06	2.9E-05	8.1E-05	1.7E-04	1.2E-04	-	-	-	-	-	-	-	-		-
Cadmium (Cd) Type I	1.1E-05	2.4E-06	2.8E-06	4.4E-06	3.0E-06	-	-	-	-	-	-	-	-		-
Lead (Pb) Type I	4.8E-06	1.4E-04	2.8E-04	1.3E-04	8.7E-05	-	-	-	-	-	-	-	-		-
Mercury (Hg) Type I	2.5E-06	6.2E-06	1.3E-05	6.0E-06	4.1E-06	-	-	-	-	-	-	-	-		-
Beryllium (Be) Type II	1.2E-08	1.6E-06	7.8E-06	1.3E-05	8.7E-06	-	-	-	-	-	-	-	-		-
Chromium (Cr) Type II	1.4E-05	1.7E-05	3.3E-05	1.1E-04	7.3E-05	-	-	-	-	-	-	-	-		-
Cobalt (Co) Type II	7.9E-07	1.7E-05	1.9E-05	2.1E-05	1.4E-05	-	-	-	-	-	-	-	-		-
Manganese (Mn) Type II	3.7E-06	6.5E-05	4.5E-05	1.1E-04	7.3E-05	-	-	-	-	-	-	-	-		-
Nickel (Ni) Type II	2.0E-05	1.1E-04	1.6E-04	2.7E-04	1.9E-04	-	-	-	-	-	-	-	-		-
Selenium (Se) Type II	2.3E-07	1.1E-04	1.9E-04	1.7E-04	1.2E-04	-	-	-	-	-	-	-	-		-
Tin (Sn) Type II	-	5.3E-05	1.9E-04	4.4E-04	3.0E-04	-	-	-	-	-	-	-	-		-
Vanadium (V) Type II	-	2.7E-05	9.8E-05	2.1E-04	1.4E-04	-	-	-	-	-	-	-	-		-
Hydrogen Chloride (HCL)	-	2.9E-03	2.0E-03	2.6E-01	1.8E-01	-	-	-	-	-	-	-	-		-
Polycyclic Aromatic Hydrocarbons (PAH)	6.2E-06	7.8E-05	6.0E-05	3.2E-05	2.2E-05	-	-	-	-	-	-	-	-		-
Hydrogen Fluoride (FL)	-	9.7E-03	1.3E-02	2.5E-01	1.7E-02	-	-	-	-	-	-	-	-		-
Emission rates, normalised (mg/m^3)															
CO	22.2	33.4	30.8	182.7	161.1	-	-	-	-	-	-	-	-	-	-
SO_2	14.6	39.4	32.2	433.7	382.4	-	-	-	-	3.8	2.6	-	5.2	5.2	-
NO_2	0.7	257.2	228.2	362.8	320.0	-	-	-	-	0.06	0.04	-	0.08	0.08	-
TSP	103.4	180.0	267.8	4.0	3.5	1.1	0.2	9.6	0.6	8.9	6.0	1.4	1.3	1.3	-
Type 1 and 2 metals (combined)	4.5	8.6	8.9	0.04	0.03	0.1	0.1	0.4	0.2	0.5	0.7	2.2	5.2	5.2	-

Discharge Point	Boiler No. 1	Boiler No. 2	Boiler No. 4	Boiler No. 5/6	Boiler No. 8	S02	S04	S03	S05	GD6	GD7	S19	SD5C	SD5N	Turbine No. 1 & 2 (Combined)
Cadmium	0.004	0.1	0.1	0.0001	0.0001	-	-	-	-	-	-	-	-	-	-
Mercury	0.0007	0.0003	0.0002	0.0001	0.0001	-	-	-	-	-	-	-	-	-	-
VOC	0.0002	0.0007	0.0009	4.4	3.8	-	-	-	-	-	-	-	-	-	-
HCL	3.3	3.7	2.7	5.6	4.9	-	-	-	-	-	-	-	-	-	-
FL	-	0.3	0.1	5.4	0.5	-	-	-	-	-	-	-	-	-	-

The emission rate limits are as follows:

Protection of the Environment Operations (Clean Air) Regulation (2010): CO: 125 mg/m^3, SO_2: 1000 mg/m^3, NO_2: 500 mg/m^3, TSP: 50 mg/m^3, Type 1 and 2 metals (combined): 1 mg/m^3, Cadmium: 0.2 mg/m^3, Mercury: 0.2 mg/m^3, VOC: 40 mg/m^3, HCL: 100 mg/m^3, FL: 50 mg/m^3

EPA: SO_2: 600 mg/m^3, NO_2: 500 mg/m^3, TSP: 30 mg/m^3, Type 1 and 2 metals (combined): 1 mg/m^3, Cadmium: 0.2 mg/m^3, Mercury: 0.2 mg/m^3, VOC: 40 mg/m^3.

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 7.2.

8.3 Predicted air quality impacts

8.3.1 Particulates

The impact of dust emissions principally relates to the potential effect on human health of inhalation of particles in the air column, and it is the finer fraction that have the greater potential to cause respiratory health effects. EPA have advised to assess $PM_{2.5}$, if PM_{10} impacts are significant. The $PM_{2.5}$ emissions from some sources on site are not known, however guidance is available for estimates of $PM_{2.5}$ from boilers in the NPI. NPI emission factors for coal boilers with a baghouse states that $PM_{2.5}$ emissions are half of PM_{10} emissions and the ratio of $PM_{2.5}$ to PM_{10} in gas fired boilers is the same. Therefore a ratio of PM_{10} to $PM_{2.5}$ emissions of 2:1 was adopted.

A summary of the maximum incremental predicted levels at each receptor site is presented in Table 8-4. The worst case predicted incremental PM_{10} level at a residential sensitive receptors is at R1 with a level of 7.3 µg/m^3.

Table 8-4 Maximum predicted incremental ground level PM_{10}, $PM_{2.5}$ and TSP concentrations

Receiver	Pollutant				
	PM_{10} (24 hour)	PM_{10} (Annual)	$PM_{2.5}$ (24 hour)	$PM_{2.5}$ (Annual)	TSP (Annual)
Criteria µg/m^3	50	25	25	8	90
R1	7.9	0.7	4.0	0.4	0.8
R2	4.3	0.4	2.1	0.2	0.5
R3	4.9	0.6	2.5	0.3	0.6
R4	4.6	0.9	2.3	0.4	0.9
C1	11.3	1.6	5.7	0.8	2.0
C2	15.8	2.7	7.9	1.3	3.0
C3	16.0	2.6	8.0	1.3	2.8
C4	15.3	2.3	7.6	1.2	2.5
C5	13.5	2.0	6.7	1.0	2.1
C6	16.5	3.2	8.3	1.6	3.5
C7	15.6	2.8	7.8	1.4	3.0

A contemporaneous assessment has been undertaken for the year 2004 in accordance with the Approved Methods. Predicted 24 hour $PM_{2.5}$ and PM_{10} values from the site in 2004 have been added to the 24 hour measured values at Wollongong for every day in the year.
The top predicted, measured and total concentrations at the most impacted residential receptor (R1) and commercial receptor (C6) are presented in Table 8-5 to Table 8-8 below. The background and incremental contributions for the highest cumulative concentrations are also included.

Results of the assessment show full compliance with the $PM_{2.5}$ and PM_{10} 24 hour criteria at the worst impacted residential sensitive receptor R1.

Results of the assessment predict exceedances of the PM_{10} 24 hour criteria for 3 days of the year and an exceedance of the $PM_{2.5}$ 24 hour criteria for one day of the year at the worst impacted commercial receptor C6. The exceedances are bold in Table 8-7 and Table 8-8. The exceedances are primarily attributed to high background concentrations as background PM_{10} accounts for 94%, 92% and 97% of the criteria and background $PM_{2.5}$ accounts for 89% of the criteria on the days of the predicted exceedances.

Plots of the predicted 24 hour maximum PM_{10} levels are provided in Figure 8 (incremental impact) and in Figure 9 (cumulative impact with 70th percentile PM_{10} levels at Albion Park South 2016 for comparative purposes).

Plots of the predicted 24 hour maximum $PM_{2.5}$ levels are provided in Figure 10 (cumulative impact with 70th percentile $PM_{2.5}$ levels at Albion Park South 2016 for comparative purposes).

Table 8-5 Summary of highest measured and predicted PM_{10} levels, µg/m^3 (R1)

Top 10 PM_{10} background		Top 10 PM_{10} incremental		Top 10 PM_{10} cumulative			
Date	PM_{10} background	Date	PM_{10} increment	Date	PM_{10} cumulative	Background contribution	Site contribution
08/03/2004	49.0	10/03/2004	7.9	08/03/2004	49.0	49.0	0.0
27/11/2004	48.4	22/03/2004	6.7	27/11/2004	48.7	48.4	0.3
21/02/2004	47.0	17/08/2004	4.3	26/03/2004	48.7	46.1	2.6
26/03/2004	46.1	01/03/2004	3.7	21/02/2004	47.8	47.0	0.8
08/12/2004	43.7	23/09/2004	3.7	09/02/2004	44.6	43.1	1.5
10/01/2004	43.4	22/01/2004	3.6	08/12/2004	43.8	43.7	0.1
09/02/2004	43.1	04/04/2004	3.5	10/01/2004	43.4	43.4	0.0
06/02/2004	41.2	28/03/2004	3.3	06/02/2004	42.9	41.2	1.7
07/12/2004	40.8	09/11/2004	3.3	22/01/2004	41.6	38.0	3.6
20/02/2004	40.4	28/04/2004	3.2	07/12/2004	41.3	40.8	0.5

Table 8-6 Summary of highest measured and predicted $PM_{2.5}$ levels, µg/m^3 (R1)

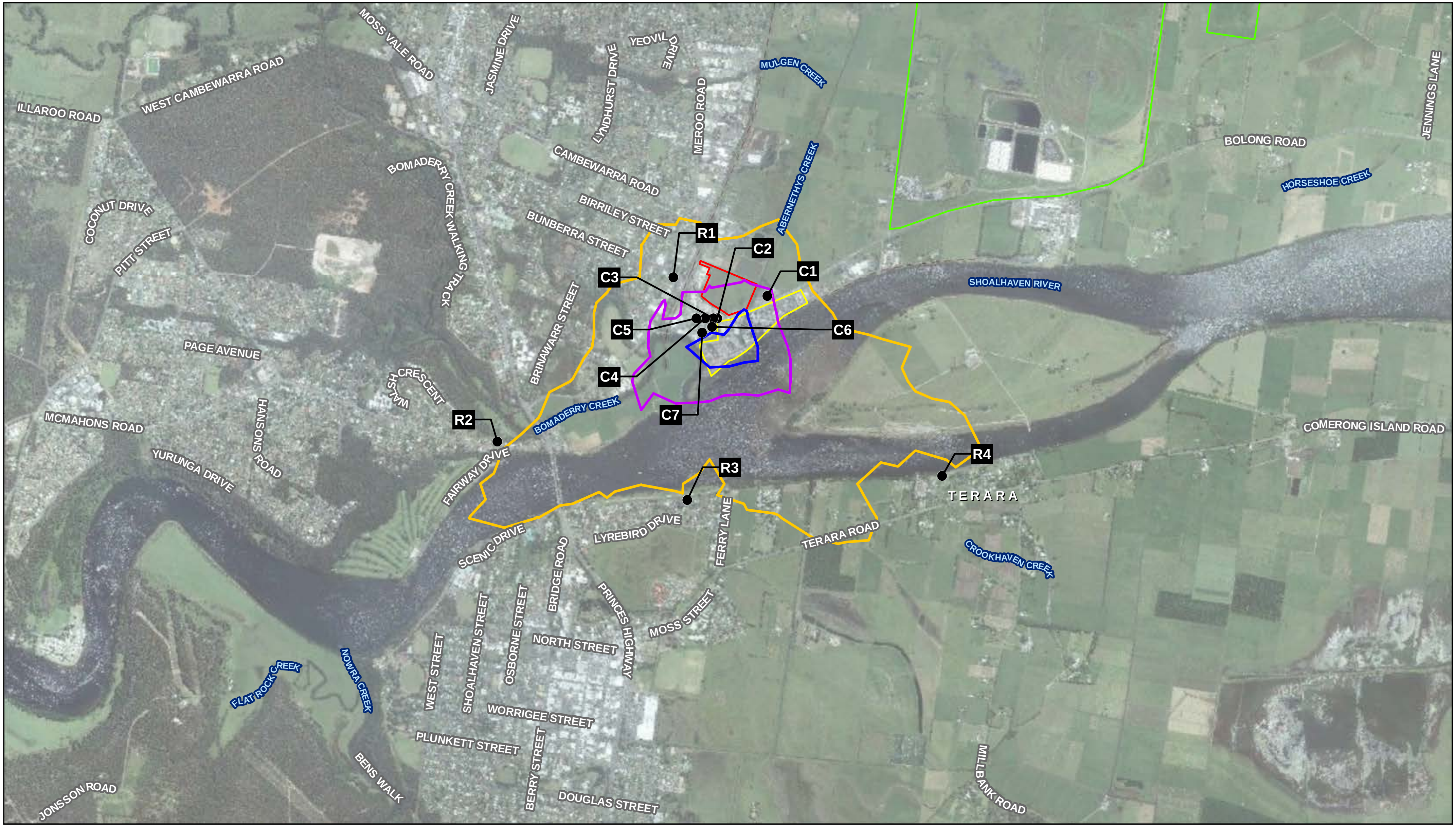
Top 10 $PM_{2.5}$ background		Top 10 $PM_{2.5}$ incremental		Top 10 $PM_{2.5}$ cumulative			
Date	$PM_{2.5}$ background	Date	$PM_{2.5}$ increment	Date	$PM_{2.5}$ cumulative	Background contribution	Site contribution
10/01/2004	22.6	10/03/2004	4.0	21/02/2004	22.7	22.3	0.4
21/02/2004	22.3	22/03/2004	3.4	10/01/2004	22.6	22.6	0.0
26/03/2004	19.9	17/08/2004	2.2	26/03/2004	21.2	19.9	1.3
06/02/2004	19.0	01/03/2004	1.9	06/02/2004	19.8	19.0	0.8
09/02/2004	18.3	23/09/2004	1.8	09/02/2004	19.1	18.3	0.8
11/02/2004	17.9	22/01/2004	1.8	11/02/2004	18.6	17.9	0.7
09/03/2004	17.6	04/04/2004	1.8	27/11/2004	17.7	17.5	0.2
08/03/2004	17.5	28/03/2004	1.6	09/03/2004	17.6	17.6	0.0
08/03/2004	17.5	09/11/2004	1.6	13/03/2004	17.5	17.0	0.5
13/03/2004	17.0	28/04/2004	1.6	08/03/2004	17.5	17.5	0.0

Table 8-7 Summary of highest measured and predicted PM_{10} levels, µg/m^3 (C6)

Top 10 PM_{10} background		Top 10 PM_{10} incremental		Top 10 PM_{10} cumulative			
Date	PM_{10} background	Date	PM_{10} increment	Date	PM_{10} cumulative	Background contribution	Site contribution
08/03/2004	49.0	22/03/2004	16.5	21/02/2004	**55.8**	47.0	8.8
27/11/2004	48.4	10/03/2004	14.0	26/03/2004	**53.4**	46.1	6.4
21/02/2004	47.0	25/02/2004	12.7	27/11/2004	**51.9**	48.4	2.9
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	12.1	09/02/2004	46.2	43.1	3.0
10/01/2004	43.4	17/08/2004	11.5	22/01/2004	46.0	38.0	7.8
09/02/2004	43.1	02/03/2004	10.9	08/12/2004	45.9	43.7	1.8
06/02/2004	41.2	09/11/2004	10.6	06/02/2004	44.8	41.2	3.5
07/12/2004	40.8	19/10/2004	10.6	07/12/2004	44.8	40.8	3.6
20/02/2004	40.4	03/04/2004	10.0	10/01/2004	43.4	43.4	0.0

Table 8-8 Summary of highest measured and predicted $PM_{2.5}$ levels, µg/m^3 (C6)

Top 10 $PM_{2.5}$ background		Top 10 $PM_{2.5}$ incremental		Top 10 $PM_{2.5}$ cumulative			
Date	$PM_{2.5}$ background	Date	$PM_{2.5}$ increment	Date	$PM_{2.5}$ cumulative	Background contribution	Site contribution
10/01/2004	22.6	22/03/2004	8.3	21/02/2004	**26.7**	22.3	4.4
21/02/2004	22.3	10/03/2004	7.0	26/03/2004	23.5	19.9	3.6
26/03/2004	19.9	25/02/2004	6.3	10/01/2004	22.6	22.6	0.0
06/02/2004	19.0	20/10/2004	6.1	07/02/2004	20.9	16.2	4.7
09/02/2004	18.3	20/03/2004	6.1	06/02/2004	20.8	19.0	1.8
11/02/2004	17.9	17/08/2004	5.8	11/02/2004	20.7	17.9	2.8
09/03/2004	17.6	02/03/2004	5.4	20/03/2004	20.6	14.5	6.1
08/03/2004	17.5	09/11/2004	5.3	13/03/2004	20.5	17.0	3.5
27/11/2004	17.5	19/10/2004	5.3	09/02/2004	19.8	18.3	1.5
13/03/2004	17.0	03/04/2004	5.0	27/11/2004	19.2	17.5	1.7



Paper Size A4

0 200 400 800

Metres

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

N

LEGEND

- Identified sensitive receptors
- Shoalhaven Starches Factory
- Environmental farm boundary
- Packing plant (proposed)

PM_{10} 24HR concentration contour ($\mu g/m^3$)

- 5
- 10
- 20

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-12534209
Revision	B
Date	26 Aug 2020

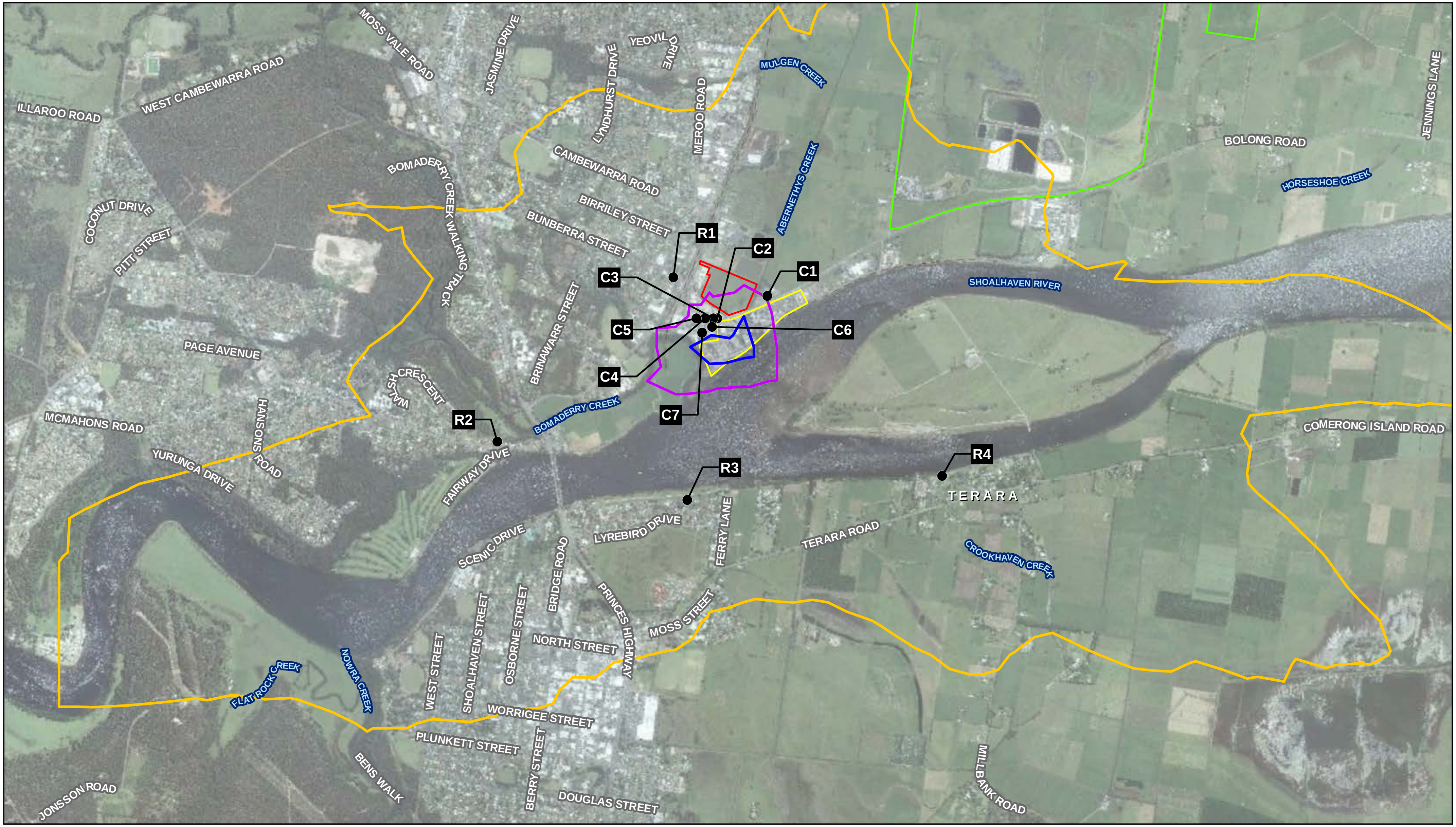
Maximum Predicted Incremental Ground Level PM_{10} Concentrations (24-hour Average), $\mu g/m^3$

Figure 8

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z003_PM10_Incremental.mxd

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

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012. Created by:eibbertson



Paper Size A4

0 200 400 800

Metres

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

N

LEGEND

● Identified sensitive receptors

PM_{10} 24HR concentration contour ($\mu g/m^3$)

20

30

40

Shoalhaven Starches Factory

Environmental farm boundary

Packing plant (proposed)

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number 21-12534209
Revision B
Date 26 Aug 2020

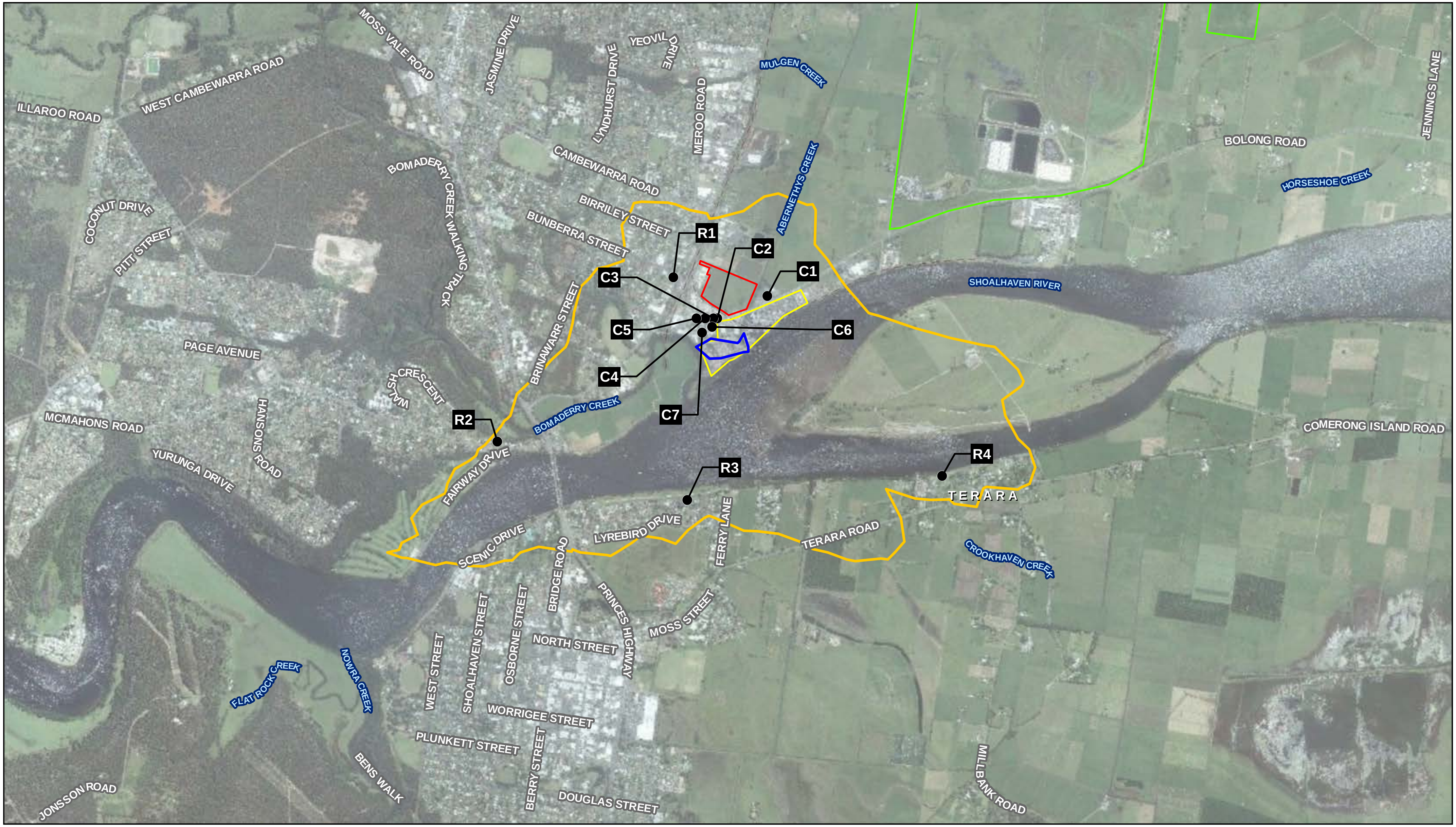
Maximum Predicted Cumulative Ground Level
PM_{10} Concentrations (24-hour Average), $\mu g/m^3$

Figure 9

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z004_PM10_Cumulative.mxd

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

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012. Created by:eibbertson



Paper Size A4

0 200 400 800

Metres

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

N

LEGEND

- Identified sensitive receptors
- Environmental farm boundary
- Packing plant (proposed)

$PM_{2.5}$ 24HR concentration contour (µg/m^3)

- 10
- 20
- Shoalhaven Starches Factory

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-12534209
Revision	B
Date	26 Aug 2020

Maximum Predicted Cumulative Ground Level $PM_{2.5}$ Concentrations (24-hour Average), µg/m^3

Figure 10

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z005_PM2pt5_Cumulative.mxd

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

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012. Created by:eibbertson

8.3.2 Products of combustion

The primary pollutants in coal and gas fired boiler emissions are oxides of nitrogen (NO_x), formed by the high temperatures in the combustors, sulfur dioxide (SO_2), formed from the sulfur content of the fuel, VOCs, hydrogen chloride (HCL), polycyclic aromatic hydrocarbons (PAH), carbon monoxide (CO) and hydrogen fluoride (HF) 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_2, NO_2, CO, HF and HCL are provided in Table 8-9 to Table 8-13. The predicted levels comply at all receptors for SO_2, CO, HF and HCL.

