Shoalhaven Starches Modification 23

Air Quality Assessment

Manildra Group

01 September 2021

→ **The Power of Commitment**

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1. Introduction

1.1 Overview

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to conduct an air quality impact assessment for a proposed modification to the approved Shoalhaven Starches Expansion Project (SSEP) (Modification 23 or Mod 23). The Shoalhaven Starches factory is located at Bolong Road in Bomaderry, New South Wales.

This report describes the background and scope of the proposed modifications, the pollutant inventory for odorous and non-odorous emission sources and the predicted air quality impacts at identified sensitive receptors.

1.2 Background

Flour and grains are processed at the factory to produce ethanol, starch, gluten, glucose and distiller's dried grain (DDG). Shoalhaven Starches is the holder of Environment Protection Licence number 883 issued for the plant by the NSW EPA.

The Shoalhaven Starches Bomaderry plant currently produces around 225 million litres (ML) of ethanol per year (production quantity fluctuates year to year based on demand). On 28 January 2009 the (then) Minister for Planning issued Project Approval MP 06_0228 for the Shoalhaven Starches Expansion Project. The Project Approval for the SSEP enabled Shoalhaven Starches, subject to certain conditions, to increase ethanol production in a staged manner at its Bomaderry Plant from the previous approved level of 126 million litres per year to 300 million litres per year. Following the Minister's determination Shoalhaven Starches have been implementing and commissioning works in accordance with this approval. Work on the change in operations has been completed, coupled to quarterly testing (independent audits) of emissions from licensed discharge points (a condition of the Licence), with the purpose to validate the predicted impacts against the original predictions in 2008 for the ethanol expansion.

The increase in ethanol production associated with the SSEP Project Approval was made in response to the NSW Government's ethanol mandate which increased the mandated ethanol content by volume in petrol in NSW from 2% to 6% in October 2011. The SSEP sought to increase ethanol production capacity at the Shoalhaven Starches site to meet the expected increase in demand for ethanol arising from this site. The increase in ethanol production required upgrades to the Stillage Recovery Plant including six additional Dried Distillers Grains Syrup (DDGS) dryers.

However, the anticipated increase in demand for ethanol has not occurred. In response, Manildra have undertaken a series of modifications to the site with a focus on exploring alternative options. These are summarised in Table 1.1.

Modifications 11, 12, 13, 16,17, 19 and 21 were assessed by GHD in the following documents:

- Shoalhaven Starches expansion project – Modification 11 and 12 (Project approval MP_06_0228) Revised odour and air quality assessment (GHD 2017)
- Shoalhaven Starches Mod 13 Air Quality Assessment Cumulative odour assessment (GHD 2017)
- Shoalhaven Starches Mod 13 Air Quality Assessment Updated Cumulative Air Quality Assessment (GHD 2017).
- Shoalhaven Starches Proposed modification application MP 06_0228 Shoalhaven Starches Expansion Project, Proposed new speciality processing facility, new gluten dryer and other associated works at 22, 24 and 171 Bolong Rd, Bomaderry, NSW (Mod 16) (GHD, February 2019).
- Manildra Group Air Quality Assessment Mod 17, 2019 (GHD, 2020)
- Manildra Modification 19 Air Quality Assessment (GHD, 2020)
- Shoalhaven Starches Modification 21 – Proposed Modification to Packing Plant and other works, Air Quality Assessment (GHD, 2021)

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 16/17	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: – The new product dryer – Plant and equipment associated with the processing of specialized 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 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	Summary of changes
	– 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 – 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.
Modification 18	Modification 18 comprised of the following: – Produce 120 ML/yr of hand sanitiser grade ethanol within the approved 300 ML/yr production limit – Repurposing of existing de-fatting building for the manufacturing of 1.5 ML/yr hand sanitiser – Relocation of approved, but not yet built gas fired boiler to be adjacent to ISO container storage area to the south east of the site to better service the existing distillery – New 24.5 m high boiler emissions stack – Extension of existing gantry and associated steam pipework between gas fired boiler and distillery for steam supply – Additional pipework to increase height of gantry from 9.75 m to 10.8 m – Erection of two 236,000 litre storage tanks for hand sanitiser storage – repurposing of de-fatting plant for hand sanitiser production storage
Modification 19	Modification 19 comprised of the following: – 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
Modification 21	Modification 21 comprised of the following:

Modification	Summary of changes
	– Modification of the packing plant layout. It is proposed to construct sixteen (16) smaller silos instead of the original 5 approved silos, install additional packer feed bines and alter the layout of the approved car parking spaces – Modification to the packing plant site layout including addition of a third rail siding, increase the height of the gantry containing the product transfer lines to the product silos, add noise mitigation walls to the train tunnel surrounding the container storage area terminate at the rail line and provide a loader maintenance and cleaning area within the container storage area – Extension of the product transfer lines and services from the Specialty Product Buildings across Bolong Road to the Packing Plant via the approved underground services crossing – Installation of an additional raw waste water tank within the Environmental Farm. The proposed raw waste water tank would be equipped with a floating roof to prevent odour emissions. – Installation of a Nitrogen Generator and Storage Tanks that will supply Nitrogen to the existing and proposed ethanol storage tanks to eliminate in-tank fire risk – Increase to indirect cooking capacity by 50%. – Installation of two additional fermenters (No. 18 and 19)

1.3 Current proposal: Modification 23

Project Approval MP06_0228 for the Shoalhaven Starches Expansion Project made provision for a gas fired co-generation that would comprise two gas turbine generators that would deliver an anticipated net power output of 40 MW of power for the site.

Subsequently under Mod 16 the Independent Planning Commission approved an additional coal fired co-generation plant. This coal fired co-generation plant would generate a total of 15 MW of power for the site.

Neither the approved gas nor coal fired co-generation plants have been constructed to date.

Following the original Project Approval Shoalhaven Starches have obtained approval and / or are seeking approval for a range of modifications to the original Project comprising a range of additional developments that were not envisaged as part of the original Project Approval. Shoalhaven Starches are forecasting that the electrical power load demand created by these and other additional works, subsequent to the original Project Approved development, will exceed the power supply capacity of the approved gas fired and coal fired co-generation plants.

Shoalhaven Starches now propose to construct a new gas-fired co-generation plant which will consist of two natural gas turbines that will generate an anticipated power output each of 30 MW, providing a total power to the site of 60 MW. The new gas fired co-generation plant will replace the approved gas fired and coal fired co-generators. In addition Shoalhaven Starches also proposed to convert their existing coal fired boilers to gas as well. It is proposed to submit a Modification Application (Mod 23) to the Department of Planning, Industry and Environment seeking approval for these proposed works.

1.4 Scope

The proposed changes (Mod 23) requires an application to the EPA assessing the associated off-site odour and air quality impacts.

In order to meet EPA NSW requirements, this report provides:

– A revised emissions inventory for odorous and combustion sources on site. A comparative analysis of the emissions inventory has been undertaken with the last major air quality assessments for the site.
– A level 2 air quality assessment of odour and air quality in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016) (the Approved Methods). Dispersion modelling was undertaken using CALPUFF version 7.
– A comparison of predicted odour and air quality results against the EPA criteria and against the previous modification results.

1.5 Assumptions

The major assumptions used in this assessment are as follows:

- Stack emission testing reports from the past measurements are accurate and representative of normal operations, and do not vary significantly
- The odour dispersion modelling using the NSW EPA and US EPA approved regulatory Gaussian puff dispersion model CALPUFF version 7, which was considered appropriate for the location. Limitations with the predicted odour are inherent within the model and in its ability to handle multiple buildings and stacks in a complex setup, with wake effects included. As such, the layout of the plant was simplified in order for the model to handle the setup
- Odour emissions from the major sources of odour were modelled as both variable emission and fixed point, volume and area sources in CALPUFF with appropriate dispersion characteristics
- The site representative meteorological data was obtained from previous assessments of the plant, which have been approved by EPA NSW in the past. The meteorological data is discussed in Section 5
- Small silos in the Packing Plant are conservatively assumed to be filled 24 hours a day
- Odour sources with horizontal releases have conservatively been modelled with vertical velocities of 0.1 m/s
- The VOC concentration in the biofilter exhaust is not high enough to induce density flows of the exhaust plume in ambient air
- The emissions inventory, and therefore the dispersion modelling results, is largely based on estimates and on data measured on site by Stephenson Environmental Management Australia (SEMA). Actual measurements are dependent on site conditions at the time of measurement and these conditions may change. GHD does not accept any responsibility for updating the measurements or estimates made by SEMA.

1.6 Report structure

This report:

- Describes the operations of the plant
- Describes the site-representative meteorological and background air quality data
- Describes the proposed modifications
- Characterises odour sources at the plant, accounting for the required changes to the Mod 23 model setup
- Presents the results of odour dispersion modelling for the proposed Mod 23 scenario using CALPUFF
- Characterises non-odour sources at the plant
- Presents the results of air quality dispersion modelling for the proposed Mod 23 scenario using CALPUFF
- Presents a summary of the results and draws conclusions as to the off-site impacts (both odour and non-odour)
- Outlines the limitations of the analyses and conclusions presented.

1.7 Limitations

This report: has been prepared by GHD for Shoalhaven Starches Pty Ltd and may only be used and relied on by Shoalhaven Starches Pty Ltd for the purpose agreed between GHD and Shoalhaven Starches Pty Ltd as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Shoalhaven Starches Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

2. Site location and context

2.1 Site description

Figure 2.1 shows the site context and location of the Shoalhaven Starches plant in Bomaderry, New South Wales. It is located between the Shoalhaven River and township of Bomaderry. The plant comprises a factory, a proposed (but not yet constructed) packing plant and environmental farm. The packing plant lies immediately to the north of the factory, while the environmental farm is situated approximately 400 m to the east. Figure 2.2 shows the site location and layout.

2.2 Nearby sensitive receptors

The Approved Methods define a sensitive receptor as “a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area”.

The site is proximate to a number of sensitive receptors. The township of Bomaderry lies to the northwest of the factory and west of the packing plant. Nowra is situated south of the plant. Commercial and industrial sensitive receptors are located directly adjacent to the site and across from it along Bolong Road.

The nearest residential sensitive receptors are located between 150 to 1300 metres from the site. The nearest commercial/industrial sensitive receptors (denoted by a receptor ID beginning with C) and residential sensitive receptors (denoted by a receptor ID beginning with R) to the site have been included in the modelling and are listed in Table 2.1, including the approximate distances and orientation of each receptor from the site. The commercial/industrial receptors also include the operating times in brackets.

The sensitive receptors are shown in Figure 2.1 and Figure 2.2.

Table 2.1 Location of identified sensitive receptors

Receptor ID	Range, m	To nearest odour source	Direction	MGA56. Easting (m)	MGA56. Northing (m)
R1	150	Packing Plant	W	281,430	6,140,610
R2	1300	Factory	SW	280,400	6,139,650
R3	700	Factory	S	281,510	6,139,310
R4	1300	Factory	SE	283,000	6,139,450
C1 (7am to 5pm, weekdays)	45	Factory	N	281,977	6,140,501
C2 (8am to 5pm, weekdays)	20	Factory	N	281,685	6,140,373
C3 (8am to 5pm, weekdays)	30	Factory	N	281,663	6,140,373
C4 (7am to 4pm, weekdays)	75	Factory	NW	281,615	6,140,371
C5 (24 hours)	125	Factory	NW	281,563	6,140,372
C6 (7am to 5pm, weekdays 7am to 12pm, Saturday)	30	Factory	NW	281,655	6,140,320
C7 (8am to 5pm, weekdays, 8am to 12pm, Saturday)	55	Factory	NW	281,597	6,140,289

Paper Size ISO A4

0 0.3 0.6 0.9 1.2

Kilometers

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

N

Manildra Group Pty Ltd
Shoalhaven Starches

Site Context

Project No. 12548374
Revision No. 0
Date 20 May 2021

FIGURE 2.1

N:\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\12548374\12548374_001_SiteContext.mxd
Print date: 20 May 2021 - 12:26

Data source:General Topo: NSW LPI DTDB 2012 © Department of Customer Service 2020. Created by: kpsroba

Paper Size ISO A4

0 20 40 60 80 100 120

Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Project No. 12548374
Revision No. 0
Date 20 May 2021

Site location and layout

FIGURE 2.2

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Print date: 20 May 2021 - 12:26

Data source: General Topo: NSW LPI DTDB 2012. © Department of Finance, Services & Innovation 2018. Created by: kpsroba

3. Operation description

3.1 General overview

Wheat flour and grains (wheat) are processed at the Shoalhaven Starches factory to produce ethanol, starch, gluten and glucose. Solid wastes are treated to produce distiller's dried grain (DDG), with liquid wastes being transferred to the environmental farm waste water treatment plant. Excess treated waste water is irrigated onto pasture. The main processing and materials treatment areas at Shoalhaven Starches comprise the:

- Flour mill
- Starch plant
- Glucose plant
- Ethanol and distillation plants
- DDG plant
- Packing plant
- Pellet Plant
- Environmental farm.

A brief description of the production process associated (including emission control) with each plant is given below. Figure 3.1 shows the layout of the plant in terms of its operational areas, along with the major odour sources of the plant, accounting for around 80% of total odour emissions (excluding the environmental farm).

3.2 Flour mill

Shoalhaven Starches commenced full operations at the flour mill in June 2011. The flour mill was originally approved by NSW Department of Planning and Environment in 2007 and was consolidated into the ethanol expansion project approval in 2008.

Proposed Modifications to the flour mill were approved in March 2016, which enabled an increase in the total flour production capacity on the site from the previously approved limit of 265,000 tonnes per annum to 400,000 tonnes per annum.

The flour is used in the plant to produce starch, gluten, glucose and ethanol. All remaining mill feed and pollard (flour sieving rejects) is processed through the DDG dryers for sale as stock feed. Flours from the various grinding operations are collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour is taken from these bins for use in existing site production processes.

All air extracted from the mill is passed through Buhler Airjet bag houses prior to being discharged to the atmosphere vertically via ten individual stacks. Approval has previously been obtained for the installation of additional plant to increase production, along with two additional exhausts from the roof of the building.

3.3 Starch plant

Within the starch plant, flour is processed to separate the starch from gluten (the protein component of flour). The starch is graded, dried and packed for shipment. Different grades of starch are manufactured for food and paper making applications. Starch that is not used for these applications is used as a raw material for the ethanol plant. Gluten is dried and sold for use in the food industry.

Aqueous (water-based) wastes are reused within the plant or are transferred to the environmental farm waste water treatment plant.

Starch Dryer No.5 has been constructed and is currently operational (see Figure 3.1). No change to the production volume is predicted.

3.4 Glucose plant

The glucose plant (contained within the starch plant area) houses two lines; the ‘confectioners’ glucose line and the ‘brewers’ glucose line. Confectioner’s glucose is distinguished by having been demineralised to remove latent odours and flavours that might be carried through to the final product by the glucose.

Both processes use starch as the raw material. The starch is broken down to its constituent glucose molecules using enzymatic and hydrolytic processes. Water is removed from the resulting solutions using evaporation to produce glucose and brewer’s solutions of desired concentration. The glucose product is shipped to customers in bulk containers.

The glucose manufacturing process generates aqueous wastes, mostly condensate from the evaporators, which is reused during regeneration of the ion exchangers.

3.5 Ethanol and distillation plants

Waste starch from the starch plant is transferred to the ethanol plant and fermented to produce ethanol. Starch (described in section 3.3), which is in suspension, is heated in jet cookers before being fermented.

Fermentation is carried out in fermentation vessels using the treated substrate to which an ethanol-producing yeast inoculum has been added. The yeast inoculum is generated using yeast propagator vessels, these being seeded using commercial strains of yeast.

Wastes from the fermenters are transferred to the DDG plant (refer to section 3.6) for processing. Fermentation liquor from the ethanol plant is transferred to the distillation plant where water and other impurities are removed to produce various grades of ethanol.

3.6 DDG plant

Wastes from the ethanol and distillation plant are dewatered in decanter centrifuges and dried in steam dryers to produce granular DDG. Light phase from the DDG decanters is evaporated to recover soluble protein (syrup) and produce clear condensate (liquid line). The syrup is added to the dryer feed for recovery of the solids (solids line). DDG granular product is transferred to the DDG Pellet Plant for pelletising; the DDG pellets are stored in silos. Some of the granular DDG product is stored in a storage shed until it is loaded into trucks in the DDG load-out area.

Exhaust gases from the existing DDG dryers (three) are transferred to the boiler air intake in order to destroy odorous components of the gases by combustion.

3.7 Steam production

Steam is generated at Shoalhaven Starches by using a combination of three gas fired boilers (numbers 1, 3 and 7) and four coal fired boilers (numbers 2, 4, 5 and 6). The combustion gases from these boilers are discharged via stacks, with boilers 5 and 6 having a combined stack. Exhaust from boilers 2 and 4 is treated in a cyclone and baghouse prior to discharge to atmosphere. Exhaust from boilers 5 and 6 is treated in a baghouse prior to discharge to atmosphere.

The number of boilers operational at any given time depends on the operational and maintenance requirements of the plant. With boiler 8 installed and coal-fired boilers operating at full capacity, only one gas-fired boiler will be operational with the other two gas-fired boilers on standby. When coal-fired boilers are not at full capacity or offline for maintenance, steam requirements are met from the natural gas boilers.

3.8 Environmental farm

A number of wastewater streams are produced at the factory. These consist of five clear condensate streams (distillation plant condensate, evaporator condensate, DDG condensate, a small flow from the carbon dioxide plant and boiler blowdown) and a combined ‘dirty’ stream from the factory processes. The ‘dirty’ wastewater streams are combined in the farm tank (located at the factory) and pumped to the waste water treatment plant. Treated water is pumped back to the factory for re-use, while excess treated water is stored in dams for irrigation on the farm.

3.9 Packing plant (proposed)

It is proposed that dried gluten/starch will be pneumatically transferred from the existing site to the proposed new packing plant via underground pipes. This dried material is proposed to be stored in silos.

At present, the approved packing plant has not been constructed at the Shoalhaven Starches sites. The proposed packing plant was assessed by SEMA in 2015.

The packing plant will consist of seven silos that will store either gluten or starch product. The medium and large silos are to be filled 24 hours a day, seven days a week, while the small silos can be filled at any time of the day for eight hours.

3.10 Other activities

3.10.1 Product load-out areas

Starch, glucose and ethanol products are loaded into road tankers from bulk storage silos and tanks. Load out of starch and glucose does not have the potential to generate odours, as these products have a low inherent odour characteristic.

Given the flammable nature of ethanol, the load out process is strictly controlled for occupational health and safety purposes. These controls have the secondary effects of minimising the potential for vapour generation and spillage.

3.10.2 Cooling towers

Cooling towers operate as part of the cooling water circuit for the ethanol glucose and DDG plants. The recirculated cooling water has the potential to absorb odours and to disperse the odours to atmosphere during the evaporative cooling (aeration) process within the cooling towers. Odour sampling undertaken at the cooling towers observed a decline in odour emissions demonstrating relatively low odour emissions and it has since been removed as an EPL odour monitoring point. Manildra advised that the cooling towers are no longer a source of odour and therefore they were removed from the odour emissions inventory.

3.10.3 Biofilters

Exhaust air from odorous sources at the DDG plant is captured and ducted to two existing soil-bed biofilters, each having a surface area of 110 m^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 3.1). The biofilters comprise a bed of organic bark and compost material (the matrix), with distribution of the odorous airstream through the floor of the biofilter via a manifold. Biological oxidation of odorous compounds takes place as the foul air percolates upward through the matrix. The oxidation is achieved by a population of microorganisms in the bed.

While the efficiency of biofilters destroying odorous components of the waste air varies according to a range of factors including soil moisture, composition and temperature, it is very high. Any odour in the exhaust air from the biofilter is due to the inherent odour of the matrix materials and typically has an ‘earthy’ characteristic.

The two biofilters at the site operate in parallel and are sized so that one biofilter can be taken offline during periodic replacement of the matrix of the sister filter.

As such, a soil-bed biofilter operating as designed, with no malfunctions, will not vary significantly in its odour emissions; it will emit at the matrix background level independent of fluctuations in the input odour loading.

3.11 Proposed modifications

3.11.1 Mod 11, 12, 13, 16, 17, 19 and 21

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).

The main changes affecting odour and air quality impacts in Mod 19 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.

The main changes affecting odour and air quality impacts in Mod 21 consist of:

- Modification of the packing plant layout. It is proposed to construct sixteen (16) smaller silos instead of the original 5 approved silos. However no change to total packing plant emissions is proposed.
- Installation of an additional raw waste water tank within the Environmental Farm. The proposed raw waste water tank would be equipped with a floating roof to prevent odour emissions. No additional odour emissions are anticipated.
- Increase to indirect cooking capacity by 50%. It is anticipated that this was result in a 50% increase in odour emissions from the glucose plant cooking.
- Installation of two additional fermenters (No. 18 and 19). It is understood the additional fermenters would be operated in batch mode to provide more fermenter redundancy for process upsets, fermenters cleans, etc. The overall throughput of the fermenters would not change and therefore no additional odour emissions are anticipated.

Further discussion of these changes in the context of the dispersion modelling is presented in Section 7.

3.11.2 Mod 23

Modification 23 is discussed in Section 1.3. The main changes affecting odour and air quality impacts consist of:

- A new gas-fired co-generation plant which will consist of two natural gas turbines that will generate an anticipated power output each of 30 MW, providing a total power to the site of 60 MW. The new gas fired co-generation plant will replace the approved gas fired and coal fired co-generators.
- Conversion of existing coal fired boilers to gas.

The proposal is expected to have a neutral impact on odour and a positive impact on combustion emissions compared against the previously modification (Mod 21). The reduction in combustion emissions (compared with Mod 21) is attributed to conversion of boilers from coal to gas which typically has lower emissions.

Paper Size ISO A4

0 10 20 30 40 50 60

Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Site layout and major odour sources

Project No. 12548374
Revision No. 0
Date 20 May 2021

FIGURE 3.1

N:\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\12548374\12548374_002_SiteLayout.mxd
Print date: 20 May 2021 - 12:26

Data source: General Topo: NSW LPI DTDB 2012. © Department of Customer Service 2020. Created by: kpsroba

4. Criteria for assessment

4.1 Odour

4.1.1 Odour Concentration

Odour 'strength' or concentration is measured in odour units (OU), where 1 OU represents the concentration of a sample that can just be detected by 50% of people in a controlled situation where there is no background ‘ambient‘ odour.

4.1.2 Measurement of Odour

The most common method of measuring odour concentration is Dynamic Olfactometry using the ‘forced choice’ method. Dynamic olfactometry simply dilutes the odour sample in known ratios with odour free air. At each dilution, the diluted odour and a zero odour is presented in turn to six panellists via two ‘sniffing’ ports. Further, the selection of the port with the diluted odour sample is randomly reassigned at each presentation. Each panellist is required (forced) to nominate the port (left or right) from which the diluted odour emanates. Each panellist’s response (i.e. 'guess', 'likely' or 'certain') is recorded. The sequence of presentations generally follows a decreasing dilution ratio, and when half of the panellists have correctly returned a ‘certain’ response, that dilution ratio is numerically equal to the concentration of the original, undiluted odour sample. Hence, for example, if the dilution needed to get the 50% response was 250:1, then by definition the original sample had an odour concentration of 250 OU.

4.1.3 EPA Criterion for Odour

EPA has defined an odour criterion and the Odour Guideline specifies how it should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are:

The **F**requency of the exposure

The **I**ntensity of the odour

The **D**uration of the odour episodes

The **O**ffensiveness of the odour

The **L**ocation of the source

These factors are often referred to as the FIDOL factors.

DEC defined the odour criterion to take account of two of these factors (**F** is set at 99 percentile, **I** is set at from 2 to 7 OU). The choice of criterion odour level has also been made to be dependent on the population of the affected area, and to some extent it could be said that population is a surrogate for location – so that the **L** factor has also been considered. The relationship between the criterion odour level **C** to affected population **P** is given below.

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

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

Population of affected community	Odour performance criteria (nose response odour certainty units at 99th percentile)
~ 125	4
~ 150	3
Urban (~2,000)	2

The NSW Approved Methods specifies a criterion of two odour units at the 99th percentile over a short term averaging nose-response time of one second for a complex mixture of odorous air pollutants in an urban area (population greater than 2000 or with schools and hospitals). The criterion is applied at the location of the nearest sensitive receptor or likely future location of sensitive receptor.

5 OU is commonly taken as a conservative measure of the odour level which can be distinguished against the ambient background level of odour, and which if offensive, could result in complaint.

1 OU generally cannot be detected in a non-laboratory situation (i.e. where the ambient background odour levels reduce the detectability of a given odorant).

As the CALPUFF dispersion model (utilised in this assessment), when operating in micrometeorological mode can only predict concentrations over an averaging period of one hour, a ratio between the one second peak concentration and 60 minute average concentration has been applied to the source odour emission rates. In this manner, the predicted one hour odour levels predicted in CALPUFF represent the corresponding one second short-term levels required to be compared to the DEC criterion. The ratio is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (i.e. near or far-field), and values are tabulated in the modelling Guideline[1]. This is reproduced in Figure 4.1.

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 4.1 Factors for estimating peak concentrations (Extract from NSW Approved Methods)

4.1.4 Other air quality impacts

Potential non-odorous air quality impacts from the site include dust and products of combustion. The following pollutants have been assessed against relevant criteria:

- Total suspended particles (TSP)
- Fine particulate matter less than 10 micron equivalent aerodynamic diameter (PM_{10})
- Fine particulate matter less than 2.5 micron equivalent aerodynamic diameter ($PM_{2.5}$)
- Products of combustion including carbon monoxide, oxides of nitrogen (NO_x), sulfur dioxide (SO_2, heavy metals (Type I & II), total volatile organic compounds (VOC) and polycyclic aromatic hydrocarbons (PAHs).

The air quality impact assessment criteria for these pollutants has been sourced from the Approved Methods and is summarised in Table 4.2.

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

Table 4.2 Air quality impact assessment criteria – other pollutants

Pollutant	Averaging period	Criterion
Particulate Matter PM_{10}	24 hours	50 µg/m³
	Annual	25 µg/m³
Particulate Matter $PM_{2.5}$	24 hours	25 µg/m³
	Annual	8 µg/m³
TSP	Annual	90 µg/m³
Carbon monoxide (CO)	15 minutes	100 mg/m³
	1 hour	30 mg/m³
	8 hours	10 mg/m³
Sulfur dioxide (SO_2)	10 minutes	712 µg/m³
	1 hour	570 µg/m³
	24 hours	228 µg/m³
Nitrogen dioxide (NO_2)	1 hour	246 µg/m³
	Annual	62 µg/m³
Polycyclic aromatic hydrocarbon (PAH)	1 hour	0.0004 mg/m³
Type 1 metals		
Arsenic	1 hour	0.00009 mg/m³
Cadmium	1 hour	0.000018 mg/m³
Lead	Annual	0.5 µg/m³
Mercury	1 hour	0.0018 mg/m³
Type 2 metals		
Beryllium	1 hour	0.000004 mg/m³
Chromium	1 hour	0.00009 mg/m³
Manganese	1 hour	0.018 mg/ m³
Nickel	1 hour	0.00018 mg/ m³

5. Meteorological data

5.1 Overview

A 12-month dataset was constructed using the 3D prognostic modelling package, TAPM and the diagnostic 3D meteorological model, CALMET for the period from January to December 2004. This 12 month period was chosen to be consistent with previous modelling undertaken for the 2008 Air Quality Assessment, approved at the time by EPA and to allow to a direct comparison to previous modelling. Further detail is provided in Appendix A in regards to the selection and construction of the meteorological dataset used in the modelling.

5.2 Meteorological modelling

The CALMET modelling can be summarised as follows:

- Prognostic models TAPM and CALMET were used for initial wind field ‘guesses’
- Observations from both the environmental farm Automatic Weather Station (AWS) and Nowra AWS were used to optimise and check the prognostic model simulations
- Wind speeds and direction observations from the environmental farm AWS were assimilated into the prognostic model to make the data site-specific

The result of assimilating this data into the CALMET simulations makes the data site-specific (required for a Level 2 assessment), and inter-annual variability is not required to be accounted for, with the conditions of the Approved Methods met for using “*at least one-year of site-specific meteorological data*”.

An annual wind rose generated using CALMET is provided in Figure 5.1 to show the wind field at the factory. The following trends are evident from Figure 5.1:

- Annual average wind speed of 3.2 m/s
- Winds are most prevalent from the west and west northwest, accounting for around one third of all winds
- Winds are least prevalent along the north-south axis
- Light winds (shown in grey) are more prevalent from the northwest
- Drainage flows occurring during stable conditions at night time are dominated by the following distinct features (in order of scale):
  - Shoalhaven River running west to east through the site
  - Browns Mountains to the northwest of the site
  - Yalwal State Forest mountain range to the west.