Contour plot of cumulative hourly average SO_2 predictions are shown in Figure 11, in order to get an appreciation of the hourly averaged pattern of dispersion.

The predicted levels for nitrogen dioxide exceed the criteria at all commercial/industrial sensitive receptors. However, the predicted levels assume that 100% of NO will be converted to NO_2 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_2.

Therefore, a more detailed assessment has been undertaken for all receptors 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_2. Background ozone data was sourced from Kembla Grange for the year 2004. The calculated NO_2 levels using Method 2 are provided in Table 8-10. Using this method no exceedances are predicted.

Effect of Mod 19 changes

No new sources of combustion products are proposed as part of Modification 19. The emissions inventory was updated with the most recent sampling results and therefore there is a slight variation in the predicted products of combustion concentrations.

Table 8-9 Maximum predicted ground level Sulfur Dioxide concentrations

Receptor	Total impact (Incremental plus background) (µg/m³)			
Criteria, µg/m³	712 (10 min[1])	570 (1 hour)	228 (24 hour)	60 (Annual)
Background, µg/m³	No data[2]	57.6	15.7	1.6
Bomaderry (R1)	253.8	194.7	48.7	5.3
North Nowra (R2)	191.0	150.8	43.3	3.7
Nowra (R3)	233.1	180.2	34.8	2.7
Terara (R4)	178.4	142.0	25.2	2.3
C1	490.8	360.3	96.2	9.5
C2	586.3	427.1	72.4	10.2
C3	537.5	393.0	69.5	9.7
C4	451.8	333.1	68.3	8.8
C5	386.0	287.1	68.8	8.0
C6	495.4	363.6	77.8	10.5
C7	420.4	311.1	76.1	9.6

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 8-10 Maximum predicted ground level Nitrogen Dioxide concentrations

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)	260.0	119.4	13.5
North Nowra (R2)	242.9	110.3	11.3
Nowra (R3)	222.7	133.2	8.8
Terara (R4)	207.1	169.0	9.0
C1	420.3	243.4	19.4
C2	475.8	175.2	23.5
C3	439.2	165.7	22.9
C4	459.4	165.5	22.2
C5	475.5	164.4	21.5
C6	424.2	164.5	24.4

Receptor	Total impact (Incremental plus background) ($\mu g/m^3$)		
Criteria, $\mu g/m^3$	246 (1 hour, Method 1)	246 (1 hour, Method 2)	62 (Annual)
Background, $\mu g/m^3$	80.8	n/a	7.1
C7	535.1	197.7	23.8

Table 8-11 Maximum predicted ground level Carbon Monoxide concentrations

Receptor	Total impact (Incremental plus background) (mg/m^3)		
Criteria, mg/m^3	100 (15 min[1])	30 (1 hour)	10 (8 hour)
Background, mg/m^3	No data[2]	1	0.6
Bomaderry (R1)	1.08	1.06	0.64
North Nowra (R2)	1.06	1.04	0.63
Nowra (R3)	1.07	1.05	0.62
Terara (R4)	1.05	1.04	0.61
C1	1.17	1.13	0.67
C2	1.22	1.17	0.67
C3	1.20	1.15	0.66
C4	1.16	1.12	0.66
C5	1.14	1.11	0.66
C6	1.18	1.14	0.67
C7	1.15	1.11	0.66

Note 1: The 15 minute concentrations were calculated from the hourly values by applying a peak to mean factor of $(60/15)^{0.2}$.

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.

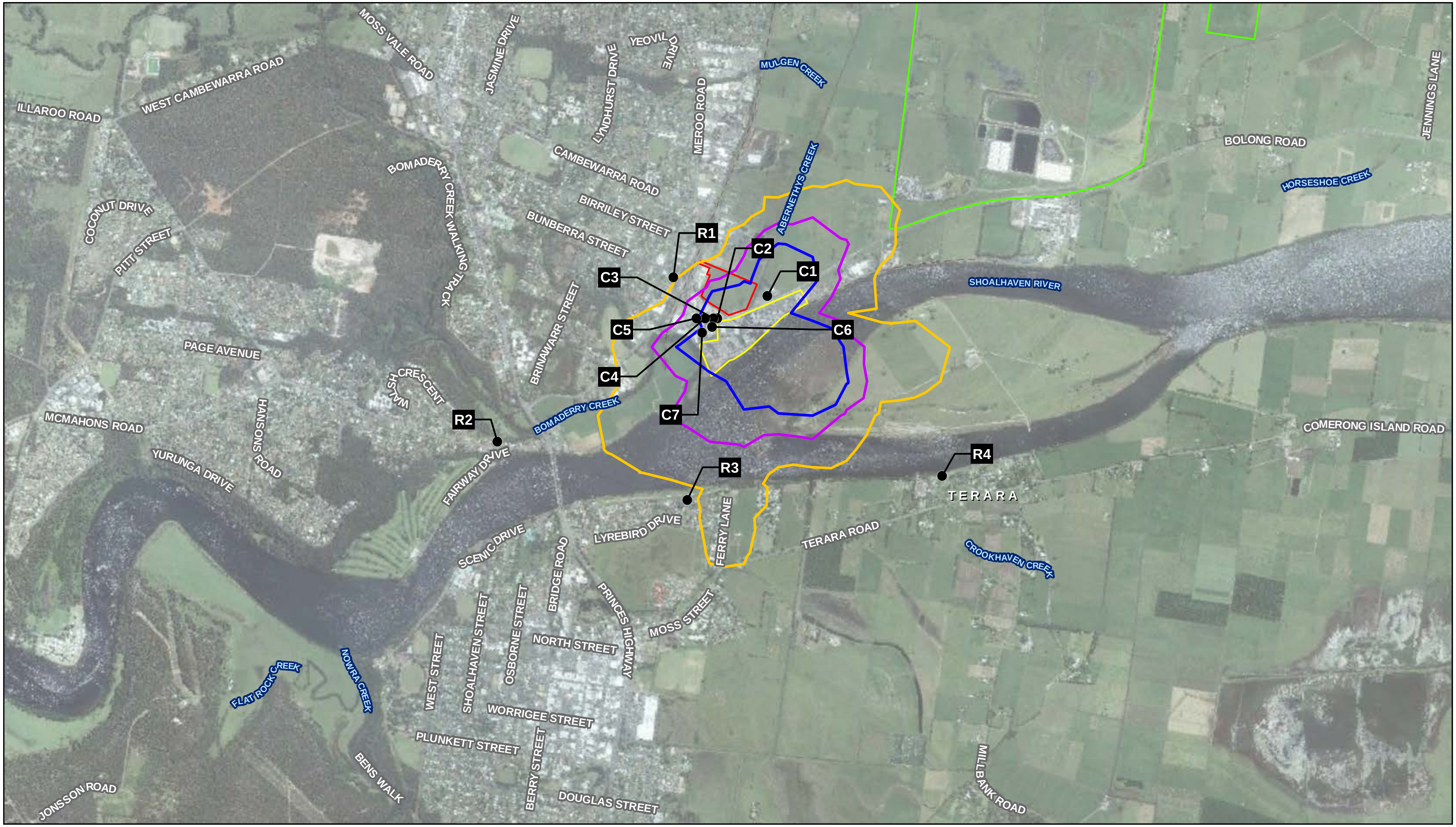
Table 8-12 Maximum predicted ground level Hydrogen Fluoride concentrations

Receptor	Total impact (Incremental plus background) ($\mu g/m^3$)			
Criteria, $\mu g/m^3$	1.5 (24 hour)	0.8 (7 day)	0.4 (30 day)	0.5 (90 day)
Background, $\mu g/m^3$	No data	No data	No data	No data
Bomaderry (R1)	0.21	0.07	0.05	0.04
North Nowra (R2)	0.17	0.05	0.04	0.02
Nowra (R3)	0.13	0.02	0.01	0.01
Terara (R4)	0.06	0.01	0.01	0.00
C1	0.62	0.22	0.10	0.06
C2	0.33	0.13	0.09	0.08

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
C3	0.32	0.13	0.09	0.07
C4	0.29	0.12	0.08	0.06
C5	0.32	0.12	0.07	0.06
C6	0.36	0.16	0.10	0.08
C7	0.33	0.15	0.10	0.08

Table 8-13 Maximum predicted ground level Hydrogen Chloride concentrations

Receptor	Averaging Period	Incremental Impact (mg/m³)	Background Concentration (mg/m³)	Total Impact (mg/m³)	Criteria (mg/m³)
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	0.001	-	0.001	0.14
C1	1 hour	0.004	-	0.004	0.14
C2	1 hour	0.004	-	0.004	0.14
C3	1 hour	0.004	-	0.004	0.14
C4	1 hour	0.003	-	0.003	0.14
C5	1 hour	0.002	-	0.002	0.14
C6	1 hour	0.003	-	0.003	0.14
C7	1 hour	0.003	-	0.003	0.14



Paper Size A4

0 200 400 800

Metres

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

N

LEGEND

- Identified sensitive receptors
- Shoalhaven Starches Factory
- Environmental farm boundary
- Packing plant (proposed)

S02 1HR concentration contour (µg/m³)

- 200
- 250
- 300

Manildra Group Pty Ltd
Shoalhaven Starches

Job Number	21-12534209
Revision	B
Date	26 Aug 2020

Maximum Predicted Cumulative Ground Level SO2 Concentrations (1 hour Average) , µg/m³

Figure 11

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\21_12534209_Z006_SO2_Cumulative.mxd

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

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012. Created by:eibbertson

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 are provided in Table 8-14. 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 19 changes

No new sources of PAH, VOC or metal emissions are proposed as part of Modification 19 compared to those assessed in Modification 17.

Table 8-14 Maximum predicted ground level PAH, VOC and metals concentrations

Receptor	Incremental Impact (mg/m³)										
Pollutant	PAH	VOC	Antimony	Arsenic	Cadmium	Mercury	Beryllium	Chromium	Manganese	Nickel	Lead
Criteria	0.0004 mg/m³ (1 hour)	Individual VOCs (1 hour)	9.00E-03 mg/m³ (1 hour)	9.00E-05 mg/m³ (1 hour)	1.80E-05 mg/m³ (1 hour)	1.80E-03 mg/m³ (1 hour)	4.00E-06 mg/m³ (1 hour)	9.00E-05 mg/m³ (1 hour)	1.80E-02 mg/m³ (1 hour)	1.80E-04 mg/m³ (1 hour)	5.0E-04 mg/m³ (Annual)[4]
Bomaderry (R1)	1.1E-06	1.7E-03	1.3E-06	1.4E-06	1.3E-07	1.3E-07	1.1E-07	8.8E-07	1.1E-06	2.8E-06	9.0E-08
North Nowra (R2)	9.0E-07	1.2E-03	9.5E-07	9.9E-07	1.2E-07	1.3E-07	7.8E-08	6.1E-07	8.5E-07	2.1E-06	5.6E-08
Nowra (R3)	1.4E-06	1.6E-03	1.2E-06	1.3E-06	2.4E-07	1.8E-07	1.0E-07	7.7E-07	1.2E-06	2.8E-06	4.5E-08
Terara (R4)	1.1E-06	1.1E-03	8.5E-07	8.9E-07	1.0E-07	9.3E-08	7.0E-08	5.6E-07	9.2E-07	1.8E-06	2.9E-08
C1	3.0E-06	4.3E-03	3.2E-06	3.5E-06	3.7E-07	4.3E-07	2.7E-07	2.2E-06	3.1E-06	7.4E-06	2.7E-07
C2	2.9E-06	5.2E-03	3.6E-06	3.8E-06	4.2E-07	4.2E-07	2.9E-07	2.5E-06	3.3E-06	8.0E-06	3.0E-07
C3	2.7E-06	4.7E-03	3.3E-06	3.5E-06	3.8E-07	3.8E-07	2.6E-07	2.3E-06	3.0E-06	7.2E-06	2.7E-07
C4	2.1E-06	3.7E-03	2.7E-06	2.8E-06	3.1E-07	2.8E-07	2.1E-07	1.8E-06	2.3E-06	5.7E-06	2.3E-07
C5	1.7E-06	2.9E-03	2.2E-06	2.3E-06	2.4E-07	2.3E-07	1.8E-07	1.5E-06	1.9E-06	4.6E-06	1.9E-07
C6	2.6E-06	4.3E-03	3.0E-06	3.2E-06	4.0E-07	3.9E-07	2.5E-07	2.1E-06	2.9E-06	7.0E-06	3.3E-07
C7	2.1E-06	3.5E-03	2.6E-06	2.7E-06	3.0E-07	3.1E-07	2.1E-07	1.7E-06	2.5E-06	5.8E-06	2.7E-07
Maximum level (on site)	6.3E-06	1.0E-02	7.1E-06	7.5E-06	2.0E-06	8.4E-07	5.9E-07	4.5E-06	6.0E-06	1.5E-05	5.3E-07

[4] Lead criteria converted from µg/m³ to mg/m³ 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 changes to the existing Ethanol Distillery Plant to increase the production of ‘beverage’ grade ethanol on site and would include the installation of distillation columns and associated processing equipment, a site boundary adjustment, the addition of 3 ethanol storage tanks, the construction of an additional ethanol loadout and the construction of three product silos.

A marginal increase was observed in predicted odour impacts as a result of the modification. The odour criteria is met at all residential sensitive receptors and it is considered highly unlikely that the increase in odour would be detected at sensitive receptors.

Air quality impacts are predicted to comply with the criteria at all residential sensitive receptors.

Overall, the proposal should be acceptable from an air quality perspective.

10. References

Department of Environment and Conservation. (2006). *Technical Framework: Assessment and management of odour from stationary sources in NSW*. Sydney: NSW government

EPA. (2016). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Sydney: NSW Government.

GHD. (2008). *Shoalhaven Starches- Report of Ethanol Upgrade Air Quality Assessment*. Melbourne VIC: GHD

GHD (2019), *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*. Sydney NSW: GHD

GHD (2020), *Air Quality Assessment Mod 17, 2019*

National Pollutant Inventory Emission estimation technique manual for Combustion in boilers Version 3.6 (December, 2011)

Odour Research Laboratories Australia (2020), *Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01*

Stephenson Environmental Management Australia. (2015). *Modifications to Existing Flour Mill. Newington NSW*: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2015). *Modifications to Packing Plant. Newington NSW*: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2017). *Emission Test Report No. 5805 Compliance stack emission survey – Quarter no. 4, 2016-2017*. Newington NSW: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2017). *Emission Test Report No. 5852/M Compliance stack emission survey – Quarter no. 1, 2017-2018*. Newington NSW: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2018). *Compliance stack emission survey – commissioning (Q1) Emission Point EPL ID 42 – Serving boiler no. 4*. Newington NSW: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2019). *EPL Odour Emission Survey Annual & Quarter 4, 2018-2019*. Newington NSW: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2020). *Emission test report no. 7071 (SD1) Stack emission survey – particulate matter Emission point EPL ID 12 – (Starch dryer no. 1)*. Newington NSW: Stephenson Environmental Management Australia

Stephenson Environmental Management Australia. (2020a) *Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 2 - Report No. 7050*

Stephenson Environmental Management Australia. (2020b) *Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 4 - Report No. 7051A*

Stephenson Environmental Management Australia. (2020c) *Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 5&6 - Report No. 7049*

Stephenson Environmental Management Australia. (2020d) *Stack Emission Survey - Particulate Matter - Starch Dryer 1, 4 and Spray Dryer - Report No. 7071*

Stephenson Environmental Management Australia. (2020e) *Starch and Gluten Dryers NOx Emission Test Report No. 7093*

The Odour Unit. (2010). *Ethanol Upgrade: DDG Biofilter Commissioning & Operating Manual . Eveleigh*, NSW: The Odour Unit

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[5], 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[6], 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).

---

[5] 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
[6] Hurley, P. The Air Pollution Model (TAPM) version 3. CSIRO Atmospheric Research Paper No. 31, 2005

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 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.

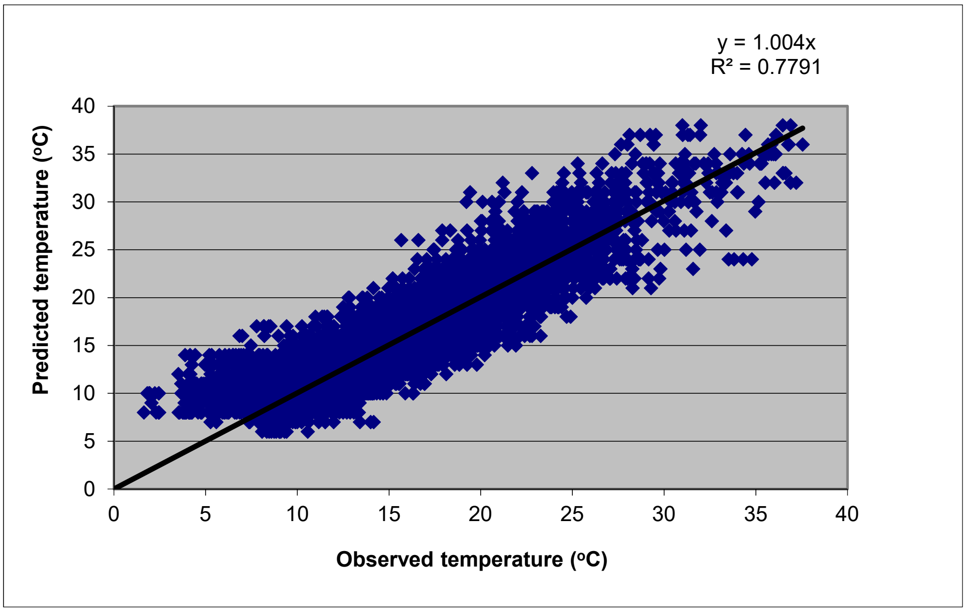


Figure A1 Scatter Plot of Observed and Predicted Ambient Temperature

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.

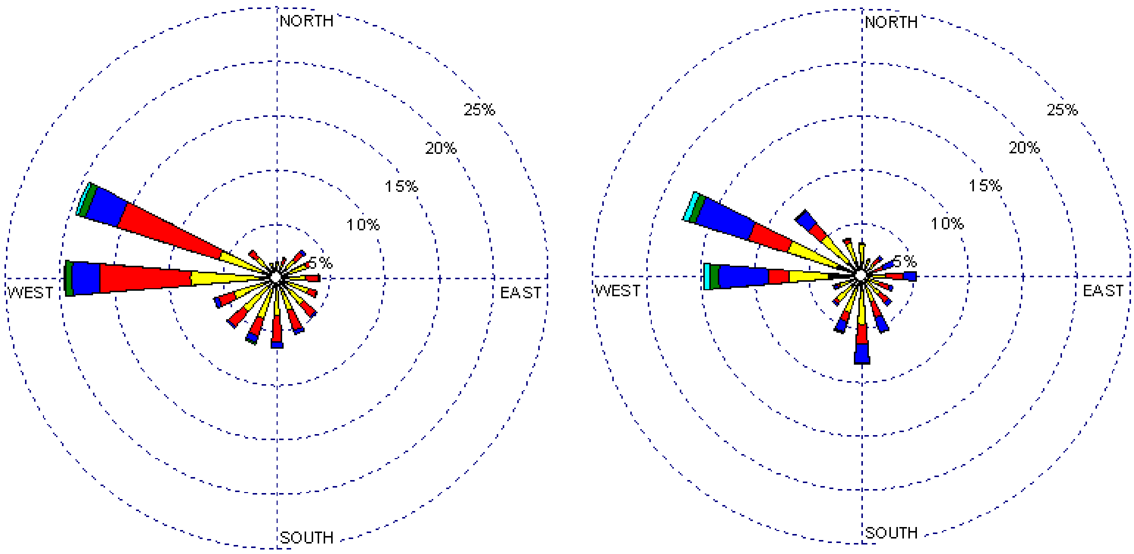
The wind speed and direction observations from the Farm AWS were assimilated into the prognostic model simulation to improve the ability of the model to capture the effects of local wind channelling and low wind speed conditions. The improvement to wind direction distributions in the model output is 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[7]. 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.

[7] Luhar, A., Hurley, P. and Rayner, K. Improving Land Surface Processes in TAPM. Part 2: Low Wind Stable Conditions. 14th IUAPPA World Congress 2007

TAPM output at Nowra AWS grid point	Recorded at Nowra AWS



Legend

WIND SPEED (m/s)

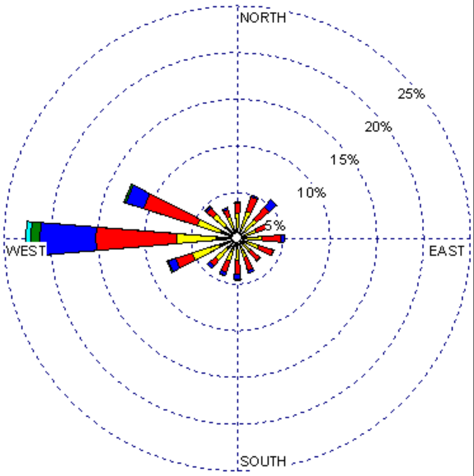
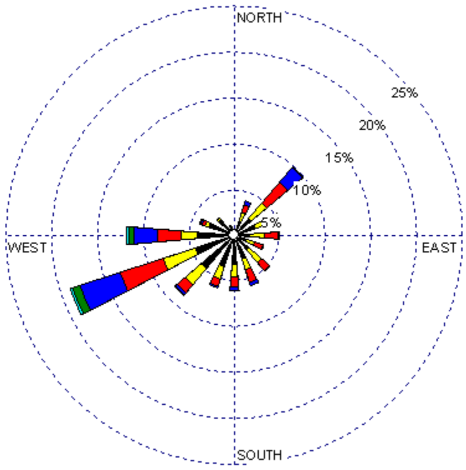
- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Project No.:

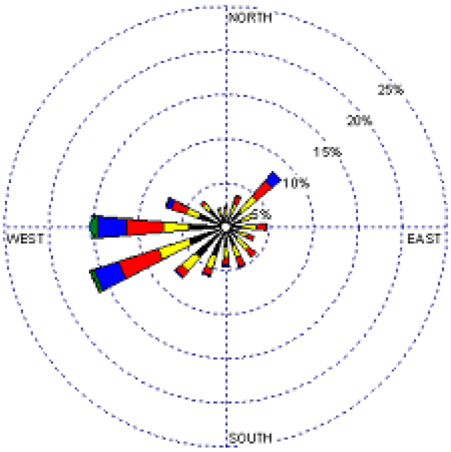
22/13594

GHD CLIENTS | PEOPLE | PERFORMANCE

Figure A2 Nowra AWS - Annual Wind Roses (Year 2004)

a) TAPM output at Farm AWS	b) Recorded at Farm AWS
	

c) TAPM output at Farm AWS grid point after Farm AWS data assimilated



Legend

Project No.:

22/13594

Figure A3 Farm AWS - Annual Wind Roses (year 2004)

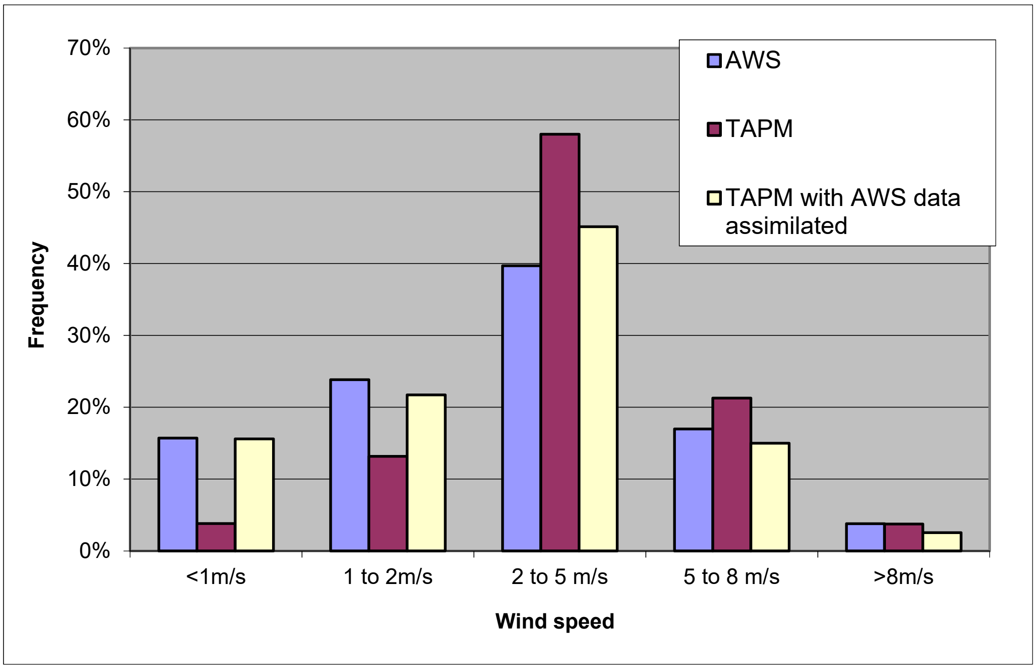


Figure A4 Wind Speed Distribution – TAPM and Farm AWS

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)[8], 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.

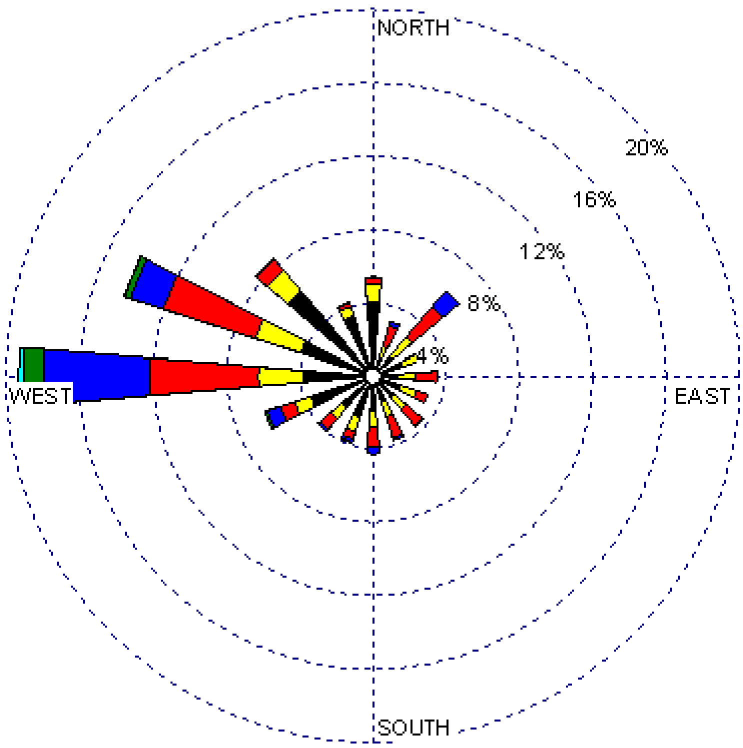
CALMET was used to produce hourly site-representative winds and micrometeorological information, which was used with the CALPUFF 3D puff-based dispersion model to assess the impacts of the air pollutants on the surrounding land uses.

[8] 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

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 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.



Legend

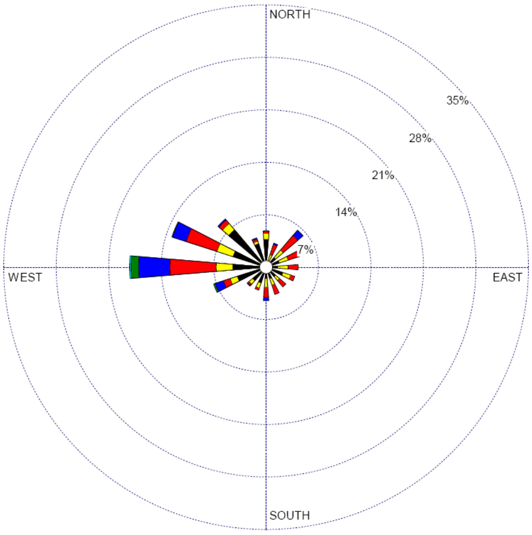
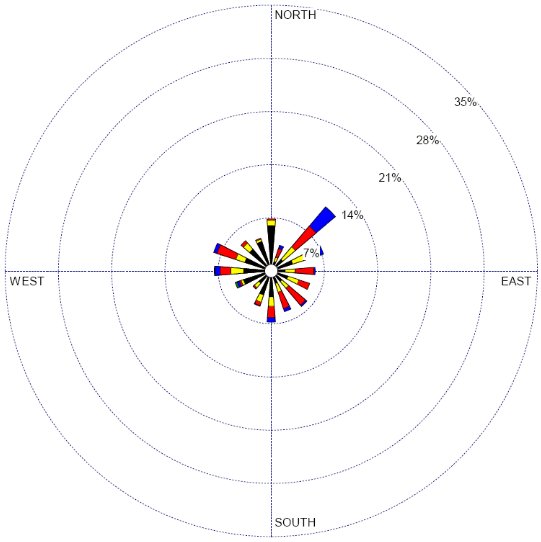
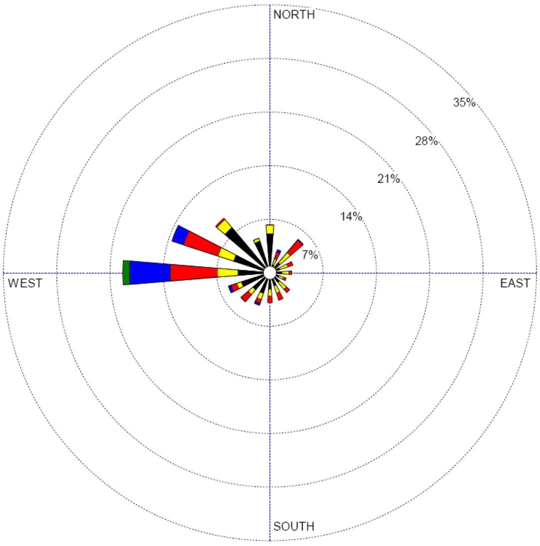
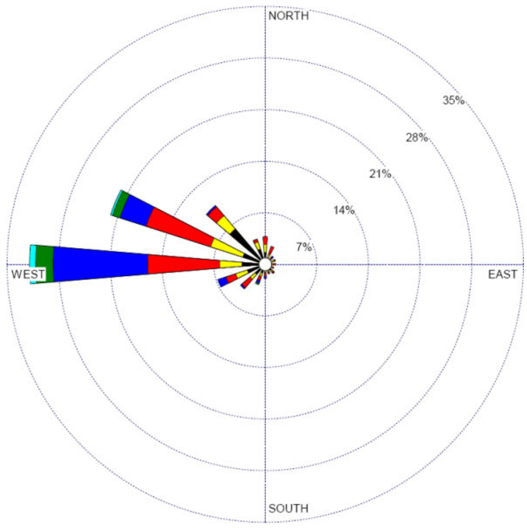
WIND SPEED (m/s)

- >= 11.1
- 8.8 - 11.1
- 5.7 - 8.8
- 3.6 - 5.7
- 2.1 - 3.6
- 0.5 - 2.1

Comments: **Average wind speed = 3.2 m/s**

Project No.: **22/13594**

Figure A5 Factory Annual Wind Rose - Year 2004

Spring (average wind speed = 3.1 m/s)	Summer (average wind speed = 2.8 m/s)
	
Autumn (average wind speed = 2.8 m/s)	**Winter (average wind speed = 4.1 m/s)**
	

Legend

Project No.:

22/13594

GHD CLIENTS | PEOPLE | PERFORMANCE

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 [1]
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%

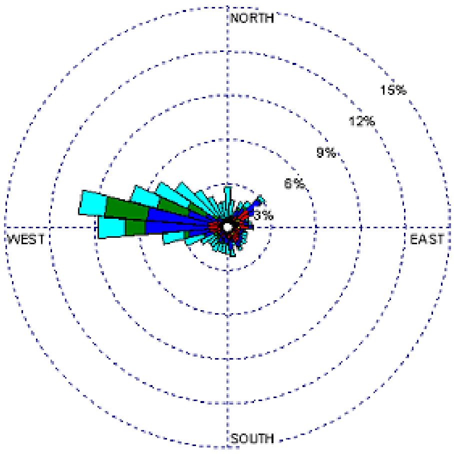
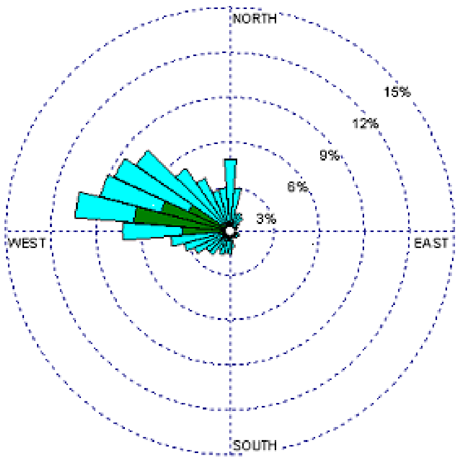
1. Stability data in this table extracted from Factory meteorological data

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.

All stability classes	E & F Stability classes (stable conditions only)
	

Legend

Stability Class

- F
- E
- D
- C
- B
- A

Comments: Location of Factory

Project No.:

22/13594

GHD CLIENTS | PEOPLE | PERFORMANCE

Figure A7 Factory Annual Stability Rose - Year 2008

Appendix B – Complete odour emission inventory

Source	EPA ID	ID	Source type	Height m	Diameter m	Exit velocity m/s	Exit temperature K	OER after control OUm^3/s	Peak to mean adjusted total OER OUm^3/s
Boiler No. 2	45	BOILR2	tall wake free	40.0	0.65	25.3	442	12,677	29,157
Boiler No. 4	42	BOILR4	tall wake free	41.0	0.90	24.3	435	27,988	Variable
Combined Boiler Stack for No. 5 & 6 Boilers. Coal combustion odour	35	BOILR5	tall wake free	54.0	2.05	14.1	410	88,902	Variable
Light phase recovery tank		DDG19	wake affected	11.0	0.10	3.3	362	74	170
Pellet Mill Silo (proposed)		PMFS	wake affected	23.0	0.16	7.0	320	173	398
Pellet Plant exhaust stack	46	PPES	tall wake free	49.2	1.50	15.7	322	67,000	Variable
Pellet silo (mill feed silo)		S12	wake affected	2.0	0.32	25.0	304	350	805
Stillage surge tank		SST	wake affected	2.0	0.20	3.3	360	173	397
Vent condensor drain		VCD	wake affected	24.1	0.30	0.3	300	4,419	10,163
Ethanol Recovery Scrubber Discharge	16	ERESC	wake affected	28.0	0.30	11.4	302	33,091	76,110
Fermenters (10-16)	44	FERM	tall wake free	21.0	0.28	5.7	306	2,500	5,750
Yeast propagators - tanks 4 & 5		YP45	wake affected	17.0	0.25	3.0	311	820	1,886
Cyclone and fabric filter		A4	wake affected	33.0	1.60	6.0	313	679	1,562
Cyclone and fabric filter		A5	wake affected	33.0	1.60	6.0	313	96	221
Cyclone and fabric filter		A6	wake affected	33.0	1.60	6.0	311	449	1,033
Cyclone and fabric filter		A7	wake affected	33.0	0.80	9.0	297	932	2,144
Drum vacuum receiver		C4	wake affected	21.0	0.20	11.0	320	1,400	3,220
Dry gluten roof bin		S07	wake affected	25.0	0.65	15.0	328	4,500	10,350

Enzyme Tanks		B7	wake affected	6.0	0.46	0.3	327	2,042	4,696
Feed transfer to distillery		E22	wake affected	15.0	0.30	0.4	300	83	191
Flash Vessel Jet Cooker		C1	wake affected	21.0	0.10	0.1	350	970	2,231
Flour bin aspirator		S13A	wake affected	2.5	0.41	22.0	306	500	1,150
Flour bin aspirator		S13B	wake affected	2.5	0.41	22.0	306	500	1,150
Flour bin motor drive		S06	wake affected	24.0	0.27	18.0	307	283	651
Flour mill stack propsed and approved 1		FMP2	wake affected	31.8	0.68	4.4	322	266	612
Flour mill stack propsed and approved 2		FMP1	wake affected	33.4	0.90	4.2	300	205	472
Retention - tank 2 (now located in adjacent tank)		GRT	wake affected	21.0	0.20	18.0	360	4,535	10,430
High protein dust collector		S08	wake affected	24.5	0.39	12.0	316	600	1,380
Incondensible gases vent		D6	wake affected	13.0	0.20	0.6	309	558	1,284
Ion exchange effluent tank		C18	wake affected	2.5	0.46	0.3	307	250	575
Jet cooker 1 - retention tank		E13	wake affected	10.0	0.27	0.8	362	1,067	2,454
Jet cooker 2 & 4 - Retention		E7	wake affected	9.0	0.10	3.1	373	567	1,304
Molecular Sieve - Vacuum drum		D2	wake affected	10.0	0.08	13.0	337	1,350	3,105
No. 1 Gluten Dryer baghouse	8	S02	wake affected	25.5	3.20	14.0	346	9,800	22,540
No. 1 Starch Dryer	12	S01	wake affected	26.0	1.30	6.8	311	2,800	6,440
No. 2 Gluten Dryer baghouse (aka. No 2 Starch Dryer)	9	S04	wake affected	27.0	3.20	17.0	340	7,200	16,560
No. 3 Gluten Dryer baghouse	10	S03	wake affected	21.0	2.50	9.2	344	12,700	29,210
No. 3 Starch Dryer	13	S18	wake affected	20.0	1.20	23.0	309	3,800	8,740

No. 4 Gluten Dryer baghouse	11	S05	wake affected	30.0	2.70	17.0	350	9,100	20,930
No. 4 Starch Dryer	14	S19	wake affected	20.0	1.20	23.0	320	3,600	8,280
No. 5 Ring Dryer Starch		SDR5	wake affected	25.0	1.20	0.1	320	4,350	10,005
No. 5 Starch Dryer (existing)	47	SD5C	wake affected	33.5	2.35	14.3	335	4,931	11,341
No. 5 Starch Dryer (new)		SD5N	wake affected	30.0	2.35	14.3	335	25,269	58,119
No. 6 Gluten Dryer		GD6	wake affected	35.0	1.70	19.1	346	12,568	28,906
No. 7 Gluten Dryer		GD7	wake affected	29.0	1.80	19.3	341	9,553	21,972
Spray dryer		S20	wake affected	19.0	1.35	6.8	335	738	1,697
Starch factory rejects collection tank		E10	wake affected	8.0	0.10	1.3	308	183	421
Large Starch Silo 1		PPL1	wake affected	26.5	0.16	6.8	323	86	199
Large Starch Silo 2		PPL2	wake affected	26.5	0.16	6.8	323	86	199
Medium Gluten Silo 1		PPM1	wake affected	20.7	0.16	6.8	323	173	398
Medium Gluten Silo 2		PPM2	wake affected	20.7	0.16	6.8	323	173	398
Medium Gluten Silo 3		PPM3	wake affected	20.7	0.16	6.8	323	173	398
Small Gluten Silo		PPS1	wake affected	34.3	0.20	18.6	323	92	211
Small Starch Silo		PPS2	wake affected	34.3	0.20	18.6	318	35	81
Biofilter A	40	BIO1	area					502	Variable
Biofilter B	41	BIO2	area					1,648	Variable
Biofilter C		BIO3	area					1,089	Variable
Biofilter D		BIO4	area					1,280	Variable
Effluent storage dam 1	19	PO1	area					1,475	Variable
Effluent storage dam 2	20	PO2	area					973	Variable
Effluent storage dam 3	21	PO3	area					2,962	Variable
Effluent storage dam 5	23	PO5	area					6,538	Variable

Effluent storage dam 6	24	PO6	area					3,097	Variable
Sulphur Oxidisation Basin	25	SOBAS	area					1,939	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
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	0.07	8.8	312	1,399	3,219
Flour Mill B		FMBA	wake affected	39.5	0.65	12.2	322	687	1,581
Flour Mill B		FMBB	wake affected	39.5	1.00	2.8	322	214	492
Flour Mill B		FMBC	wake affected	39.5	1.00	4.9	322	659	1,516
Flour Mill B		FMBD	wake affected	39.5	0.65	29.1	300	748	1,720
Flour Mill B		FMBE	wake affected	39.5	1.10	10.2	300	748	1,720
Flour Mill B		FMBF	wake affected	39.5	1.10	3.5	300	566	1,301
Flour Mill C		FMC1	wake affected	37.6	0.65	12.2	322	687	1,581
Flour Mill C		FMC2	wake affected	37.6	0.65	6.5	293	214	492
Flour Mill C		FMC3	wake affected	37.6	0.65	11.7	322	659	1,516
Gluten dryer no. 8		GD8	wake affected	29.0	1.90	19.1	346	12,568	28,906
Product dryer no. 9		PD9	wake affected	35.6	0.85	15.3	346	9,800	22,540
Beverage Ethanol D500 Vent (Column washing vent 2)		CWV2	wake affected	55.0	0.07	8.8	312	1,399	3,219

Appendix C – Site sampling reports

Appendix C contains the following sampling reports:

- Odour Research Laboratories Australia (2020), Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01
- Stephenson Environmental Management Australia. (2020). Emission test report no. 7071 (SD1) Stack emission survey – particulate matter Emission point EPL ID 12 – (Starch dryer no. 1). Newington NSW: Stephenson Environmental Management Australia
- Stephenson Environmental Management Australia. (2020a) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 2 - Report No. 7050
- Stephenson Environmental Management Australia. (2020b) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 4 - Report No. 7051A
- Stephenson Environmental Management Australia. (2020c) Compliance Stack Emission Survey - Q4 2019-2020 - Boiler 5&6 - Report No. 7049
- Stephenson Environmental Management Australia. (2020d) Stack Emission Survey - Particulate Matter - Starch Dryer 1, 4 and Spray Dryer - Report No. 7071
- Stephenson Environmental Management Australia. (2020e) Starch and Gluten Dryers NOx Emission Test Report No. 7093

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:

Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	Beverage Ethanol D500 Vent.
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7091/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5394 to 5395
	SEMA Sample number(s):	728109 to 728110
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	16 July 2020
	Order number:	5123
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	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

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 ± 3°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 Emission Sampling

Odour emission sampling was undertaken on the Vent D500 Beverage Ethanol Plant.

Odour Emission Test Results

The measured odour emission concentrations and exhaust gas flow rates are summarised in Table 1 and detailed in Tables 2.

Table 1 - Summary of Odour Emission Test Results – D500 Vent, July 15th 2020

Sample location	Run No.	Date sampled	Odour Conc. (ou)	Stack Gas Temp. (°C)	Velocity (m/s)	Volumetric Flow rate dry (**wet**) (m^3/s)	MOER ($ou.m^3/s$)	Oxygen (%)
D500 Vent	1	15-July-20	20,700	39.1	8.8	0.03 (0.03)	660	20.7
	2	15-July-20	26,600	39.1			850	20.8

Key:

MOER	=	Mass Odour Emission Rate
ou	=	odour units
ou.m3/s	=	odour unit volume per second
Temp.	=	temperature
°C	=	degrees Celsius
m^3/s	=	cubic metres per second (at 1atmosphere and 273 Kelvin)
m/s	=	metres per second
%	=	percentage

Table 2 - Odour Emission and Exhaust Gas Test Detailed Results – Beverage Ethanol D500 Vent

Emission Test Results	Velocity & Flow / Moisture			
Test Location	**Beverage Ethanol D500 Vent**			
Date	15-July-2020			
Flow report method	**Dry**	**Wet**	**Dry**	**Wet**
Run	1	1	2	2
Method	TM-1, TM-2 & TM-22		TM-1, TM-2 & TM-22	
Sample Start Time (hrs)	14:21	14:21	14:40	14:40
Sample Stop Time (hrs)	14:39	14:39	15:02	15:02
Inlet/Exhaust	Exhaust		Exhaust	
Stack Temperature (^oC)	39.1	39.1	39.1	39.1
Stack Cross-Sectional area (m^2)	0.004	0.004	0.004	0.004
Average Stack Gas Velocity (m/s)	8.8	8.8	8.8	8.8
Actual Gas Flow Volume (am^3/min)	2.3	2.3	2.3	2.3
Total Normal Gas Flow Volume (m^3/min)	1.9	2.0	1.9	2.0
Total Normal Gas Flow Volume (m^3/s)	0.032	0.032	0.034	0.034
Total Stack Pressure (kPa)	101.83	101.83	101.83	101.83
Moisture Content (% by volume)	5.89	5.89	5.89	5.89
Molecular Weight Dry Stack Gas (g/gmole)	28.828	28.832	28.832	28.832
Dry Gas Density (kg/m^3)	1.29	1.29	1.29	1.29
Oxygen (%)	20.7	20.8	20.7	20.8
Analysis	Odour		Odour	
Method	AS4323.3		AS4323.3	
ORLA Number	5394	5394	5395	5395
SEMA Number	728019	728019	728020	728020
Sample Start Time (hrs)	14:27	14:27	14:45	14:45
Sample Finish Time (hrs)	14:39	14:39	15:02	15:02
Odour Concentration (As Received) (ou)	20700	20700	26600	26600
Odour Concentration (Final) (ou)	**20700**	20700	**26600**	26600
Normal MOER (As Received) (ou m^3/s)	660	700	850	900
Normal MOER (Final) (ou m^3/s)	660	700	850	900
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit		No Limit	
Sample Storage Period, prior to disposal	2 days		2 days	
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

Odour Olfactometry Results – 7091/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) 1 *	(ou) 2 *	
Sample ID: Beverage Ethanol D500 Vent Run 1	728019	15/07/2020 14:27	5394	16/07/2020 10:40	4	8	Nil	20,700	20,700	Coffee, caramel liqueur, nutty, garbage, sharp, sweet vinegar, banana, sweet, fruity (-1)^
Sample ID: Beverage Ethanol D500 Vent Run 2	728020	15/07/2020 14:45	5395	16/07/2020 11:09	4	8	Nil	26,600	26,600	Coffee, grainy, nutty, sharp, sweet vinegar, banana, fruity (-1)

Odour Panel Calibration Results – 7091/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5393	16.07.2020	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:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] 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.