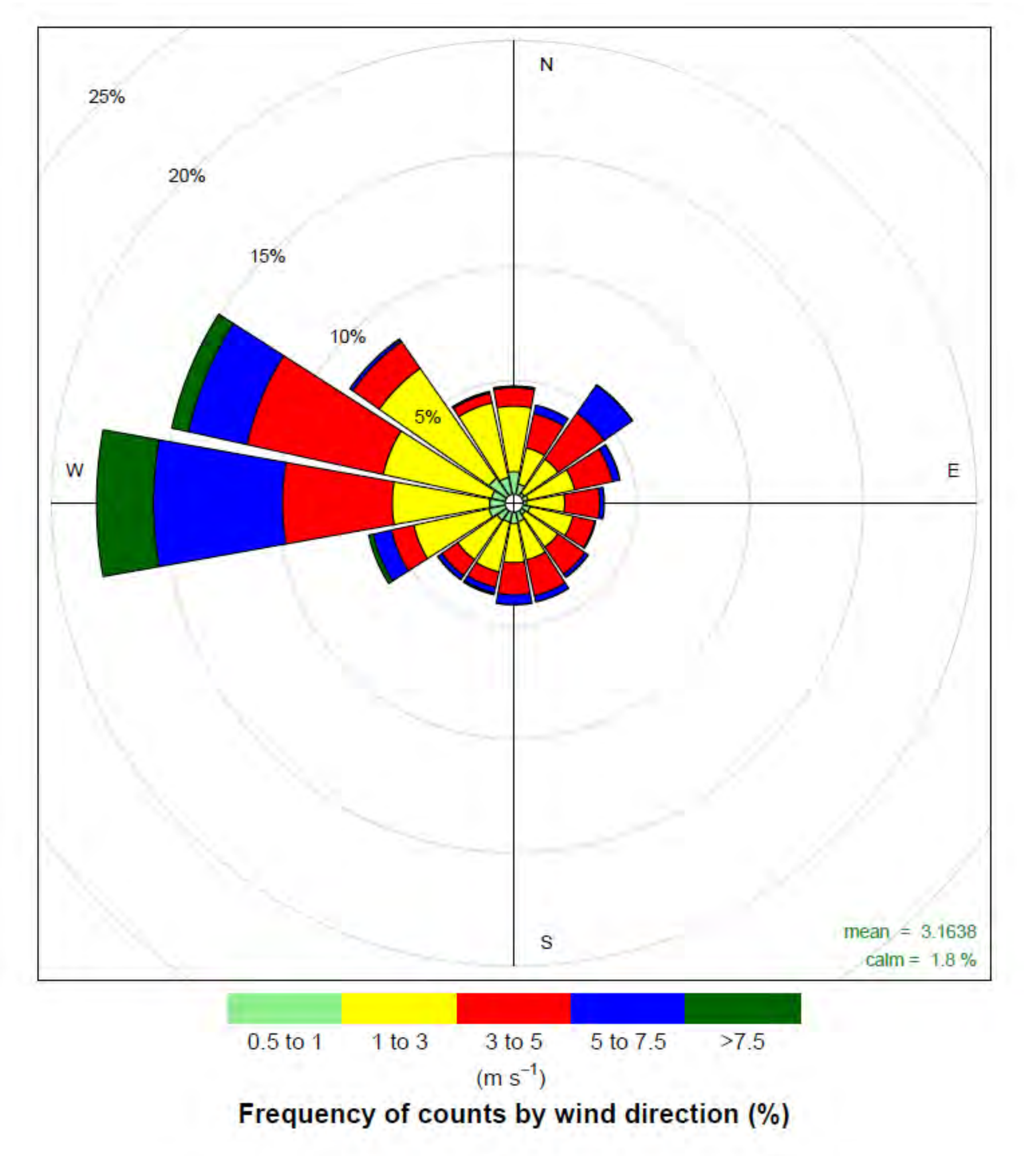


Figure 5.1 CALMET wind rose for the factory

5.2.1 Representative year discussion

GHD has undertaken an analysis of more recent measured meteorological data from the Shoalhaven Starches site, in order to determine if the existing EPA approved model would still be considered representative, given the age of the meteorological data. Figure 5.2 below shows annual wind roses for the site for both 2004 CALMET data (the data used in this assessment) and available site observations (dated from 29/04/2019 to 26/05/2020). The following comments are provided regarding the representativeness and suitability of 2004 CALMET data for use in this assessment:

– General wind pattern alignment between observations and modelled meteorological conditions is considered acceptable. Both wind roses show winds are predominantly from the west and have an even spread of winds from the south and east. The more recent observations have a lower percentage of winds occurring from the north compared to the modelling data. Consequently, the modelling data may be over predicting impacts to the south, (i.e. potential to result in less impact at R3 located to the south of the site which is the worst case receptor in terms of odour)
– Changing the meteorological file used in modelling will not enable a direct comparison of changes at the site between modifications. Recalibration of the baseline model (running original 2008 Air Quality assessment model with new meteorological file) would be required to meaningfully compare the relative change in impacts of each modification.

– Currently, only a limited site-specific meteorological dataset exists. While the comparison of this observed dataset shows good general alignment with the modelled meteorological conditions, it is recommended that site based meteorology be reviewed at the end of 2021 or when there is a sufficient number of years available for representative analysis. Currently, insufficient quantity of data is available to conduct a representative year analysis and therefore the alignment of observations against meteorological trends over longer timeframes cannot be assessed.

Based on this review GHD finds the 2004 meteorological dataset used in the assessment appropriate for use in this assessment.

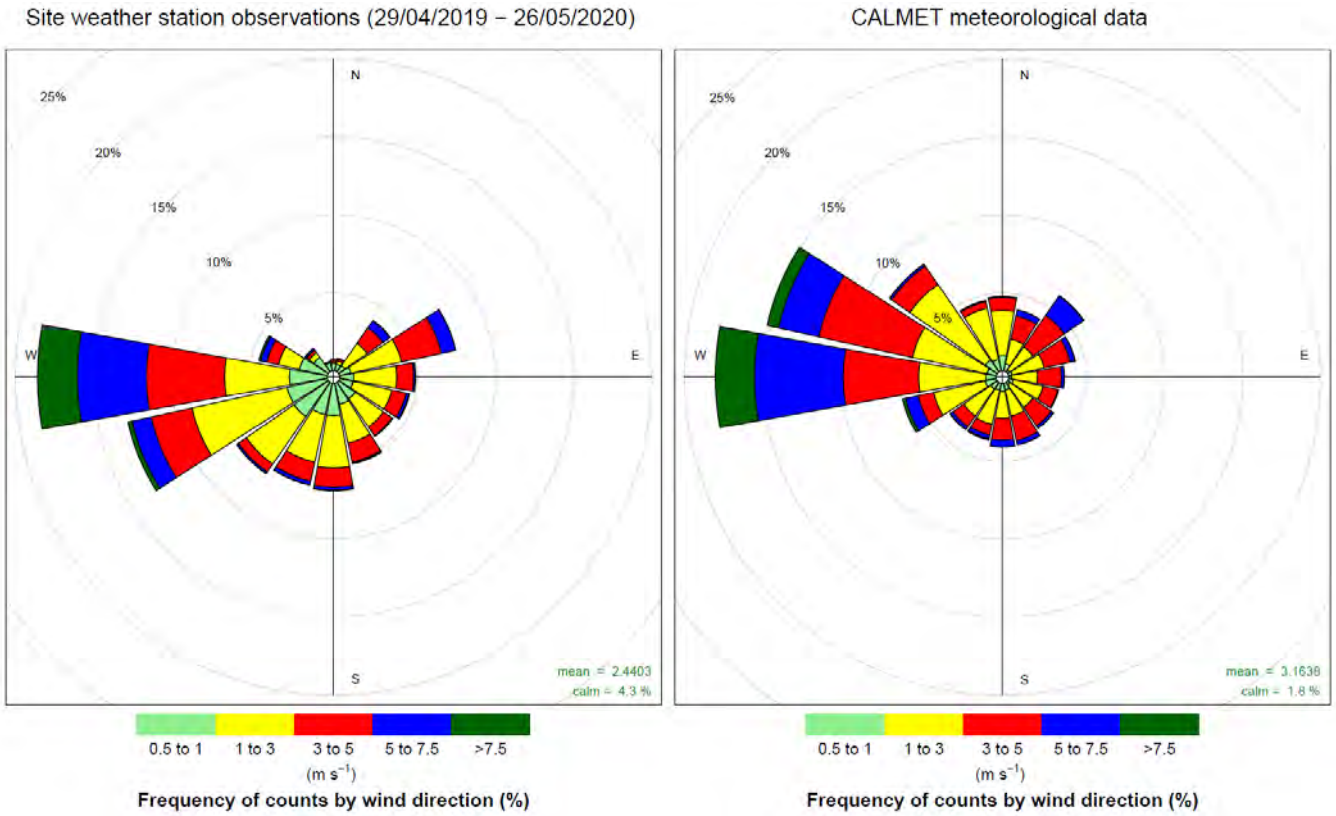


Figure 5.2 Comparison of site weather station observations and CALMET meteorological

6. Background air quality

The Department of Planning, Industry and Environment (DPIE) operate a state wide air quality monitoring network, with the nearest monitoring site to Shoalhaven Starches being the Albion Park South station located approximately 34 km northeast of the site, followed by the Kembla Grange station located approximately 46 km northeast of the site, followed by the Wollongong station located approximately 54 km northeast of the site.

Use of background data from the closest DPIE monitoring station(s) was prioritised where sufficient data was available (stations prioritised in order from Albion Park South to Kembla Grange to Wollongong).

A contemporaneous assessment approach was adopted to assess PM_{10}, $PM_{2.5}$ and NO_2 (NO_2 was assessed using Method 2 from the Approved Methods). Albion Park South commenced operation in 2005 meaning that contemporaneous data was not available for comparison to the GHD CALPUFF model of the site which uses meteorology from 2004. Therefore, contemporaneous 24 hour average variable PM_{10} and $PM_{2.5}$ data was sourced from Wollongong station (insufficient data from Kembla Grange) and contemporaneous one hour average NO_2 and O_3 data was sourced from Kembla Grange station.

Previous modification assessments from Mod 13 (GHD, 2018) onwards utilised the following background data:

– Data from the Albion Park South station for the 2016 calendar year:
  - 1 hour, 24 hour and annual averaged SO_2 data for use in the cumulative assessment
  - 70^{th} percentile PM_{10} and $PM_{2.5}$ data for graphically plotting only (refer Figure 8.2 and Figure 8.3. 70^{th} percentile concentrations were considered a reasonable representation of ambient PM_{10} and $PM_{2.5}$ concentrations)

– Data from the Wollongong station for the 2016 calendar year:
  - 1 hour and 8 hour averaged CO data for use in the cumulative assessment (it is noted that CO predictions are orders of magnitude below the assessment criteria therefore no further investigation regards background CO concentrations was undertaken).

For consistency purposes to allow meaningful comparison between modifications, the same 2016 Albion Park South data was adopted for this assessment. As part of this assessment, GHD reviewed the most recent calendar year of SO_2 data (01/01/2020-01/01/2021) and noted that background 1 hour average SO_2 concentrations were that same as those recorded in 2016 while background 24 hour and annual SO_2 concentrations had both decreased. Therefore use of background 2016 data was considered conservative. Additionally, it is noted that particulate levels in recent years (particularly in 2019 to 2020) were not considered representative of typical concentrations due to elevated levels cause by bushfires and therefore GHD did not update the 70^{th} percentile data used for plotting purposes.

Background levels of SO_2, CO and 70^{th} percentile PM_{10} and $PM_{2.5}$ used in the assessment are provided in Table 6.1.

Table 6.1 Background Air Quality Data – Albion Park South (2016)

Pollutant	Averaging Period	Concentration [2]	Units
Sulfur dioxide (SO_2)	1 hour	57.6	µg/m^3
	24 hour	15.7	
	Annual	1.6	
Carbon monoxide (CO)[3]	1 hour	1.0	mg/m^3
	8 hour	0.6	
PM_{10}	24 hours	43.2	µg/m^3
	70^{th} percentile 24 hour average	18.3	

[2] Values are 100^{th} percentile, except where stated as 70^{th} percentile for PM_{10} and $PM_{2.5}$
[3] CO was sourced from the Wollongong monitoring station as this was not available at Albion Park South

Pollutant	Averaging Period	Concentration [2]	Units
	Annual	14.9	
$PM_{2.5}$	24 hours	30.7	$\mu g/m^3$
	70th percentile 24 hour average	8.0	
	Annual	7.2	

The contemporaneous particulate assessment was undertaken using data from Wollongong in 2004. A review of particulate levels at Wollongong and Albion Park is provided in Table 6.2. Average particulate levels at Wollongong have reduced from 2004 to 2016. Levels at Albion Park South in 2016 are lower than the levels at Wollongong over the same period. Therefore use of contemporaneous 2004 PM_{10} and $PM_{2.5}$ data from Wollongong is likely conservative as background concentrations have decreased over time (shown via comparison of 2004 Wollongong data to 2016 Wollongong data) and concentrations in Wollongong are higher than those closer to the site (shown via comparison of 2016 Wollongong to 2016 Albion Park data).

Table 6.2 Review of particulate monitoring at Albion Park South and Wollongong, $\mu g/m^3$

Site and Year	Albion Park 2016	Wollongong 2016	Wollongong 2004
Average PM_{10}	14.9	17.3	25.5
70^{th} percentile PM_{10}	18.3	20.7	28.8
90^{th} percentile PM_{10}	25.6	29.7	37.8
Average $PM_{2.5}$	7.2	7.4	9.7
70^{th} percentile $PM_{2.5}$	8.0	8.3	12.2
90^{th} 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 $\mu g/m^3$
– NO_2 – 54.5 $\mu g/m^3$
– PM_{10} – 28.1 $\mu g/m^3$

The results show all pollutants are significantly lower than the levels recorded at Albion Park South, and would include any emissions from the Shoalhaven Starches site. The maximum levels all readily comply with the relevant criteria. Using the background SO_2 and CO data from the Albion Park South monitoring station 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[4] 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 21. The odour sources associated with these modifications have been discussed in depth in previous air quality assessments.

The following assumptions and additional changes were made to the baseline odour model:

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

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

of the stack is proposed to be 0.85 m. The flow rates were calculated based on 20% of the proposed gluten dryer 8.

- As part of the Mod 19 proposal, a new distillation plant (with columns and associated processing equipment) is proposed to be installed immediately to the west of the existing Ethanol Distillery Plant. One additional emission source associated with this change is the new Distillation plant Column Washing Vent (CWV2), which is a duplication of the existing source (CWV). The stack height of the new source as provided by Manildra, is 55 metres tall. Stack diameter, exit velocity and temperature were sourced from the sampling report for the similar existing source (*Odour Research Laboratories Australia (2020) Olfactometry Test Report for Beverage Ethanol D500 Vent Report No. 7091/ORLA/01)*. Cooling tower odours were removed in Mod 19 due to improvements at the site and subsequently being removed as a EPL odour sampling point.
- As part of the Mod 21 proposal, the following changes were added:
  - installation of additional biofilter capacity to improve odour performance and increase biofilter ability to treat a higher volume of odorous air. Therefore odour concentrations from biofilter sampling undertaken prior to the diversion of odorous air from DDG4 have been used in this assessment.
  - odour emissions from the indirect cooking facility were increased by 50%.
  - Boiler 5/6 emissions were modelled with an exit velocity of 10 metres per second.
- As part of the current proposal (Mod 23), the following changes were made:
  - All boilers would be converted to gas fired. Odour emissions from boiler no 5 & 6 (gas fired) was estimated based on quarterly odour sampling data scaled based on proposed flowrate.
- Odour emission rates were assumed to be unchanged for the other emission sources.

7.1.3 Source summary and comparison

Modelling for the proposed Mod 23 scenario comprised the following sources:

- 65 point sources in total throughout the site;
- 63 point sources with constant emissions
- Two point sources with variable emissions
- 11 area sources (consisting of two biofilters and the effluent treatment ponds)
- Five volume sources within the factory area.
- These sources are detailed in Table 7.1 and Appendix B.

A comparison of the sources between Mod 13, Mod 16, Mod 17, Mod 19, Mod 21 and the current modification is provided in Table 7.1.

This shows that the total odour levels from the current proposal decrease by approximately 15% compared with the previous Mod 21 Q2 (attributed to conversion of boilers to gas and therefore removal of coal/woodchip fired boilers 2 and 4 as an odour source) and increased by approximately 10% compared with previous Mod 21 Q3 (attributed to variability in odour sampling data).

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	Modelled Mod 21 MOER OU.m^3/s		Modelled Mod 23 MOER OU.m^3/s
						Q2	Q3	
Boilerhouse								
Boiler no 2	BOILR2	-	-	-	12,677	8,309	7,025	-
Boiler no 4	BOILR4	3,171	5,666	22,077	27,988	37,247	29,207	-
Boiler no 5 & 6	BOILR5	38,463	43,711	68,610	88,902	94,550	102,780	70,708
Sub total MOER		**41,634**	**49,377**	**90,687**	**129,567**	**140,106**	**139,013**	**70,708**
% of total MOER		**15.0%**	**18.3%**	**23.8%**	**29.9%**	**29.7%**	**37.9%**	**17.6%**
DDG Plant								
Condenser drain	VCD	31	31	31	4,419	4,419	4,419	4,419
DDG tent storage area	DDG36	1,929	1,929	1,929	1,929	1,929	1,929	1,929
Product storage sheds	DDG34	1,023	1,023	1,023	1,023	1,023	1,023	1,023
Light phase tank	DDG19	20	20	20	74	74	74	74
Cooling towers	DDG46	172	172	172	-	0	0	-
DDG Loadout Shed Awning	DDG35	923	923	923	923	923	923	923
Pellet exhaust stack	PPES	38,240	31,544	88,073	67,000	84,100	40,442	84,100
Pellet silo	S12	350	350	350	350	350	350	350
Stillage surge tank	SST	149	149	149	173	173	173	173
Pellet plant fugitives (non-DDG sources)	PPF	5,771	5,771	5,771	5,771	5,771	5,771	5,771
Additional Cooling towers	CTP	172	172	172	-	0	0	-
Sub total MOER		**48,780**	**42,084**	**98,613**	**81,661**	**98,761**	**55,103**	**98,761**
% of total MOER		**17.5%**	**15.6%**	**25.9%**	**18.9%**	**20.9%**	**15.0%**	**24.5%**
Ethanol Plant								
Yeast Propagators -tanks 4 and 5	YP45	820	820	820	820	820	820	820
Grain retention tank	GRT	3,250	3,250	3,250	4,535	4,535	4,535	4,535
Ethanol recovery scrubber	ERESC	3,132	10,660	15,405	33,091	41,258	15,198	41,258

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s		Modelled Mod 23 MOER OU.m³/s
						Q2	Q3	
Fermenters 10-16	FERM	2,668	3,298	795	2,500	2,000	2,804	2,000
Jet cooker 1 retention tank	E13	1,067	1,067	1,067	1,067	1,067	1,067	1,067
Jet cooker 2/4 grain retention	E7	567	567	567	567	851	851	851
Feed to distillery	E22	83	83	83	83	83	83	83
Sub total MOER		**11,587**	**19,745**	**21,987**	**42,663**	**50,613**	**25,358**	**50,613**
% of total MOER		**4.2%**	**7.3%**	**5.8%**	**9.9%**	**10.7%**	**6.9%**	**12.6%**
Distillery								
Incondensable gases vent	D6	558	558	558	558	558	558	558
Molec. sieve vacuum drum	D2	1,350	1,350	1,350	1,350	1,350	1,350	1,350
Column Washing Vent	CWV	23	25	27	1,399	1,218	1,218	1,218
Distillation plant Column Washing Vent	CWV2				1,399	1,218	1,218	1,218
Sub total MOER		**1,931**	**1,933**	**1,935**	**4,707**	**4,344**	**4,344**	**4,344**
% of total MOER		**0.7%**	**0.7%**	**0.5%**	**1.1%**	**1.0%**	**1.0%**	**1.0%**
Starch and Glucose								
Flour mill A Exhaust	A4	679	679	679	679	679	679	679
Flour mill A Exhaust	A5	96	96	96	96	96	96	96
Flour mill A Exhaust	A6	449	449	449	449	449	449	449
Flour mill A Exhaust	A7	932	932	932	932	932	932	932
Drum vac receiver	C4	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Dry gluten roof bin	S07	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Enzyme tanks	B7	2,042	2,042	2,042	2,042	2,042	2,042	2,042
Flash vessel jet cooker	C1	970	970	970	970	970	970	970
Flour bin aspirator	S13A	500	500	500	500	500	500	500
Flourbin aspirator	S13B	500	500	500	500	500	500	500
Flourbin motor drive	S06	283	283	283	283	283	283	283
Flour mill aspiration (Mod 8)	FMP1	266	205	205	205	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	Modelled Mod 21 MOER OU.m^3/s		Modelled Mod 23 MOER OU.m^3/s
						Q2	Q3	
Flour mill aspiration (Mod 8)	FMP2	205	266	266	266	266	266	266
High protein dust collector	S08	600	600	600	600	600	600	600
Ion exchange effluent tank	C18	250	250	250	250	250	250	250
No 1 gluten dryer baghouse	S02	5,925	5,166	5,166	9,800	9,800	7,136	9,800
No 1 starch dryer	S01	5,193	5,193	11,316	2,800	3,200	6,358	3,200
No 2 gluten/starch dryer	S04	2,354	5,166	5,166	7,200	6,000	3,362	6,000
No 3 gluten dryer baghouse	S03	58,917	29,036	21,696	12,700	32,000	11,540	32,000
No 3 starch dryer	S18	1,663	5,166	5,166	3,800	6,800	1,942	6,800
No 4 gluten dryer baghouse	S05	31,222	22,433	13,693	9,100	20,000	9,768	20,000
No 4 starch dryer	S19	1,824	4,008	5,020	3,600	2,500	1,848	2,500
No 5 ring dryer gluten/starch	SDR5	4,817	4,817	4,817	4,350	4,625	3,378	4,625
No 5 starch dryer (existing)	SD5C	6,800	6,800	3,393	4,931	2,123	3,172	2,123
No 5 starch dryer (new stack)	SD5N	-	-	17,387	25,269	10,877	16,256	10,877
No 6 gluten dryer	GD6	12,568	12,568	12,568	12,568	12,568	12,568	12,568
No 7 gluten dryer	GD7	9,553	9,553	9,553	9,553	9,553	9,553	9,553
Spray dryer	S20	738	738	738	738	738	738	738
Starch factory rejects	E10	183	183	183	183	183	183	183
Farm tank	F18	3,834	3,834	3,834	3,833	3,833	3,833	3,833
Pellet mill silo	PMFS	173	173	173	173	173	173	173
Flour Mill B Exhaust	FMBA to FMBM	5,637	4,621	4,621	3,621	3,621	3,621	3,621
Flour Mill C Exhaust	FMC1 to FMC3	n/a	1,658	1,658	1,560	1,560	1,560	1,560
Gluten dryer No.8	GD8	n/a	12,568	12,568	12,568	12,568	12,568	12,568
Product dryer 9	PD9	n/a	n/a	5,166	9,800	9,800	7,136	9,800
Sub total MOER		**165,073**	**147,353**	**157,553**	**151,819**	**166,194**	**130,365**	**166,194**
% of total MOER		**59.3%**	**54.7%**	**41.3%**	**35.1%**	**35.2%**	**35.6%**	**41.3%**

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s		Modelled Mod 23 MOER OU.m³/s
						Q2	Q3	
Packing Plant (Not constructed)								
Starch silo 1	PPL1	86	86	86	86	86	86	86
Starch silo 2	PPL2	86	86	86	86	86	86	86
Gluten silo 1	PPM1	173	173	173	173	173	173	173
Gluten silo 2	PPM2	173	173	173	173	173	173	173
Gluten silo 3	PPM3	173	173	173	173	173	173	173
Small gluten silo	PPS1	92	92	92	92	92	92	92
Small starch silo	PPS2	35	35	35	35	35	35	35
Sub total MOER		**818**	**818**	**818**	**818**	**818**	**818**	**818**
% of total MOER		**0.3%**	**0.3%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**
Area sources: Environmental farm after WWTP								
Biofilter A (additional capacity installed in Mod 21)	BIO1	440	1,408	1,386	502	1,307	1,239	1,307
Biofilter B (additional capacity installed in Mod 21)	BIO2	330	803	1,111	1,648	1,208	1,187	1,208
Biofilter C	BIO3	1,089	1,089	1,089	1,089	1,089	1,307	1,089
Biofilter D	BIO4	1,280	1,280	1,280	1,280	1,281	1,208	1,281
Storage dam 1	PO1	148	71	119	1,475	948	948	948
Storage dam 2	PO2	1,656	248	143	973	687	687	687
Storage dam 3	PO3	192	569	1,231	2,962	1,626	1,626	1,626
Storage dam 5	PO5	515	971	1,922	6,538	1,248	1,248	1,248
Storage dam 6	PO6	1,775	1,435	793	3,097	1,435	1,435	1,435
Sulfur oxidisation basin	SOBAS	830	349	535	1,939	489	489	489
Membrane bio-reactor	MBR	62	62	62	54	54	54	54
Sub total MOER		**8,317**	**8,286**	**9,671**	**21,557**	**11,372**	**11,429**	**11,177**
% of total MOER		**3.0%**	**3.1%**	**2.5%**	**5.0%**	**2.4%**	**3.1%**	**2.8%**
Total (Mod 11 and Mod 12)		**278,140**						

Source	Model Reference	MOER OU.m³/s (Mod 13)	MOER OU.m³/s (Mod 16)	Modelled Mod 17 MOER OU.m³/s	Modelled Mod 19 MOER OU.m³/s	Modelled Mod 21 MOER OU.m³/s		Modelled Mod 23 MOER OU.m³/s
						Q2	Q3	
Total (Mod 16)			**269,595**					
Total (Mod 17)				**381,265**				
Total (Mod 19)					**432,792**			
Total (Mod 21)						**472,208**	**366,428**	
Total (Mod 23)								**402,811**

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

Table 7.2 shows the predicted 99th percentile odour impacts (one second nose-response time) for the proposed Mod 23 operations and the previous modifications. Figure 7.1 shows the predicted odour levels for the proposal Mod 23 and the previous modification results.

The predicted odour levels for Mod 23 show a general decrease compared against Mod 21 (Q2) predictions and are relatively unchanged compared against Mod 21 (Q3) predictions. The decrease compared to Mod 21 Q2 odour levels is attributed to conversion of boilers to gas and therefore removal of coal/woodchip fired boilers 2 and 4 as an odour source. The relatively minor fluctuation in odour predictions compared to Mod 21 Q3 is attributed to variability in odour sampling.

The results for Mod 23 show that the impact assessment odour criteria are achieved at all residential sensitive receptors.

Seven commercial/industrial receptors are included in the assessment. These are all located within approximately 125 m of the site. One second, 99th percentile odour impacts have been predicted based on the hours of operation of the receptors as per Section 2.2 (i.e. predicted odour impacts when the sites are not operational have been excluded from the assessment).

Mod 23 predicted marginal exceedances of the 6 OU criteria (assumed the same criteria as R1) at commercial/industrial receptors C2, C3, C4, C5, and C7 due to the higher quarterly odour sampling results.

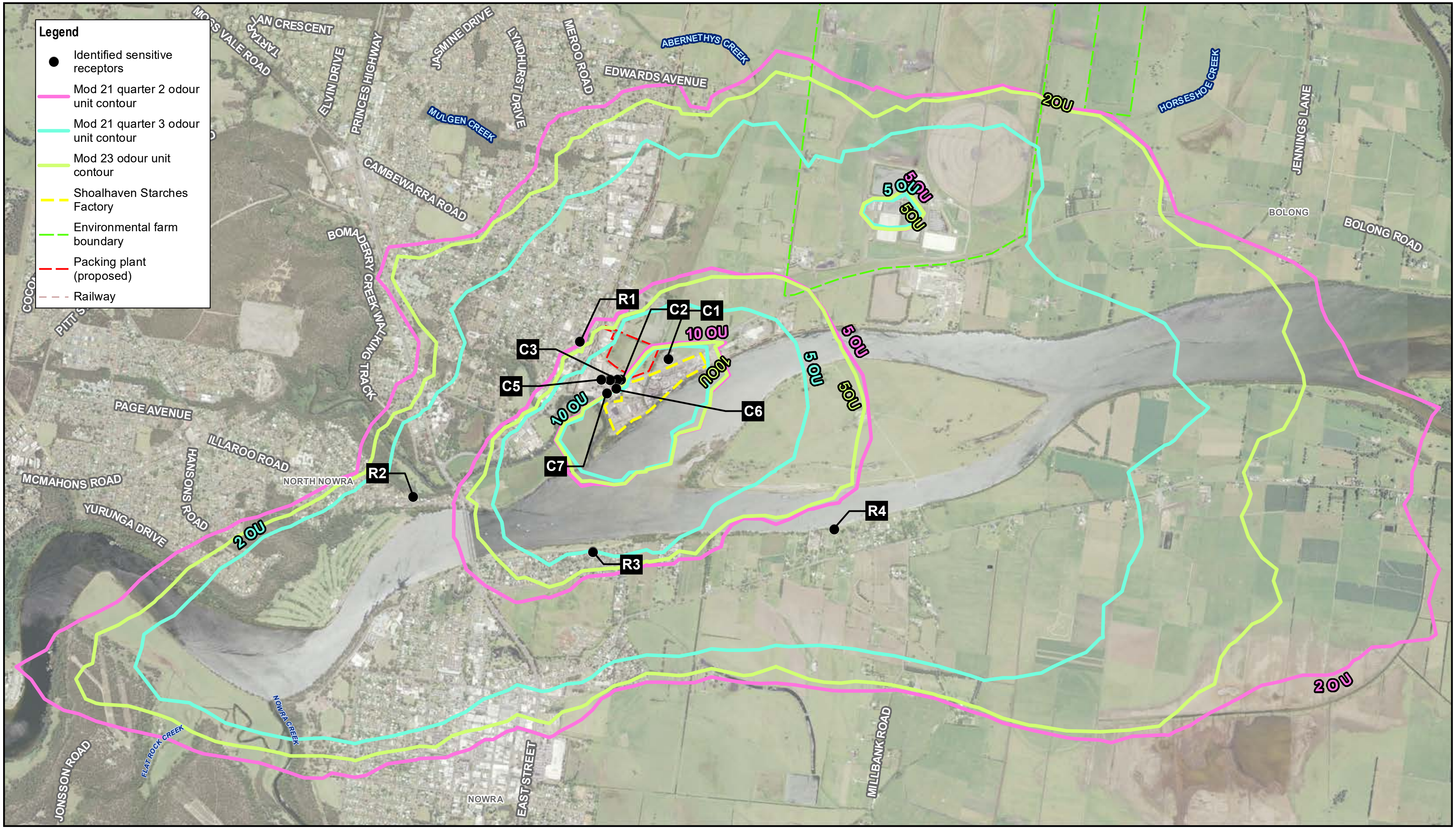
Commercial receptors C1 and C6 are located approximately 45 and 80 metres from the site. Given the industrial nature of these receptor, and its existing proximity to the site no significant odour impacts are anticipated from the proposal.

Two odour complaints (one in October 2020 and one in March 2021) attributed to the Shoalhaven Starches plant was received in the last year.

Table 7.2 ***Predicted peak (99th percentile, short term averaged) odour impact at nearby receptors***

Receptor	Range, m	To nearest odour source	Direction	2009 EA approved 'base case' Odour criterion	Odour impact, OU, 99th percentile, nose-response time						
					Mod 13	Mod 16	Mod 17[5]	Mod 19	Mod 21 (Q2)	Mod 21 (Q3)	Mod 23
R1 Bomaderry	150	Packing Plant	W	6	3.3	3.5	4	4	5	4	5
R2 North Nowra	1300	Factory	SW	3	2.5	2.6	3	3	4	3	3
R3 Nowra	700	Factory	S	5	4	4.6	5	5	6	5	5
R4 Terara	1300	Factory	SE	5	3.7	3.7	4	4	5	4	5
C1	45	Factory	N	n/a	n/a	10.3	12	12	14	12	12
C2	20	Factory	N	n/a	n/a	5.8	8	10	10	9	8
C3	30	Factory	N	n/a	n/a	5.3	7	9	9	8	8
C4	75	Factory	NW	n/a	n/a	4.4	6	7	8	7	7
C5	125	Factory	NW	n/a	n/a	6.1	7	7	8	7	7
C6	30	Factory	NW	n/a	n/a	5.4	7	10	10	9	9
C7	55	Factory	NW	n/a	n/a	4.8	7	8	9	8	8

[5] Predicted odour concentrations rounded to nearest whole number from MOD17 onwards as per EPA advice



Paper Size ISO A4

0 160 320 480 640 800 960

Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Odour impacts, 99th percentile, short term averaged – Modification 23

Project No. **12548374**
Revision No. **0**
Date **18 Aug 2021**

FIGURE 7.1

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\12548374\12548374_003_Odour_Mod23.mxd
Print date: 18 Aug 2021 - 09:59

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012© Department of Customer Service 2020. Created by: kpsroba

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 23 includes all existing air emissions sources and those proposed in previous Modifications (up to and including Modification 21). Emission rates were estimated for a factory throughput of 300 ML per annum (maximum approved throughput).

Two new emission sources being the new gas-fired co-generation plant consisting of two natural gas turbines are proposed as part of Modification 23. The new gas fired natural gas turbines would replace the approved (but not constructed) gas fired and coal fired co-generators. Additionally, all existing coal fired boilers would be converted to gas fired.

The gas turbines and gas-fired boilers would be a source of particulates, combustion pollutants, PAH, VOC's and metals.

Generally the emissions estimation methodology adopted for Modification 23 was consistent with that of previous modifications. Modification 23 emission rates were updated based on most recent sampling data to reflect the site's current operations. Assumptions and changes made to the baseline air quality model as part of this assessment are discussed in detail below for each of the individual source types.

8.1.1 Boiler emissions

Emission estimation based on site specific sampling data was prioritised where available, however sampling data for gas fired boiler was not available. Therefore, emissions factors from the *National Pollutant Inventory Emission estimation technique manual for Combustion in boilers Version 3.6 (December 2011)* (NPI factors) were used (emissions factors for natural gas (≤30MW wall fired)).

Use of boilers 1, 2, 4 and 8 are on standby duty as part of Mod 23 only boiler 5/6 would be active.

Conversion of existing coal fired boilers to gas significantly reduces the emissions of combustion pollutants (CO, SO_2 and NO_2), PAH, VOC's and metals and eliminates the emission of some pollutants including antimony, Tin and Vanadium (emissions factors for these pollutants are not provided for gas fired boilers).

8.1.2 Product dryer emissions

No changes to the product dryer emissions were made from those presented in Mod 21.

8.1.3 Other emission sources

Other emissions sources would remain unchanged from previous air quality assessments.

It should be noted that the gas turbines assessed as part of the 2008 air quality assessment (GHD, 2008) and have been approved by EPA were removed from the model as they would be replaced by the new gas-fired co-generation plant proposed in this modification.

The modelled emission rates from turbines are summarised in Table 8.1 and Table 8.2.

Table 8.1 Emission inventory – Particulate matter

Discharge Point	Model ID	EPA ID	Emission control	TSP	PM_{10}
Boiler No. 5/6	BOILR5	35	Fabric filter	0.097	0.097
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

Discharge Point	Model ID	EPA ID	Emission control	TSP	PM_{10}
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	Cylone and wet-scrubber	0.044	0.033
Starch dryer No. 3	S18		Cylone and wet-scrubber	0.04	0.013
Starch dryer No. 4	S19	14	Cylone and wet-scrubber	0.057	0.029
Starch dryer No. 5	SD5C	47	Cyclone	0.062	0.062
No. 5 Starch Dryer	SD5N		Cyclone	0.32	0.32
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-FMBF		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	0.35	0.35
Co-generator turbine No. 2 (proposed)	turb2		Gas-fired	0.35	0.35
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)	SILO5		Fabric filter	0.013	0.013
Product dryer 9	PD9		Fabric filter	0.015	0.0003

Table 8.2 Emission inventory – Products of combustion

Discharge Point	Boiler No. 5/6	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No .6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5	Product dryer 9	Co-generator turbine No. 1	Co-generator turbine No. 2
Model ID	BOILR5	S02	S04	S03	S05	SDR5	GD6	GD7	GD8	S18	S19	SD5C	SD5N	S20	PD9	turb1	turb2
Fuel type	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Status / details	Existing, changing from coal-fired to gas	Natural gas is fed through to the dryers for combustion														Proposed in MOD23, to replace approved Co-generator turbines	
Stack height (m)	54	25.5	27	21	30	25	35	29	29	20	20	33.5	30	19	35.6	45	45
Exhaust temp. (K)	410	344	337	347	345	320	346	341	346	309	312	341	341	344	346	374	374
Stack diameter (m)	2.05	3.2	3.2	2.5	2.7	1.2	1.7	1.8	1.9	1.2	1.2	2.35	2.35	1.35	0.85	2.7	2.7
Exhaust velocity (m/s)	10	0.1	0.1	11.0	21.0	0.1	20	19	20	23.0	22.0	2.9	14.7	8	15.3	18	18
Oxygen (%)	ND	20.9	20.9	20.9	20.6	20.9	20.9	20.9	ND	20.9	20.9	ND	ND	20.5	ND	ND	ND
Moisture (%)	ND	7.3	5.9	6.3	6.4	6.8	7	6.5	ND	5.8	3.2	ND	ND	3.5	ND	ND	ND
Exhaust Flow rate, actual (m3/s)	22.4	20.2	17.1	48.3	40.2	18.8	45.3	40.9	56.7	22.7	21.0	ND	ND	12.1	8.7	103.1	103.1
Ratio (Actual to normalised flow)	ND	1.3	1.4	1.3	1.3	1.3	1.4	1.3	ND	1.2	1.2	ND	ND	1.3	ND	ND	ND
Emission rate (g/s)																	
CO	1.1	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.0023	0.012	0.014	0.014	9.2	9.2
SO_2	0.014	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00066	0.00011	0.00055	0.00066	0.00066	0.61	0.61
NO_2	0.65	0.12	0.024	0.43	0.060	0.075	0.10	0.06	0.23	0.038	0.036	0.016	0.082	0.048	0.035	7.2	7.2
VOC	0.072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic (As) Type I	2.6E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadmium (Cd) Type I	1.4E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead (Pb) Type I	6.5E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mercury (Hg) Type I	3.4E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beryllium (Be) Type II	1.6E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chromium (Cr) Type II	1.8E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cobalt (Co) Type II	1.1E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manganese (Mn) Type II	5.0E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel (Ni) Type II	2.7E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Selenium (Se) Type II	3.1E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Discharge Point	Boiler No. 5/6	Gluten dryer No. 1	Gluten dryer No. 2	Gluten dryer No. 3	Gluten dryer No. 4	Ring Dryer No. 5	Gluten dryer No .6	Gluten Dryer No. 7	Gluten Dryer No. 8	Starch dryer No. 3	Starch dryer No. 4	Starch dryer No. 5	No. 5 Starch Dryer	Spray dryer 5	Product dryer 9	Co-generator turbine No. 1	Co-generator turbine No. 2
Polycyclic Aromatic Hydrocarbons (PAH)	8.3E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emission rates, normalised (mg/Nm^3, dry, 273 K, 101.3 K)[6]																	
CO	ND	1.0	1.2	0.4	0.5	1.0	0.4	0.5	ND	0.8	0.8	ND	ND	1.5	ND	48.8[6]	48.8[6]
SO_2	ND	0.04	0.1	0.02	0.02	0.04	0.02	0.02	ND	0.03	0.04	ND	ND	0.1	ND	ND	ND
NO_2	ND	8.0	2.0	12.0	2.0	5.0	3.0	2.0	ND	2.0	2.0	ND	ND	5.1	ND	39.0[6]	39.0[6]
TSP	ND	1.0	1.3	0.6	0.7	0.8	0.6	1.1	ND	2.1	3.2	ND	ND	0.3	ND	ND	ND
Type 1 and 2 metals (combined)	ND																
Cadmium	ND																
Mercury	ND																
VOC	ND																

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: 350 mg/m^3 (any boiler operating on a fuel other than gas), NO_2: 70 mg/m^3 (any turbine operating on gas), 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.

[6] For co-generator turbine No.1 and 2, normalized emission concentrations are presented as mg/Nm^3, dry, 273 K, 101.3 K at 15% O_2 based on emissions guarantees provided by GE Power

8.2 Dispersion modelling

The air quality dispersion modelling was conducted using the Gaussian puff model CALPUFF Version 7. The model settings were as described in Section 8.2.

8.3 Predicted air quality impacts

8.3.1 Particulates

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. As the boilers are proposed to be converted to gas fired, it is anticipated that particulate emissions would be primarily composed of finer fraction particulates.

The $PM_{2.5}$ emissions from some sources on site are not known, however guidance is available for estimates of $PM_{2.5}$ from gas fired boilers in the NPI. NPI emission factors for gas fired boilers state that $PM_{2.5}$ emissions are equal to that of PM_{10} emissions. Therefore a ratio of PM_{10} to $PM_{2.5}$ emissions of 1:1 was adopted.

A summary of the maximum incremental predicted levels at each receptor site is presented in Table 8.3. The worst case predicted incremental PM_{10} level at a residential sensitive receptors is at R1 with a level of 7.6 µg/m^3.

Table 8.3 Maximum predicted incremental ground level PM_{10}, $PM_{2.5}$ and TSP concentrations (µg/m^3)

Receptor	Pollutant				
	TSP	PM_{10}		$PM_{2.5}$	
Averaging period	Annual	24 hour	Annual	24 hour	Annual
Criteria µg/m^3	90	50	25	25	8
R1	0.7	7.5	0.6	7.5	0.6
R2	0.4	3.7	0.3	3.7	0.3
R3	0.6	4.6	0.5	4.6	0.5
R4	0.9	4.3	0.8	4.3	0.8
C1	1.8	10.5	1.4	10.5	1.4
C2	2.5	14.6	2.3	14.6	2.3
C3	2.4	15.1	2.2	15.1	2.2
C4	2.1	14.6	2.0	14.6	2.0
C5	1.8	12.9	1.7	12.9	1.7
C6	3.0	16.1	2.8	16.1	2.8
C7	2.6	14.4	2.4	14.4	2.4

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 8.4 to Table 8.7 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 and the $PM_{2.5}$ 24 hour criteria for 3 days of the year at the worst impacted commercial receptor C6. The exceedances are bold in Table 8.6 and Table 8.7. 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%, 80% and 58% of the criteria on the days of the predicted exceedances.

Plots of the predicted 24 hour maximum PM_{10} levels are provided in Figure 8.1 (incremental impact) and in Figure 8.2 (cumulative impact with 70^{th} 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 8.3 (cumulative impact with 70^{th} percentile $PM_{2.5}$ levels at Albion Park South 2016 for comparative purposes).

Table 8.4 Summary of highest measured and predicted PM_{10} levels, µg/m^3 (at receptor 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	7.5	08/03/2004	49.0	49.0	0.0
27/11/2004	48.4	22/03/2004	6.3	27/11/2004	48.7	48.4	0.3
21/02/2004	47.0	17/08/2004	4.2	26/03/2004	48.6	46.1	2.5
26/03/2004	46.1	23/09/2004	3.5	21/02/2004	47.7	47.0	0.7
08/12/2004	43.7	01/03/2004	3.5	09/02/2004	44.4	43.1	1.3
10/01/2004	43.4	28/03/2004	3.3	08/12/2004	43.8	43.7	0.1
09/02/2004	43.1	04/04/2004	3.1	10/01/2004	43.4	43.4	0.0
06/02/2004	41.2	22/01/2004	3.0	06/02/2004	42.7	41.2	1.5
07/12/2004	40.8	23/02/2004	3.0	07/12/2004	41.3	40.8	0.5
20/02/2004	40.4	09/11/2004	3.0	22/01/2004	41.0	38.0	3.0

Table 8.5 Summary of highest measured and predicted $PM_{2.5}$ levels, µg/m^3 (at receptor R1)

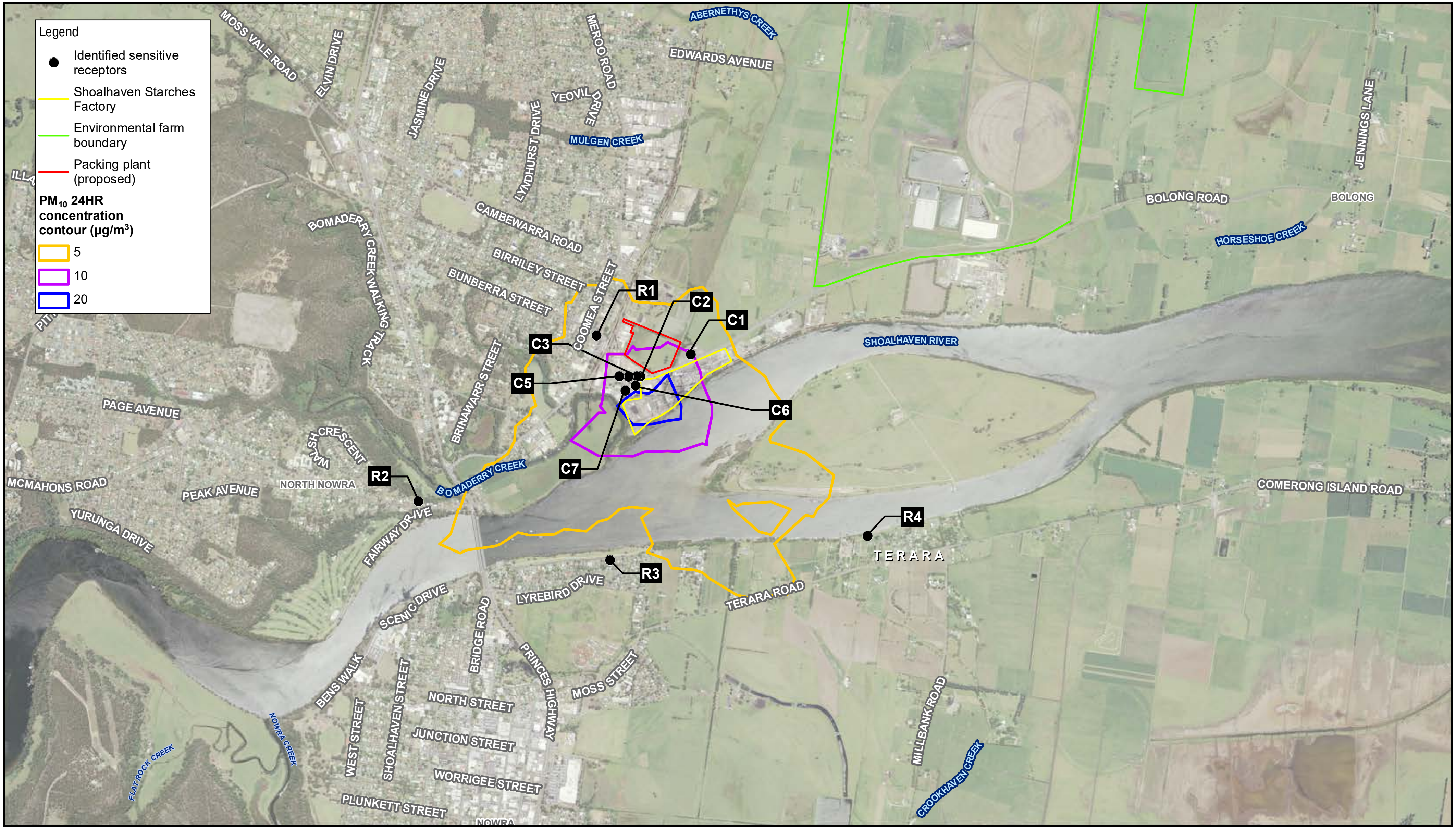
Top 10 $PM_{2.5}$ background		**Top 10 $PM_{2.5}$ incremental**		**Top 10 $PM_{2.5}$ cumulative**			
Date	**$PM_{2.5}$ background**	**Date**	**$PM_{2.5}$ increment**	**Date**	**$PM_{2.5}$ cumulative**	**Background contribution**	**Site contribution**
10/01/2004	22.6	10/03/2004	7.5	21/02/2004	23.0	22.3	0.7
21/02/2004	22.3	22/03/2004	6.3	10/01/2004	22.6	22.6	0.0
26/03/2004	19.9	17/08/2004	4.2	26/03/2004	22.4	19.9	2.5
06/02/2004	19.0	23/09/2004	3.5	06/02/2004	20.5	19.0	1.5
09/02/2004	18.3	01/03/2004	3.5	09/02/2004	19.6	18.3	1.3
11/02/2004	17.9	28/03/2004	3.3	11/02/2004	19.0	17.9	1.1
09/03/2004	17.6	04/04/2004	3.1	13/03/2004	17.8	17.0	0.8
08/03/2004	17.5	22/01/2004	3.0	27/11/2004	17.8	17.5	0.3
08/03/2004	17.5	23/02/2004	3.0	07/05/2004	17.8	16.1	1.7
13/03/2004	17.0	09/11/2004	3.0	07/02/2004	17.7	16.2	1.5

Table 8.6 Summary of highest measured and predicted PM_{10} levels, µg/m³ (at receptor 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	16.1	21/02/2004	**54.3**	47.0	7.3
27/11/2004	48.4	10/03/2004	13.9	26/03/2004	**52.4**	46.1	6.3
21/02/2004	47.0	20/03/2004	11.4	27/11/2004	**51.3**	48.4	2.9
26/03/2004	46.1	20/10/2004	11.1	08/03/2004	49.0	49.0	0.0
08/12/2004	43.7	25/02/2004	10.7	09/02/2004	46.2	43.1	3.1
10/01/2004	43.4	17/08/2004	10.2	08/12/2004	45.7	43.7	2.0
09/02/2004	43.1	02/03/2004	9.7	22/01/2004	45.6	38.0	7.6
06/02/2004	41.2	09/11/2004	9.5	06/02/2004	44.4	41.2	3.2
07/12/2004	40.8	03/04/2004	9.3	07/12/2004	44.1	40.8	3.3
20/02/2004	40.4	22/11/2004	9.2	10/01/2004	43.4	43.4	0.0

Table 8.7 Summary of highest measured and predicted $PM_{2.5}$ levels, µg/m³ (at receptor 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	16.1	21/02/2004	**29.6**	22.3	7.3
21/02/2004	22.3	10/03/2004	13.9	26/03/2004	**26.2**	19.9	6.3
26/03/2004	19.9	20/03/2004	11.4	20/03/2004	**25.9**	14.5	11.4
06/02/2004	19.0	20/10/2004	11.1	07/02/2004	24.1	16.2	7.9
09/02/2004	18.3	25/02/2004	10.7	11/02/2004	23.2	17.9	5.3
11/02/2004	17.9	17/08/2004	10.2	10/03/2004	22.8	8.9	13.9
09/03/2004	17.6	02/03/2004	9.7	13/03/2004	22.8	17.0	5.8
08/03/2004	17.5	09/11/2004	9.5	10/01/2004	22.6	22.6	0.0
08/03/2004	17.5	03/04/2004	9.3	06/02/2004	22.2	19.0	3.2
13/03/2004	17.0	22/11/2004	9.2	03/04/2004	21.8	12.5	9.3



Paper Size ISO A4

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Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Maximum Predicted Incremental Ground Level PM_{10} Concentrations (24-hour Average)

Project No. 12548374
Revision No. 0
Date 18 Aug 2021

FIGURE 8.1

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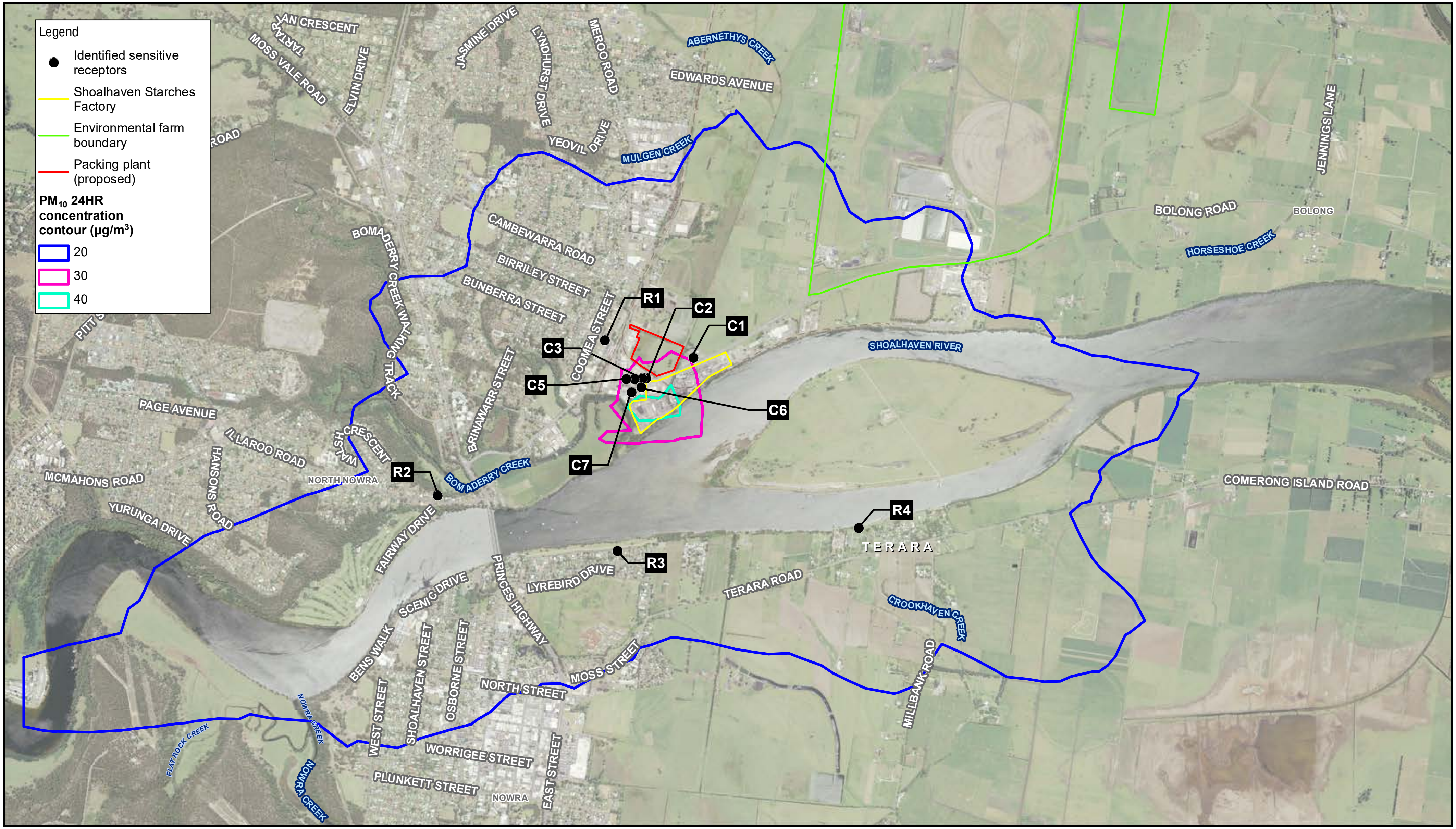
Print date: 18 Aug 2021 - 09:40

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012© Department of Customer Service 2020. Created by: kpsroba



Paper Size ISO A4

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Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Maximum Predicted Cumulative Ground Level PM_{10} Concentrations (24-hour Average)

Project No. 12548374
Revision No. 0
Date 18 Aug 2021

FIGURE 8.2

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\12548374\12548374_013_PM10Cumulative_August2021.mxd
Print date: 18 Aug 2021 - 09:46

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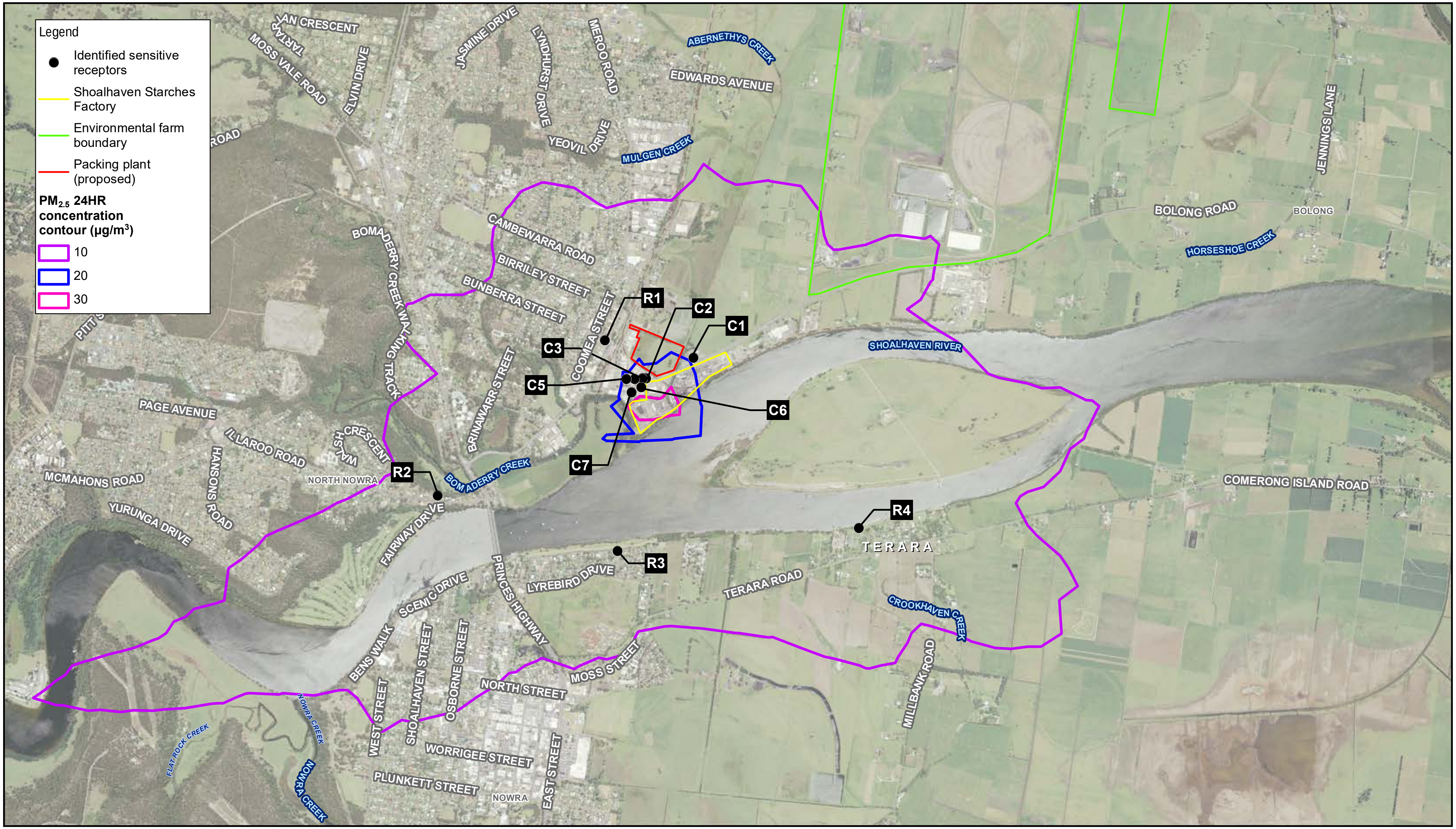


Paper Size ISO A4

0 180 360 540 720 900 1,080

Metres

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

N

GHD

Manildra Group Pty Ltd
Shoalhaven Starches

Maximum Predicted Cumulative Ground Level $PM_{2.5}$ Concentrations (24-hour Average)

Project No. 12548374
Revision No. 0
Date 18 Aug 2021

FIGURE 8.3

\\ghdnet\ghd\AU\Sydney\Projects\21\12534209\GIS\Maps\Deliverables\12548374\12548374_014_PM25Cumulative_August2021.mxd
Print date: 18 Aug 2021 - 09:52

Data source: Aerial Imagery: SIXMAPS, 2018. General Topo: NSW LPI DTDB 2012© Department of Customer Service 2020. Created by: kpsroba

8.3.2 Products of combustion

The primary pollutants in gas fired boilers and gas turbines emissions are oxides of nitrogen (NO_x), formed by the high temperatures in the combustors, carbon monoxide (CO), VOCs, and polycyclic aromatic hydrocarbons (PAH) all formed by incomplete combustion of the fuel.