Panellist Rolling Average:

16/07/2020: SR =46.9, PR = 61.3, TL =33.3, JW= 43.8

^ 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 panellist responses at the recognition threshold.

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

--END OF TEST REPORT--

Stephenson
Environmental Management Australia

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

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

EMISSION TEST REPORT NO.7071(SD1)

STACK EMISSION SURVEY – PARTICULATE MATTER

EMISSION POINT EPL ID 12 - (STARCH DRYER NO. 1)

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: 7071(SD1)/S25601/20

DATE OF SURVEY: 14 MAY 2020

DATE OF ISSUE: 22 MAY 2020

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

1 EMISSION TEST REPORT NO.7071(SD1)

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	7071/S25601/20
Test Date:	14 April 2020
Production Conditions:	Normal operating conditions, refer section 1.4.
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, total solid particulate matter and particulate matter less than 10 microns (PM10).
Sample Locations:	EPL No.883; EPL ID No. 12 – Starch Dryer No. 1 Stack
Sample ID Nos.:	See Attachment A

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2164
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report No. 2164
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071

Deviations from Test Methods Nil.

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 22 May 2020

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7071(SD#1) - EPL ID 12

Parameter	Unit of measure	Location EPL ID 12 (Starch Dryer No. 1) Tested: 14 April 2020 Average Result
Sampling times	hours	13:45-15:15
Temperature	°C	38
Pressure	kPa	102.7
Velocity	m/s	6
Actual Volumetric Flow	am³/s	13
Volumetric Flow	m³/s	11
Moisture	%	1.6
Molecular Weight Dry Stack Gas	g/g mole	28.5
Dry Gas Density	kg/m³	1.27
Oxygen	%	20.9
Particulate Matter less than 10 microns	mg/m³	3
Total Solid Particulates	mg/m³	4

Key to Table 1.1:

EPL	=	Environment Protection Licence
ID	=	identification no.
%	=	percentage
Conc.	=	concentration
--	=	Not referenced in EPL
°C	=	degrees Celsius
<	=	less than
>	=	greater than
kg/m³	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m³/s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
m/s	=	metres per second
am³/s	=	dry cubic metre per second @ in-stack conditions
mg/m³	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2, USEPA 201A	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2, USEPA 201A	50%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%

Key:

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

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

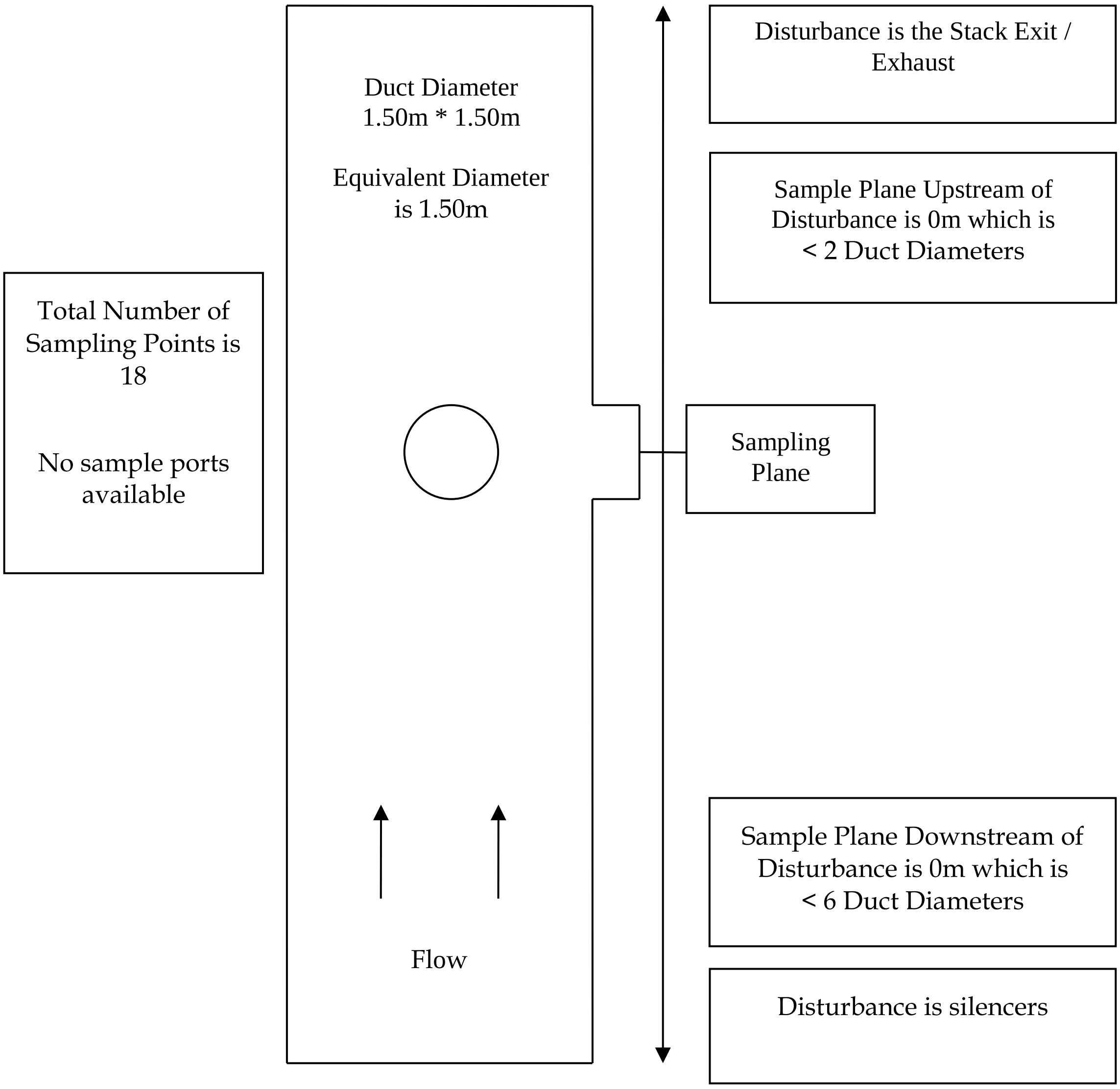
Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m^{3}- which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of $\pm$ 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.3 PROCESS DATA - STARCH DRYER NO. 1

Shoalhaven Starches personnel considered Starch Dryer No.1 was operating under typical conditions on the day of testing. Refer Shoalhaven Starches for details.

1.4 SAMPLING LOCATION – STARCH DRYER NO. 1



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-1 STARCH DRYER NO. 1 – SAMPLE LOCATION

1.5 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	14-Jun-19	14-Jun-20
645	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
920	Thermocouple	02-Dec-19	02-Jun-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
466	Nozzle TSP Box 2	05-Dec-19	05-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
927	Balance		Response Check with SEMA Site Mass
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
946	combustion analyzer	16-Mar-20	16-Sep-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

ATTACHMENT A – NATA CERTIFICATE OF ANALYSIS

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2164

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	7071/S25601/2020
	Analysis Requested:	TM-15, OM-5
	Chain of Custody Number	S25607
	Date Analysis Completed:	15 May 2020
	No. of Samples Tested:	2
	Sample Locations:	EPL ID No. 12 (Starch Dryer #1)
	Sample ID Nos.:	727947, 727948
	Filter ID Nos.:	15348, 15346

This report cannot be reproduced except in full

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

NATA
WORLD RECOGNISED ACCREDITATION

Identification	The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods	Nil

Issue Date
15 May 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2164

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Boiler 4 TSP	727947	15348	14/05/2020	15/05/2020	0.00310
Boiler 4 PM10	727948	15346	14/05/2020	15/05/2020	0.00291

Key:
g = grams

Stephenson

Environmental Management Australia

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

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

EMISSION TEST REPORT NO.7050

COMPLIANCE STACK EMISSION SURVEY – QUARTER NO. 4, 2019-2020

EMISSION POINT EPL ID 45 - (BOILER NO. 2)

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.:	**7050/S25389A/20**
DATE OF SURVEY:	**1 APRIL 2020**
DATE OF ISSUE:	**22 APRIL 2020**

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

1 EMISSION TEST REPORT NO.7050

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	7050/S25389A/20
Test Date:	1 April 2020
Production Conditions:	Normal operating conditions, refer section 1.4.
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, carbon monoxide, carbon dioxide, oxygen, nitrogen oxides, metals Type I and II, stack pressure, sulfur dioxide, total solid particulate matter and volatile organic compounds
Sample Locations:	EPL No.883; EPL ID No. 45 – Boiler No. 2 Stack
Sample ID Nos.:	See Attachment A

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Carbon Dioxide	NSW TM-24, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Carbon Monoxide	NSW TM-32, USEPA M10	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Metals	NSW TM-12, 13 & 14, USEPA M29	Envirolab Services Accreditation No. 2901 Report No. 240353
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Oxygen	NSW TM-25, USEPA M3A,	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2159
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7050

Sulfur Dioxide	NSW TM-4, USEPA M6C	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report No. 2159
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7050
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No 2020 - 1587

Deviations from Test Methods Nil.

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 22 April 2020

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7050 - EPL ID 45

Parameter	Unit of measure	Location EPL ID 45 (Boiler 2) Tested 1 April 2020 Average Result	EPL 883 100% Emission Conc. Limit (mg/m³)
Sampling times	hours	12:56-14:30	--
Temperature	°C	221	--
Pressure	kPa	102.0	--
Velocity	m/s	8.8	--
Actual Volumetric Flow	am³/s	8.4	--
Volumetric Flow	m³/s	4.4	--
Moisture	%	6.7	--
Molecular Weight Dry Stack Gas	g/g mole	30	--
Dry Gas Density	kg/m³	1.34	--
Carbon dioxide	%	10.3	--
Carbon monoxide (1 hr block average @ 7% O_2)	mg/m³	32	--
Sulfur dioxide (1 hr block average @ 7% O_2)	mg/m³	444	600
Nitrogen oxides (1 hr block average @ 7% O_2)	mg/m³	276	500
Oxygen	%	8.8	> 5%
Particulate Matter less than 10 microns	mg/m³	11.5	--
Total Solid Particulates (@ 7% O_2)	mg/m³	14.1	30
VOCs (as n-propane equivalent @ 7% O_2)	mg/m³	<5.1	40
VOCs (uncorrected for n-propane @ 7%O_2)	mg/m³	<5.3	--
Metals - Type I & II Substances in Aggregate (@ 7% O_2)	mg/m³	0.074	1
Antimony (Sb) Type I	mg/m³	< 0.00430	--
Arsenic (As) Type I	mg/m³	< 0.00430	--
Beryllium (Be) Type II	mg/m³	< 0.00032	--
Cadmium (Cd) Type I	mg/m³	0.00021	0.2
Chromium (Cr) Type II	mg/m³	0.00322	--
Cobalt (Co) Type II	mg/m³	0.00322	--
Copper (Cu)	mg/m³	0.00967	--
Lead (Pb) Type I	mg/m³	0.02042	--
Magnesium (Mg)	mg/m³	< 0.16118	--
Manganese (Mn) Type II	mg/m³	0.00322	--
Mercury (Hg) Type I	mg/m³	0.00092	0.2
Nickel (Ni) Type II	mg/m³	0.02149	--
Selenium (Se) Type II	mg/m³	0.02149	--
Tin (Sn) Type II	mg/m³	< 0.01075	--
Vanadium (V) Type II	mg/m³	< 0.00537	--

Key to Table 1.1:

EPL	=	Environment Protection Licence
ID	=	identification no.
%	=	percentage
Conc.	=	concentration
--	=	Not referenced in EPL
^{o}C	=	degrees Celsius
<	=	less than
>	=	greater than
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second $0^{o}C$ and 101.3 kilopascals (kPa)
m/s	=	metres per second
am^3/s	=	dry cubic metre per second @ in-stack conditions
mg/m^3	=	milligrams per cubic metre at $0^{o}C$ and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA 7E	15%
Oxygen and Carbon Dioxide	NSW TM-24, TM-25, USEPA 3A	1% actual
Carbon Monoxide	TM-32, USEPA 10	15%
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2,	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2,	50%
Metals - Type I & II Substances in Aggregate	NSW TM-12,13 & 14+, USEPA M29*	100%+ *(50-200%)**
Sulfur Dioxide	NSW TM-4, USEPA M6C	15%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA M18	25%

Key:

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

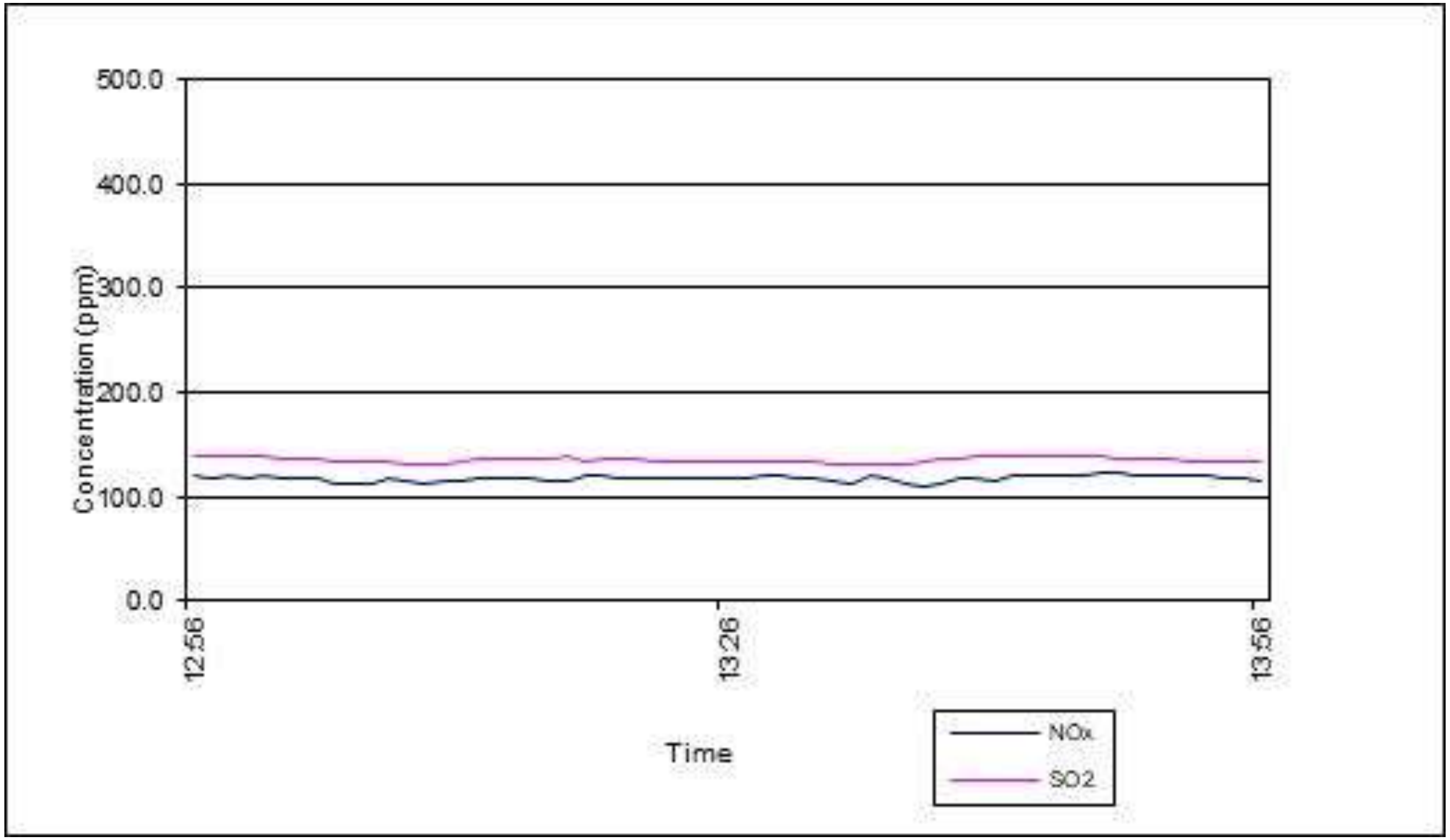
Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

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

Note: ISO 9096 is for 20-1000 mg/m^{3}- which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of ± 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.3 CONTINUOUS LOGGED RECORD OF SO_2 AND NO_X – 1 APRIL 2020

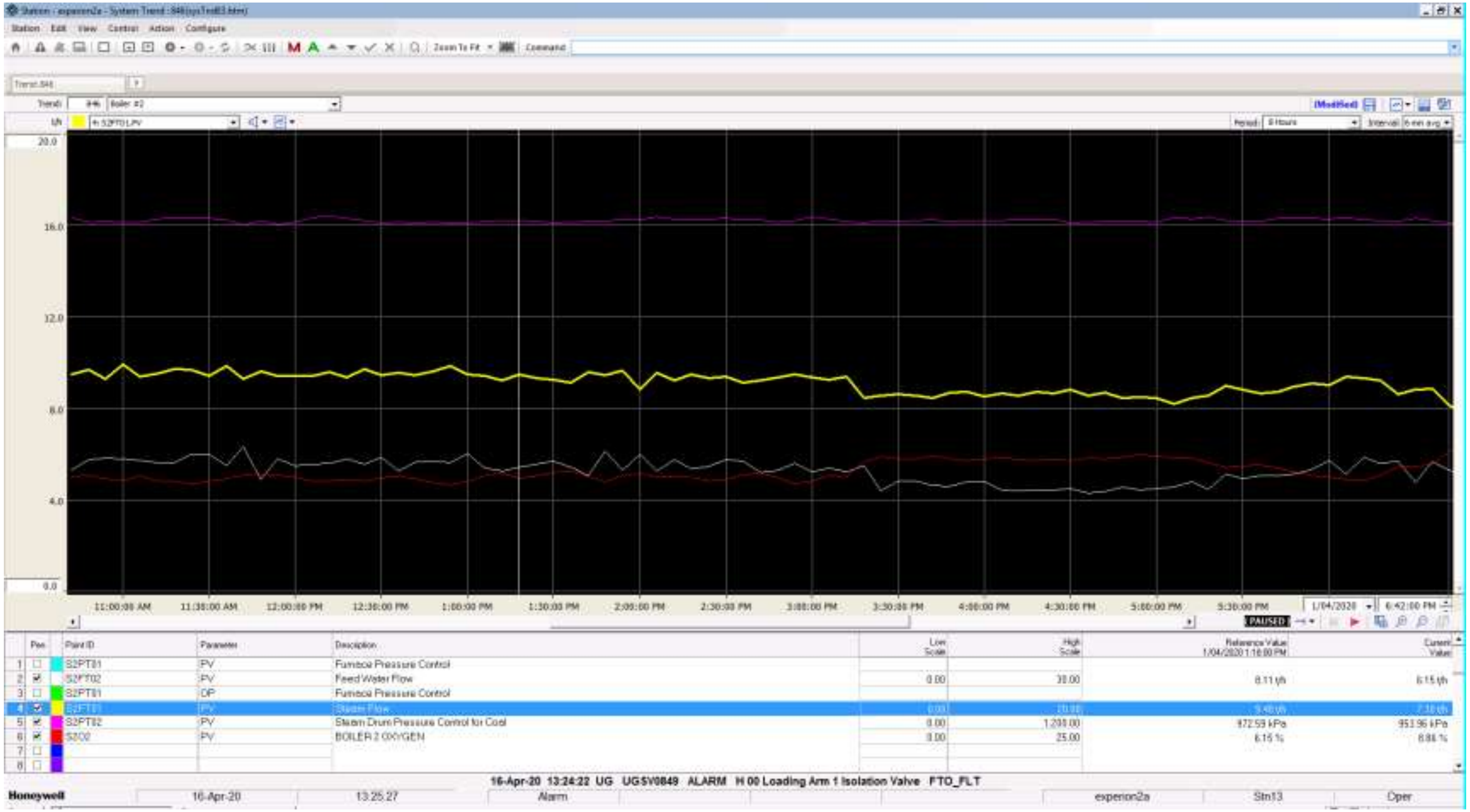
FIGURE 1-1 CONTINUOUS LOGGED TREND OF SO_2 AND NO_X IN PPM



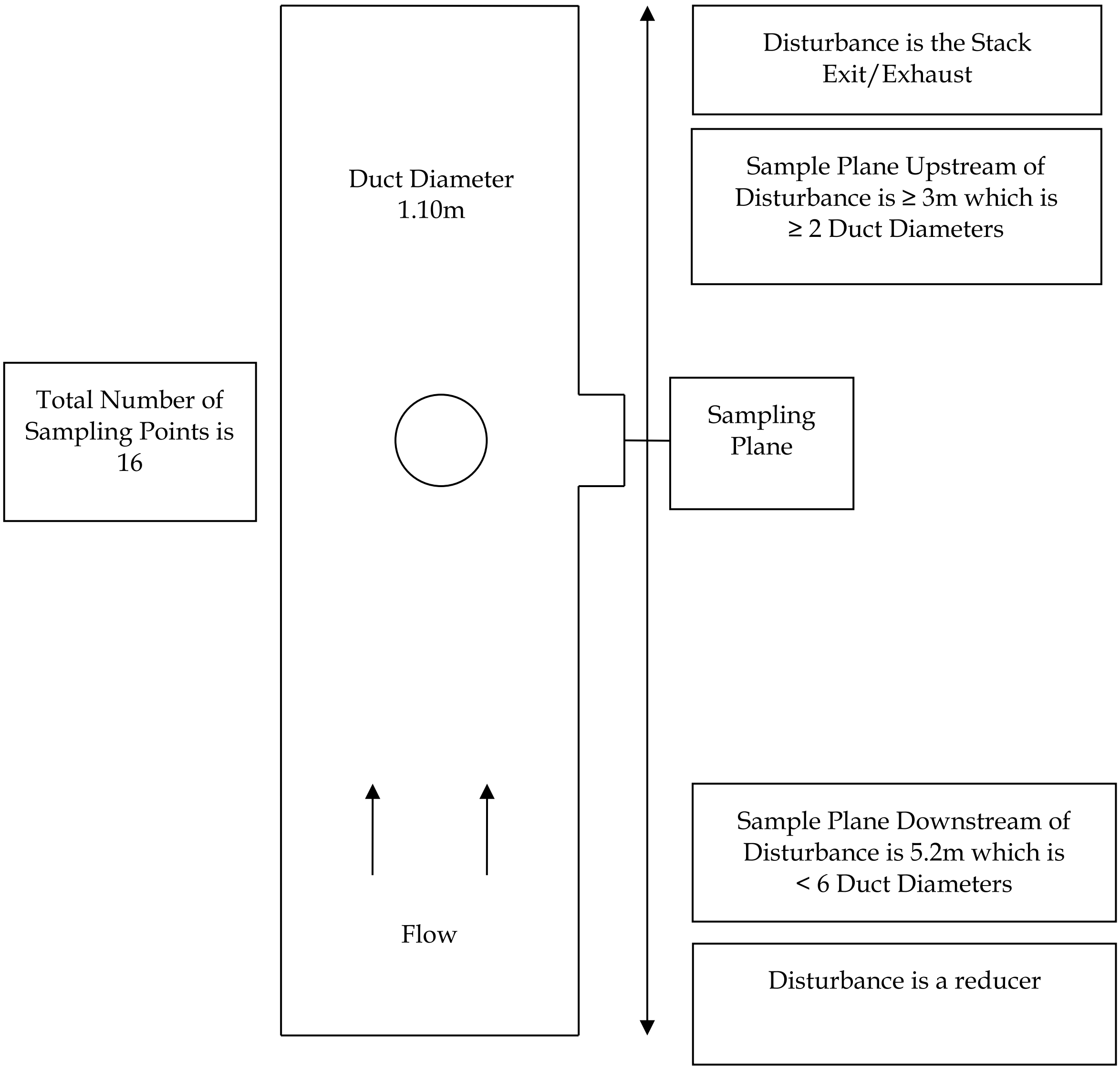
1.4 PROCESS DATA - BOILER NO. 2

Shoalhaven Starches personnel considered Boiler 2 was operating under typical conditions on the day of testing.