All pollutants have all been assessed against their relevant criteria from the Approved Methods.

Predicted levels for SO_2, NO_2 and CO are provided in Table 8.8 to Table 8.10. The predicted levels comply at all receptors for SO_2, NO_2 and CO.

The predicted levels for nitrogen dioxide were presented for two cases. The first case assumed 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. The second case adopted a more detailed assessment by using Method 2 (Section 8.2.2) of the Approved Methods which 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 8.9. Compliance was predicted for both methods.

Effect of Mod 23 changes

Conversion of existing coal fired boilers to gas significantly reduces the emissions of combustion pollutants and consequently the proposal was predicted to have a positive impact (compared with Mod 21) on combustion emissions as air emissions from gas are typically lower than coal.

Table 8.8 Maximum predicted ground level Sulfur Dioxide concentrations

Receptor	Total impact (Incremental plus background) (µg/m^3)			
Criteria, µg/m^3	**712 (10 min[1])**	**570 (1 hour)**	**228 (24 hour)**	**60 (Annual)**
Background, µg/m^3	**No data[2]**	**57.6**	**15.7**	**1.6**
Bomaderry (R1)	63.9	62.0	16.5	1.7
North Nowra (R2)	60.3	59.5	16.0	1.6
Nowra (R3)	59.6	59.0	15.8	1.6
Terara (R4)	58.8	58.4	15.8	1.6
C1	62.2	60.8	16.3	1.7
C2	66.5	63.8	16.8	1.7
C3	66.3	63.7	17.1	1.7
C4	65.5	63.2	17.0	1.7
C5	67.5	64.5	16.8	1.8
C6	67.6	64.6	16.7	1.7
C7	68.6	65.3	16.6	1.7

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 8.9 Maximum predicted ground level Nitrogen Dioxide concentrations

Receptor	Total impact (Incremental plus background) (µg/m^3)		
Criteria, µg/m^3	**246 (1 hour, Method 1)**	**246 (1 hour, Method 2)**	**62 (Annual)**
Background, µg/m^3	**80.8**	**n/a**	**7.1**
Bomaderry (R1)	132.7	97.8	8.7
North Nowra (R2)	107.7	97.8	7.6
Nowra (R3)	99.7	97.8	7.4
Terara (R4)	95.2	103.2	7.5
C1	147.0	97.8	10.2
C2	157.9	105.3	10.4
C3	155.2	102.8	10.3
C4	159.4	108.4	10.2
C5	177.1	105.2	10.1
C6	165.6	114.8	10.4
C7	182.9	115.0	10.2

Table 8.10 Maximum predicted ground level Carbon Monoxide concentrations

Receptor	Total impact (Incremental plus background) (mg/m^3)		
Criteria, µg/m^3	**100 (15 min[1])**	**30 (1 hour)**	**10 (8 hour)**
Background, µg/m^3	**No data[2]**	**1**	**0.6**
Bomaderry (R1)	1.09	1.07	0.63
North Nowra (R2)	1.04	1.03	0.61
Nowra (R3)	1.03	1.02	0.60
Terara (R4)	1.02	1.01	0.61
C1	1.07	1.06	0.63
C2	1.12	1.09	0.64
C3	1.12	1.09	0.65
C4	1.11	1.08	0.65
C5	1.14	1.11	0.65
C6	1.14	1.11	0.64
C7	1.16	1.12	0.64

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.

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 8.11. 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 23 changes

Conversion of existing coal fired boilers to gas significantly reduces the emissions of PAH, VOC's and metals and eliminates the emission of some pollutants including antimony, Tin and Vanadium and consequently the proposal was predicted to have a positive impact (compared with Mod 21) on combustion emissions as air emissions from gas are typically lower than coal.

Table 8.11 Maximum predicted ground level PAH, VOC and metals concentrations

Receptor	Incremental Impact (mg/m^3)[7]									
Pollutant	**PAH**	**VOC**	**Arsenic**	**Cadmium**	**Mercury**	**Beryllium**	**Chromium**	**Manganese**	**Nickel**	**Lead**
Criteria	**0.0004 mg/m^3 (1 hour)**	**Individual VOCs (1 hour)**	**9.00E-05 mg/m^3 (1 hour)**	**1.80E-05 mg/m^3 (1 hour)**	**1.80E-03 mg/m^3 (1 hour)**	**4.00E-06 mg/m^3 (1 hour)**	**9.00E-05 mg/m^3 (1 hour)**	**1.80E-02 mg/m^3 (1 hour)**	**1.80E-04 mg/m^3 (1 hour)**	**5.0E-04 mg/m^3 (Annual)[8]**
Averaging period and percentile	**1 hour, 99.9th percentile**									**Annual, 100th percentile**
Bomaderry (R1)	2.0E-08	1.7E-04	6.3E-09	3.5E-08	8.2E-09	3.8E-11	4.4E-08	1.2E-08	6.6E-08	5.8E-10
North Nowra (R2)	1.7E-08	1.4E-04	5.2E-09	2.9E-08	6.7E-09	3.1E-11	3.6E-08	9.8E-09	5.4E-08	3.2E-10
Nowra (R3)	2.4E-08	2.1E-04	7.5E-09	4.1E-08	9.7E-09	4.5E-11	5.2E-08	1.4E-08	7.9E-08	1.5E-10
Terara (R4)	1.3E-08	1.1E-04	4.1E-09	2.3E-08	5.3E-09	2.5E-11	2.9E-08	7.8E-09	4.3E-08	7.3E-11
C1	7.3E-08	6.3E-04	2.3E-08	1.3E-07	3.0E-08	1.4E-10	1.6E-07	4.3E-08	2.4E-07	1.3E-09
C2	4.4E-08	3.8E-04	1.4E-08	7.6E-08	1.8E-08	8.3E-11	9.7E-08	2.6E-08	1.5E-07	9.8E-10
C3	4.1E-08	3.6E-04	1.3E-08	7.1E-08	1.7E-08	7.8E-11	9.1E-08	2.5E-08	1.4E-07	9.5E-10
C4	3.5E-08	3.0E-04	1.1E-08	6.1E-08	1.4E-08	6.6E-11	7.7E-08	2.1E-08	1.2E-07	9.0E-10
C5	3.1E-08	2.7E-04	9.7E-09	5.3E-08	1.3E-08	5.8E-11	6.8E-08	1.8E-08	1.0E-07	8.7E-10
C6	4.2E-08	3.6E-04	1.3E-08	7.3E-08	1.7E-08	8.0E-11	9.3E-08	2.5E-08	1.4E-07	9.8E-10
C7	3.4E-08	2.9E-04	1.1E-08	5.8E-08	1.4E-08	6.4E-11	7.4E-08	2.0E-08	1.1E-07	9.6E-10
Maximum level (on site)	1.1E-07	9.1E-04	3.3E-08	1.8E-07	4.3E-08	2.0E-10	2.3E-07	6.2E-08	3.4E-07	1.4E-09

[7]

[8] Lead criteria converted from $\mu g/m^3$ to mg/m^3 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 a new gas-fired co-generation plant (to replace the approved gas fired and coal fired co-generators) and conversion of existing coal fired boilers to gas. In addition, Manildra propose to install additional biofilter capacity in the previously approved location to improve odour performance.

Odour dispersion modelling was undertaken for the quarter with maximum odour emissions (in accordance with the methodology adopted for past modification air quality assessments). A marginal decrease in odour levels was predicted compared against Mod 21 Q2 and relatively unchanged odour levels was predicted compared against Mod 21 Q3. The decrease compared to Mod 21 Q2 odour levels is attributed to conversion of boilers to gas and therefore removal of coal/woodchip fired boilers 2 and 4 as an odour source. The relatively minor fluctuation in odour predictions compared to Mod 21 Q3 is attributed to variability in odour sampling.

The odour dispersion modelling predicted compliance of the odour criteria at all residential receptors.

Dispersion modelling of combustion products, particulates, PAH, VOCs and metals predicted compliance with the criteria at all residential sensitive receptors.

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

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[9], 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[10], was used to simulate the meteorology over the subject site with consideration to the DECC *Approved Methods*. TAPM is an approved model for specialist applications and its use, as part of this assessment, is described in the next section.

The observations from the Farm AWS and Nowra AWS were first used for optimising and checking the performance of the prognostic model simulation.

Wind speed and wind direction data from the Farm AWS were then assimilated into the prognostic model.

The subsequent TAPM output (with assimilated Farm AWS data) was then passed to meteorological pre-processor model CALMET (version 5.5).

A2 Prognostic Meteorological Modelling

TAPM (version 3.0.7) was developed at CSIRO Division of Atmospheric Research as a PC-based prognostic modelling system that can predict regional scale three-dimensional meteorology. TAPM accesses databases of synoptic weather analyses from the Bureau of Meteorology. The model then provides the link between the

[9] 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
[10] Hurley, P. The Air Pollution Model (TAPM) version 3. CSIRO Atmospheric Research Paper No. 31, 2005

synoptic large-scale flows and local climatology, which includes characterising such factors as local land use and topography, and their influence on atmospheric stability and mixing height.

TAPM was initially configured with a nested model grid coverage designed to capture:

- Broad scale synoptic flows
- Regional to local scale wind channelling
- The influence of local land use

The nested grids were then configured with surface characteristics, such as terrain elevation, surface type (land use and vegetation type), soil type and deep soil moisture content.

Specific model settings were:

- Four nested grids at 1 000 m, 3 000 m, 10 000 m and 25 000 m resolution, with 55 x 55 grid points. The grid was set to ensure the locations of the Farm AWS and Nowra AWS were within the inner nested grid
- Surface vegetation and precipitation processes were included, whereas, non-hydrostatic processes were not included

Following an initial model run, the model output from the grid point nearest to the Farm AWS was compared with data recorded at that station. Specifically, the predicted hourly ambient temperatures and the annual wind rose (wind speed and direction distributions) were compared with corresponding recordings. Model output from the model grid point nearest to the Nowra AWS was also compared with an annual wind rose derived from data recorded at that station.

Figure A1 shows the scatter plot of observed and predicted ambient temperature at the Farm AWS. The determined optimal model configuration produced a correlation coefficient of 0.88 for predicted temperature. The strong correlation between predicted and recorded temperature indicates that the model is accurately calculating the surface energy balance, which, in turn, adds confidence to the hourly varying predictions made for atmospheric stability and the height of the mixed layer.

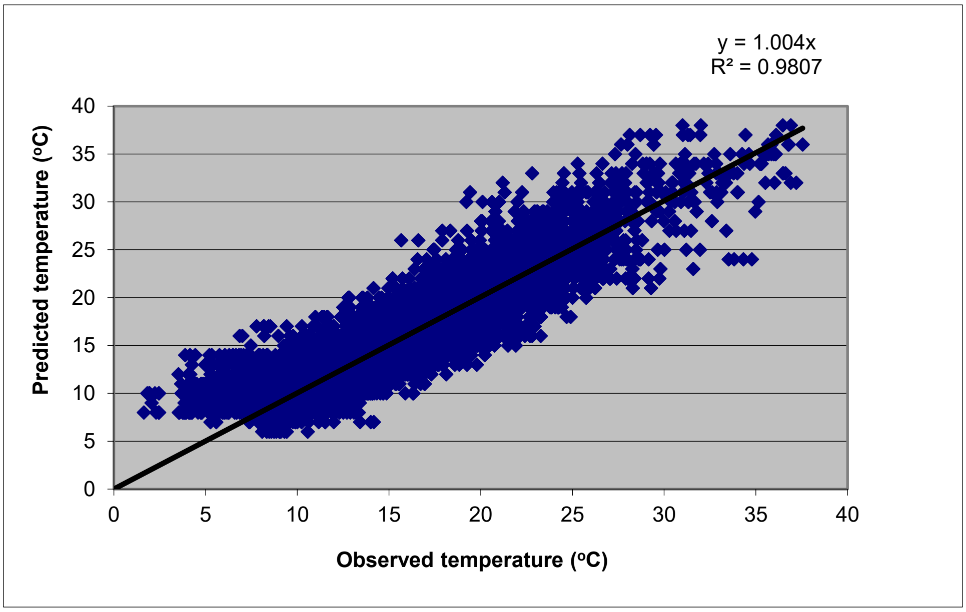


Figure A1 Scatter Plot of Observed and Predicted Ambient Temperature

A2.1 Wind Distribution

Figure A2 shows the predicted (a) and observed (b) wind roses for the location of the Nowra AWS. The directional distribution of winds predicted by TAPM shows reasonable agreement with the recorded observations and with the wind patterns expected for this region.

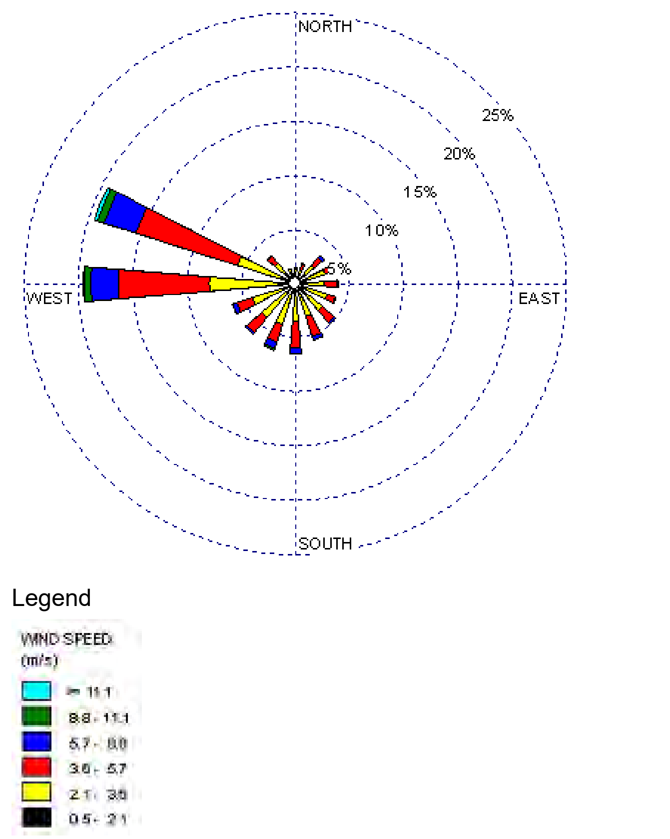
Figure A3 shows the predicted (a) and observed (b) wind roses for the location of the Farm AWS after the initial TAPM simulation. The directional distribution of winds predicted by TAPM shows reasonable agreement with the recorded wind patterns expected for this region.

The wind speed and direction observations from the Farm AWS were assimilated into the prognostic model simulation to improve the ability of the model to capture the effects of local wind channelling and low wind speed conditions. The improvement to wind direction distributions in the model output is clearly evident in Figure A3(c). The marked improvement in the capture of low wind events is examined below.

It is understood that TAPM performs reasonably well at simulating low wind speeds when the atmosphere is unstable but is known to perform relatively poorly during stable atmospheric conditions[11]. 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.

TAPM output at Nowra AWS grid point



Recorded at Nowra AWS

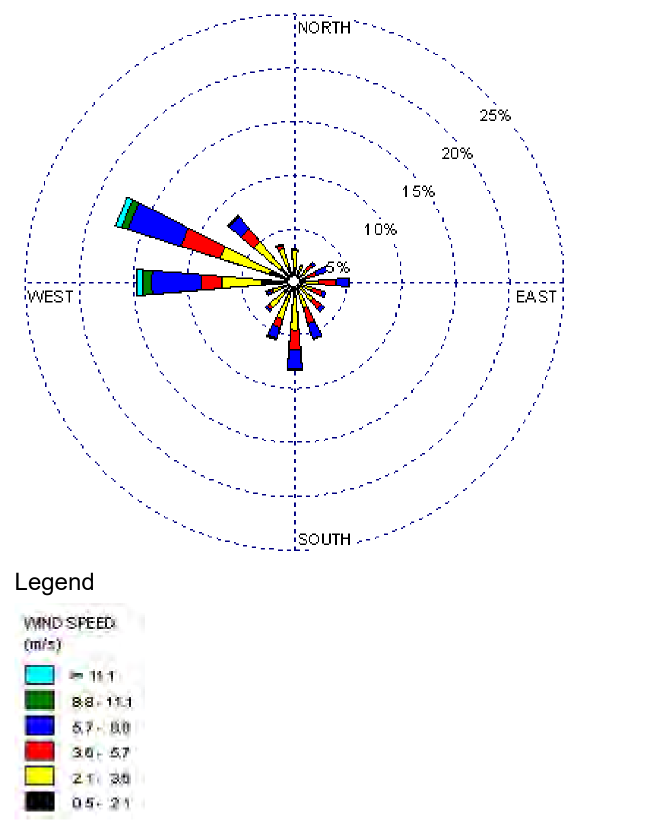


Figure A2 Nowra AWS - Annual Wind Roses (Year 2004)

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

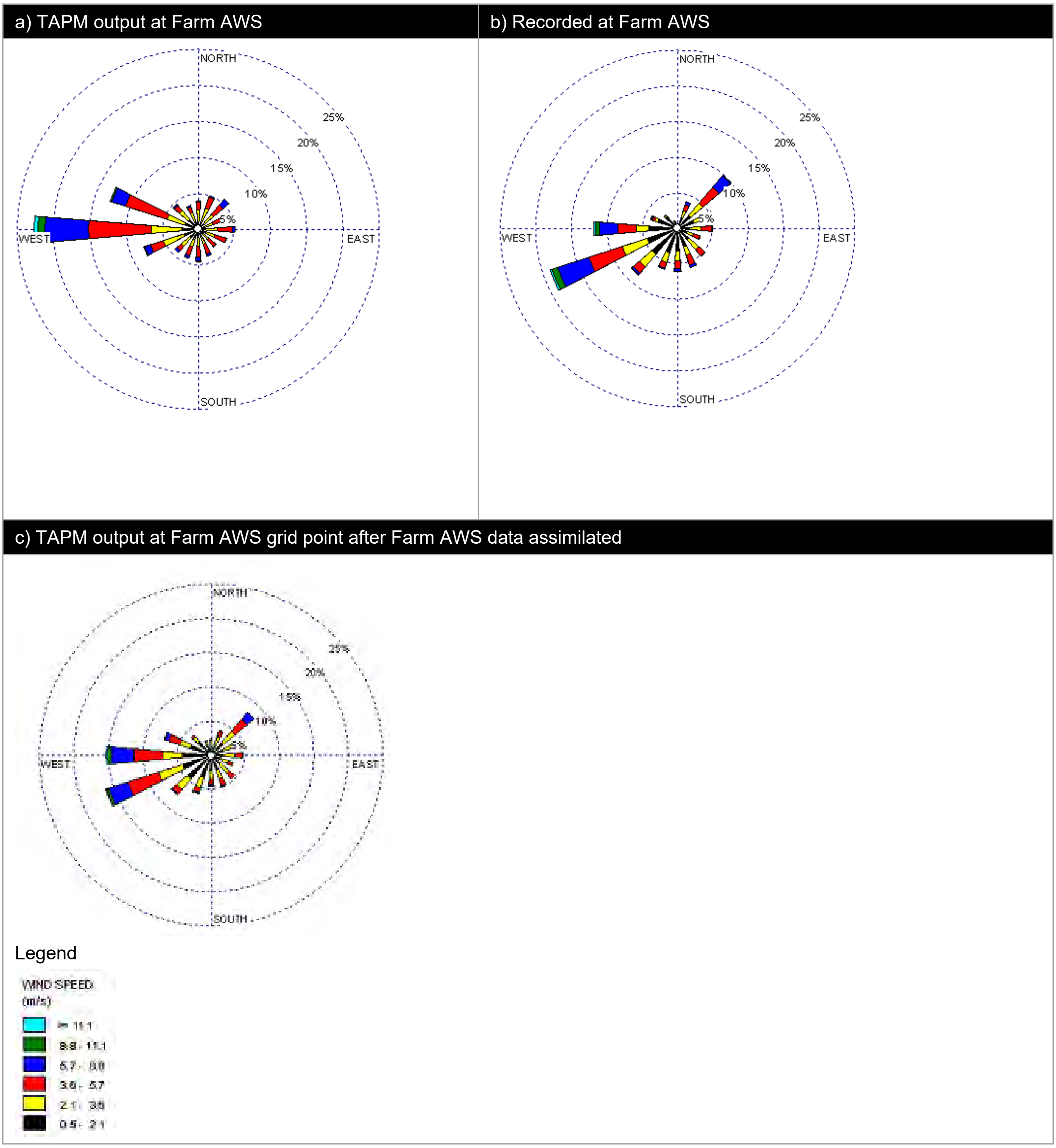


Figure A3 Farm AWS - Annual Wind Roses (year 2004)

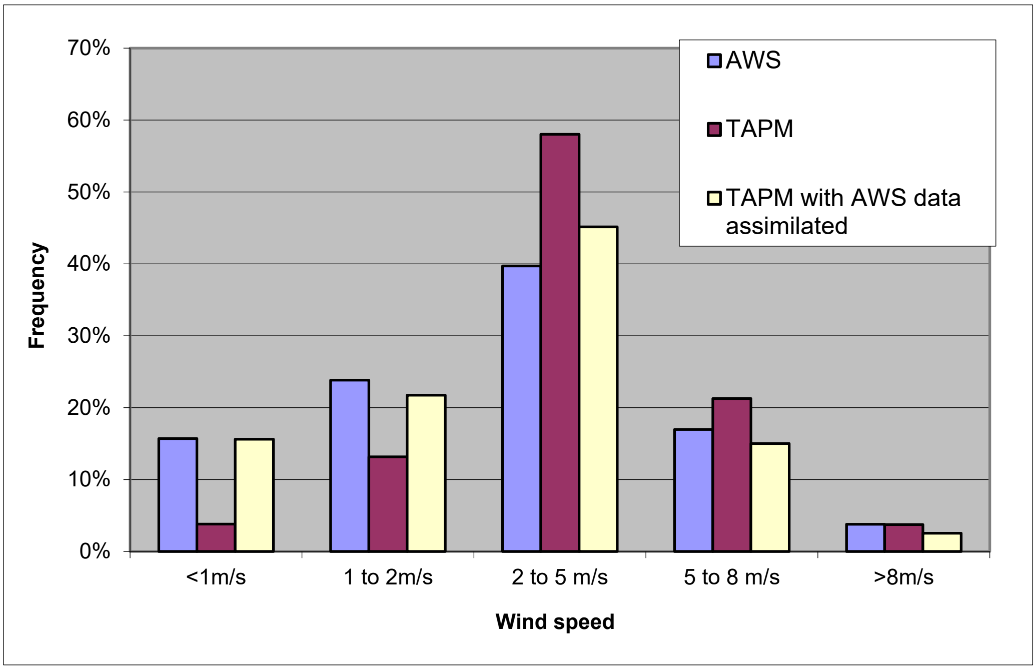


Figure A4 Wind Speed Distribution – TAPM and Farm AWS

To further investigate the effect of data assimilation on model output, a sensitivity analysis was conducted to compare the subsequent CALPUFF model predictions using meteorological input derived with and without the assimilation of observed wind speed and wind direction data from the Farm AWS into TAPM. Good agreement was found in the general pattern of dispersion (i.e. similar directions of poor dispersion), however, the highest ground level odour concentrations were predicted when the assimilated meteorological data file was used, which was expected given the higher frequency of light winds.

A3 Diagnostic Meteorological Model - CALMET

The TAPM output (with assimilated data) was then passed to model CALMET (version 5.5)[12], which is the 3D meteorological diagnostic model pre-processor to the CALPUFF 3D puff based dispersion model.

Hourly varying 3D meteorological data, at a 1000 m resolution, were extracted from the TAPM inner nested grid and passed to CALMET in their entirety as initial guess fields. Surface meteorological parameters and vertical profile data were also extracted from TAPM at a grid point near the factory, and used as if they were observations in the diagnostic model (i.e. pseudo-data).

CALMET was configured with a 15 km by 15 km grid at 200 m resolution and with local scale surface characteristics, such as terrain elevation and land use (e.g. forest or sparse growth, water or residential). The land use and terrain elevation information was derived from US Geological Survey and AusLig data, respectively, with adjustments based upon inspection of aerial photographs, topographical and land uses maps, and a site inspection.

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

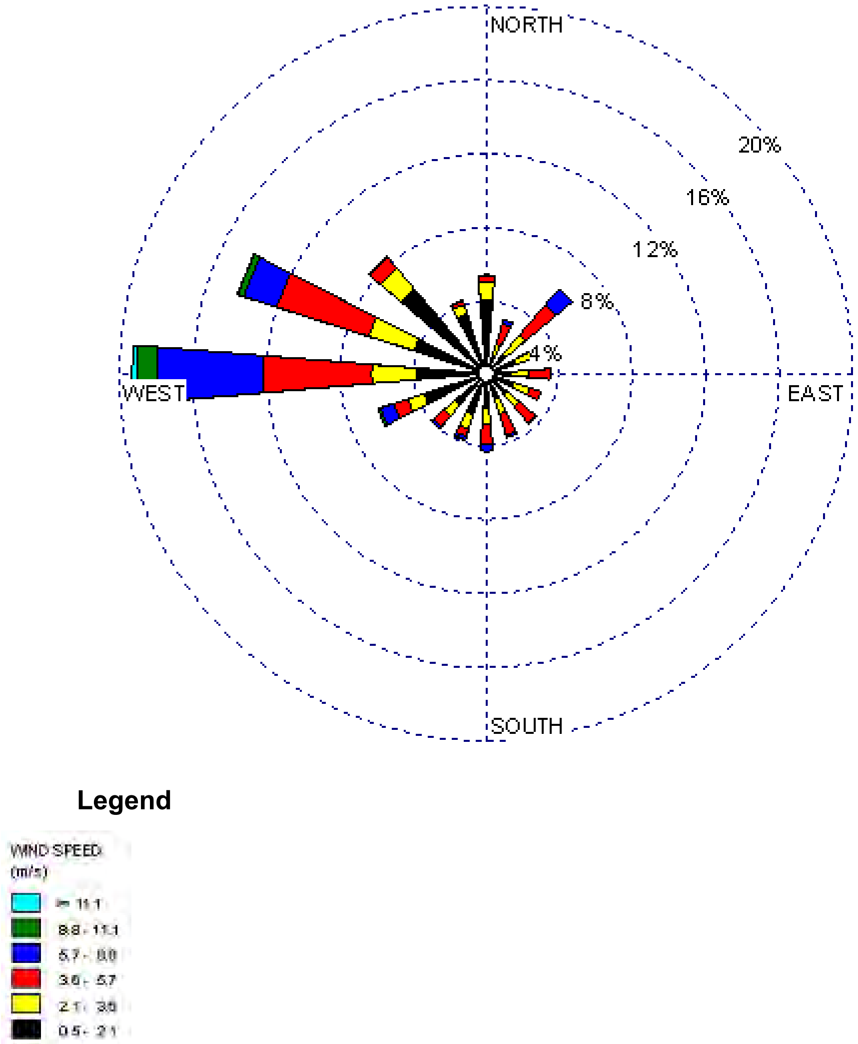
A3.1 Site-specific meteorology

Figure A5 shows a wind rose that illustrates the distribution of wind speed and direction at the location of the Factory. On an annual basis the prevailing winds are from the west with winds also from the west-north-west, north-west, west-south-west and north-east. The mean wind speed is 3.2 m/s, with higher speed winds associated

[12] Scire J.S., E.M. Insley, R.J. Yamartino, and M.E. Fernau, 1995: A User's Guide for the CALMET Meteorological Model. Report prepared for the USDA Forest Service by EARTH TECH, Concord, MA. See: http://www.src.com/calpuff/calpuff1.htm

with westerly winds with speeds up to 11 m/s; such speeds are not reached from other directions. The highest frequency of light winds occurs from the south-west, west and north.