FIGURE 1-2 CONTINUOUS LOGGED TREND OF BOILER 2 STEAM FLOW OPERATING CONDITIONS



1.5 SAMPLING LOCATION – BOILER NO. 2



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

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

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

1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	14-Jun-19	14-Jun-20
539	USEPA Meter Box (gas meter)	03-Dec-19	03-Dec-20
645	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
920	Thermocouple	02-Dec-19	02-Jun-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
428	Nozzle TSP Swagelok 3	05-Dec-19	05-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
927	Balance		Response Check with SEMA Site Mass
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
835	Personal Sampler	26-Feb-20	26-Feb-21
946	combustion analyzer	16-Mar-20	16-Sep-20
924	Nozzle USEPA Metals Set Glass	05-Dec-19	05-Dec-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	05-May-20
262 ppm 263 ppm 249 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB 4441	23-Jun-21

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2159

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	7050/S25389A/20
	Analysis Requested:	TM-15, OM-5
	Chain of Custody Number	S25586
	Date Analysis Completed:	2 April 2020
	No. of Samples Tested:	2
	Sample Locations:	EPL ID No. 45 (Boiler 2)
	Sample ID Nos.:	727893, 727894
	Filter ID Nos.:	15326, 15327

This report cannot be reproduced except in full

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

Identification The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods Nil

Issue Date
15 April 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2159

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Boiler 2 TSP	727893	15326	01/04/2020	02/04/2020	0.01339
Boiler 2 PM10	727894	15327	01/04/2020	02/04/2020	0.00993

Key:
g = grams

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 240353

Client Details	
Client	Stephenson & Associates
Attention	Jay Weber
Address	PO Box 6398, Silverwater, NSW, 1811

Sample Details	
Your Reference	7050
Number of Samples	m29 sample train
Date samples received	03/04/2020
Date completed instructions received	03/04/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details	
Date results requested by	21/04/2020
Date of Issue	20/04/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Simon Mills, Group R&D Manager

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 240353
Revision No: R00

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Page | **1 of 8**

Client Reference: 7050

Metals in Emissions USEPA m29						
Our Reference		240353-2	240353-3	240353-4	240353-5	240353-6
Your Reference	UNITS	727895-2	727895-3	727895-4	727895-5A	727895-5B
Type of sample		Acetone Rinse	Front half rinse - 0.1N HNO3	Back half - 5% HNO3 / 10% H2O2	4th impinger rinse - 0.1N HNO3	4% KMnO4/ 10% H2SO4
Date prepared	-	07/04/2020	07/04/2020	07/04/2020	07/04/2020	07/04/2020
Date analysed	-	07/04/2020	07/04/2020	07/04/2020	07/04/2020	07/04/2020
Volume	mL	[NA]	49	299	64	209
Particle Matter	mg	8.0	[NA]	[NA]	[NA]	[NA]

Metals in Emissions USEPA m29						
Our Reference		240353-7	240353-8	240353-9	240353-10	240353-11
Your Reference	UNITS	727895-Analytical Fraction 1A	727895-Analytical Fraction 2A	727895-Analytical Fraction 1B	727895-Analytical Fraction 2B	727895-Analytical Fraction 3A
Type of sample		m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger
Date prepared	-	07/04/2020	07/04/2020	07/04/2020	07/04/2020	07/04/2020
Date analysed	-	07/04/2020	07/04/2020	07/04/2020	07/04/2020	07/04/2020
Antimony	µg	<4	<4	[NA]	[NA]	[NA]
Arsenic	µg	<4	<4	[NA]	[NA]	[NA]
Barium	µg	20	<3	[NA]	[NA]	[NA]
Beryllium	µg	<0.3	<0.3	[NA]	[NA]	[NA]
Cadmium	µg	0.2	<0.1	[NA]	[NA]	[NA]
Chromium	µg	2	1	[NA]	[NA]	[NA]
Cobalt	µg	3	<0.3	[NA]	[NA]	[NA]
Copper	µg	9	<3	[NA]	[NA]	[NA]
Lead	µg	19	<1	[NA]	[NA]	[NA]
Magnesium	µg	<150	<150	[NA]	[NA]	[NA]
Manganese	µg	1	2	[NA]	[NA]	[NA]
Mercury	µg	[NA]	[NA]	<0.05	0.70	<0.05
Nickel	µg	18	2	[NA]	[NA]	[NA]
Phosphorus	µg	1,200	<150	[NA]	[NA]	[NA]
Selenium	µg	<4	20	[NA]	[NA]	[NA]
Silver	µg	<3	<3	[NA]	[NA]	[NA]
Thallium	µg	<15	<15	[NA]	[NA]	[NA]
Tin	µg	<10	<10	[NA]	[NA]	[NA]
Vanadium	µg	<5	<5	[NA]	[NA]	[NA]
Zinc	µg	750	<6	[NA]	[NA]	[NA]

Client Reference: 7050

Metals in Emissions USEPA m29			
Our Reference		240353-12	240353-13
Your Reference	UNITS	727895-Analytical Fraction 3B	727895-Analytical Fraction 3C
Type of sample		m29 - Impinger	m29 - Impinger
Date prepared	-	07/04/2020	07/04/2020
Date analysed	-	07/04/2020	07/04/2020
Mercury	µg	0.06	0.1

Client Reference: 7050

Method ID	Methodology Summary
Metals-010	Determination of Metals in impingers and filters by ICP-OES/MS and Cold Vapour AAS using USEPA29 and in house methods METALS-010, 020, 021 and METALS-022.
Metals-029	Sample is evaporated to dryness at ambient temperature and pressure, dessicated and weighed back as per USEPA m29.

Client Reference: 7050

QUALITY CONTROL: Metals in Emissions USEPA m29					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			07/04/2020	[NT]	[NT]	[NT]	[NT]	07/04/2020	[NT]
Date analysed	-			07/04/2020	[NT]	[NT]	[NT]	[NT]	07/04/2020	[NT]
Particle Matter	mg	0.2	Metals-029	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Antimony	µg	4	Metals-010	<4	[NT]	[NT]	[NT]	[NT]	118	[NT]
Arsenic	µg	4	Metals-010	<4	[NT]	[NT]	[NT]	[NT]	110	[NT]
Barium	µg	3	Metals-010	<3	[NT]	[NT]	[NT]	[NT]	99	[NT]
Beryllium	µg	0.3	Metals-010	<0.3	[NT]	[NT]	[NT]	[NT]	88	[NT]
Cadmium	µg	0.1	Metals-010	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Chromium	µg	0.3	Metals-010	<0.3	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cobalt	µg	0.3	Metals-010	<0.3	[NT]	[NT]	[NT]	[NT]	99	[NT]
Copper	µg	3	Metals-010	<3	[NT]	[NT]	[NT]	[NT]	99	[NT]
Lead	µg	1	Metals-010	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Magnesium	µg	150	Metals-010	<150	[NT]	[NT]	[NT]	[NT]	104	[NT]
Manganese	µg	0.3	Metals-010	<0.3	[NT]	[NT]	[NT]	[NT]	95	[NT]
Mercury	µg	0.05	Metals-010	<0.05	[NT]	[NT]	[NT]	[NT]	99	[NT]
Nickel	µg	0.3	Metals-010	<0.3	[NT]	[NT]	[NT]	[NT]	99	[NT]
Phosphorus	µg	150	Metals-010	<150	[NT]	[NT]	[NT]	[NT]	97	[NT]
Selenium	µg	4	Metals-010	<4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Silver	µg	3	Metals-010	<3	[NT]	[NT]	[NT]	[NT]	106	[NT]
Thallium	µg	15	Metals-010	<15	[NT]	[NT]	[NT]	[NT]	107	[NT]
Tin	µg	10	Metals-010	<10	[NT]	[NT]	[NT]	[NT]	121	[NT]
Vanadium	µg	5	Metals-010	<5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Zinc	µg	6	Metals-010	<6	[NT]	[NT]	[NT]	[NT]	102	[NT]

Client Reference: 7050

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Client Reference: 7050

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Client Reference: 7050

Report Comments
Please note that Magnesium, Vanadium and Tin are not covered under USEPA m29 methodology but are accredited under in house methodology. Please note Container 5C was not supplied and therefore forms no part of Analytical Fraction 3C.

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Jay Weber
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2020-1587

Samples analysed as received

SAMPLE ORIGIN: Project No: 7050

DATE OF INVESTIGATION: 01/04/2020 **DATE RECEIVED:** 7/04/20

ANALYSIS REQUIRED: Volatile Organic Compounds

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

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

M Mazereeuw

Martin Mazereeuw
Manager

Date: 22/04/20

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

Page 1

SafeWork NSW

TestSafe AUSTRALIA

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

Client : Jay Weber
Sample ID : 727896

Date Sampled : 1-Apr-2020
Reference Number ie : 2020-1587-1

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)			
1	2-Methylbutane	78-78-4	ND	ND
2	n-Pentane	109-66-0	ND	ND
3	2-Methylpentane	107-83-5	ND	ND
4	3-Methylpentane	96-14-0	ND	ND
5	Cyclopentane	287-92-3	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND
8	n-Hexane	110-54-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND
10	Cyclohexane	110-82-7	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND
12	2,2,4-Trimethylpentane	540-84-1	ND	ND
13	n-Heptane	142-82-5	ND	ND
14	n-Octane	111-65-9	ND	ND
15	n-Nonane	111-84-2	ND	ND
16	n-Decane	124-18-5	ND	ND
17	n-Undecane	1120-21-4	ND	ND
18	n-Dodecane	112-40-3	ND	ND
19	n-Tridecane	629-50-5	ND	ND
20	n-Tetradecane	629-59-4	ND	ND
21	α-Pinene	80-56-8	ND	ND
22	β-Pinene	127-91-3	ND	ND
23	D-Limonene	138-86-3	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)			
24	Dichloromethane	75-09-2	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND
26	1,2-Dichloroethane	107-06-2	ND	ND
27	Chloroform	67-66-3	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND
30	Trichloroethylene	79-01-6	ND	ND
31	Carbon tetrachloride	56-23-5	ND	ND
32	Perchloroethylene	127-18-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND
34	Chlorobenzene	108-90-7	ND	ND
35	1,2-Dichlorobenzene	95-50-1	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)			
37	Acetonitrile	75-05-8	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		ND	ND

No	Compounds	CAS No	Front (µg/section)	Back (µg/section)
	Aromatic hydrocarbons (LOQ = 1µg/compound/section)			
39	Benzene	71-43-2	ND	ND
40	Ethylbenzene	100-41-4	ND	ND
41	Isopropylbenzene	98-82-8	ND	ND
42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
45	Styrene	100-42-5	ND	ND
46	Toluene	108-88-3	ND	ND
47	p-Xylene &/or m-Xylene	106-42-3 / 108-38-3	ND	ND
48	o-Xylene	95-47-6	ND	ND
	Ketones (LOQ #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
49	Acetone	67-64-1	ND	ND
50	Acetoin	513-86-0	ND	ND
51	Diacetone alcohol	123-42-2	ND	ND
52	Cyclohexanone	108-94-1	ND	ND
53	Isophorone	78-59-1	ND	ND
54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
	Alcohols (LOQ = 25µg/compound/section)			
56	Ethyl alcohol	64-17-5	ND	ND
57	n-Butyl alcohol	71-36-3	ND	ND
58	Isobutyl alcohol	78-83-1	ND	ND
59	Isopropyl alcohol	67-63-0	ND	ND
60	2-Ethyl hexanol	104-76-7	ND	ND
61	Cyclohexanol	108-93-0	ND	ND
	Acetates (LOQ = 25µg/compound/section)			
62	Ethyl acetate	141-78-6	ND	ND
63	n-Propyl acetate	109-60-4	ND	ND
64	n-Butyl acetate	123-86-4	ND	ND
65	Isobutyl acetate	110-19-0	ND	ND
	Ethers (LOQ = 25µg/compound/section)			
66	Ethyl ether	60-29-7	ND	ND
67	*tert*-Butyl methyl ether (MTBE)	1634-04-4	ND	ND
68	Tetrahydrofuran (THF)	109-99-9	ND	ND
	Glycols (LOQ = 25µg/compound/section)			
69	PGME	107-98-2	ND	ND
70	Ethylene glycol diethyl ether	629-14-1	ND	ND
71	PGMEA	108-65-6	ND	ND
72	Cellosolve acetate	111-15-9	ND	ND
73	DGMEA	112-15-2	ND	ND
	Worksheet check		yes	yes

2020-1587

Page 2 of 3

TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

SafeWork NSW

Test Safe AUSTRALIA

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

ND = Not Detected

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

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

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-
- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

2020-1387 Page 3 of 3

TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08061 0817

Stephenson
Environmental Management Australia

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

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

EMISSION TEST REPORT NO.7051A

COMPLIANCE STACK EMISSION SURVEY – QUARTER NO. 4, 2019-2020

EMISSION POINT EPL ID 42 - (SERVING BOILER NO. 4)

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.:	**7051A/S25390/20**
DATE OF SURVEY:	**24 APRIL & 21 MAY 2020**
DATE OF ISSUE:	**22 MAY 2020**

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

1 EMISSION TEST REPORT NO.7051A

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	7051/S25390/20
Test Dates:	24 April & 21 May 2020
Production Conditions:	Boiler was operating at normal capacity during emission testing. See attachment B.
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, carbon monoxide, carbon dioxide, oxygen, nitrogen oxides, metals Type I and II, stack pressure, sulfur dioxide, total solid particulate matter and volatile organic compounds
Sample Locations:	EPL No.883; EPL ID No. 42 – Boiler No. 4 Stack
Sample ID Nos.:	See Attachment A

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Carbon Dioxide	NSW TM-24, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Carbon Monoxide	NSW TM-32, USEPA M10	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Metals	NSW TM-12, 13 & 14, USEPA M29	Envirolab Services Accreditation No. 2901 Report No. 241738
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Oxygen	NSW TM-25, USEPA M3A,	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2165
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7051

Sulfur Dioxide	NSW TM-4, USEPA M6C	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report No. 2165
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7051
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No 2020 - 1728

Deviations from Test Methods Nil.

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 22 May 2020

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7051 - EPL ID 42 BOILER 4

Parameter	Unit	EPL ID 42 - Boiler 4 Tested 24 April 2020 Average Result	EPL ID 42 - Boiler 4 Tested 21 May 2020 Average Result	EPL 883 100% emission concentration limit (mg/m^3)
Sampling times	hours	13:56-15:33	11:29-12:49	*n/a*
Temperature	^oC	179	152	--
Pressure	kPa	101.7	101.2	--
Velocity	m/s	17	14	--
Actual Volumetric Flow	am^3/s	18	15	--
Volumetric Flow	m^3/s	10	9.2	--
Moisture	%	5	5	--
Molecular Weight Dry Stack Gas	g/gmole	29.5	29.7	--
Dry Gas Density	kg/m^3	1.32	1.32	--
CO_2	%	6.4	7.3	--
CO (1 hr block ave @ 7% O_2)	mg/m^3	41	---	--
SO_2 (1 hr block ave @ 7% O_2)	mg/m^3	396	---	600
NO_2 (1 hr block ave @ 7% O_2)	mg/m^3	<2	---	500
NO_x (1 hr block ave @ 7% O_2)	mg/m^3	460	---	--
O_2	%	12.9	11.9	> 5%
PM_{10} (@ 7% O_2)	mg/m^3	---	5.5	--
TSP (@ 7% O_2)	mg/m^3	---	15	30
VOCs (n-propane equiv.@ 7% O_2)	mg/m^3	<4.0	---	40
VOCs (uncorrected @ 7%O_2)	mg/m^3	<4.2	---	--
Metals - Type I & II Substances in Aggregate (@ 7% O_2)	mg/m^3	0.081	---	1
Antimony (Sb) Type I	mg/m^3	< 0.0085	---	--
Arsenic (As) Type I	mg/m^3	< 0.0085	---	--
Beryllium (Be) Type II	mg/m^3	0.00085	---	--
Cadmium (Cd) Type I	mg/m^3	0.00021	---	0.2
Chromium (Cr) Type II	mg/m^3	0.0032	---	--
Cobalt (Co) Type II	mg/m^3	0.0021	---	--
Copper (Cu)	mg/m^3	0.011	---	--
Lead (Pb) Type I	mg/m^3	0.030	---	--
Magnesium (Mg)	mg/m3	< 0.32	---	--
Manganese (Mn) Type II	mg/m^3	0.0051	---	--
Mercury (Hg) Type I	mg/m^3	0.0015	---	0.2
Nickel (Ni) Type II	mg/m^3	0.017	---	--
Selenium (Se) Type II	mg/m^3	0.021	---	--
Tin (Sn) Type II	mg/m^3	< 0.021	---	--
Vanadium (V) Type II	mg/m^3	< 0.011	---	--

Key to Table 1.1:

EPL	=	Environment Protection Licence
ID	=	identification no.
%	=	percentage
na	=	not applicable
--	=	not referenced in EPL
CO	=	carbon monoxide
CO_2	=	carbon dioxide
SO_2	=	sulfur dioxide
NO_2	=	nitrogen dioxide
NO_x	=	oxides of Nitrogen (as nitrogen dioxide)
O_2	=	oxygen
^oC	=	degrees Celsius
<	=	less than
>	=	greater than
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
m/s	=	metres per second
am^3/s	=	dry cubic metre per second @ in-stack conditions
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Nitrogen Oxides	NSW TM-11, USEPA 7E	15%
Oxygen and Carbon Dioxide	NSW TM-24, TM-25, USEPA 3A	1% actual
Carbon Monoxide	TM-32, USEPA 10	15%
Particulate > 20 mg/m³	NSW TM-15, AS4323.2,	15%
Particulate < 20 mg/m³	NSW TM-15, AS4323.2,	50%
Metals - Type I & II Substances in Aggregate	NSW TM-12,13 & 14+, USEPA M29*	100%+ *(50-200%)**
Sulfur Dioxide	NSW TM-4, USEPA M6C	15%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA M18	25%

Key:

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

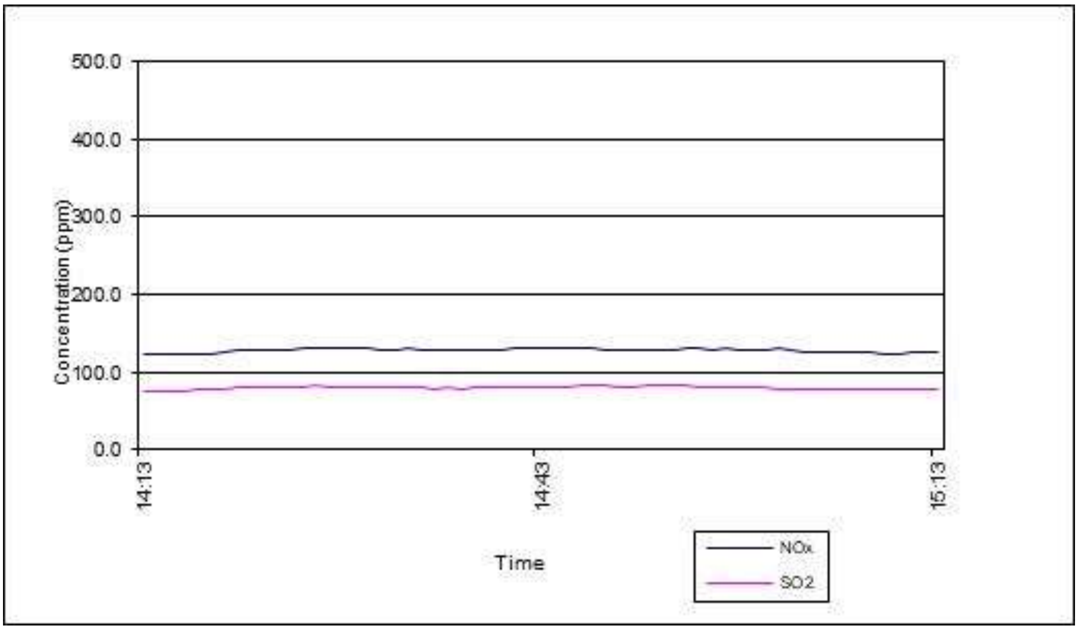
Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

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

Note: ISO 9096 is for 20-1000 mg/m^{3} which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^{3} correlates to 5 mg/m^{3} with most quoted uncertainties of $\pm$ 5.3 mg/m^{3} @ 6.4 mg/m^{3}. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^{3} under lab conditions.

1.3 CONTINUOUS LOGGED RECORD OF SO_2 AND NO_X - 24 APRIL 2020

FIGURE 1-1 CONTINUOUS LOGGED TREND OF SO_2 AND NO_X IN PPM



1.4 PROCESS DATA - BOILER NO. 4

Shoalhaven Starches personnel considered Boiler 4 was operating under typical conditions on the day of testing.