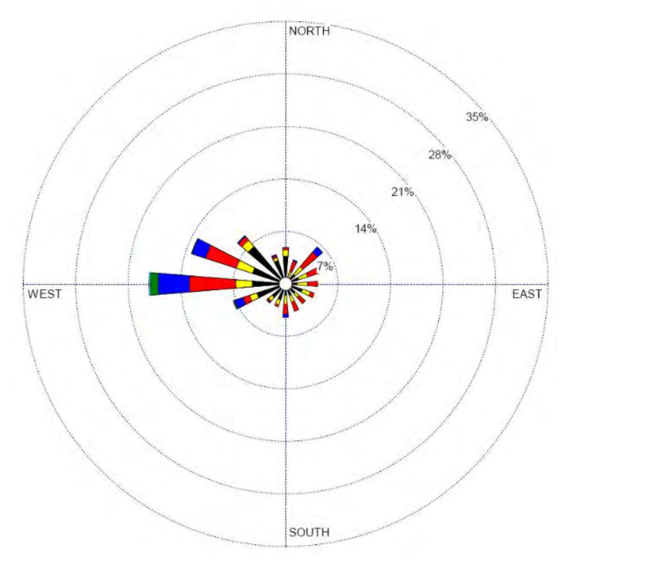
Figure A6 provides a seasonal breakdown of the predicted wind distribution at the Factory, this figure reveals a north-easterly predominance during summer (sea-breeze) and a westerly predominance during the other seasons, in particular during winter.



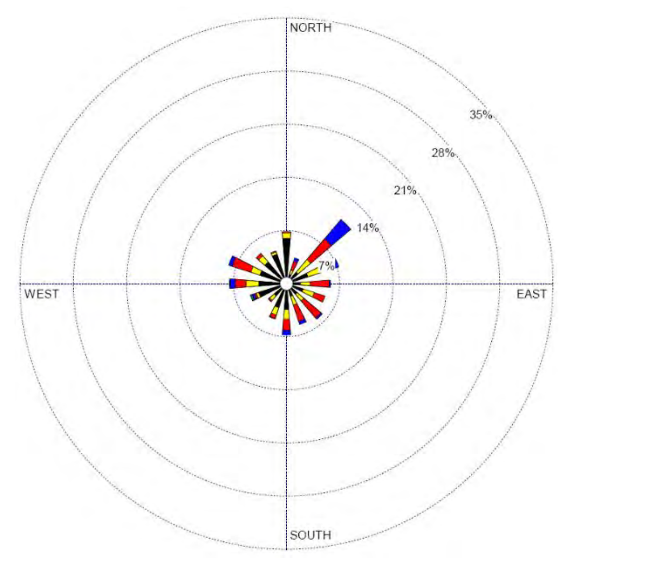
Comments: Average wind speed = 3.2 m/s

Figure A5 ***Factory Annual Wind Rose - Year 2004***

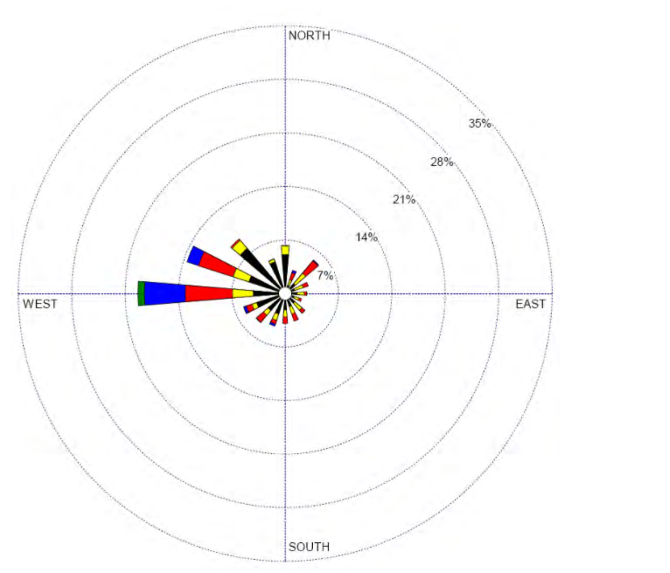
Spring (average wind speed = 3.1 m/s)



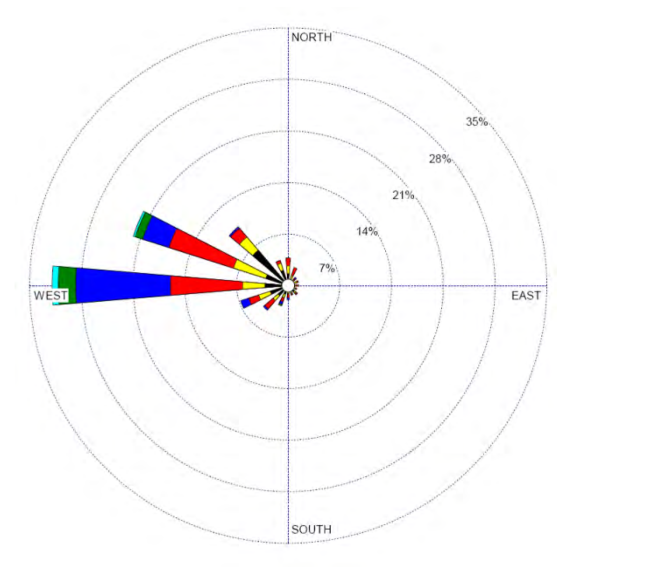
Summer (average wind speed = 2.8 m/s)



Autumn (average wind speed = 2.8 m/s)



Winter (average wind speed = 4.1 m/s)



Legend

Project No.:
22/13594

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 A.9.1 Atmospheric Stability Classes and Distribution

Stability Class	Description	Frequency of Occurrence[13]
A	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.	2%
B	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.	14%
C	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.	17%
D	Neutral atmospheric conditions. Occur during the day or night with stronger winds. Or during periods of total cloud cover, or during twilight (transition) period.	22%
E	Slightly stable atmospheric conditions occurring during the night-time with some cloud and/or light-moderate winds.	12%
F	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.	32%

Potential off-site odour impact would tend to be maximised when winds are light and the atmosphere is stable, conditions that typically occur during the early evening and night-time. Table A1 shows that these conditions occurred for approximately 44% of the time.

The occurrence of stable air flows is of significance as these generally provide the conditions for worst case dispersion of emissions to air from ground based (or near-ground based) sources, and hence potentially the highest impact to odour amenity. This is due to the limited mixing in the vertical plane of these light wind airflows, and hence less dilution of the emissions from the majority of odour sources, which are either at ground level or wake affected short stacks. Therefore, the distribution of light wind stable flows can define the directions of “poor odour dispersion” from the factory and environmental farm.

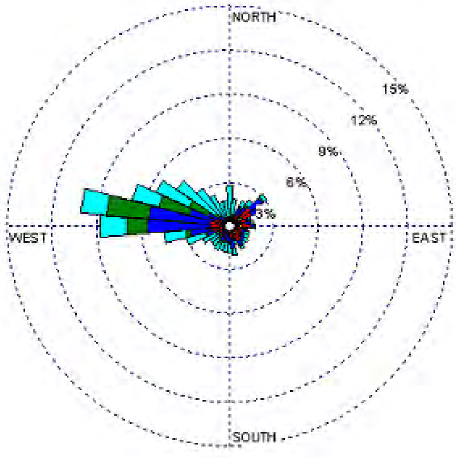
Vertical mixing of airflows can be brought about by two mechanisms. The first is mechanical mixing caused by the shear stresses as air moves over rough terrain. The second is via thermal convective mixing, which has the potential to occur significantly only during daytime. The occurrence of unstable and strong-wind neutral air flows generally provide the conditions for the highest ground level concentrations due to emissions to air from elevated stack sources, such as the coal-fired boiler exhaust stacks found at the factory.

A rose that illustrates the directional distribution of the predicted atmospheric stability is shown in Figure A7. During these stable periods, the regional scale cool air drainage flows down the river valley from the west to dominate the transport and dispersion of emissions to air from the factory and environmental farm. To a lesser extent, local slope drainage flows from the elevated terrain located to the north, west-north-west and west-south-west of the site would also generate these conditions for poor dispersion.

[13] Stability data in this table extracted from Factory meteorological data

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

All stability classes

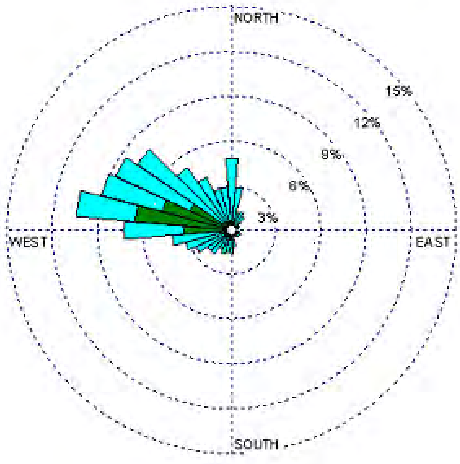


Legend

Stability Class

F
E
D
C
B
A

E & F Stability classes (stable conditions only)



Legend

Stability Class

F
E
D
C
B
A

Figure A7 Factory Annual Stability Rose - Year 2008

Appendix B

Complete odour emission inventory

Table B.1 Complete odour emission inventory (Mod 23)

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)
Combined Boiler Stack for No. 5 & 6 Boilers	35	BOILR5	tall wake free	54.0	2.05	10	413	70,708	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	10.9	323	70,900	Variable
Pellet silo (mill feed silo)		S12	wake affected	2.0	0.32	0.1	304	350	805
Stillage surge tank		SST	wake affected	2.0	0.20	3.3	360	173	397
Vent condenser 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	9.3	295	41,258	94,894
Fermenters (10-16)	44	FERM	tall wake free	21.0	0.28	3.1	303	2,000	4,600
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	1.30	7.3	300	679	1,562
Cyclone and fabric filter		A5	wake affected	33.0	0.90	5.2	303	96	221
Cyclone and fabric filter		A6	wake affected	33.0	1.07	5.3	293	449	1,033
Cyclone and fabric filter		A7	wake affected	33.0	1.07	10.2	322	932	2,144
Drum vacuum receiver		C4	wake affected	21.0	0.20	11.0	320	1,400	3,220

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)
Dry gluten roof bin		S07	wake affected	25.0	0.65	0.1	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	0.1	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	0.1	306	500	1,150
Flour bin aspirator		S13B	wake affected	2.5	0.41	0.1	306	500	1,150
Flour bin motor drive		S06	wake affected	24.0	0.27	0.1	307	283	651
Flour mill stack proposed and approved 1		FMP2	wake affected	31.8	0.68	4.4	322	266	612
Flour mill stack proposed 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	0.1	316	600	1,380
Incondensable 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	0.1	307	250	575
Jet cooker 1 - retention tank		E13	wake affected	10.0	0.27	0.1	362	1,067	2,454
Jet cooker 2 & 4 - Retention		E7	wake affected	9.0	0.10	3.1	373	851	1,956
Molecular Sieve - Vacuum drum		D2	wake affected	10.0	0.08	13.0	337	1,350	3,105

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)
No. 1 Gluten Dryer baghouse	8	S02	wake affected	25.5	3.20	0.1	344	9,800	22,540
No. 1 Starch Dryer	12	S01	wake affected	26.0	1.30	6.8	309	3,200	7,360
No. 2 Gluten Dryer baghouse (aka. No 2 Starch Dryer)	9	S04	wake affected	27.0	3.20	0.1	336	6,000	13,800
No. 3 Gluten Dryer baghouse	10	S03	wake affected	21.0	2.50	11.6	343	32,000	73,600
No. 3 Starch Dryer	13	S18	wake affected	20.0	1.20	20.0	307	6,800	15,640
No. 4 Gluten Dryer baghouse	11	S05	wake affected	30.0	2.70	16.0	347	20,000	46,000
No. 4 Starch Dryer	14	S19	wake affected	20.0	1.20	21.2	310	2,500	5,750
No. 5 Ring Dryer Starch		SDR5	wake affected	25.0	1.20	0.1	320	4,625	10,638
No. 5 Starch Dryer (existing)	47	SD5C	wake affected	33.5	2.35	2.9	340	2,123	4,882
No. 5 Starch Dryer (new)		SD5N	wake affected	30.0	2.35	14.7	340	10,877	25,018
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	0.1	335	738	1,697
Starch factory rejects collection tank		E10	wake affected	8.0	0.10	0.1	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

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)
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					1,307	Variable
Biofilter B	41	BIO2	area					1,208	Variable
Biofilter C		BIO3	area					1,089	Variable
Biofilter D		BIO4	area					1,281	Variable
Effluent storage dam 1	19	PO1	area					948	Variable
Effluent storage dam 2	20	PO2	area					687	Variable
Effluent storage dam 3	21	PO3	area					1,626	Variable
Effluent storage dam 5	23	PO5	area					1,248	Variable
Effluent storage dam 6	24	PO6	area					1,435	Variable
Sulphur Oxidisation Basin	25	SOBAS	area					489	Variable
Membrane bio-reactor		MBR	wake affected					54	Variable
DDG load out shed - awning		DDG35	volume					923	2,123
DDG product storage sheds		DDG34	volume					1,023	2,353
DDG tent storage area		DDG36	volume					1,929	4,437
Pellet plant fugitives (discharged direct to atmosphere)		PPF	wake affected					5,771	13,273
Farm tank		F18	volume					3,833	8,817

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)
Column washing vent		CWV	wake affected	48.0	0.07	8.8	312	1,218	2,801
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	1,218	2,801

Appendix C

Site sampling reports

Appendix C contains the following sampling reports:

– Stephenson Environmental Management Australia. (2020) EPL Odour Emission Survey Quarter 2, 2020-2021
– Stephenson Environmental Management Australia. (2020a) EPL Odour Emission Survey Quarter 3, 2020-2021

Stephenson
Environmental Management Australia

EPL Odour Emission Survey Quarter 2, 2020-2021

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.:	**7095/S25548A/20**
Dates of Survey:	**5 & 12 August and 8 & 28 October, 2020**
Date of Interim Report Issue:	**28 August, 2020**
Date of Final Report Issue:	**4 January, 2021**

Stephenson
Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
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EPL ODOUR EMISSION SURVEY QUARTER 2, 2020-2021

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.:	**7095/S25548A/20**
DATES OF SURVEY:	**5 & 12 AUGUST AND 8 & 28 OCTOBER, 2020**
DATE OF INTERIM REPORT ISSUE:	**28 AUGUST, 2020**
DATE OF FINAL REPORT ISSUE:	**4 JANUARY, 2021**

P W STEPHENSON

J WEBER

M KIMBER

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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 an EPA Identification No., was also sampled.

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

The quarters are defined as below:

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

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

2 MONITORING REQUIREMENTS

2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015)

2.1.1 CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS

Table 2-1 identifies the point and diffuse sources as defined by the 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 (DDG Evaporators 1, 2 & 3)	1	Quarterly
39A	Inlet Pipe to Biofilters A & B (DDG Evaporator 4)	1	Quarterly
40	Outlet of Biofilter A	2	Quarterly
41	Outlet of Biofilter B	2	Quarterly
42	Boiler No.4	1	Quarterly
44	Fermenter	1	Quarterly
45	Boiler No.2	1	Quarterly
46	DDG Pellet Plant Stack	1	Quarterly
47	No. 5 Starch Dryer	1	Quarterly

2.1.2 CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS

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

Key to Tables 2.2 to 2.5:

%	=	percent
^{o}C	=	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

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

Pollutant	Units	Frequency	Approved Method
Dry Gas Density	kg/m^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, 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.

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

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

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

4 ODOUR EMISSION TEST RESULTS

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

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

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

Appendix C details calibration of instruments used to take measurements.

Appendix D shows sample locations.

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

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

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

Key:

ou = odour units

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

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

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

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

5 CONCLUSIONS

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

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

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

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

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

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

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

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

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

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

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

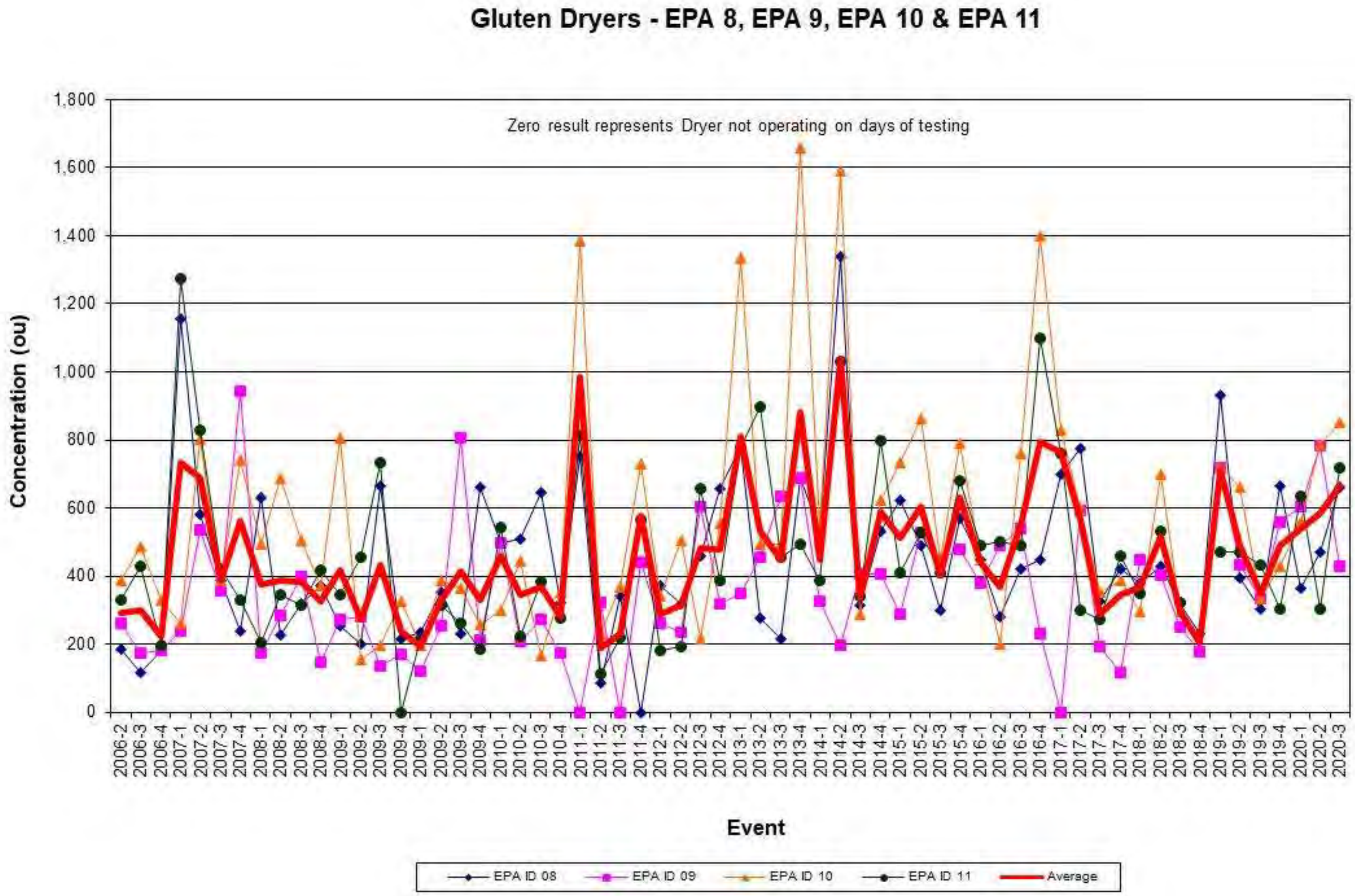


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13 &14)

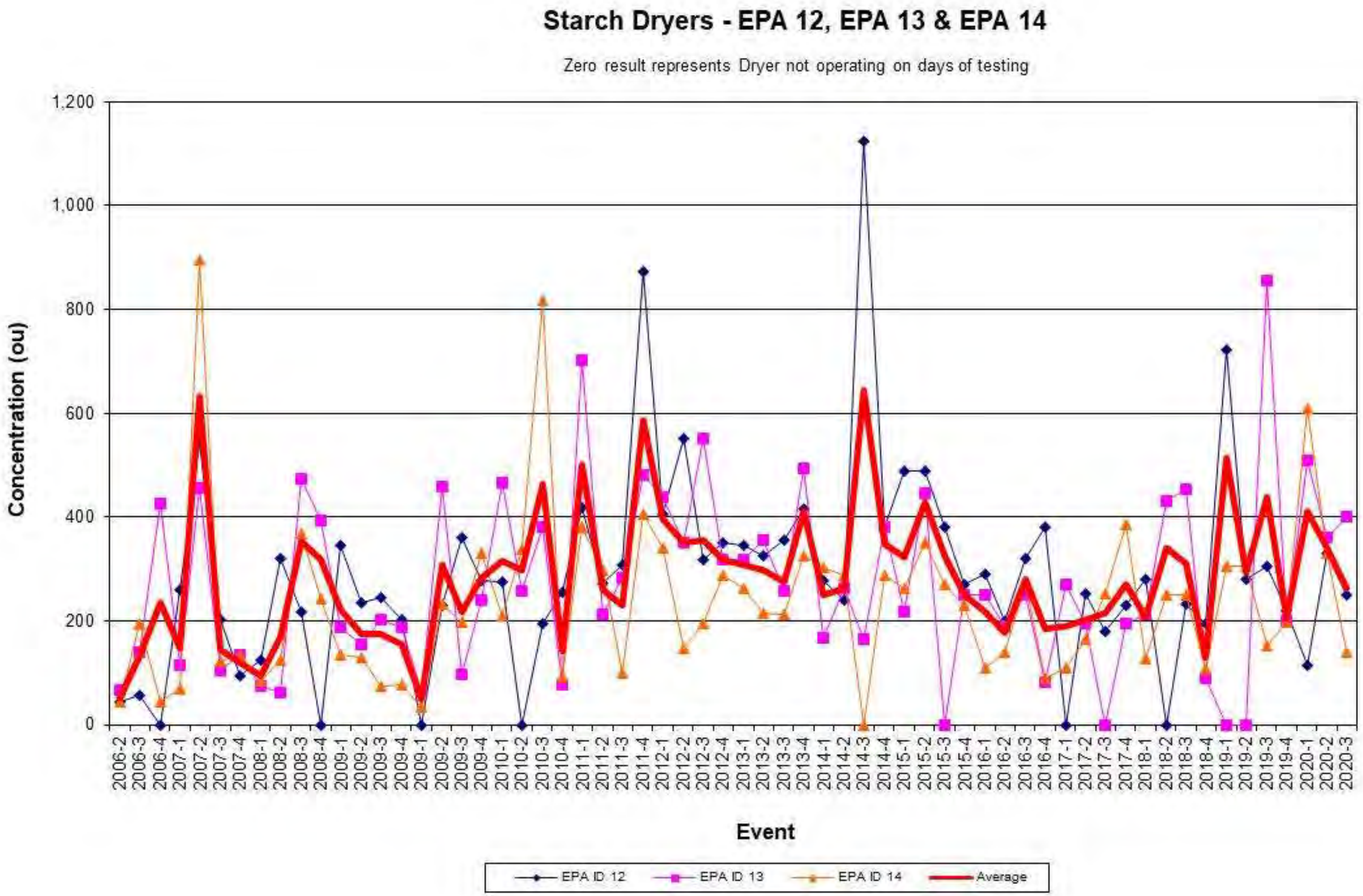


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47)

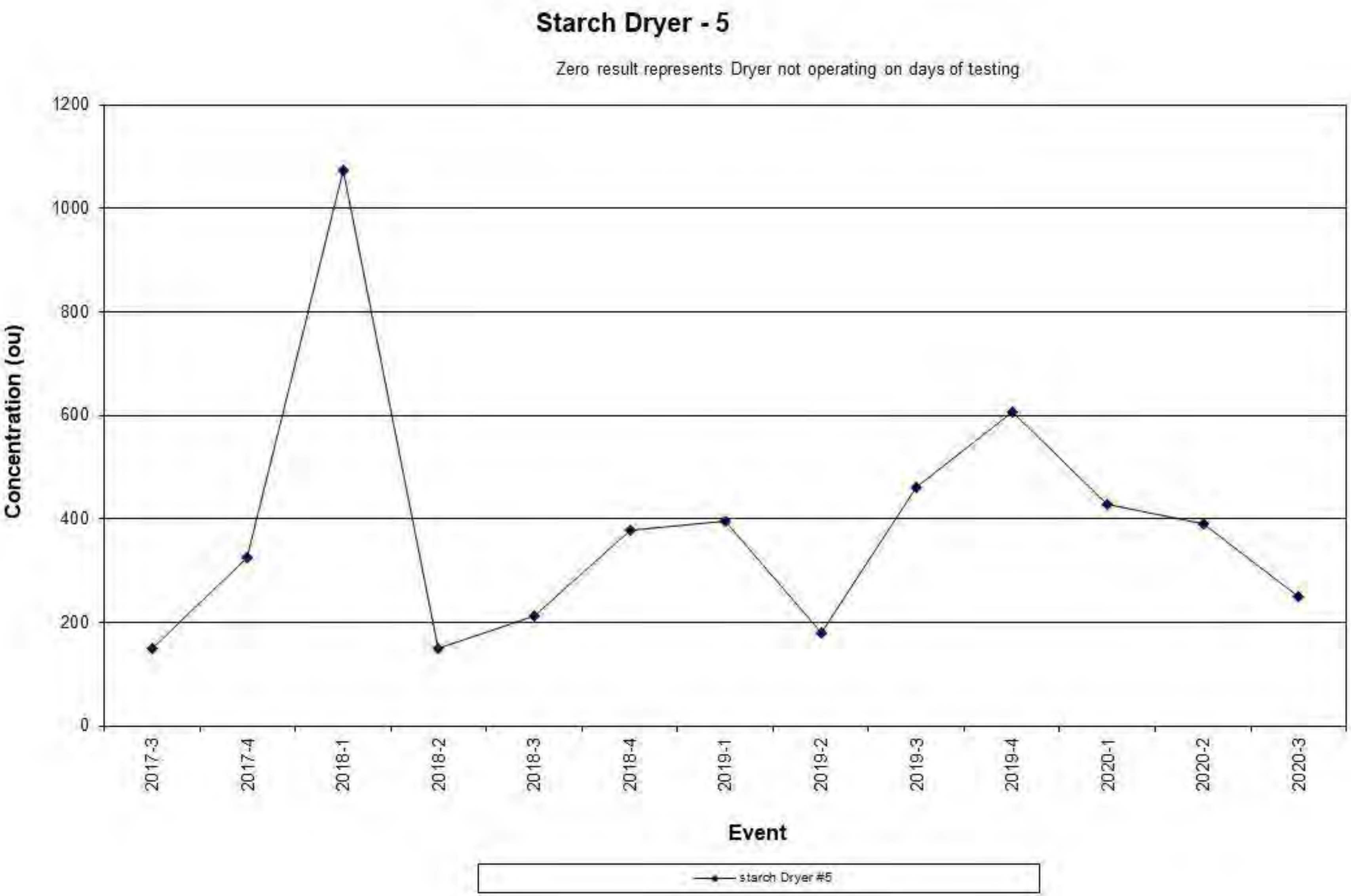


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44)

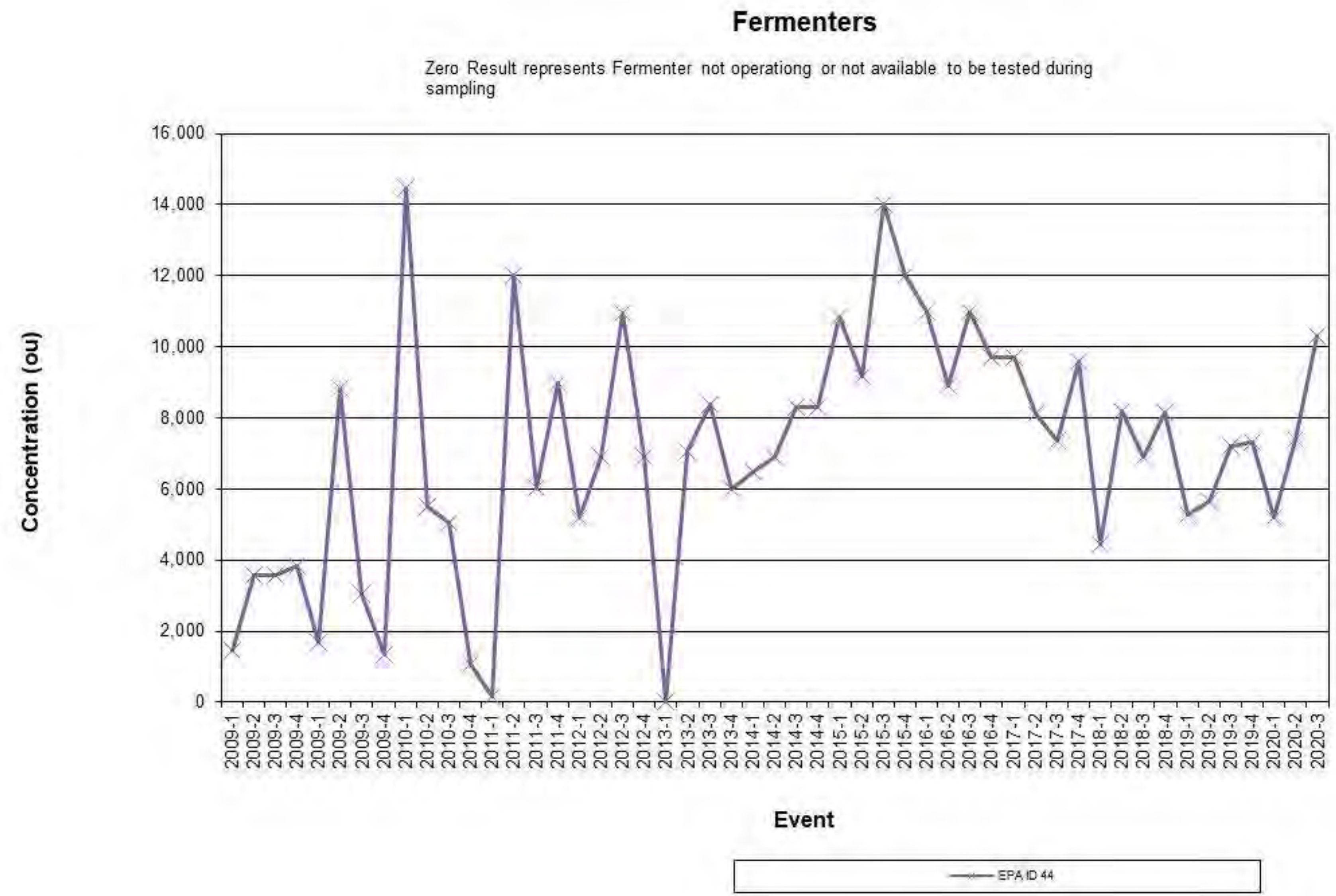


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16)

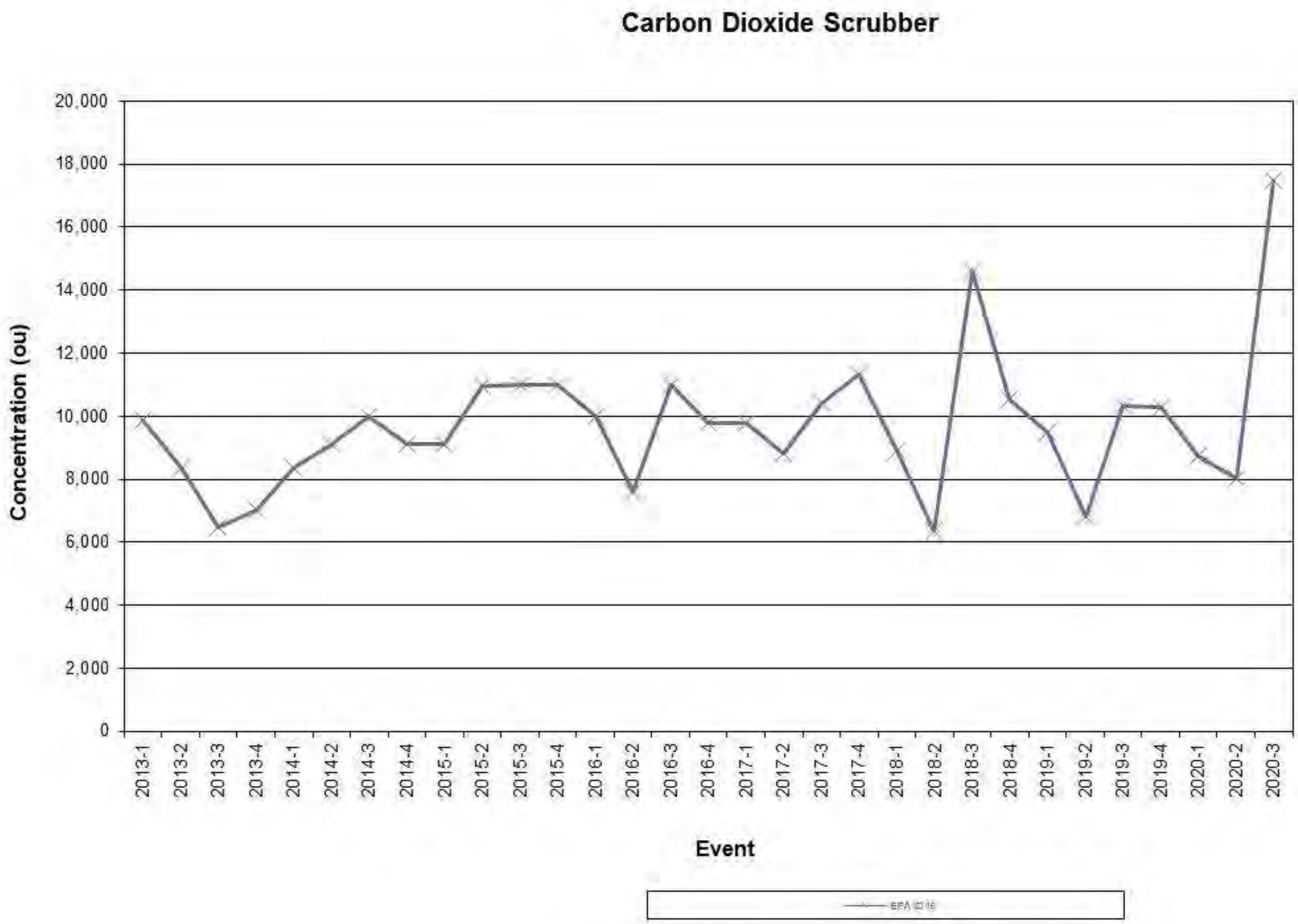


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35)

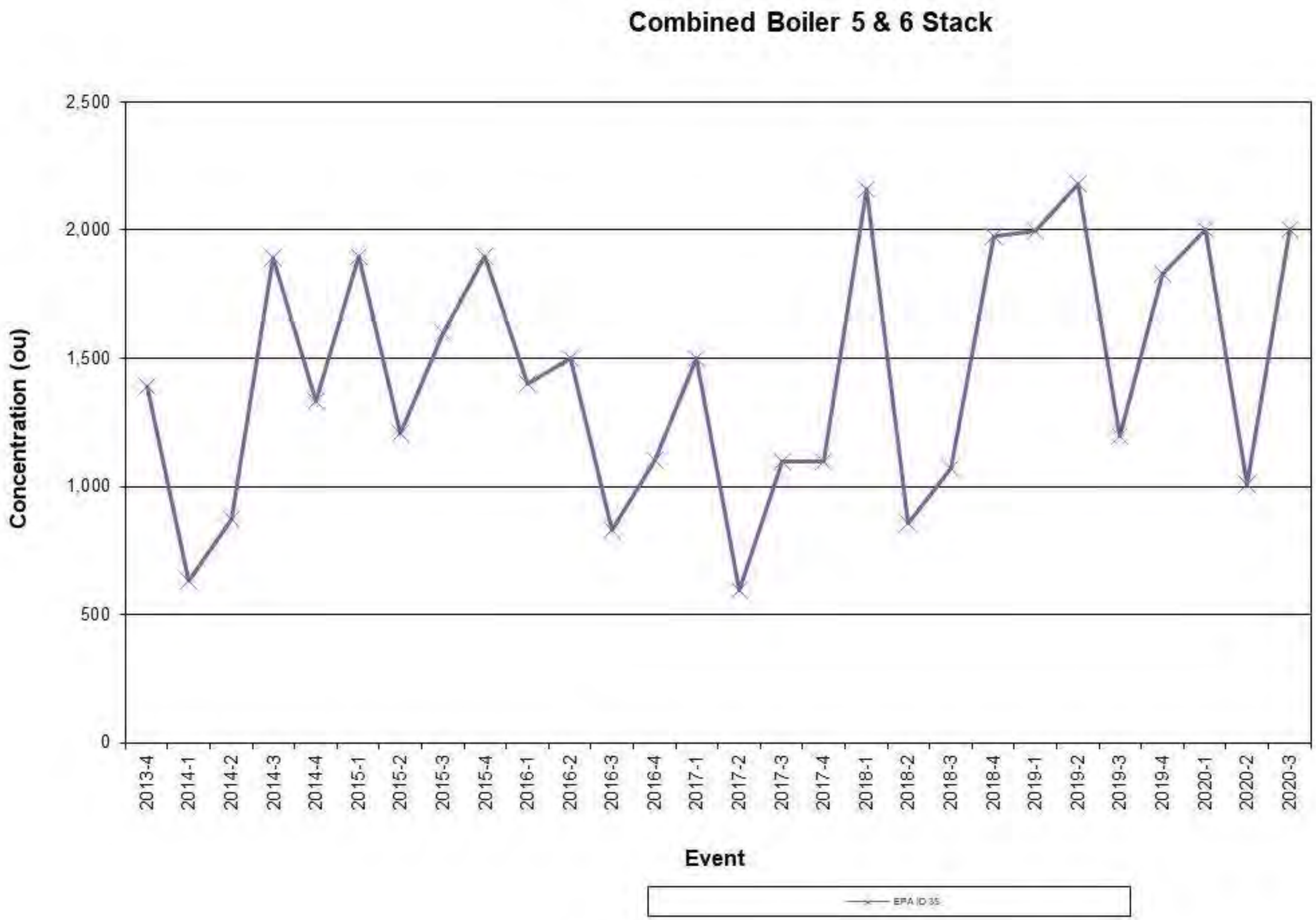


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42)

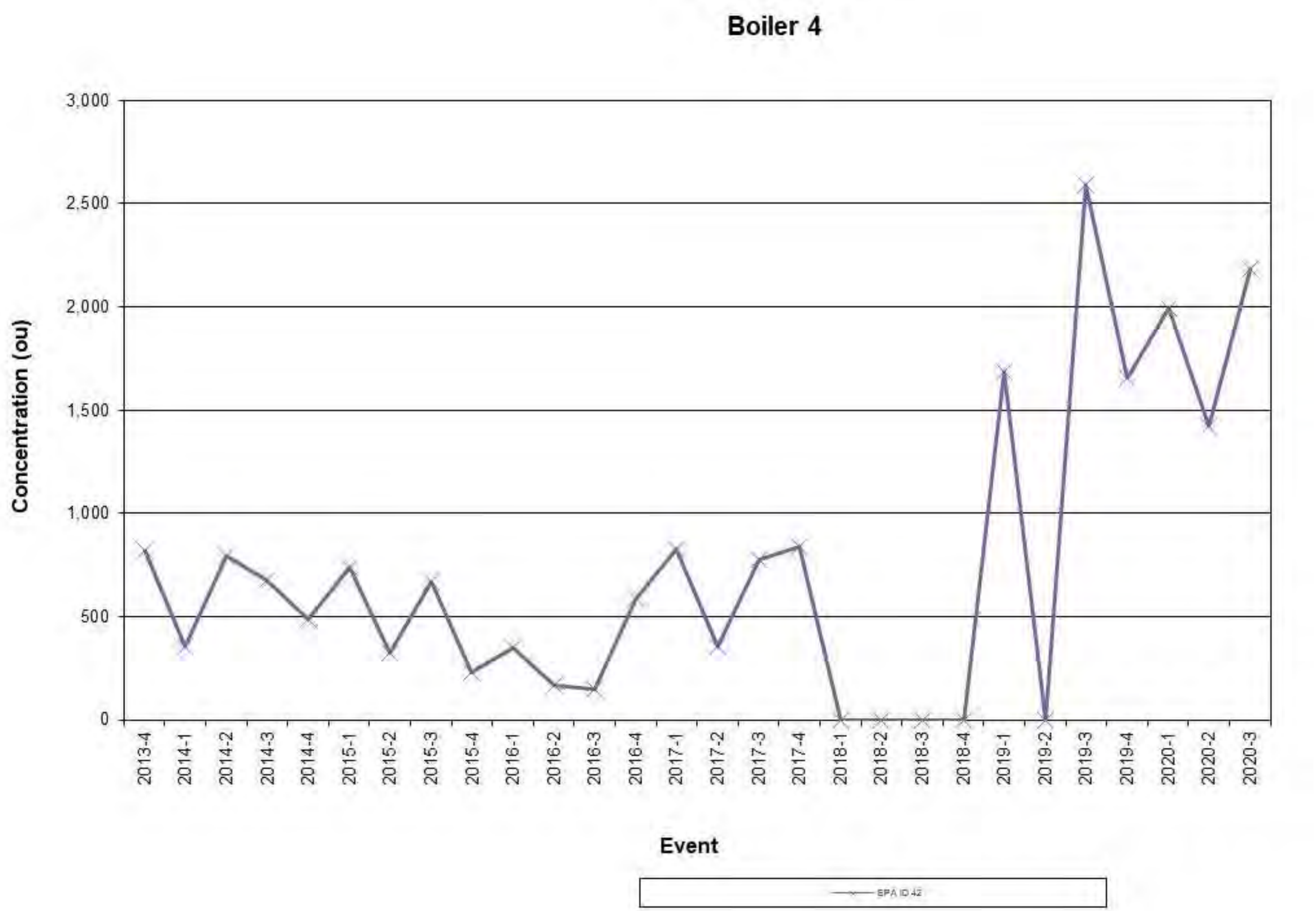


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45)

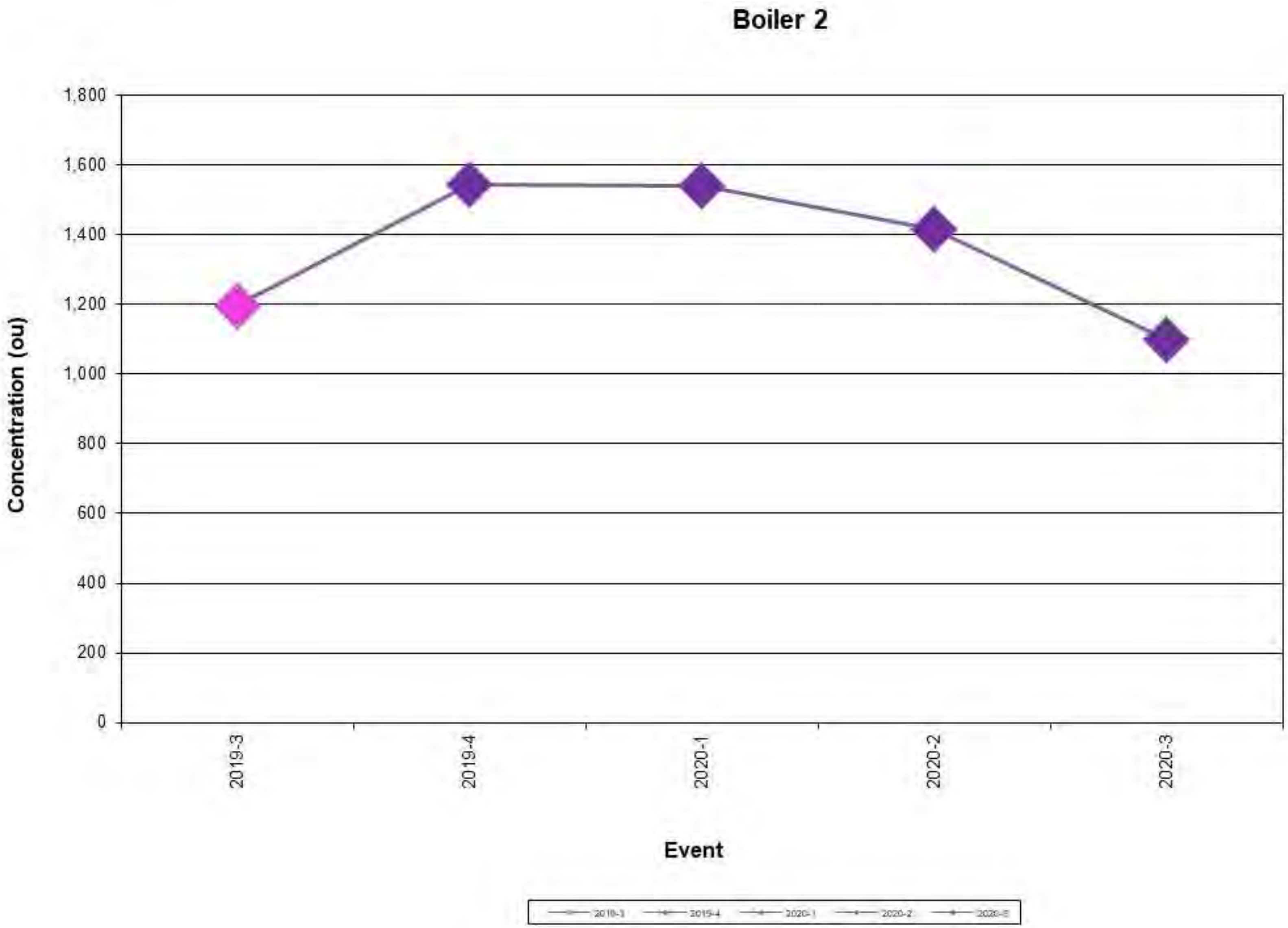


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41)

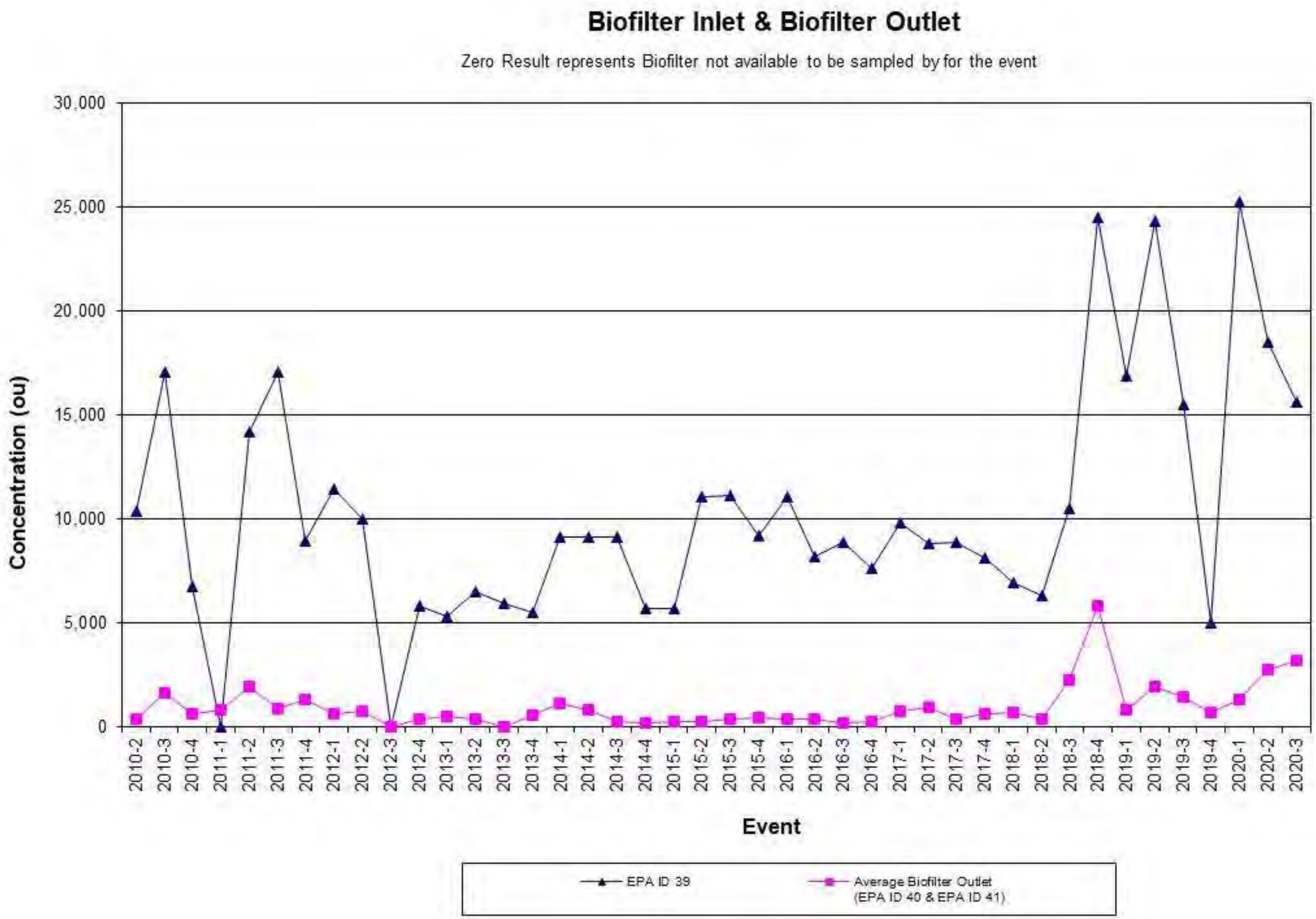
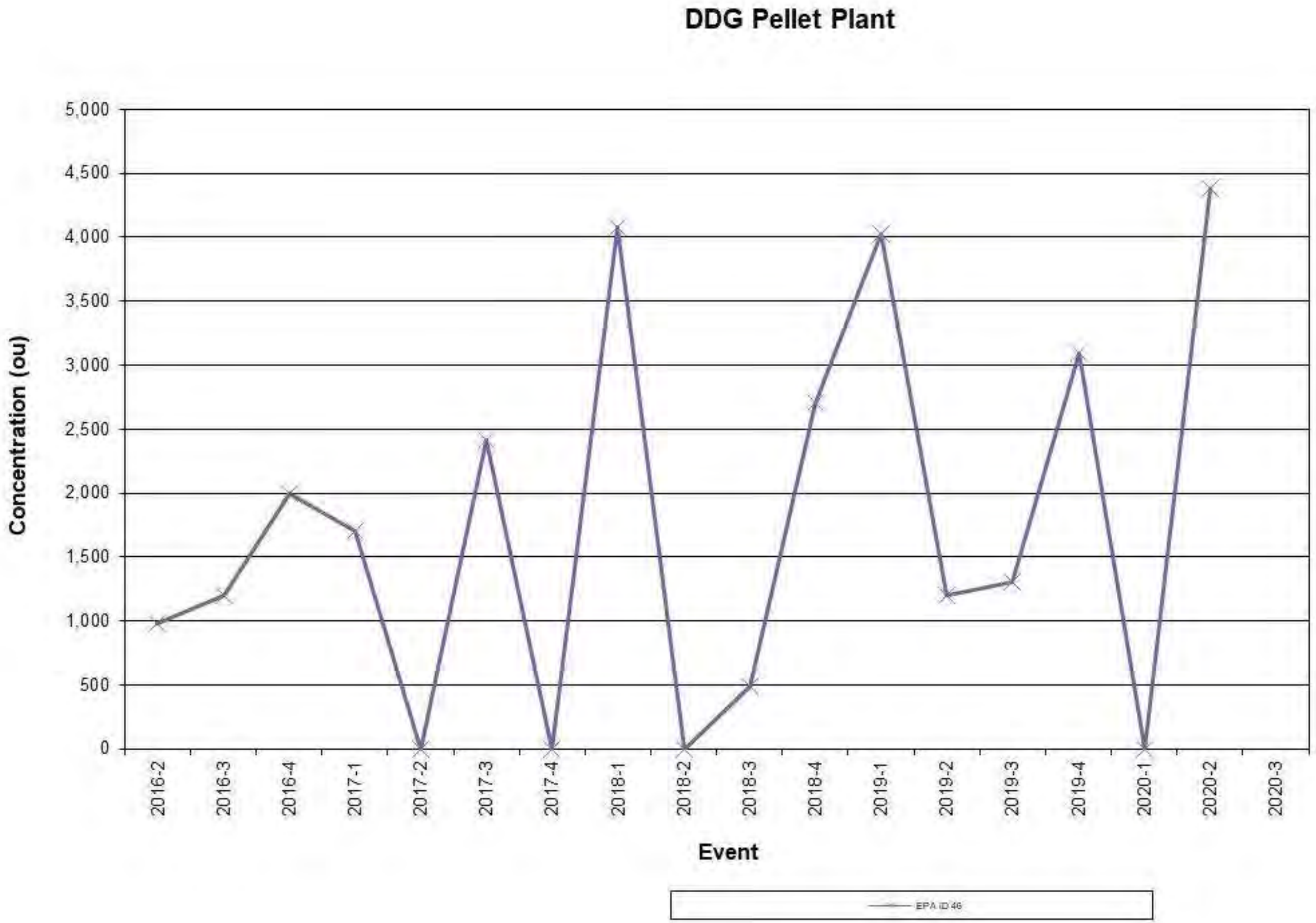


FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46)



6 TEST METHODS

6.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

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

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

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

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

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

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

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows could be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows could be different from the other two flows and is able to: ▪ 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-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
^{o}C	=	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 $0^{0}C$ and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at $0^{o}C$ 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	**7095**			
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	05-Aug-20	05-Aug-20	05-Aug-20	05-Aug-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:07	10:30	12:00	11:32
Flow Stop Time (hrs)	12:24	10:40	12:21	11:53
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	71.4	63	70.1	73.5
Stack Cross-Sectional area (m^2)	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	14.0	18.1	11.6	16.0
Actual Gas Flow Volume (am^3/min)	1,201	1,190	3,080	2,222
Total Normal Gas Flow Volume (m^3/min)	887	837	2,253	1,651
Total Normal Gas Flow Volume (m^3/s)	14.8	14.0	37.6	27.5
Total Stack Pressure (kPa)	101.4	92.1	101.4	101.1
Moisture Content (% by volume)	6.9	4.8	8.1	5.5
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^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	5417	5407	5408	5409
SEMA Number	728041	728032	728033	728034
Sample Start Time (hrs)	12:14	10:35	12:11	11:43
Sample Finish Time (hrs)	12:24	10:40	12:21	11:53
Odour Concentration (As Received) (ou)	660	430	850	720
Odour Concentration (Final) (ou)	**660**	**430**	**850**	**720**
Normal MOER (As Received) (ou m^3/s)	9,800	6,000	32,000	20,000
Normal MOER (Final) (ou m^3/s)	9,800	6,000	32,000	20,000
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample storage period prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

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

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

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

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

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

TABLE A-4 EMISSION TEST RESULTS – FERMENTER 13 & CO_2 SCRUBBER OUTLET

Emission Test Results		
Project Number	**7095**	
Project Name	**Shoalhaven Starches**	
Test Location	**EPA ID 44 Fermenter 13**	**EPA ID 16 CO_2 Scrubber outlet**
Date	05-Aug-20	05-Aug-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	12:54	13:04
Flow Stop Time (hrs)	13:15	13:25
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	29.7	22.4
Stack Cross-Sectional area (m^2)	0.071	0.196
Average Stack Gas Velocity (m/s)	3.1	9.3
Actual Gas Flow Volume (am^3/min)	13.1	110
Total Normal Gas Flow Volume (m^3/min)	11.4	99
Total Normal Gas Flow Volume (m^3/s)	0.190	1.645
Total Stack Pressure (kPa)	101.11	101.07
Moisture Content (% by volume)	3.30	2.56
Molecular Weight Dry Stack Gas (g/gmole)	29.6	31.2
Dry Gas Density (kg/m^3)	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5410	5412
SEMA Number	728035	728037
Sample Start Time (hrs)	13:05	13:15
Sample Finish Time (hrs)	13:15	13:25
Odour Concentration (As Received) (ou)	10,300	17,500
Odour Concentration (Final) (ou)	**10,300**	**17,500**
Normal MOER (As Received) (ou m^3/s)	2,000	28,800
Normal MOER (Final) (ou m^3/s)	2,000	28,800
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
Calculations checked by	PWS	PWS

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

Emission Test Results		
Project Number	**7095**	
Project Name	**Shoalhaven Starches**	
Test Location	**EPA ID 39 Biofilter Inlet DDG Evaporators 1, 2 & 3**	**EPA ID 39A Biofilter Inlet DDG Evaporator 4**
Date	8-Oct-20	8-Oct-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	12:18	12:22
Flow Stop Time (hrs)	12:46	12:43
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	39.8	31.1
Stack Cross-Sectional area (m^2)	0.283	0.049
Average Stack Gas Velocity (m/s)	14.3	7.5
Actual Gas Flow Volume (am^3/min)	243	22
Total Normal Gas Flow Volume (m^3/min)	189	19
Total Normal Gas Flow Volume (m^3/s)	3.1	0.3
Total Stack Pressure (kPa)	96.25	101.06
Moisture Content (% by volume)	6.23	4.12
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m^3)	1.287	1.287
Oxygen (%)	20.9	20.9
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5434	5435
SEMA Number	728098	728099
Sample Start Time (hrs)	12:32	13:09
Sample Finish Time (hrs)	12:46	13:19
Odour Concentration (As Received) (ou)	15,600	41,900
Odour Concentration (Final) (ou)	**15,600**	**41,900**
Normal MOER (As Received) (ou m^3/s)	49,100	13,200
Normal MOER (Final) (ou m^3/s)	49,100	13,200
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
Calculations checked by	PWS	PWS

TABLE A- 6 EMISSION TEST RESULTS DDG PELLET PLANT

Emission Test Results		
Project Number	**7095**	
Project Name	**Shoalhaven Starches**	
Test Location	**Part EPA ID 46* DDG Pellet Cooler East Stack**	**Part EPA ID 46* DDG Pellet Silo**
Date	28-Oct-20	28-Oct-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	16:25	15:54
Flow Stop Time (hrs)	16:48	16:06
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	69.0	56.0
Stack Cross-Sectional area (m^2)	0.665	0.126
Average Stack Gas Velocity (m/s)	14	12
Actual Gas Flow Volume (am^3/min)	571	87
Total Normal Gas Flow Volume (m^3/min)	434	70
Total Normal Gas Flow Volume (m^3/s)	7.2	1.2
Total Stack Pressure (kPa)	99.70	102.11
Moisture Content (% by volume)	3.21	3.57
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m^3)	1.29	1.29
Oxygen (%)	20.9	20.9
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5438	5437
SEMA Number	728112	728111
Sample Start Time (hrs)	16:38	16:08
Sample Finish Time (hrs)	16:48	16:18
Odour Concentration (As Received) (ou)	8,800	6,200
Odour Concentration (Final) (ou)	**8,800**	**6,200**
Normal MOER (As Received) (ou m^3/s)	63,600	7,300
Normal MOER (Final) (ou m^3/s)	63,600	7,300
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
Calculations checked by	PWS	PWS

Key:

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

TABLE A- 7 EMISSION TEST RESULTS – BIOFILTER OUTLETS

Emission Test Results				
Project Number	**7095**			
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	8-Oct-20	8-Oct-20	8-Oct-20	8-Oct-20
Run	1			
Method	TM-2 & TM-22			
Sample & Flow Start Time (hrs)	13:10	13:41	13:06	13:32
Sample & Flow Stop Time (hrs)	13:20	13:51	13:16	13:43
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^{o}C)	37.6	38.4	30.6	27.8
Proportion of Inlet air flow (%)	**26**	**25**	**26**	**23**
Analysis	Odour	Odour	Odour	Odour
Method	AS4323.3	AS4323.3	AS4323.3	AS4323.3
ORLA Number	728094	728096	728095	728097
SEMA Number	5430	5432	5431	5433
Odour Concentration (As Received) (ou)	1,200	1,400	4,000	6,200
Odour Concentration (Final) (ou)	**1,200**	**1,400**	**4,000**	**6,200**
Normal MOER (As Received) (ou m^3/s)	1,100	1,200	3,700	4,900
Normal MOER (Final) (ou m^3/s)	1,100	1,200	3,700	4,900
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

APPENDIX B – CERTIFICATES OF ANALYSIS

Odour Research Laboratories Australia

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

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

Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Starch Dryers 1, 3, 4 and 5 Gluten Dryers 1, 2, 3 and 4 Fermenter 13 CO_2 Scrubber inlet and outlet Boilers 2, 4 and 5&6
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7095/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5405 - 5420
	SEMA Sample number(s):	728031 - 728044
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	31 July 2020
	Order number:	5147
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	14 August 2020

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NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

ODOUR CONCENTRATION MEASUREMENTS RESULTS 7095/ORLA/01

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq \chi \leq 92{,}102$ 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.