FIGURE 1-2 CONTINUOUS LOGGED TREND OF BOILER 4 STEAM FLOW OPERATING CONDITIONS AND OPACITY 24 APRIL

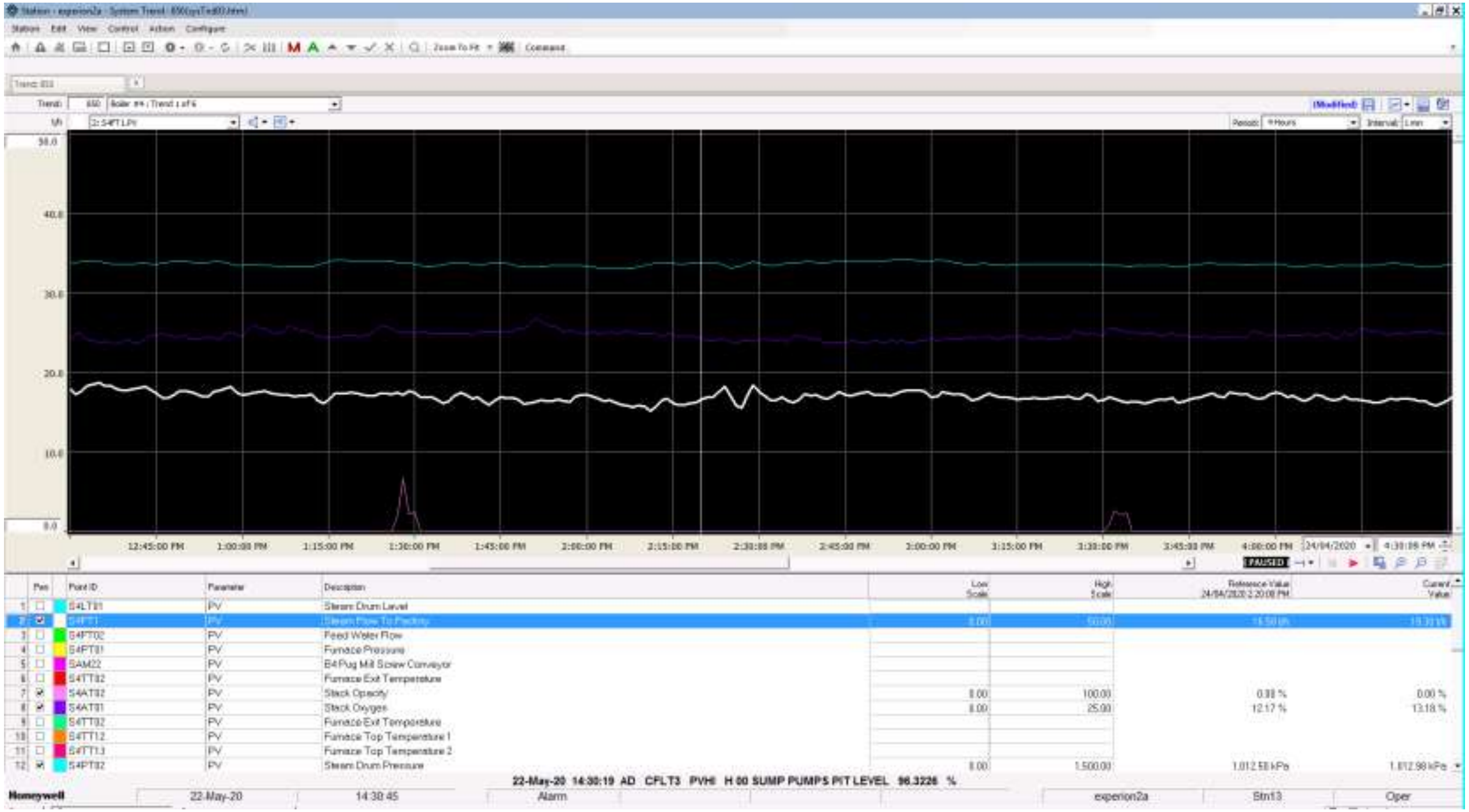
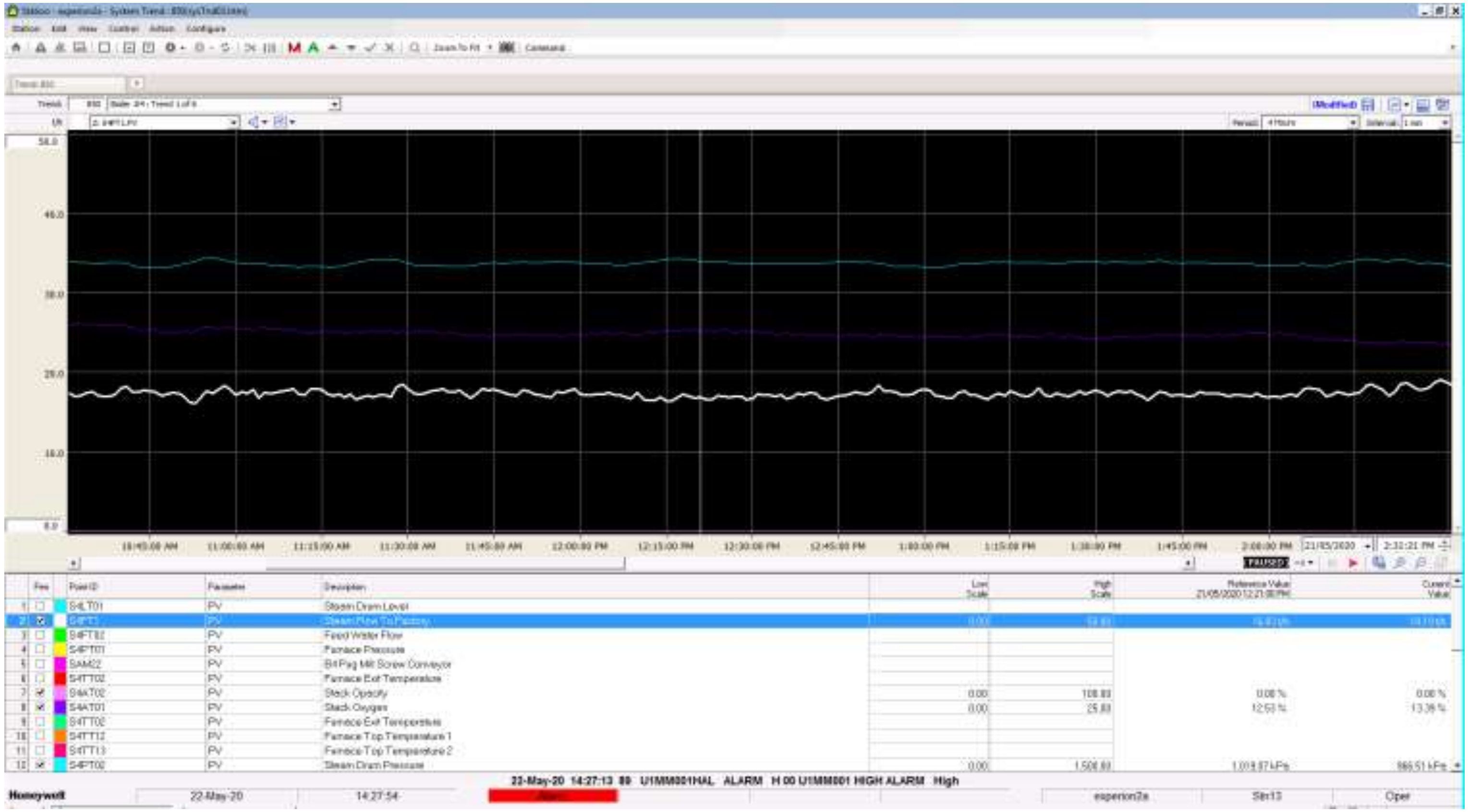
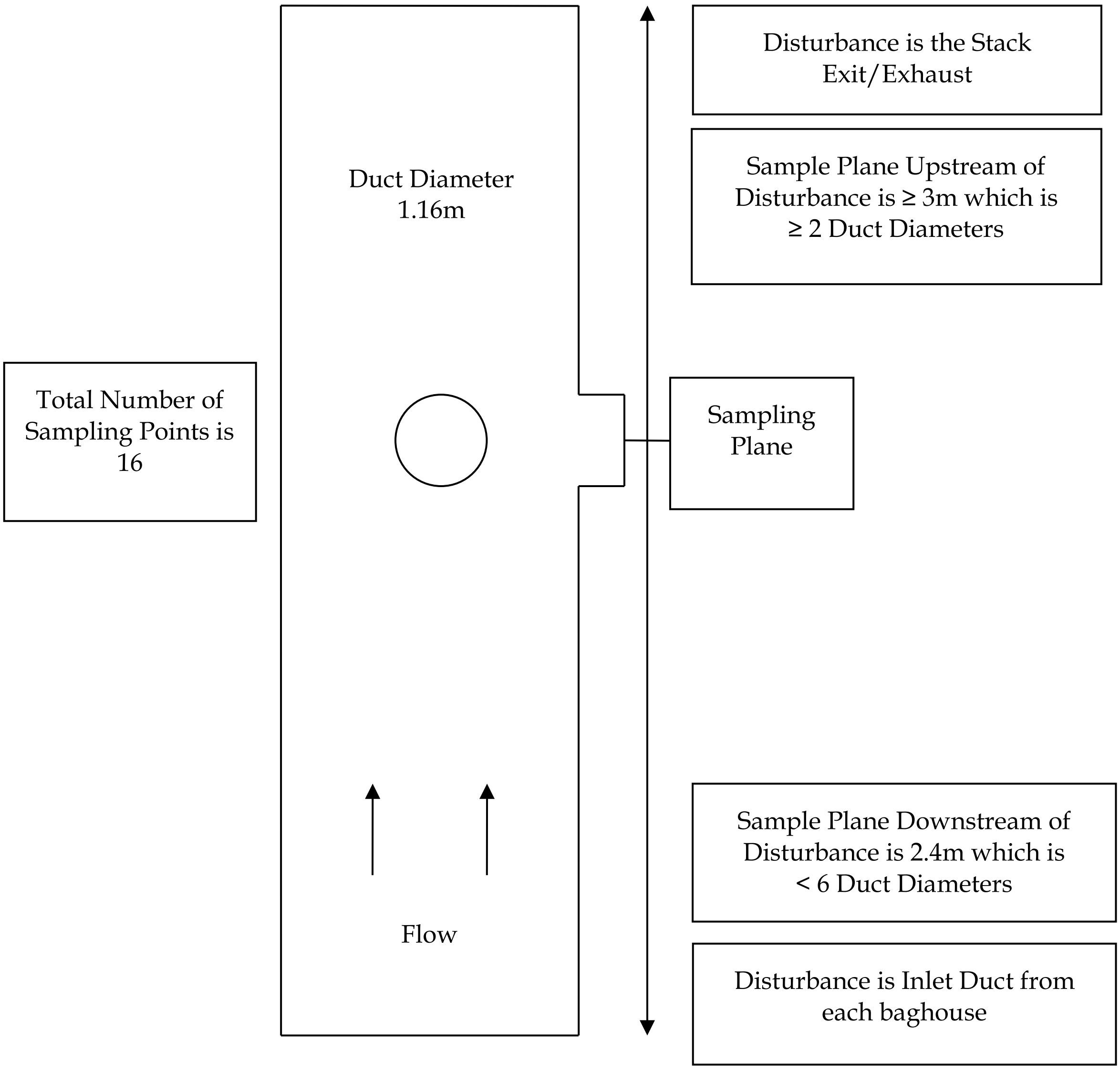


FIGURE 1-3 CONTINUOUS LOGGED TREND OF BOILER 4 STEAM FLOW OPERATING CONDITIONS *AND* OPACITY 21 MAY



1.5 SAMPLING LOCATION – BOILER NO. 4



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

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

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

1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	14-Jun-19	14-Jun-20
539	USEPA Meter Box (gas meter)	03-Dec-19	03-Dec-20
645	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
920	Thermocouple	02-Dec-19	02-Jun-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
427	Nozzle TSP Swagelok 3	05-Dec-19	05-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
927	Balance		Response Check with SEMA Site Mass
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
834	Personal Sampler	26-Feb-20	26-Feb-21
946	combustion analyzer	16-Mar-20	16-Sep-20
407	Nozzle USEPA Metals Set Glass	05-Dec-19	05-Dec-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	05-May-20
262 ppm 263 ppm 249 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB 4441	23-Jun-21

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2165

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au

Project Number:	7051/S25390/20
Analysis Requested:	TM-15, OM-5
Chain of Custody Number	S25609
Date Analysis Completed:	22 May 2020
No. of Samples Tested:	2
Sample Locations:	EPL ID No. 42 (Boiler 4)
Sample ID Nos.:	727949, 727950
Filter ID Nos.:	15366, 15365

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

Identification: The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods: Nil

Issue Date
22 May 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2165

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Boiler 4 TSP	727949	15366	21/05/2020	22/05/2020	0.00633
Boiler 4 PM10	727950	15365	21/05/2020	22/05/2020	0.00308

Key:
g = grams

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 241738

Client Details	
Client	Stephenson & Associates
Attention	Jay Weber
Address	PO Box 6398, Silverwater, NSW, 1811

Sample Details	
Your Reference	7051
Number of Samples	m29 sample train
Date samples received	28/04/2020
Date completed instructions received	28/04/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details	
Date results requested by	08/05/2020
Date of Issue	07/05/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Simon Mills, Group R&D Manager

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 241738
Revision No: R00

Client Reference: 7051

Metals in Emissions USEPA m29						
Our Reference		241738-2	241738-3	241738-4	241738-5	241738-6
Your Reference	UNITS	727899-2	727899-3	727899-4	727899-5A	727899-5B
Date Sampled		24/04/2020	24/04/2020	24/04/2020	24/04/2020	24/04/2020
Type of sample		Acetone Rinse	Front half rinse - 0.1N HNO3	Back half - 5% HNO3 / 10% H2O2	4th impinger rinse - 0.1N HNO3	4% KMnO4/ 10% H2SO4
Date prepared	-	30/04/2020	30/04/2020	30/04/2020	30/04/2020	30/04/2020
Date analysed	-	30/04/2020	30/04/2020	30/04/2020	30/04/2020	30/04/2020
Volume	mL	[NA]	73	268	59	206
Particle Matter	mg	29	[NA]	[NA]	[NA]	[NA]

Metals in Emissions USEPA m29						
Our Reference		241738-7	241738-8	241738-9	241738-10	241738-11
Your Reference	UNITS	727899-Analytical Fraction 1A	727899-Analytical Fraction 2A	727899-Analytical Fraction 1B	727899-Analytical Fraction 2B	727899-Analytical Fraction 3A
Date Sampled		24/04/2020	24/04/2020	24/04/2020	24/04/2020	24/04/2020
Type of sample		m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger
Date prepared	-	30/04/2020	30/04/2020	30/04/2020	30/04/2020	30/04/2020
Date analysed	-	30/04/2020	30/04/2020	30/04/2020	30/04/2020	30/04/2020
Antimony	µg	<4	<4	[NA]	[NA]	[NA]
Arsenic	µg	<4	<4	[NA]	[NA]	[NA]
Barium	µg	86	<3	[NA]	[NA]	[NA]
Beryllium	µg	0.4	<0.3	[NA]	[NA]	[NA]
Cadmium	µg	0.1	<0.1	[NA]	[NA]	[NA]
Chromium	µg	1	0.5	[NA]	[NA]	[NA]
Cobalt	µg	1	<0.3	[NA]	[NA]	[NA]
Copper	µg	5	<3	[NA]	[NA]	[NA]
Lead	µg	14	<1	[NA]	[NA]	[NA]
Magnesium	µg	<150	<150	[NA]	[NA]	[NA]
Manganese	µg	2	0.4	[NA]	[NA]	[NA]
Mercury	µg	[NA]	[NA]	<0.05	0.57	<0.05
Nickel	µg	7.7	0.3	[NA]	[NA]	[NA]
Phosphorus	µg	380	<150	[NA]	[NA]	[NA]
Selenium	µg	<4	10	[NA]	[NA]	[NA]
Silver	µg	<3	<3	[NA]	[NA]	[NA]
Thallium	µg	<15	<15	[NA]	[NA]	[NA]
Tin	µg	<10	<10	[NA]	[NA]	[NA]
Vanadium	µg	<5	<5	[NA]	[NA]	[NA]
Zinc	µg	240	<6	[NA]	[NA]	[NA]

Client Reference: 7051

Metals in Emissions USEPA m29			
Our Reference		241738-12	241738-13
Your Reference	UNITS	727899-Analytical Fraction 3B	727899-Analytical Fraction 3C
Date Sampled		24/04/2020	24/04/2020
Type of sample		m29 - Impinger	m29 - Impinger
Date prepared	-	30/04/2020	30/04/2020
Date analysed	-	30/04/2020	30/04/2020
Mercury	µg	0.06	0.08

Envirolab Reference: 241738
Revision No: R00

Page | 3 of 8

Client Reference: 7051

Method ID	Methodology Summary
Metals-029	Sample is evaporated to dryness at ambient temperature and pressure, dessicated and weighed back as per USEPA m29.
Metals-m29	Determination of Metals in impingers and filters by ICP-OES/MS and Cold Vapour AAS using USEPA29 and in house methods METALS-004, 020, 021 and METALS-022.

Client Reference: 7051

QUALITY CONTROL: Metals in Emissions USEPA m29						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			30/04/2020	[NT]	[NT]	[NT]	[NT]	30/04/2020	[NT]
Date analysed	-			30/04/2020	[NT]	[NT]	[NT]	[NT]	30/04/2020	[NT]
Particle Matter	mg	0.2	Metals-029	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Antimony	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	103	[NT]
Arsenic	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	93	[NT]
Barium	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	94	[NT]
Beryllium	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	106	[NT]
Cadmium	µg	0.1	Metals-m29	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Chromium	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	91	[NT]
Cobalt	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	104	[NT]
Copper	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	96	[NT]
Lead	µg	1	Metals-m29	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Magnesium	µg	150	Metals-m29	<150	[NT]	[NT]	[NT]	[NT]	108	[NT]
Manganese	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	91	[NT]
Mercury	µg	0.05	Metals-m29	<0.05	[NT]	[NT]	[NT]	[NT]	109	[NT]
Nickel	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	95	[NT]
Phosphorus	µg	150	Metals-m29	<150	[NT]	[NT]	[NT]	[NT]	99	[NT]
Selenium	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	96	[NT]
Silver	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	94	[NT]
Thallium	µg	15	Metals-m29	<15	[NT]	[NT]	[NT]	[NT]	105	[NT]
Tin	µg	10	Metals-m29	<10	[NT]	[NT]	[NT]	[NT]	100	[NT]
Vanadium	µg	5	Metals-m29	<5	[NT]	[NT]	[NT]	[NT]	93	[NT]
Zinc	µg	6	Metals-m29	<6	[NT]	[NT]	[NT]	[NT]	93	[NT]

Client Reference: 7051

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Client Reference: 7051

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Client Reference: 7051

Report Comments
Please note that impinger 5C was not provided and hence has no contribution to Analytical Fraction 3C (for run 727899). Please note that Magnesium, Vanadium and Tin are not covered under USEPA m29 methodology but are accredited under in house methodology.

SafeWork NSW

Test Safe AUSTRALIA

Jay Weber
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2020-1728

Samples analysed as received

SAMPLE ORIGIN: Project No. 7051

DATE OF INVESTIGATION: 24/04/2020 **DATE RECEIVED:** 28/04/20

ANALYSIS REQUIRED: Volatile Organic Compounds Screen

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

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

Martin Mazereeuw
Manager

Date: 6/05/20

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179

ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025 - Testing

Page 1

SafeWork NSW

Test Safe AUSTRALIA

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

Client : Jay Weber | **Date Sampled : 24-Apr-2020**

Sample ID : 727900 | **Reference Number le : 2020-1728-1**

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

2020-1728 Page 2 of 3

TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

SafeWork NSW

Test Safe AUSTRALIA

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

ND = Not Detected

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

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

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

2020-1728 Page 3 of 3

TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

Stephenson
Environmental Management Australia

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

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

EMISSION TEST REPORT NO.7049

COMPLIANCE STACK EMISSION SURVEY – QUARTER NO. 4, 2019-2020

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

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: 7049/S25370A/20

DATES OF SURVEY: 8 APRIL 2020

DATE OF ISSUE: 30 APRIL 2020

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

1 EMISSION TEST REPORT NO. 7049

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	7049/S25370A/20
Test Date:	8 April 2020
Production Conditions:	Normal operating conditions, refer section 1.4
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, carbon monoxide, carbon dioxide, oxygen, nitrogen oxides, metals Type I and II, stack pressure, sulfur dioxide, total solid particulate matter and volatile organic compounds
Sample Locations:	EPL No.883; EPL ID No. 35 – Combined Stack Boilers No. 5 & 6
Sample ID Nos.:	See Attachment A

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis by NATA Accreditation No. & Report No.*
Carbon Dioxide	NSW TM-24, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Carbon Monoxide	NSW TM-32, USEPA M10	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Metals	NSW TM-12, 13 & 14, USEPA M29	Envirolab Services, Accreditation No. 2901, Report No. 240723
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Oxygen	NSW TM-25, USEPA M3A,	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2160
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7049

Sulfur Dioxide	NSW TM-4, USEPA M6C	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report No. 2160
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7049
Volatile Organic Compounds	NSW TM-34, USEPA M18	TestSafe Australia, Accreditation No. 3726, Report No. 2020- 1657

Deviations from Test Methods Nil.

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 30 April 2020

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7049, EPL ID 35

Parameter	Unit	Location EPL ID 35 (Boilers 5 & 6) Tested 8 April, 2020 Average Result	EPL(No.883) 100% Emission Conc. Limit (mg/m^3)
Sampling times	hours	12:39-14:19	--
Temperature	^oC	137	--
Pressure	kPa	102.1	--
Velocity	m/s	16	--
Actual Volumetric Flow	am^3/s	52	--
Volumetric Flow	m^3/s	32	--
Moisture	%	7.3	--
Molecular Weight Dry Stack Gas	g/gmole	30.1	--
Dry Gas Density	kg/m^3	1.34	--
Carbon dioxide	%	11.0	--
Carbon monoxide (1 hr block ave @ 7% O_2)	mg/m^3	214	--
Sulfur dioxide (1 hr block ave @ 7% O_2)	mg/m^3	508	600
Nitrogen oxides (1 hr block ave @ 7% O_2)	mg/m^3	425	500
Oxygen	%	8.4	> 5%
Particulate Matter less than 10 microns	mg/m^3	2.2	--
Total Solid Particulates (@ 7% O_2)	mg/m^3	4.7	30
VOCs (as n-propane equivalent@ 7% O_2)	mg/m^3	<4.9	40
VOCs (uncorrected for n-propane @ 7%O_2)	mg/m^3	<5.1	--
Metals - Type I & II Substances (@ 7% O_2)	mg/m^3	0.016	1
Antimony (Sb) Type I	mg/m^3	< 0.0043	--
Arsenic (As) Type I	mg/m^3	< 0.0043	--
Beryllium (Be) Type II	mg/m^3	< 0.00032	--
Cadmium (Cd) Type I	mg/m^3	0.00011	0.2
Chromium (Cr) Type II	mg/m^3	0.0027	--
Cobalt (Co) Type II	mg/m^3	0.00053	--
Copper (Cu)	mg/m^3	0.0043	--
Lead (Pb) Type I	mg/m^3	0.0032	--
Magnesium (Mg)	mg/m^3	0.16	--
Manganese (Mn) Type II	mg/m^3	0.0027	--
Mercury (Hg) Type I	mg/m^3	0.00015	0.2
Nickel (Ni) Type II	mg/m^3	0.0069	--
Selenium (Se) Type II	mg/m^3	< 0.0043	--
Tin (Sn) Type II	mg/m^3	< 0.011	--
Vanadium (V) Type II	mg/m^3	< 0.0053	--

Key to Table 1.1:

EPL	=	Environment Protection Licence
ID	=	identification no.
%	=	percentage
Conc.	=	concentration
--	=	Not referenced in EPL
^{o}C	=	degrees Celsius
<	=	less than
>	=	greater than
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m^3/s	=	dry cubic metre per second $0^{o}C$ and 101.3 kilopascals (kPa)
m/s	=	metres per second
am^3/s	=	dry cubic metre per second @ in-stack conditions
mg/m^3	=	milligrams per cubic metre at $0^{o}C$ and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA M4	25%
Nitrogen Oxides	NSW TM-11, USEPA M7E	15%
Oxygen and Carbon Dioxide	NSW TM-24, TM-25, USEPA M3A	1% actual
Carbon Monoxide	TM-32, USEPA M10	15%
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2,	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2,	50%
Metals - Type I & II Substances in Aggregate	NSW TM-12,13 & 14+, USEPA M29*	100%+ *(50-200%)**
Sulfur Dioxide	NSW TM-4, USEPA M6C	15%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%
Volatile Organic Compounds (adsorption tube)	NSW TM-34, USEPA M18	25%

Key:

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

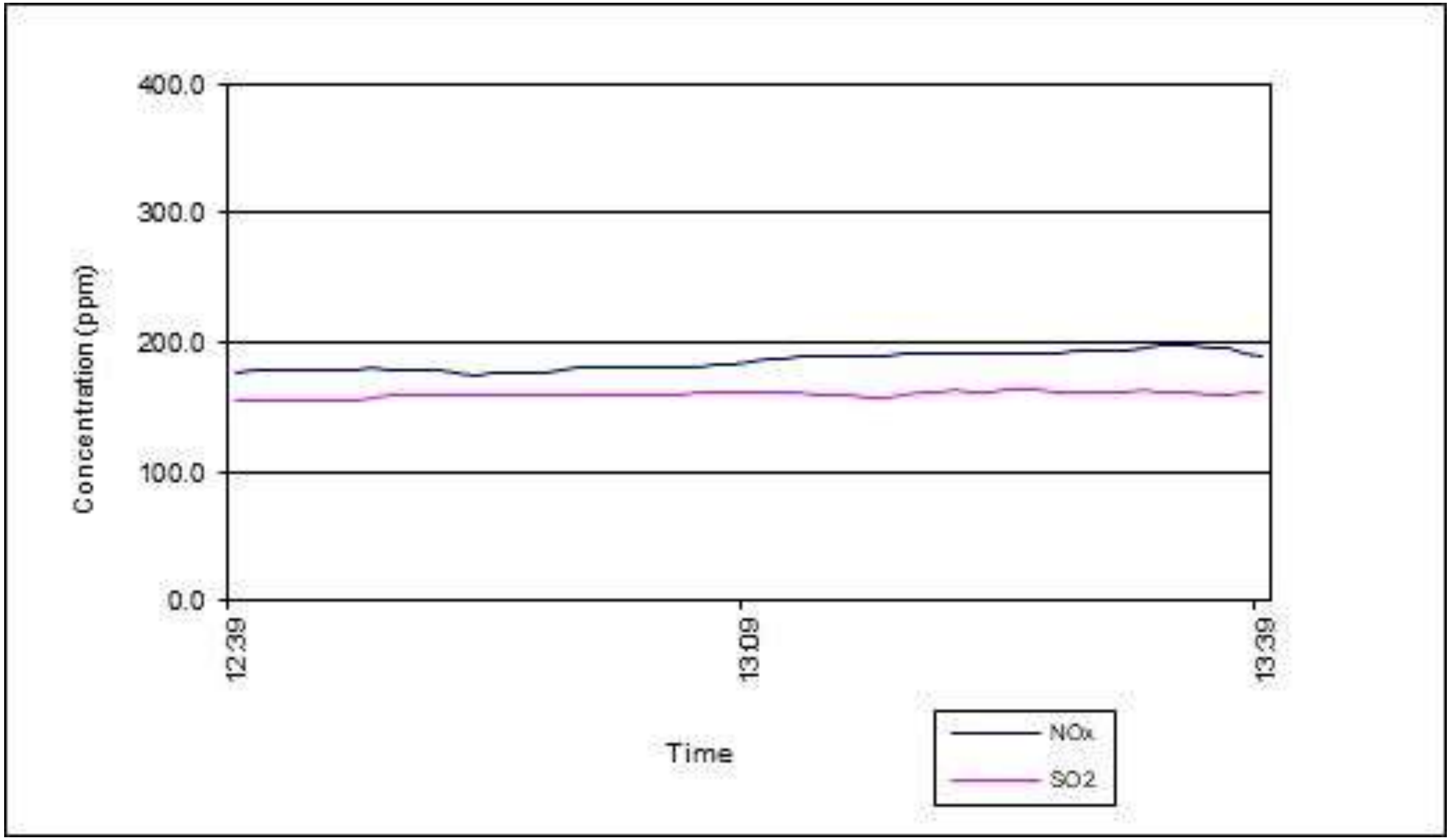
Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