14 August, 2020

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7095/ORLA/01

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

Odour Research Laboratories Australia

Odour Olfactometry Results – 7095/ORLA/01

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

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7095/ORLA/01

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

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

Notes from Odour Olfactometry Results:

[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:

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

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

^ denotes the Average Hedonic 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:

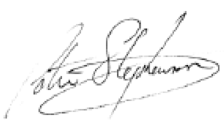
Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Sites:	Biofilter Outlets A & B East, Biofilter Outlets A & B West, Biofilter Inlet from DDG Evaporators 1, 2, 3 & 4, DDG Pellet Silo and DDG Pellet Cooler East Stack
	Telephone:	02 4423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

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.

04 January, 2021



Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7095/ORLA/02

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

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7095/ORLA/02

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

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

Notes from Odour Olfactometry Results:

[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 ≤ χ ≤ 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:

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

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

^ denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the 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	07-May-20	07-Nov-20
775	Thermocouple	07-May-20	07-Nov-20
893	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
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	07-May-20	07-Nov-20
920	Thermocouple	07-May-20	07-Nov-20
769	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	16-Mar-20	16-Sep-20
675	Personal Sampler	12-Mar-20	12-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
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- 3 INSTRUMENT CALIBRATION DETAILS DAY 3

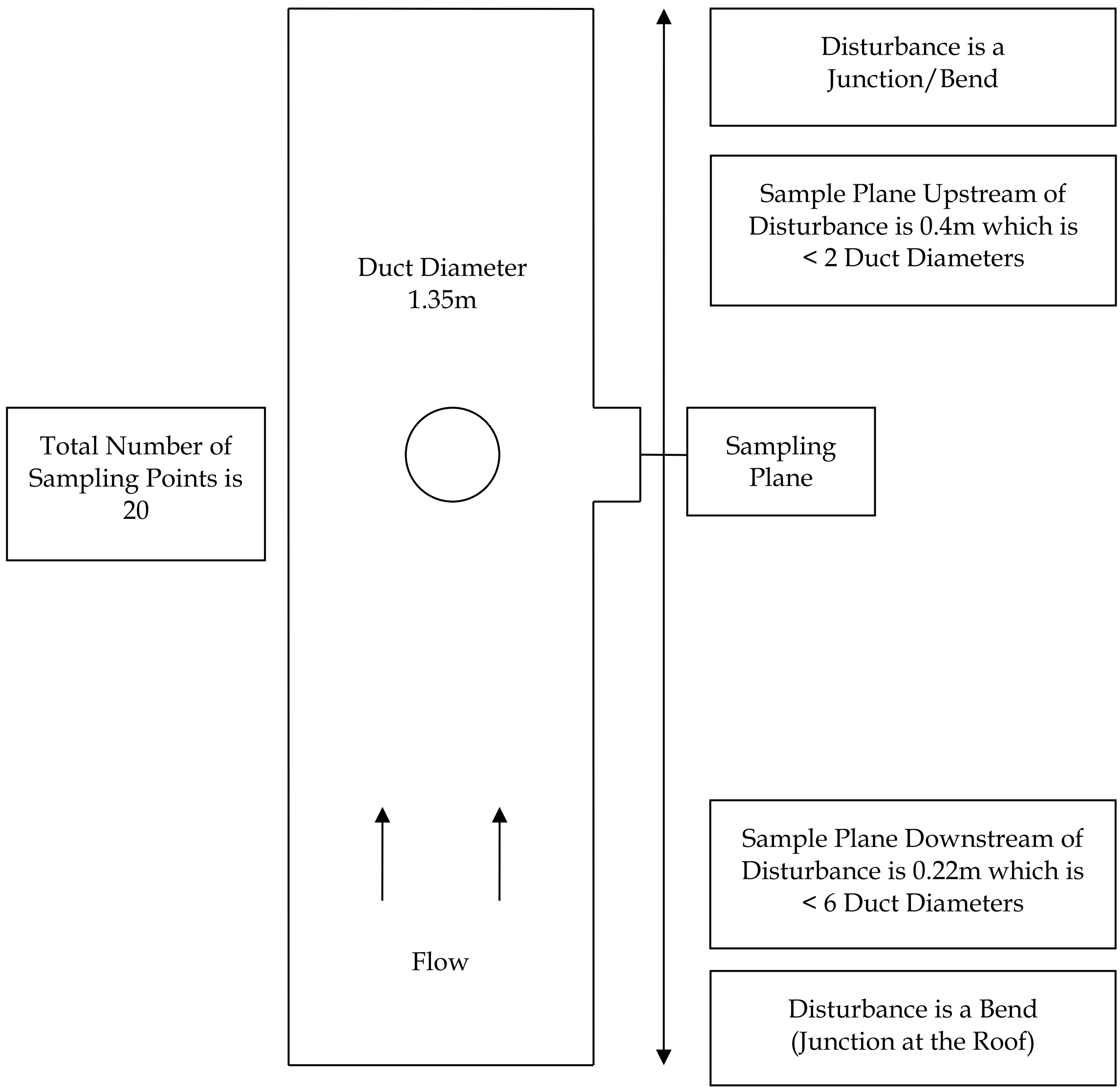
SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	07-May-20	07-Nov-20
919	Thermocouple	07-May-20	07-Nov-20
775	Thermocouple	07-May-20	07-Nov-20
815	Digital Manometer	06-Dec-19	06-Dec-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	02-Sep-20	02-Mar-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
678	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	05-Dec-19	05-Dec-20
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-4 INSTRUMENT CALIBRATION DETAILS DAY 4

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	06-Dec-19	06-Dec-20
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	Combustion Analyzer	02-Sep-20	02-Mar-21
676	Personal Sampler	26-Feb-20	26-Feb-21
613	Barometer	05-Dec-19	05-Dec-20
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



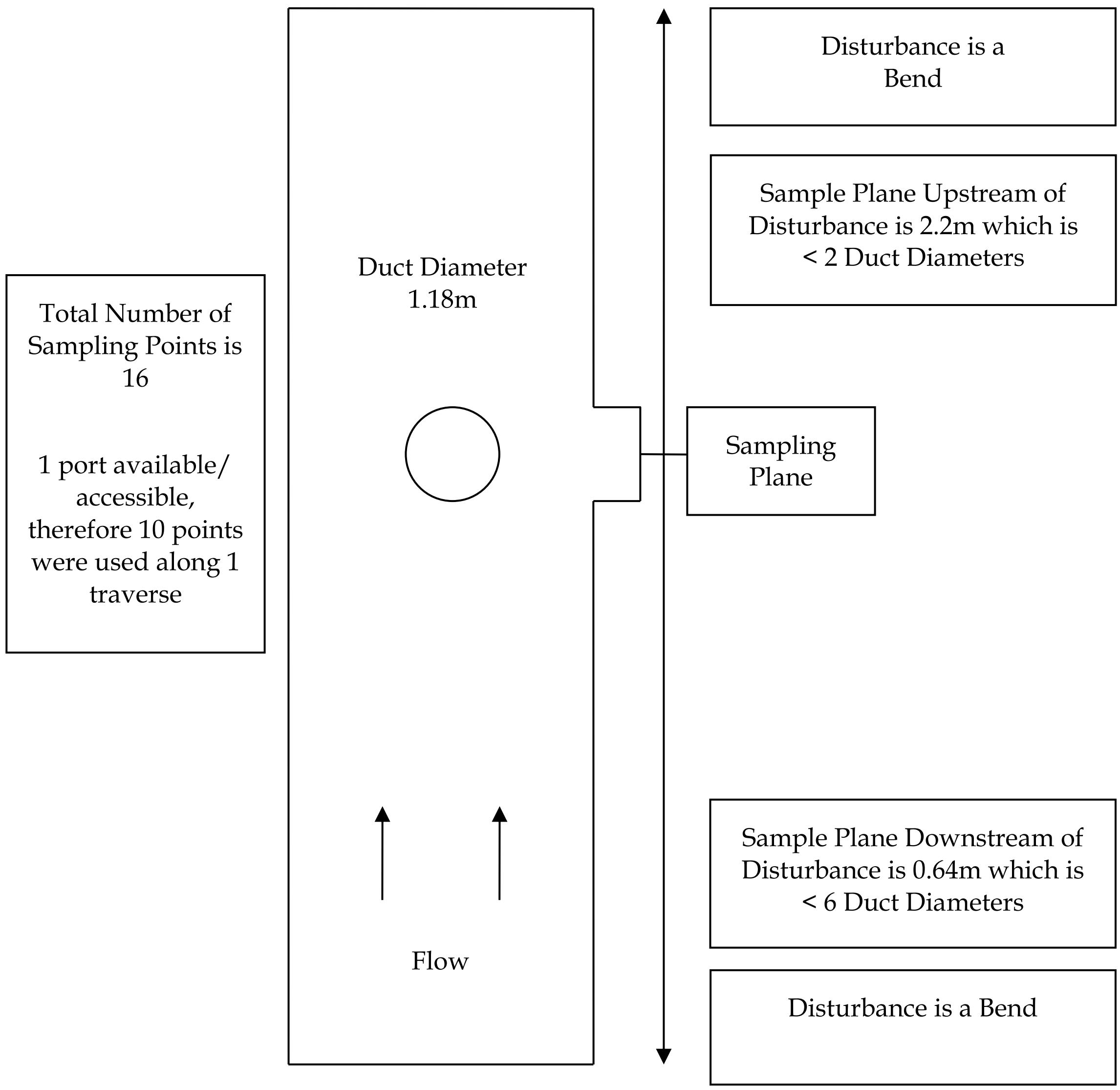
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



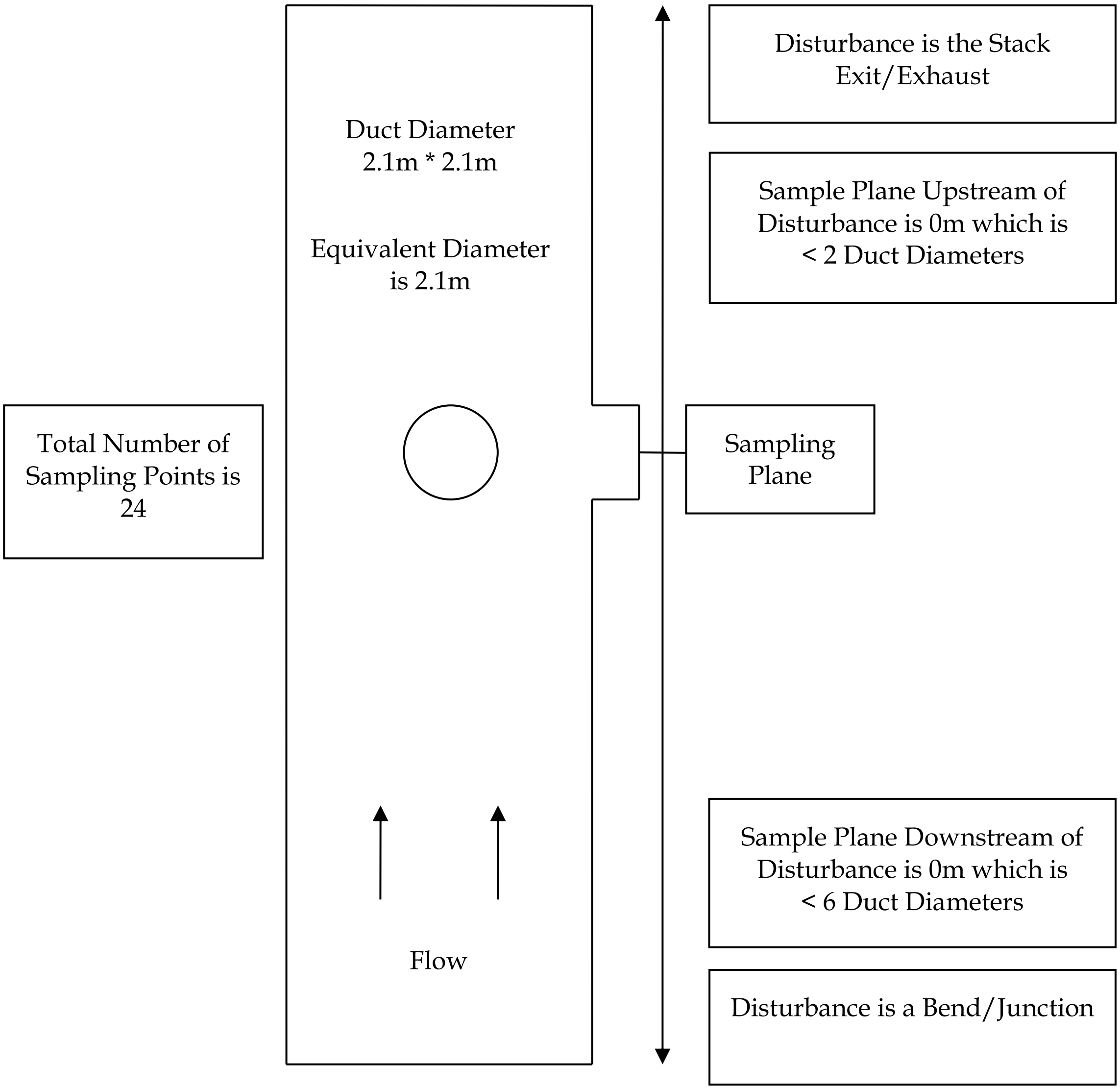
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



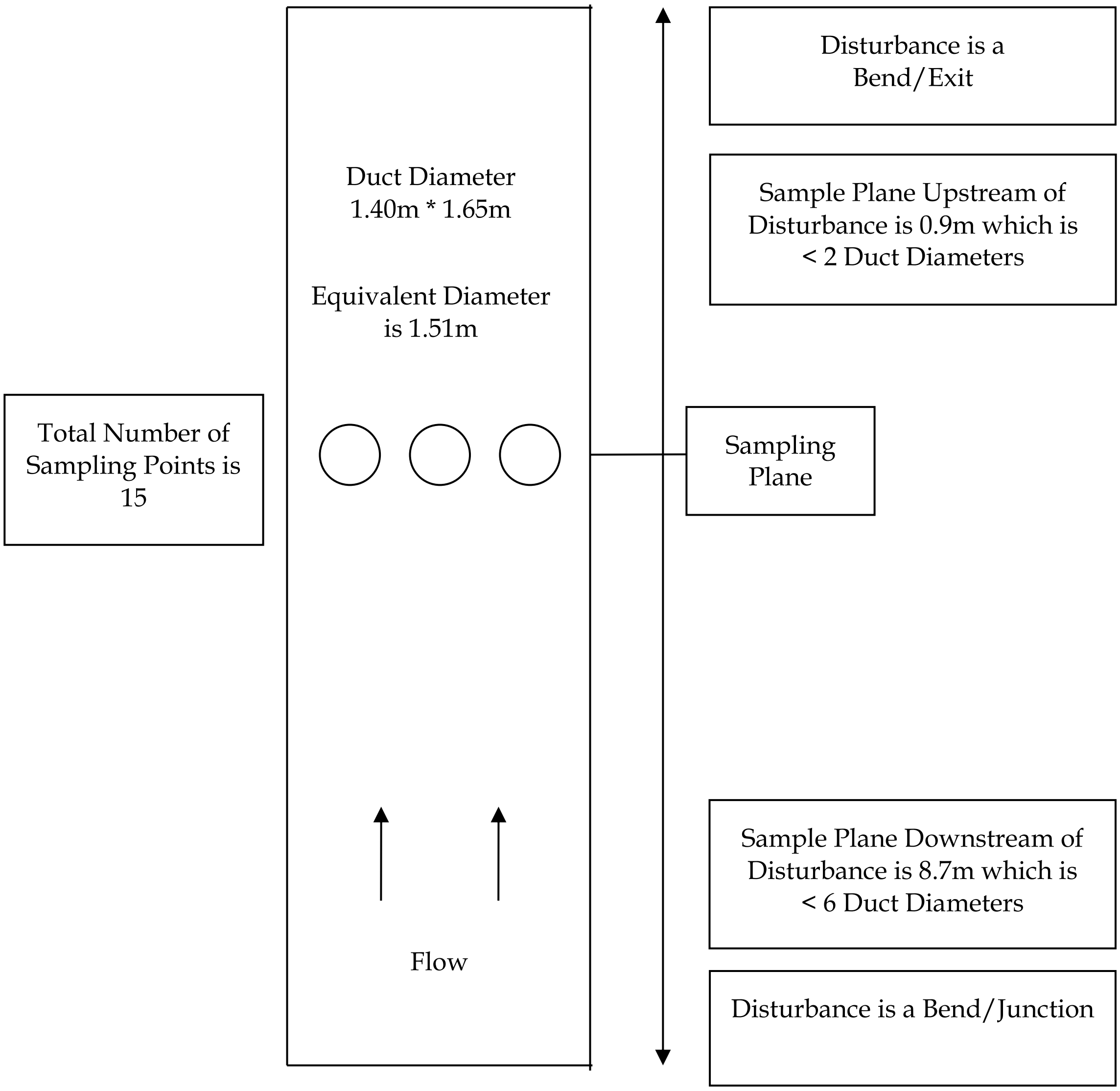
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



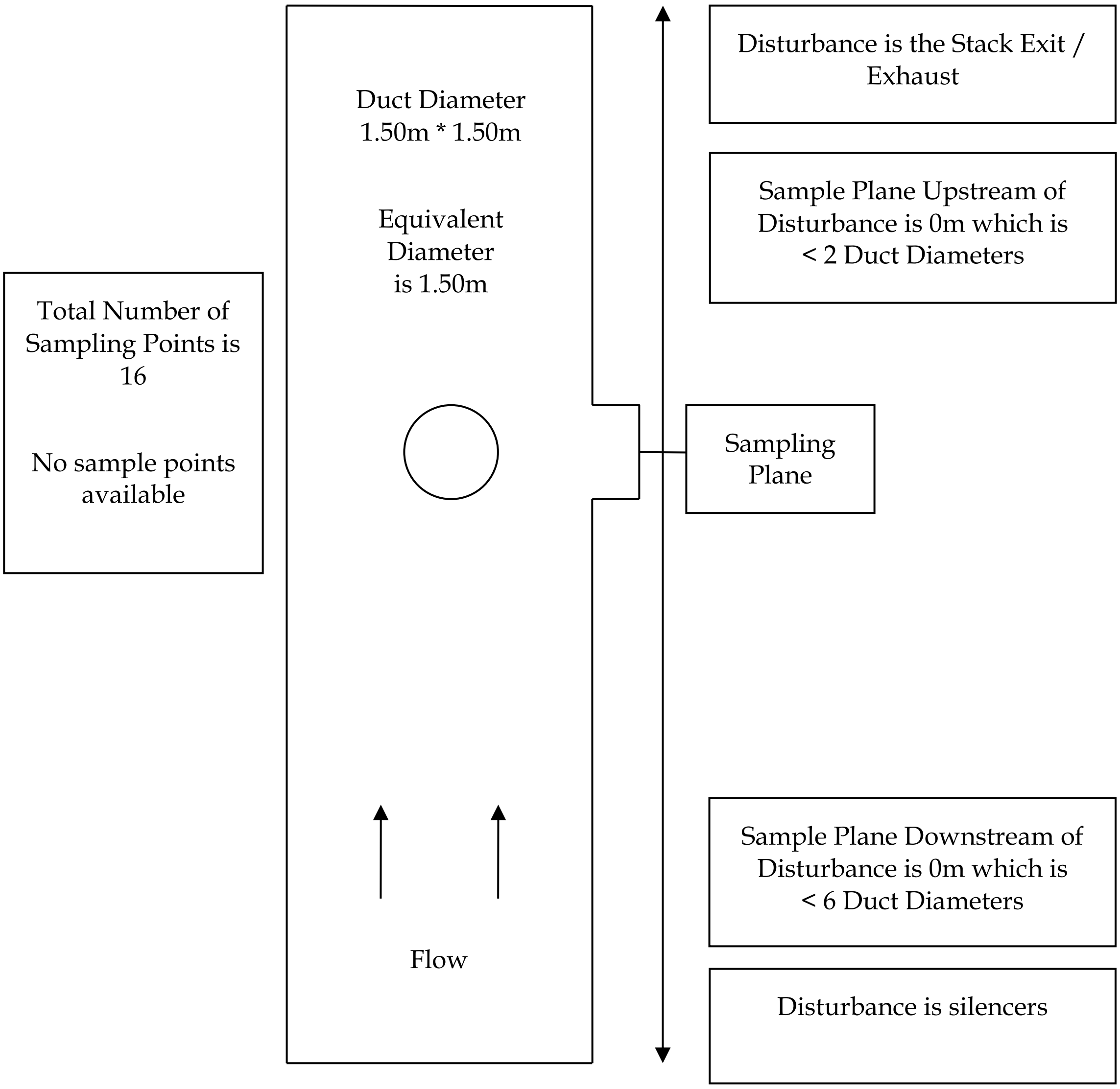
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



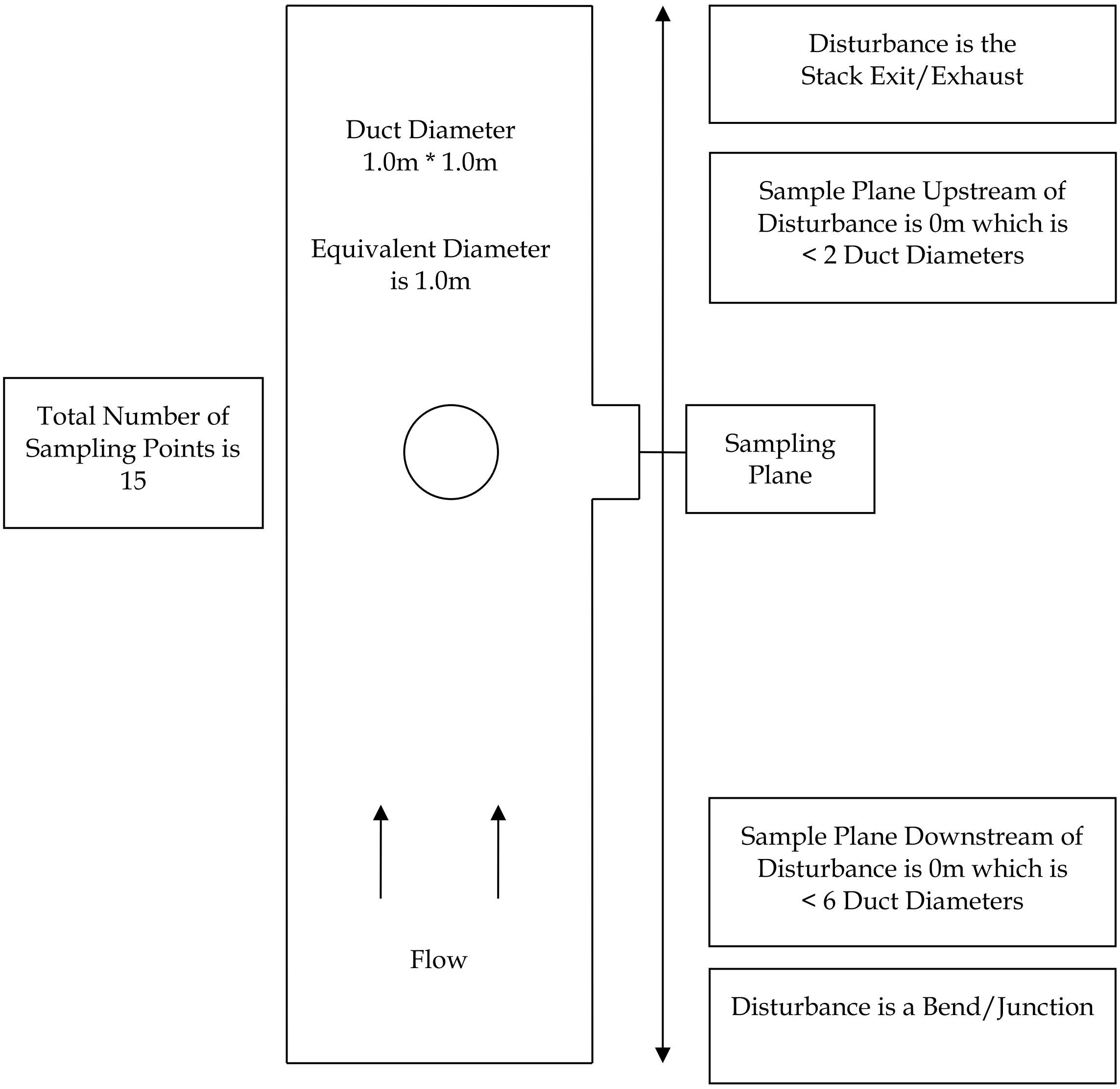
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