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

Note: ISO 9096 is for 20-1000 mg/m^3 which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of $\pm$ 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.3 CONTINUOUS LOGGED RECORD OF SO_2 AND NO_x - 8 APRIL 2020

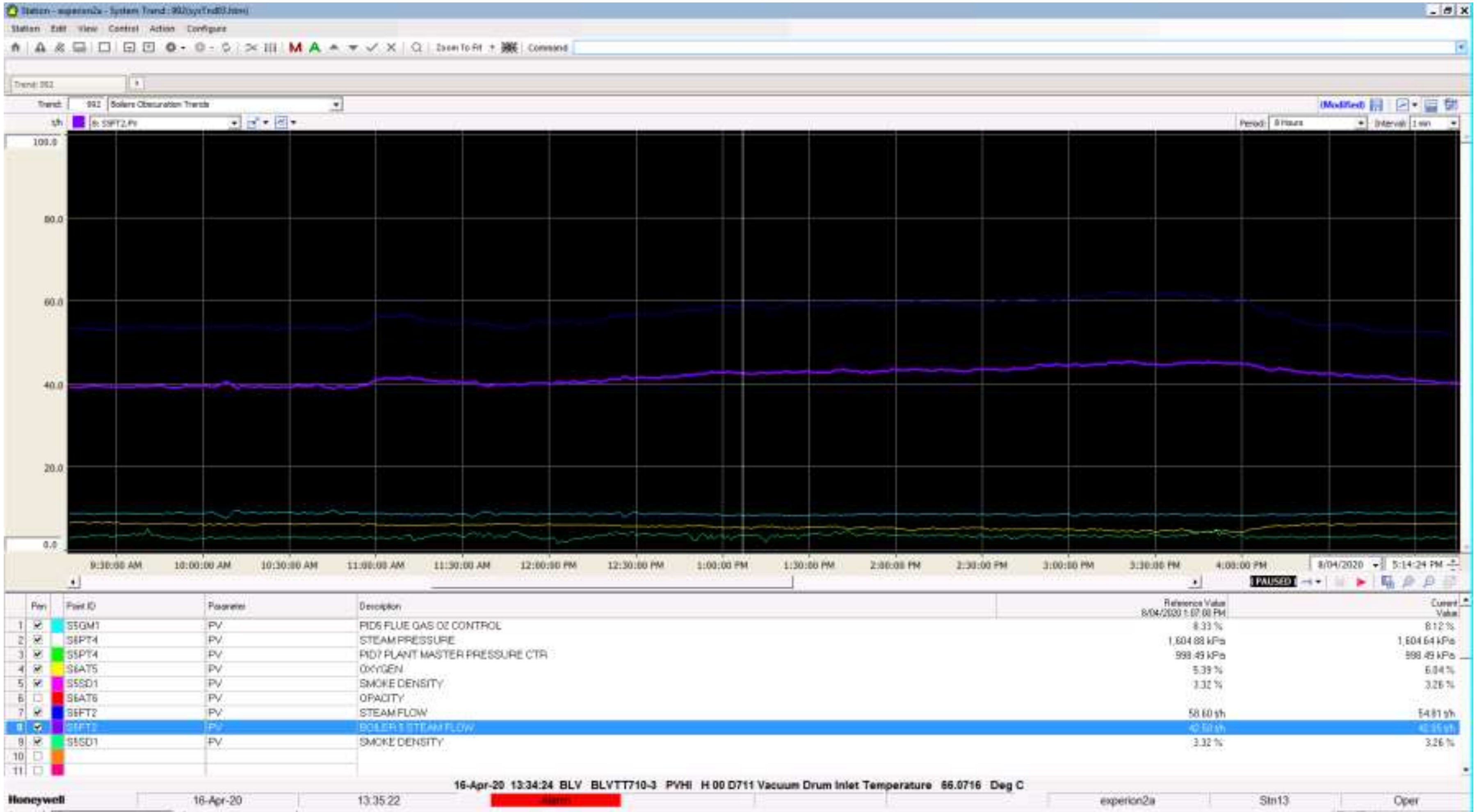
FIGURE 1-1 CONTINUOUS LOGGED TREND OF SO_2 AND NO_x IN PPM



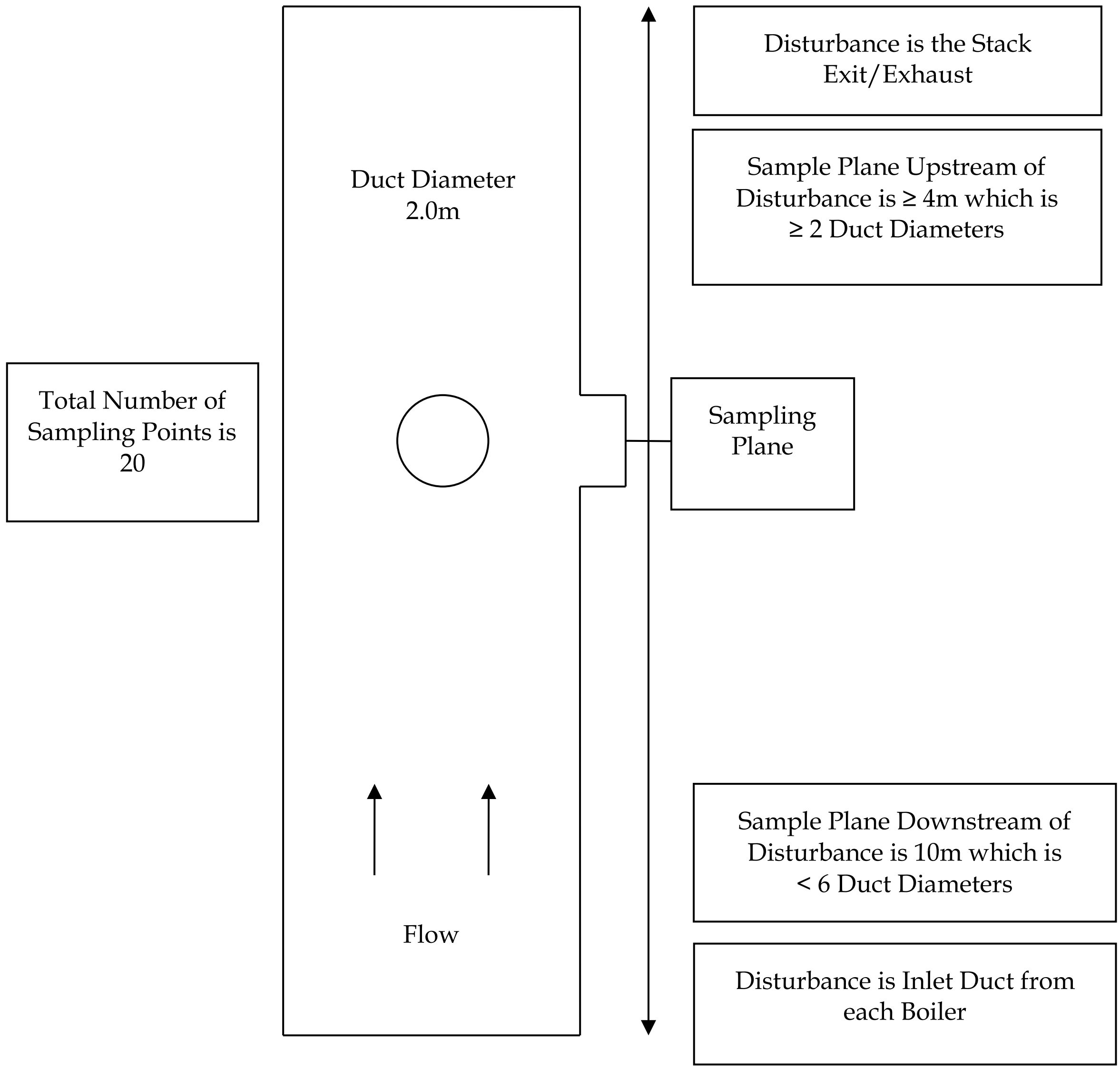
1.4 PROCESS DATA - BOILER NOS. 5 & 6

Shoalhaven Starches personnel considered Boilers 5 & 6 were operating under typical conditions on the day of testing.

FIGURE 1-2 CONTINUOUS LOGGED TREND OF BOILER 5 & 6 STEAM FLOW OPERATING CONDITIONS AND OPACITY



1.5 SAMPLING LOCATION – BOILER NOS. 5 & 6



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

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

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

1.6 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	14-Jun-19	14-Jun-20
539	USEPA Meter Box (gas meter)	03-Dec-19	03-Dec-20
645	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
920	Thermocouple	02-Dec-19	02-Jun-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
428	Nozzle TSP Swagelok 3	05-Dec-19	05-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
927	Balance		Response Check with SEMA Site Mass
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
835	Personal Sampler	26-Feb-20	26-Feb-21
946	combustion analyzer	16-Mar-20	16-Sep-20
924	Nozzle USEPA Metals Set Glass	05-Dec-19	05-Dec-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	05-May-20
262 ppm 263 ppm 249 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB 4441	23-Jun-21

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2160

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au

Project Number:	7049/S25370A/20
Analysis Requested:	TM-15, OM-5
Chain of Custody Number	S25580
Date Analysis Completed:	15 April 2020
No. of Samples Tested:	2
Sample Locations:	EPL ID No. 35 (Boiler 5 & 6)
Sample ID Nos.:	727883 & 727884
Filter ID Nos.:	15328 & 15329

Identification The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods Nil

Issue Date
15 April 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2160

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Boiler 5 & 6	727883	15328	08/04/2020	15/04/2020	0.00446
Boiler 5 & 6	727884	15329	08/04/2020	15/04/2020	0.00242

Key:
g = grams

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 240723

Client Details	
Client	Stephenson & Associates
Attention	Jay Weber
Address	PO Box 6398, Silverwater, NSW, 1811

Sample Details	
Your Reference	7049
Number of Samples	m29 sample train
Date samples received	09/04/2020
Date completed instructions received	09/04/2030

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details	
Date results requested by	29/04/2020
Date of Issue	28/04/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Simon Mills, Group R&D Manager

Authorised By

Nancy Zhang, Laboratory Manager

Envirolab Reference: 240723
Revision No: R00

Page | 1 of 8

Client Reference: 7049

Metals in Emissions USEPA m29						
Our Reference		240723-2	240723-3	240723-4	240723-5	240723-6
Your Reference	UNITS	727885-2	727885-3	727885-4	727885-5A	727885-5B
Type of sample		Acetone Rinse	Front half rinse - 0.1N HNO3	Back half - 5% HNO3 / 10% H2O2	4th impinger rinse - 0.1N HNO3	4% KMnO4/ 10% H2SO4
Date Sampled		08/04/2020	08/04/2020	08/04/2020	08/04/2020	08/04/2020
Date prepared	-	17/04/2020	17/04/2020	17/04/2020	17/04/2020	17/04/2020
Date analysed	-	17/04/2020	17/04/2020	17/04/2020	17/04/2020	17/04/2020
Volume	mL	[NA]	73	279	51	214
Particle Matter	mg	7.6	[NA]	[NA]	[NA]	[NA]

Metals in Emissions USEPA m29						
Our Reference		240723-7	240723-8	240723-9	240723-10	240723-11
Your Reference	UNITS	727885-Analytical Fraction 1A	727885-Analytical Fraction 2A	727885-Analytical Fraction 1B	727885-Analytical Fraction 2B	727885-Analytical Fraction 3A
Type of sample		m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger	m29 - Impinger
Date Sampled		08/04/2020	08/04/2020	08/04/2020	08/04/2020	08/04/2020
Date prepared	-	17/04/2020	17/04/2020	17/04/2020	17/04/2020	17/04/2020
Date analysed	-	17/04/2020	17/04/2020	17/04/2020	17/04/2020	17/04/2020
Antimony	µg	<4	<4	[NA]	[NA]	[NA]
Arsenic	µg	<4	<4	[NA]	[NA]	[NA]
Barium	µg	20	<3	[NA]	[NA]	[NA]
Beryllium	µg	<0.3	<0.3	[NA]	[NA]	[NA]
Cadmium	µg	0.1	<0.1	[NA]	[NA]	[NA]
Chromium	µg	2	0.5	[NA]	[NA]	[NA]
Cobalt	µg	0.5	<0.3	[NA]	[NA]	[NA]
Copper	µg	4	<3	[NA]	[NA]	[NA]
Lead	µg	3	<1	[NA]	[NA]	[NA]
Magnesium	µg	<150	<150	[NA]	[NA]	[NA]
Manganese	µg	2	0.5	[NA]	[NA]	[NA]
Mercury	µg	[NA]	[NA]	<0.05	<0.05	<0.05
Nickel	µg	5.6	0.9	[NA]	[NA]	[NA]
Phosphorus	µg	<150	<150	[NA]	[NA]	[NA]
Selenium	µg	<4	<4	[NA]	[NA]	[NA]
Silver	µg	<3	<3	[NA]	[NA]	[NA]
Thallium	µg	<15	<15	[NA]	[NA]	[NA]
Tin	µg	<10	<10	[NA]	[NA]	[NA]
Vanadium	µg	<5	<5	[NA]	[NA]	[NA]
Zinc	µg	710	<6	[NA]	[NA]	[NA]

Envirolab Reference: 240723
Revision No: R00

Client Reference: 7049

Metals in Emissions USEPA m29			
Our Reference		240723-12	240723-13
Your Reference	UNITS	727885-Analytical Fraction 3B	727885-Analytical Fraction 3C
Type of sample		m29 - Impinger	m29 - Impinger
Date Sampled		08/04/2020	08/04/2020
Date prepared	-	17/04/2020	17/04/2020
Date analysed	-	17/04/2020	17/04/2020
Mercury	µg	0.06	0.08

Client Reference: 7049

Method ID	Methodology Summary
Metals-029	Sample is evaporated to dryness at ambient temperature and pressure, dessicated and weighed back as per USEPA m29.
Metals-m29	Determination of Metals in impingers and filters by ICP-OES/MS and Cold Vapour AAS using USEPA29 and in house methods METALS-004, 020, 021 and METALS-022.

Client Reference: 7049

QUALITY CONTROL: Metals in Emissions USEPA m29					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			17/04/2020	[NT]	[NT]	[NT]	[NT]	17/04/2020	[NT]
Date analysed	-			17/04/2020	[NT]	[NT]	[NT]	[NT]	17/04/2020	[NT]
Particle Matter	mg	0.2	Metals-029	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Antimony	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	109	[NT]
Arsenic	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	93	[NT]
Barium	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	90	[NT]
Beryllium	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cadmium	µg	0.1	Metals-m29	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Chromium	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cobalt	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	106	[NT]
Copper	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	100	[NT]
Lead	µg	1	Metals-m29	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Magnesium	µg	150	Metals-m29	<150	[NT]	[NT]	[NT]	[NT]	102	[NT]
Manganese	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	94	[NT]
Mercury	µg	0.05	Metals-m29	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Nickel	µg	0.3	Metals-m29	<0.3	[NT]	[NT]	[NT]	[NT]	99	[NT]
Phosphorus	µg	150	Metals-m29	<150	[NT]	[NT]	[NT]	[NT]	97	[NT]
Selenium	µg	4	Metals-m29	<4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Silver	µg	3	Metals-m29	<3	[NT]	[NT]	[NT]	[NT]	104	[NT]
Thallium	µg	15	Metals-m29	<15	[NT]	[NT]	[NT]	[NT]	107	[NT]
Tin	µg	10	Metals-m29	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
Vanadium	µg	5	Metals-m29	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Zinc	µg	6	Metals-m29	<6	[NT]	[NT]	[NT]	[NT]	99	[NT]

Envirolab Reference: 240723
Revision No: R00

Client Reference: 7049

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Client Reference: 7049

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Client Reference: 7049

Report Comments

Please note that Magnesium, Vanadium and Tin are not covered under USEPA m29 methodology but are accredited under in house methodology.

Please note that impinger 5C was not provided and hence has no contribution to Analytical Fraction 3C (for run727885).

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Jay Weber
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2020-1657

Samples analysed as received

SAMPLE ORIGIN: Project No. 7049

DATE OF INVESTIGATION: 08/04/2020 **DATE RECEIVED:** 16/04/20

ANALYSIS REQUIRED: Volatile Organic Compounds

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

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

M Mazereeuw

Martin Mazereeuw
Manager

Date: 27/04/20

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

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

Client : Jay Weber | **Date Sampled : 8-Apr-20**

Sample ID : 797866 | **Reference Number ie : 2020-1657-1**

No	Compounds	CAS No	Front	Back	No	Compounds	CAS No	Front	Back
			µg/section					µg/section	
	Aliphatic hydrocarbons (LOQ = 5µg/compound/section)					**Aromatic hydrocarbons** (LOQ = 1µg/compound/section)			
1	2-Methylbutane	*78-78-4*	ND	ND	39	Benzene	*71-43-2*	ND	ND
2	n-Pentane	*109-66-0*	ND	ND	40	Ethylbenzene	*100-41-4*	ND	ND
3	2-Methylpentane	*107-83-5*	ND	ND	41	Isopropylbenzene	*98-82-8*	ND	ND
4	3-Methylpentane	*96-14-0*	ND	ND	42	1,2,3-Trimethylbenzene	*526-73-8*	ND	ND
5	Cyclopentane	*287-92-3*	ND	ND	43	1,2,4-Trimethylbenzene	*95-63-6*	ND	ND
6	Methylcyclopentane	*96-37-7*	ND	ND	44	1,3,5-Trimethylbenzene	*108-67-8*	ND	ND
7	2,3-Dimethylpentane	*565-59-3*	ND	ND	45	Styrene	*100-42-5*	ND	ND
8	n-Hexane	*110-54-3*	ND	ND	46	Toluene	*108-88-3*	ND	ND
9	3-Methylhexane	*589-34-4*	ND	ND	47	p-Xylene &/or m-Xylene	*106-42-3* *108-38-3*	ND	ND
10	Cyclohexane	*110-82-7*	ND	ND	48	o-Xylene	*95-47-6*	ND	ND
11	Methylcyclohexane	*108-87-2*	ND	ND		**Ketones** (LOQ #49, #54 & #55 =5µg/c/s, #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	*540-84-1*	ND	ND	49	Acetone	*67-64-1*	ND	ND
13	n-Heptane	*142-82-5*	ND	ND	50	Acetoin	*513-86-0*	ND	ND
14	n-Octane	*111-65-9*	ND	ND	51	Diacetone alcohol	*123-42-2*	ND	ND
15	n-Nonane	*111-84-2*	ND	ND	52	Cyclohexanone	*108-94-1*	ND	ND
16	n-Decane	*124-18-5*	ND	ND	53	Isophorone	*78-59-1*	ND	ND
17	n-Undecane	*1120-21-4*	ND	ND	54	Methyl ethyl ketone (MEK)	*78-93-3*	ND	ND
18	n-Dodecane	*112-40-3*	ND	ND	55	Methyl isobutyl ketone (MIBK)	*108-10-1*	ND	ND
19	n-Tridecane	*629-50-5*	ND	ND		**Alcohols** (LOQ = 25µg/compound/section)			
20	n-Tetradecane	*629-59-4*	ND	ND	56	Ethyl alcohol	*64-17-5*	ND	ND
21	α-Pinene	*80-56-8*	ND	ND	57	n-Butyl alcohol	*71-36-3*	ND	ND
22	β-Pinene	*127-91-3*	ND	ND	58	Isobutyl alcohol	*78-83-1*	ND	ND
23	D-Limonene	*138-86-3*	ND	ND	59	Isopropyl alcohol	*67-63-0*	ND	ND
	Chlorinated hydrocarbons (LOQ = 5µg/compound/section)				60	2-Ethyl hexanol	*104-76-7*	ND	ND
24	Dichloromethane	*75-09-2*	ND	ND	61	Cyclohexanol	*108-93-0*	ND	ND
25	1,1-Dichloroethane	*75-34-3*	ND	ND		**Acetates** (LOQ = 25µg/compound/section)			
26	1,2-Dichloroethane	*107-06-2*	ND	ND	62	Ethyl acetate	*141-78-6*	ND	ND
27	Chloroform	*67-66-3*	ND	ND	63	n-Propyl acetate	*109-60-4*	ND	ND
28	1,1,1-Trichloroethane	*71-55-6*	ND	ND	64	n-Butyl acetate	*123-86-4*	ND	ND
29	1,1,2-Trichloroethane	*79-00-5*	ND	ND	65	Isobutyl acetate	*110-19-0*	ND	ND
30	Trichloroethylene	*79-01-6*	ND	ND		**Ethers** (LOQ = 25µg/compound/section)			
31	Carbon tetrachloride	*56-23-5*	ND	ND	66	Ethyl ether	*60-29-7*	ND	ND
32	Perchloroethylene	*127-18-4*	ND	ND	67	*tert*-Butyl methyl ether (MTBE)	*1634-04-4*	ND	ND
33	1,1,2,2-Tetrachloroethane	*79-34-5*	ND	ND	68	Tetrahydrofuran (THF)	*109-99-9*	ND	ND
34	Chlorobenzene	*108-90-7*	ND	ND		**Glycols** (LOQ = 25µg/compound/section)			
35	1,2-Dichlorobenzene	*95-50-1*	ND	ND	69	PGME	*107-98-2*	ND	ND
36	1,4-Dichlorobenzene	*106-46-7*	ND	ND	70	Ethylene glycol diethyl ether	*629-14-1*	ND	ND
	Miscellaneous (LOQ #37= 5µg & #38=25µg/compound/section)				71	PGMEA	*108-65-6*	ND	ND
37	Acetonitrile	*75-05-8*	ND	ND	72	Cellosolve acetate	*111-15-9*	ND	ND
38	n-Vinyl-2-pyrrolidinone	*88-12-0*	ND	ND	73	DGMEA	*112-15-2*	ND	ND
	Total VOCs (LOQ =50µg/compound/section)		81	ND		Worksheet check		yes	yes

2020-1657 | Page 2 of 3

TestSafe Australia – Chemical Analysis Branch

ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia

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

ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

NSW GOVERNMENT | SafeWork NSW

TestSafe AUSTRALIA

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

A non-target compound was identified as 2-chloro-acrolein [CAS No: 683-51-2] with low probability of 13 out of 100 and was estimated at 81 µg per section.

ND = Not Detected

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

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

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025 - Testing

SW08051 0817

Stephenson
Environmental Management Australia

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

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

EMISSION TEST REPORT NO.7071

STACK EMISSION SURVEY – PARTICULATE MATTER

EMISSION POINTS

EPL ID 12 - STARCH DRYER NO. 1

EPL ID 14 - STARCH DRYER NO. 4 AND

SPRAY DRYER

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.:	**7071/S25601/20**
DATE OF SURVEY:	**14 MAY 2020, 30 JUNE 2020**
DATE OF ISSUE:	**13 JULY 2020**

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

1 EMISSION TEST REPORT NO.7071

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	7071/S25601/20
Test Date:	14 May and 30 June 2020
Production Conditions:	Normal operating conditions, refer section 1.4.
Analysis Requested:	Dry gas density, flow, moisture, molecular weight of stack gases, temperature, total solid particulate matter and particulate matter less than 10 microns (PM_{10}).
Sample Locations:	EPL No.883; EPL ID No. 12 – Starch Dryer No. 1 Stack, EPK ID No. 14 – Starch Dryer No. 4, and Spray Dryer
Sample ID Nos.:	See Attachment A

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Particulate Matter less than 10 microns	NSW OM-5, USEPA 201A	SEMA, Accreditation No. 15043, Particle Test Report No. 2164 & 2168
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071
Total Solid Particulates	NSW TM-15, AS4323.2	SEMA, Accreditation No. 15043, Particle Test Report Nos. 2164 & 2168
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 7071

Deviations from Test Methods Nil.

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date: 13 July 2020

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7071

Parameter	Unit of measure	Location EPL ID 12 (Starch Dryer No. 1)	Location EPL ID 14 (Starch Dryer No. 4)	Location Spray Dryer
		Tested: 14 May 2020 Average Result	Tested: 30 June 2020 Average Result	Tested: 30 June 2020 Average Result
Sampling times	hours	13:45-15:15	12:50-14:10	14:31-15:51
Temperature	°C	38	39	71
Pressure	kPa	102.7	102.3	102.3
Velocity	m/s	6	22	8
Actual Volumetric Flow	am³/s	13	22	12.1
Volumetric Flow	m³/s	11	19	9.4
Moisture	%	1.6	3.4	3.5
Molecular Weight Dry Stack Gas	g/g mole	28.5	28.5	28.6
Dry Gas Density	kg/m³	1.27	1.27	1.28
Oxygen	%	20.9	20.9	20.5
Particulate Matter less than 10 microns	mg/m³	3	1.5	0.2
Total Solid Particulates	mg/m³	4	3.0	0.3

Key to Table 1.1:

EPL	=	Environment Protection Licence
ID	=	identification no.
%	=	percentage
Conc.	=	concentration
--	=	Not referenced in EPL
°C	=	degrees Celsius
<	=	less than
>	=	greater than
kg/m³	=	kilograms per cubic metre
kPa	=	kilo Pascals
g/g mole	=	grams per gram mole
m³/s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
m/s	=	metres per second
am³/s	=	dry cubic metre per second @ in-stack conditions
mg/m³	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa) @ Reference Conditions (where specified)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, NSW TM-22, USEPA 4	25%
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2, USEPA 201A	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2, USEPA 201A	50%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%

Key:

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

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

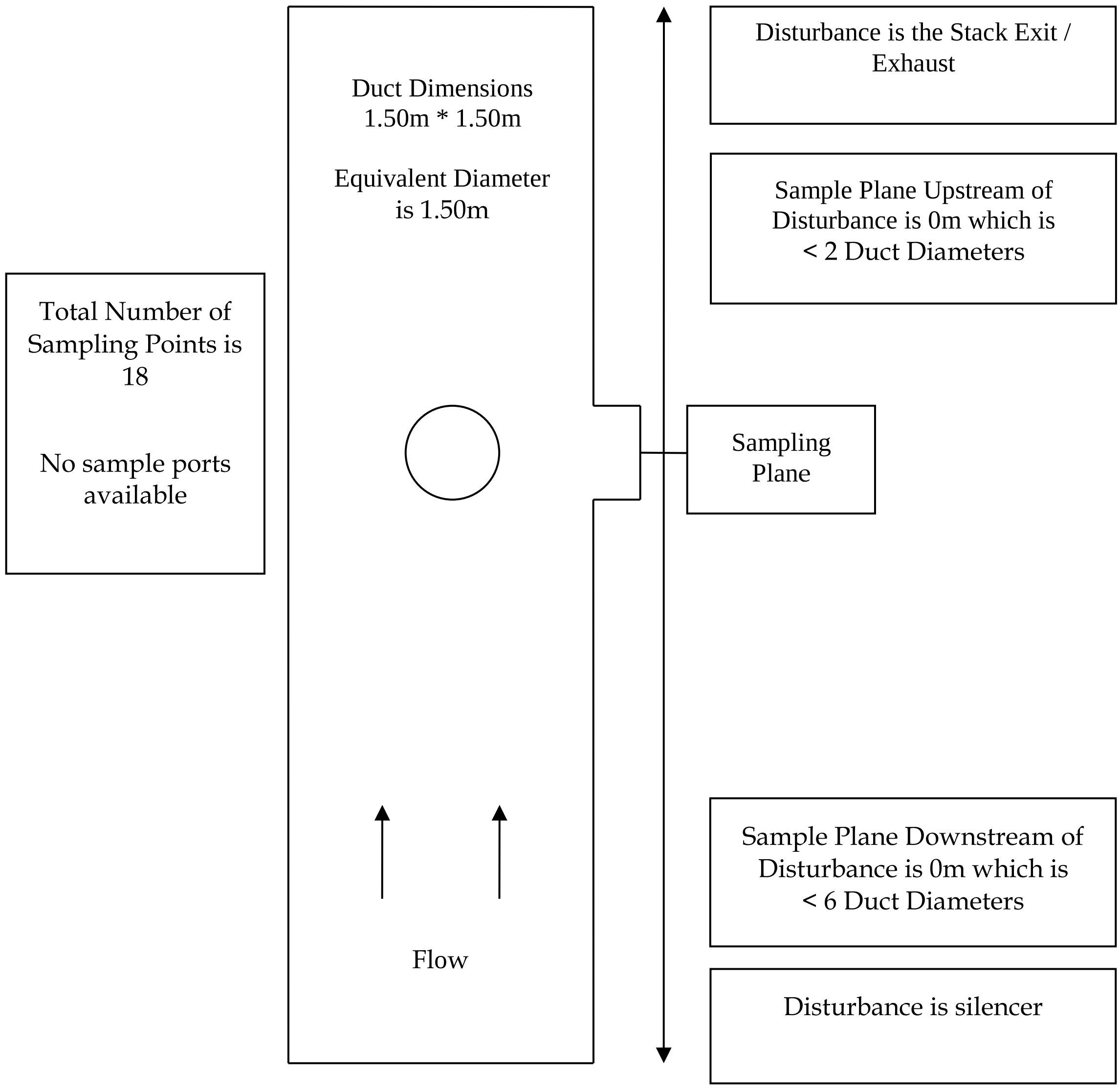
Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m^{3-} which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of $\pm$ 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.3 PROCESS DATA -

Shoalhaven Starches personnel considered Starch Dryer No.1, Starch Dryer No. 4, and the Spray Dryer were operating under typical conditions on the day of testing. Refer Shoalhaven Starches for details.

1.4 SAMPLING LOCATION – STARCH DRYER NO. 1



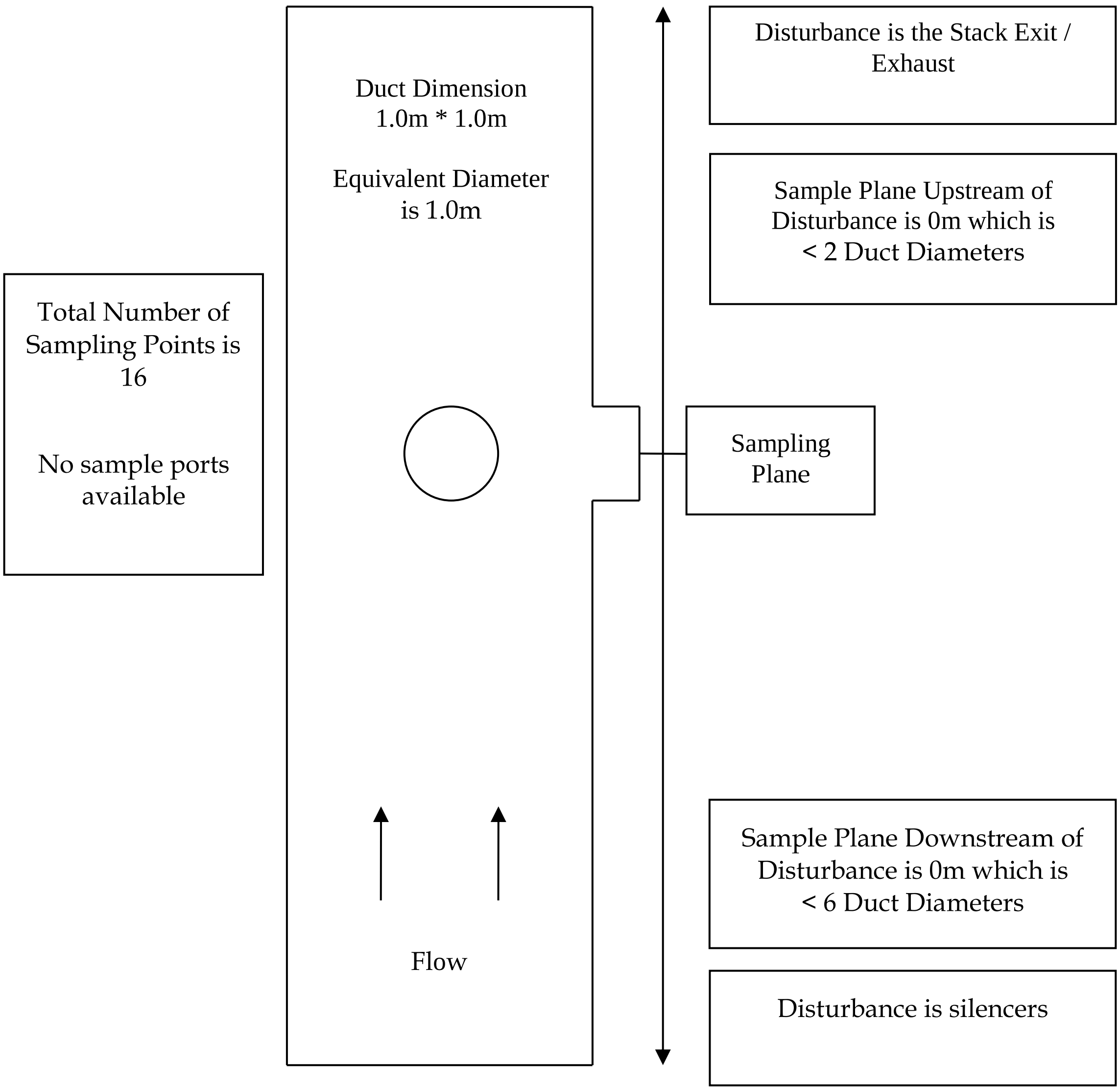
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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-1 STARCH DRYER NO. 1 – SAMPLE LOCATION

1.5 SAMPLING LOCATION – STARCH DRYER NO. 4



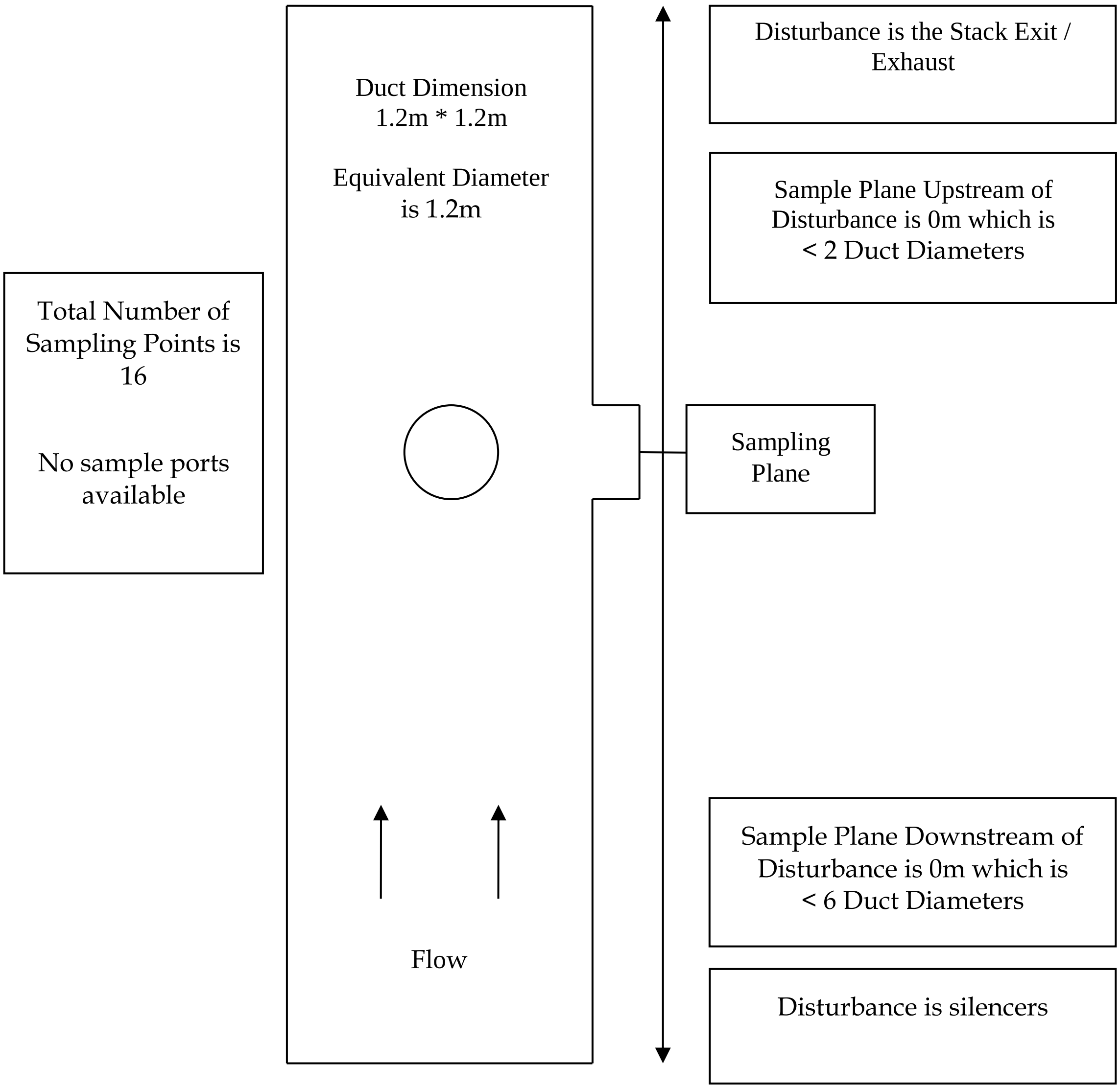
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the 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-2 STARCH DRYER NO. 4 – SAMPLE LOCATION

1.6 SAMPLING LOCATION – SPRAY DRYER



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-3 SPRAY DRYER – SAMPLE LOCATION

1.7 INSTRUMENT CALIBRATION DETAILS DAY 1- 14 MAY 2020

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	14-Jun-19	14-Jun-20
645	Stopwatch	03-Dec-19	03-Jun-20
857	Digital Temperature Reader	02-Dec-19	02-Jun-20
920	Thermocouple	02-Dec-19	02-Jun-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
466	Nozzle TSP Box 2	05-Dec-19	05-Dec-20
815	Digital Manometer	06-Dec-19	06-Dec-20
927	Balance		Response Check with SEMA Site Mass
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
946	combustion analyzer	16-Mar-20	16-Sep-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

1.8 INSTRUMENT CALIBRATION DETAILS DAY 2- 30 JUNE 2020

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
867	Gas Meter	21-Feb-20	21-Feb-21
908	Gas Meter	11-May-20	11-May-21
646	Stopwatch	11-May-20	11-Nov-20
857	Digital Temperature Reader	07-May-20	07-Nov-20
769	Thermocouple	07-May-20	07-Nov-20
428	Nozzle TSP Swagelok 3	05-Dec-19	05-Dec-20
427	Nozzle TSP Swagelok 2	05-Dec-19	05-Dec-20
916	Nozzle PM10 Head	05-Dec-19	05-Dec-20
527	Nozzle PM10 Head	05-Dec-19	05-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
927	Balance		Response Check with SEMA Site Mass
929	Calibrated Site Mass	26-Feb-20	26-Feb-21
815	Digital Manometer	06-Dec-19	06-Dec-20
613	Barometer	05-Dec-19	05-Dec-20
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
0.099% 9.8% 10.1%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALWB 5361	17-Jul-21

ATTACHMENT A – NATA CERTIFICATE OF ANALYSIS

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2164

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	7071/S25601/2020
	Analysis Requested:	TM-15, OM-5
	Chain of Custody Number	S25607
	Date Analysis Completed:	15 May 2020
	No. of Samples Tested:	2
	Sample Locations:	EPL ID No. 12 (Starch Dryer #1)
	Sample ID Nos.:	727947, 727948
	Filter ID Nos.:	15348, 15346

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

Identification	The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods	Nil

Issue Date
15 May 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2164

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Starch Dryer #1 TSP	727947	15348	14/05/2020	15/05/2020	0.00310
Starch Dryer #1 PM10	727948	15346	14/05/2020	15/05/2020	0.00291

Key:
g = grams

Stephenson
Environmental Management Australia

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

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

Particle Test Report No. 2168

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	7071/S25601/2020
	Analysis Requested:	TM-15, OM-5
	Chain of Custody Number	S25649
	Date Analysis Completed:	6 July 2020
	No. of Samples Tested:	4
	Sample Locations:	EPL ID No. 14 (Starch Dryer #4), and Spray Dryer
	Sample ID Nos.:	727999, 728000, 728001, 728002
	Filter ID Nos.:	15387, 15356, 15363, 15362

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

NATA
WORLD RECOGNISED ACCREDITATION

Identification — The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	AS4323.2-1995 (R2014) (NSW TM-15)
PM_{10}	AS4323.2-1995 (R2014) (NSW OM-5)

Deviations from Test Methods — Nil

Issue Date
6 July 2020

Peter Stephenson
Managing Director

Gravimetric Results – Test Report No. 2168

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Starch Dryer #4 TSP	727999	15387	30/06/2020	6/07/2020	0.00204
Starch Dryer # 4 PM_{10}	728000	15356	30/06/2020	6/07/2020	0.00127
Spray Dryer TSP	728001	15363	30/06/2020	6/07/2020	0.00028
Spray Dryer PM_{10}	728002	15362	30/06/2020	6/07/2020	0.00018

Key:
g = grams

Stephenson
Environmental Management Australia

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

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

Emissions Test Report No. 7093

The sampling and analysis was commissioned by:

Client	Organisation:	Shoalhaven Starches Pty Ltd
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	7093/20
	Test Date(s):	20 February, 14 May, 4 June and 30 June 2020
	Production Conditions:	Each dryer tested under normal conditions for the specific dryer
	Analysis Requested:	Nitrogen Oxides (NO_x), Moisture, Oxygen (O_2), Temperature, Flow and Velocity
	Sample Locations:	Starch dryers 1, 4 and 5 Gluten dryers 1, 2, 3 and 4
	Sample ID Nos.:	Not Applicable

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

NATA
WORLD RECOGNISED ACCREDITATION

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

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

Deviations from Test Methods Nil

Sampling Times NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.

Reference Conditions NSW – As per

(1) Environment Protection Licence conditions, or

(2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

Issue Date
30 July 2020

P W Stephenson
Managing Director

SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 7093

Parameter	Unit of measure	Starch Dryer 1	Starch Dryer 4	Starch Dryer 5	Gluten Dryer 1	Gluten Dryer 2	Gluten Dryer 3	Gluten Dryer 4
		14/05/2020	30/06/2020	20/02/2020	14/05/2020	04/06/2020	14/05/2020	04/06/2020
Temperature	^oC	38	39	68	71	64	74	72
Pressure	kPa	102.7	102.3	102.7	102.5	93.2	102.5	102.2
Velocity	m/s	6	22	14	14	17	11	21
Volumetric Flow	m^3/s	11	18	49	15	12	36	30
Moisture	%	1.6	3.2	6.3	7.3	14	6.3	6.4
Molecular weight dry stack gas	g/g mole	28.9	28.9	28.9	28.9	28.9	28.9	28.9
Gas Density	kg/m^3	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Nitrogen Oxides @ stack O_2	mg/Nm^3	ns	2	<2	8	2	12	2
Oxygen	%	20.9	20.9	20.8	20.9	20.9	20.9	20.6
Dryer auxiliary gas burner setting – (advised by operators)	%	nil	nil	266 m^3/hour	8	20	7	15

Key:

^oC	=	degrees Celsius
kPa	=	kilo Pascal
m/s	=	metres per second
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
%	=	percentage
g/g mole	=	grams per gram mole
kg/m^3	=	kilograms per cubic metre
mg/Nm^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa)
O_2	=	oxygen
ns	=	not sampled because an auxiliary gas burner is not fitted

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, USEPA 4	25%
Nitrogen Oxides	USEPA 7E	15%
Oxygen	USEPA 3A	1% actual
Velocity	AS4323.1, USEPA 2	5%

Key:

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

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

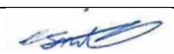
Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

GHD

Level 15
133 Castlereagh Street
T: 61 2 9239 7100   F: 61 2 9239 7199   E: sydmail@ghd.com

12534209-21166-3/https://projectsportal.ghd.com/sites/pp15_01/manildramodification/ProjectDocs/12534209-REP_Manildra MOD19 Air Quality Assessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	P Pandey N Spurrett	E Smith		E Smith		26/08/2020
1	P Pandey N Spurrett	E Smith		E Smith		28/08/2020

www.ghd.com

APPENDIX F – ODOUR COMPLAINTS RECORDS

MANILDRA GROUP OF COMPANIES

Environmental Complaint

Complaint No: CC-ESHOAL052

Customer Code: SCUST90124

Date Lodged: 14-Jun-2019

Customer:	Community Environmental Complaint - Direct
Batch No.:	N/A
Product:	N/A
Complaint Detail:	Odour Complaint 14-6-19 Backforest Rd
Problem:	Odour complaint received via phone message from Sue Shoeing on 14-6-2019 at 12:59 pm located at Backforest Rd (see attached) Spoke to the complainant on the day of the complaint. Odour described as pungent, which comes and goes and appears to be coming from the Manildra Farm.
Cause Cat:	ODOUR Odour
Cause:	Cause unknown. Winds were noted light to moderate westerly winds at the time of the complaint.
Who To Do:	
Action Required By:	16-Jun-2019
Action:	Called the complainant on 14-6-19 to discuss the details of the complaint. A survey of the complainants location at ~ 2:00 p.m on 14-6-19 could not identify any odour as described by the complainant. Winds were still light westerly, with the location downwind of Shoalhaven Starches Environmental Farm. An inspection of the Environmental Farm did not reveal any unusual or abnormal odours. Advised the complainant we would continue to monitor odours at the Farm and to call if there were any more odour issues.
Review:	No further correspondence received from the complainant. No other complaints received of this nature. No further action taken.

Status:	9 Closed	**Dept:**	SHOQA
Approved By:	Studdert.John	**Manufacturing Site:**	Shoalhaven Starches
Date:	22-Nov-2019	**Product Rejected:**	No
Recorded By:	Studdert.John	**Potential Claim:**	No

John Studdert

From: Accounts Receivable
Sent: Friday, 14 June 2019 12:49 PM
To: John Studdert
Subject: phone message:

Follow Up Flag: Follow up
Flag Status: Flagged

Please call Sue Shoeing
02 4464 2134
0411 038 853

Re: complaint of the odour she and some others are getting from Manildra,

-if she dosnt answer, please leave a message and she will call back as she may be out with the horses,

Melissa Sheiles | Accounts Receivable
340 Bolong Road, BOMADERRY NSW 2540
P: +61 2 4423 8222 |
E: nowra.receivables@manildra.com.au
manildra.com.au

MANILDRA GROUP
100% AUSTRALIAN OWNED

APPENDIX G – CORRECTIVE ACTION REPORTS

No CAR attached in this odour audit