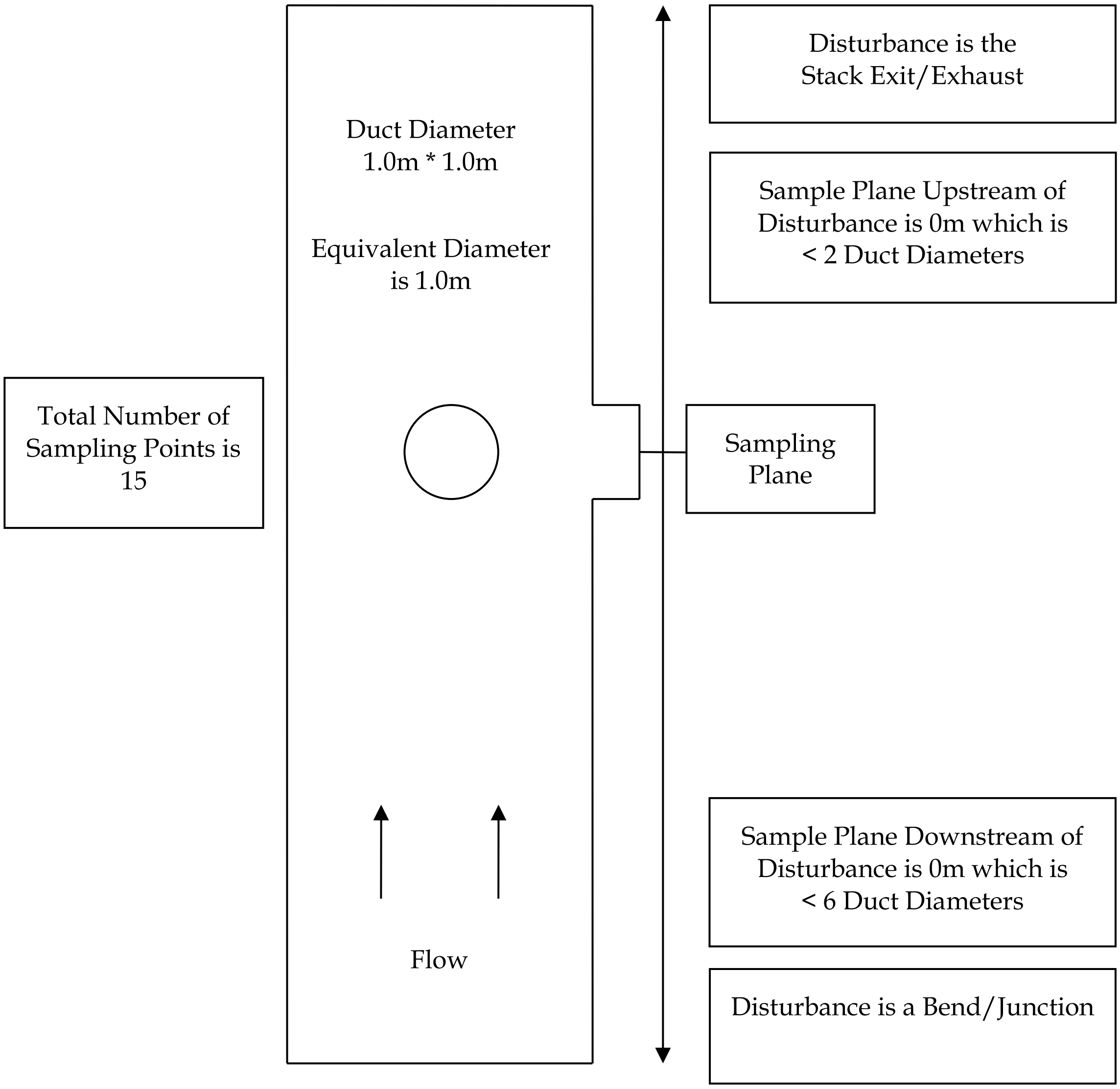
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



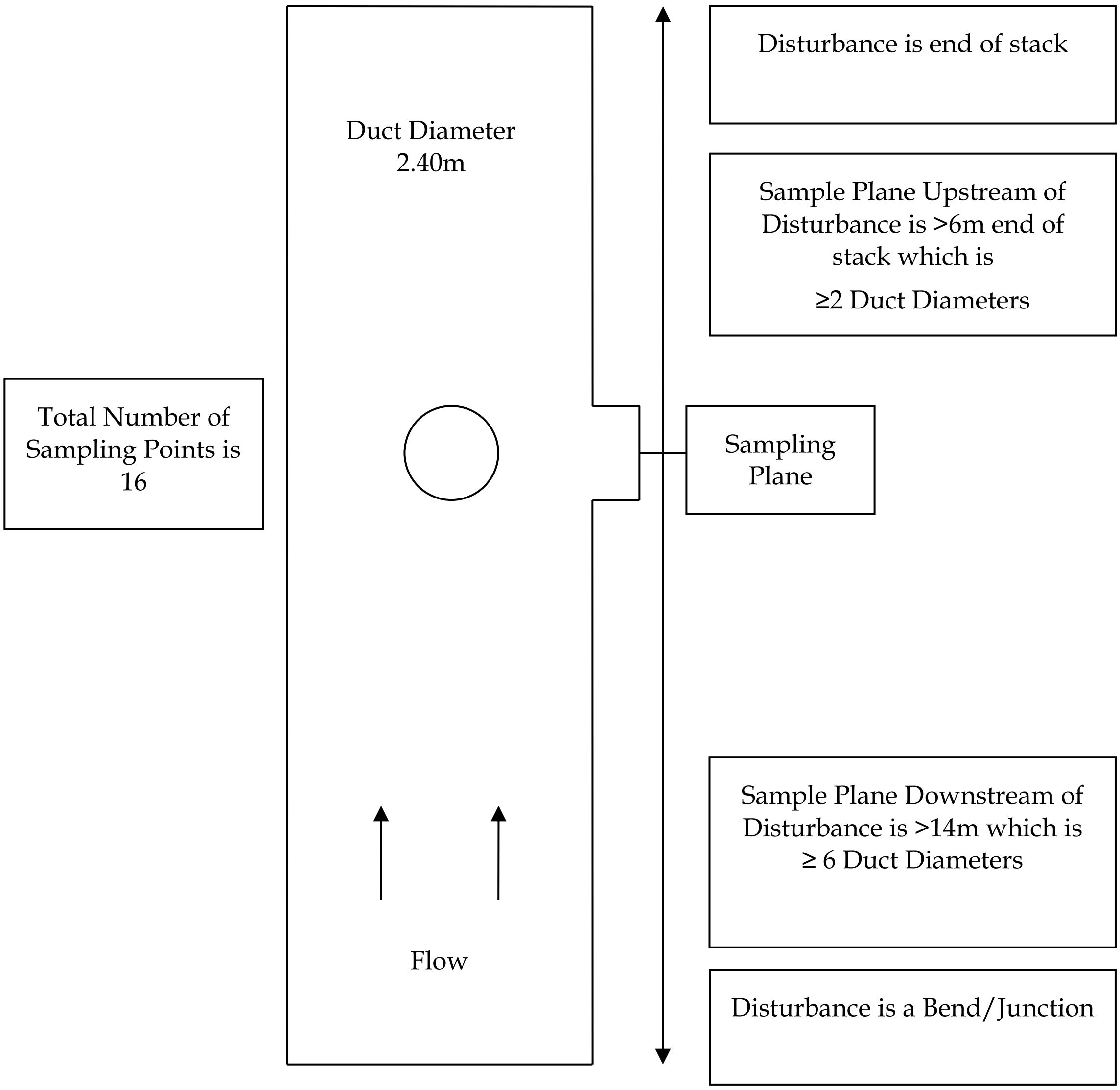
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

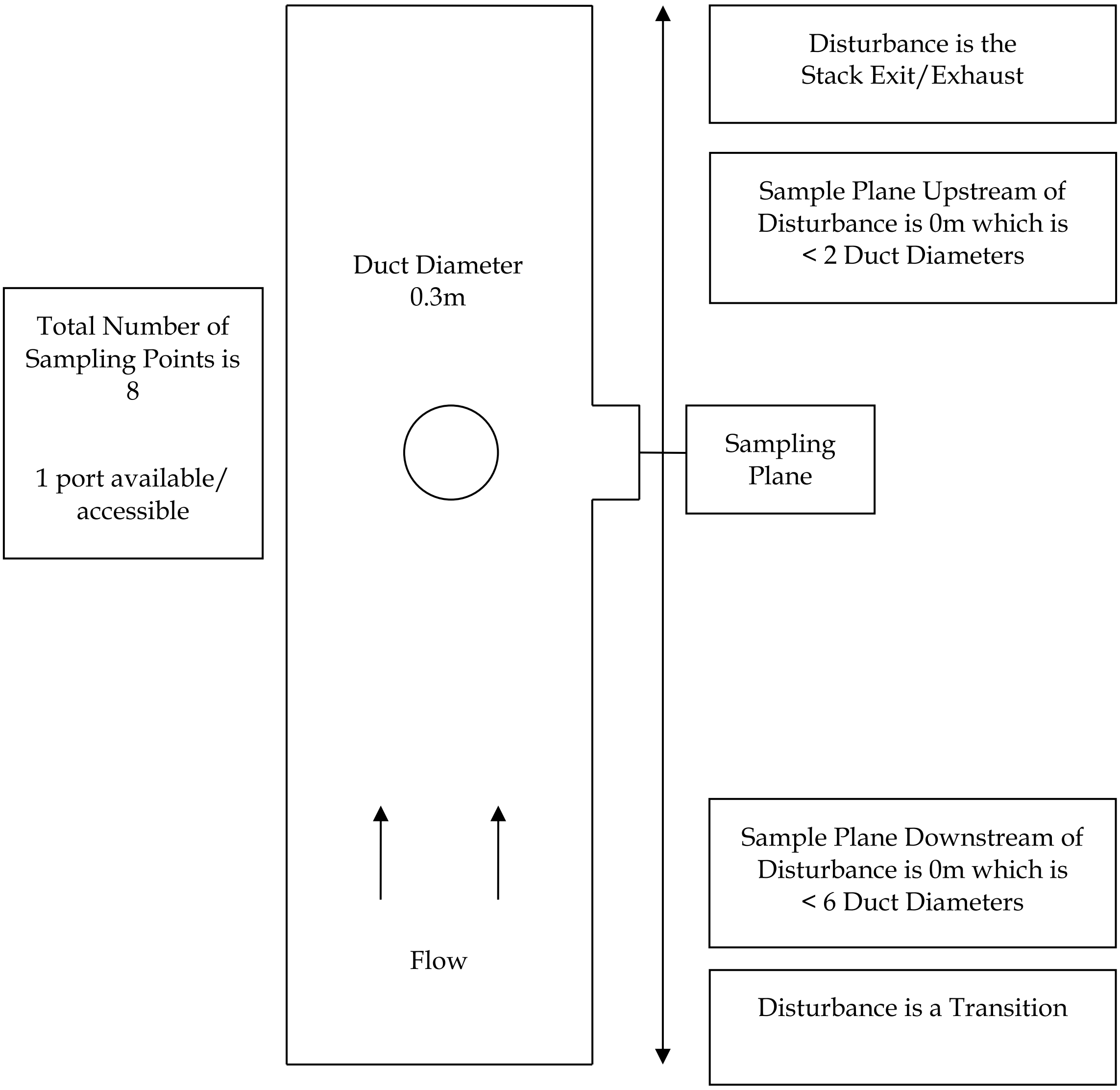


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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.

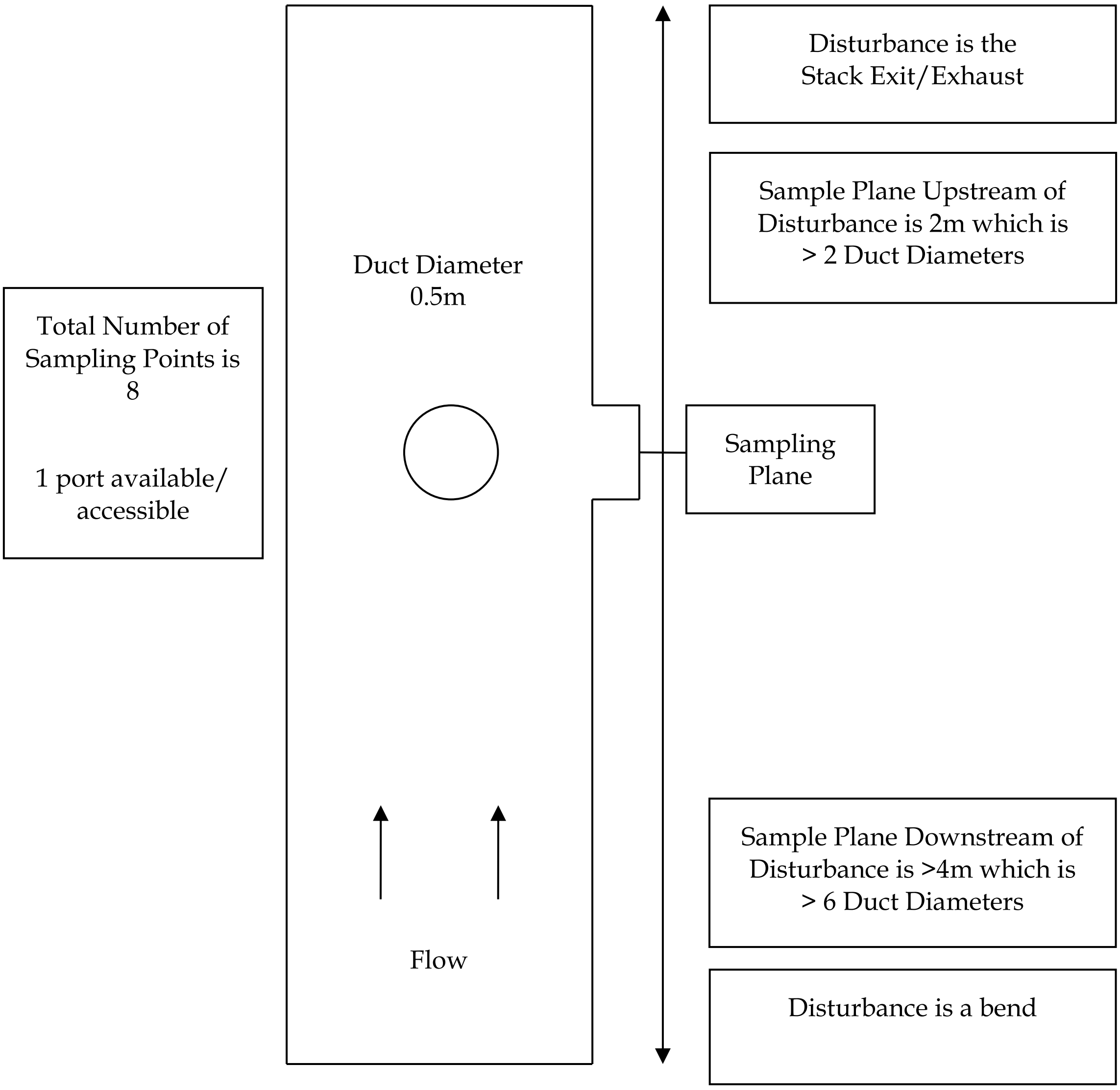
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

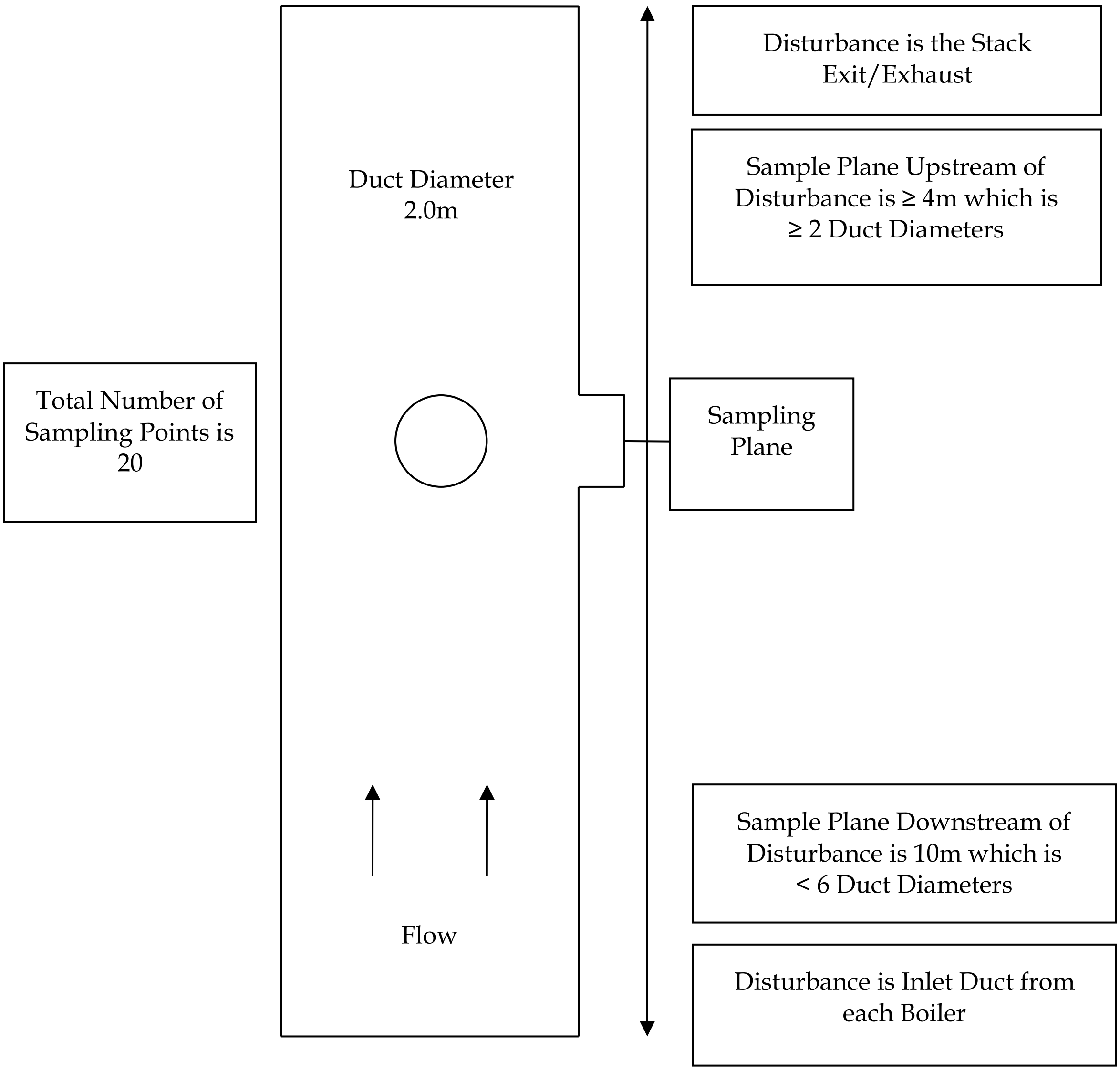


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

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



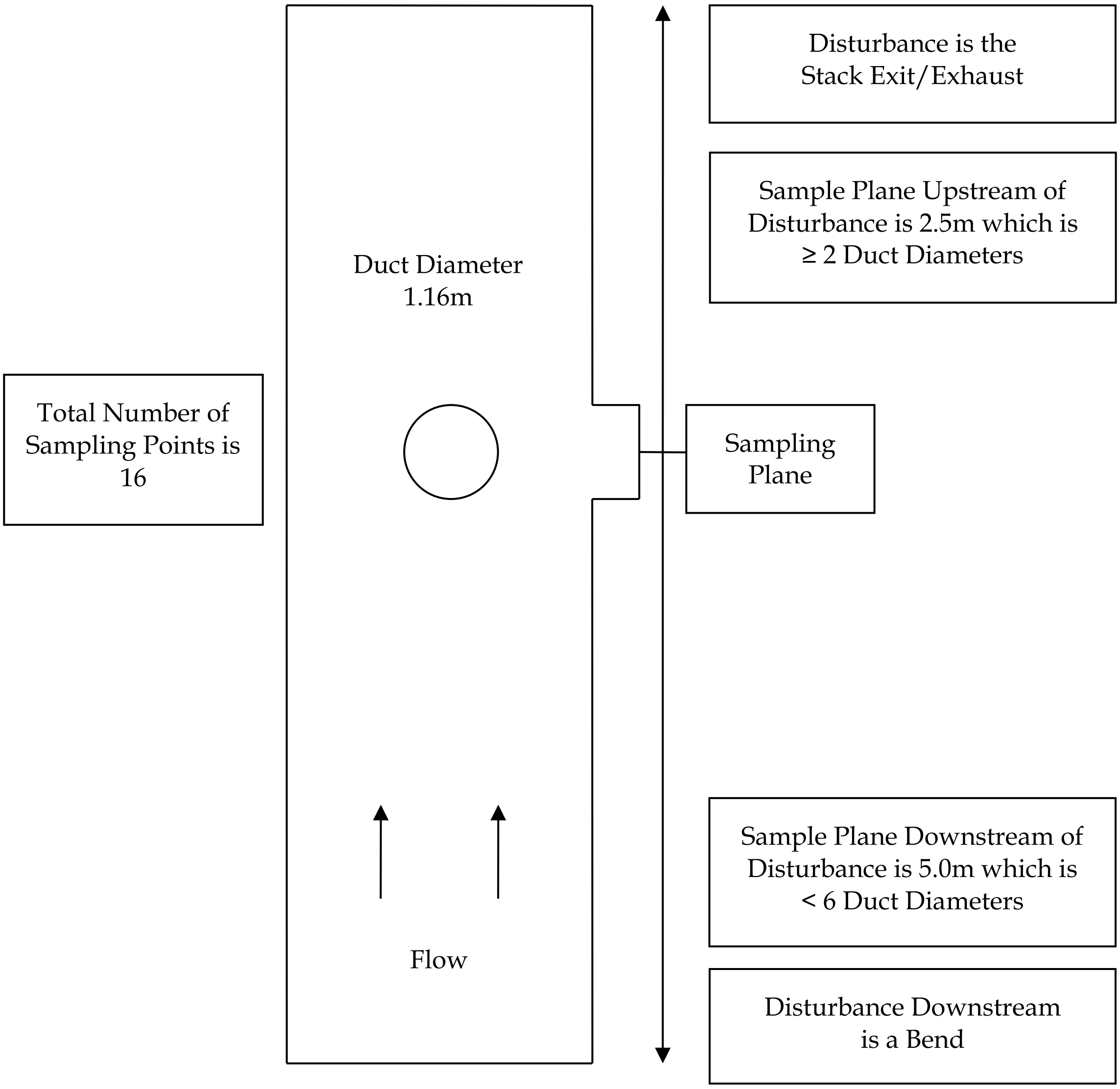
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



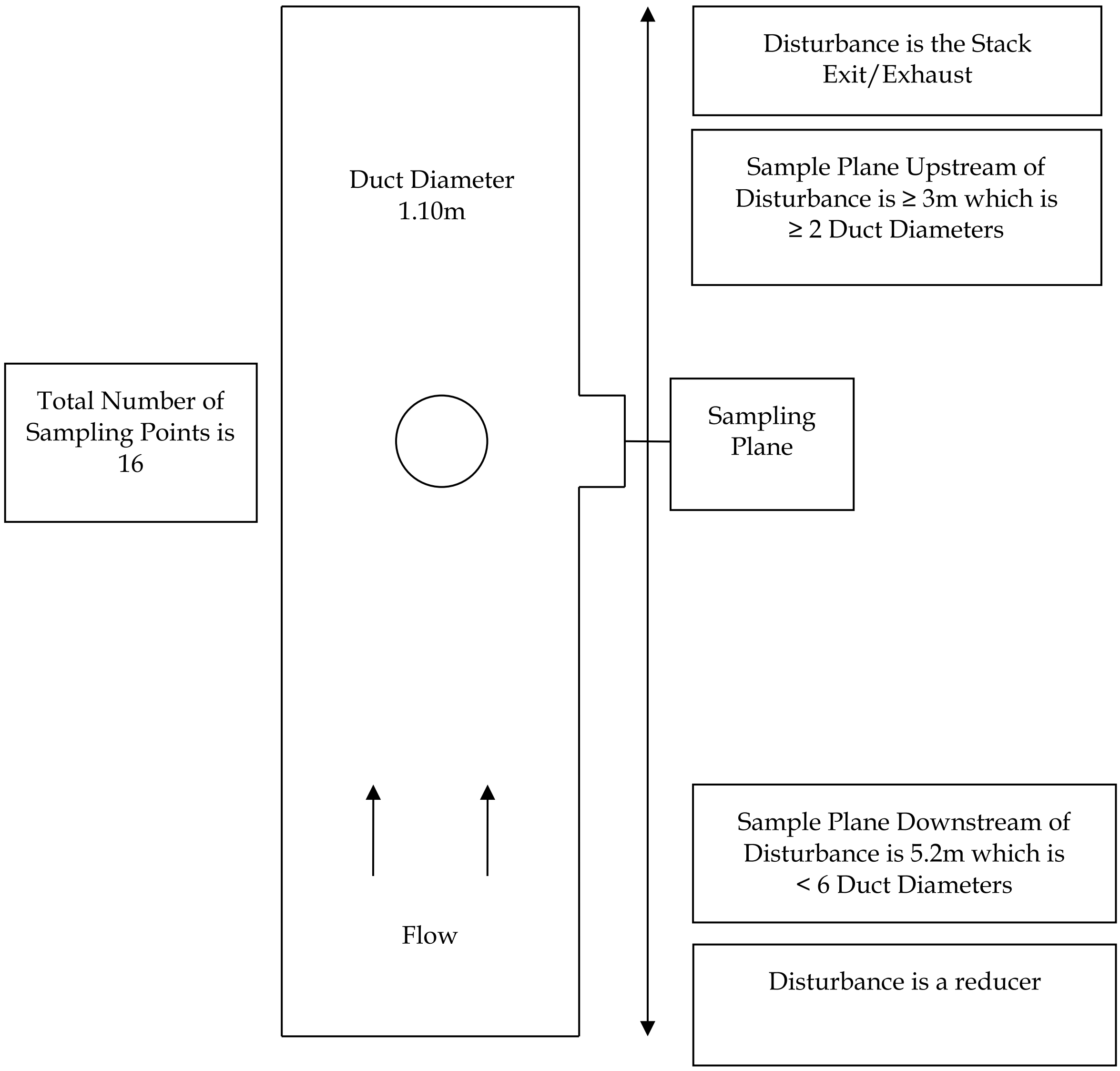
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

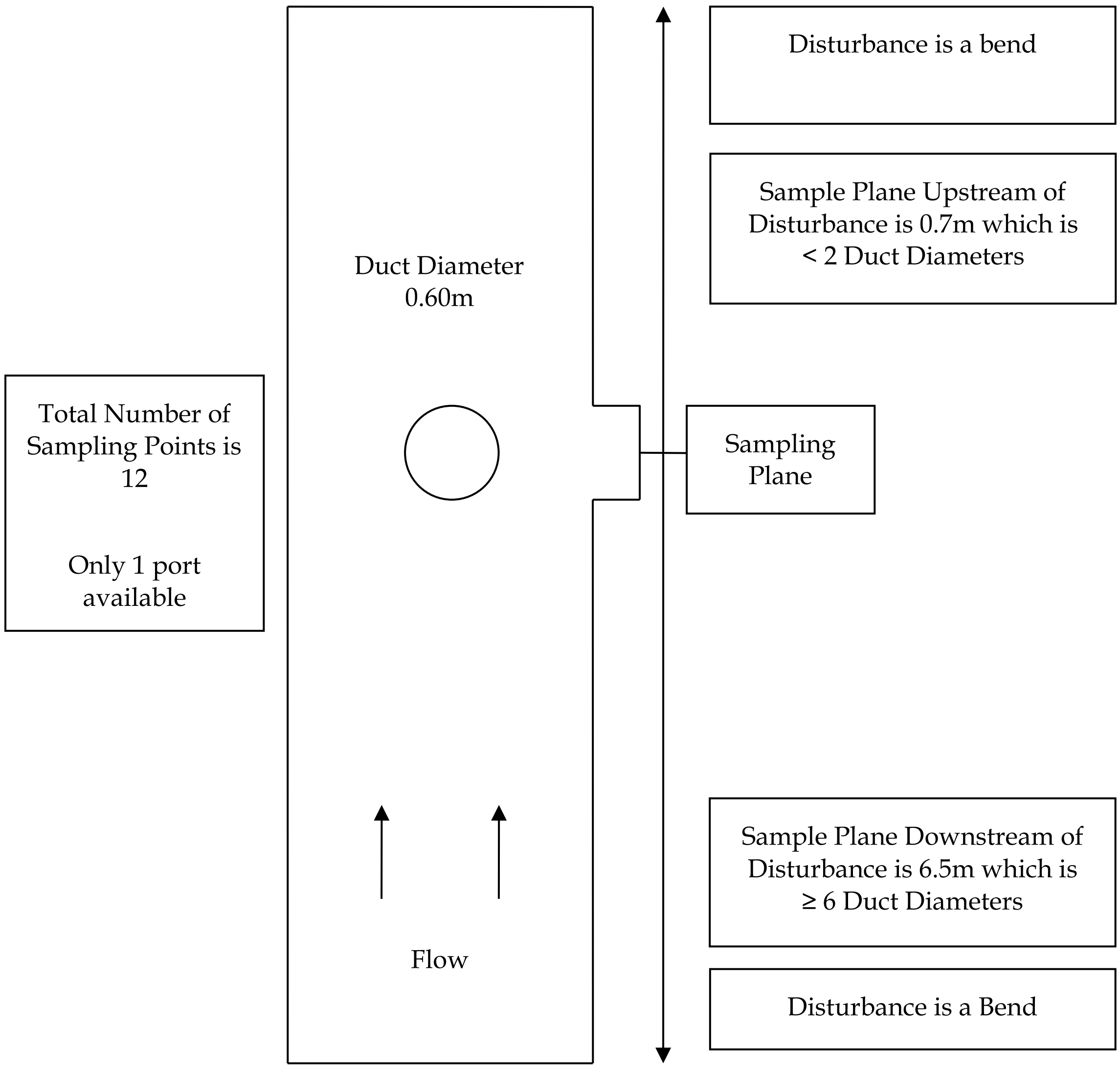


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

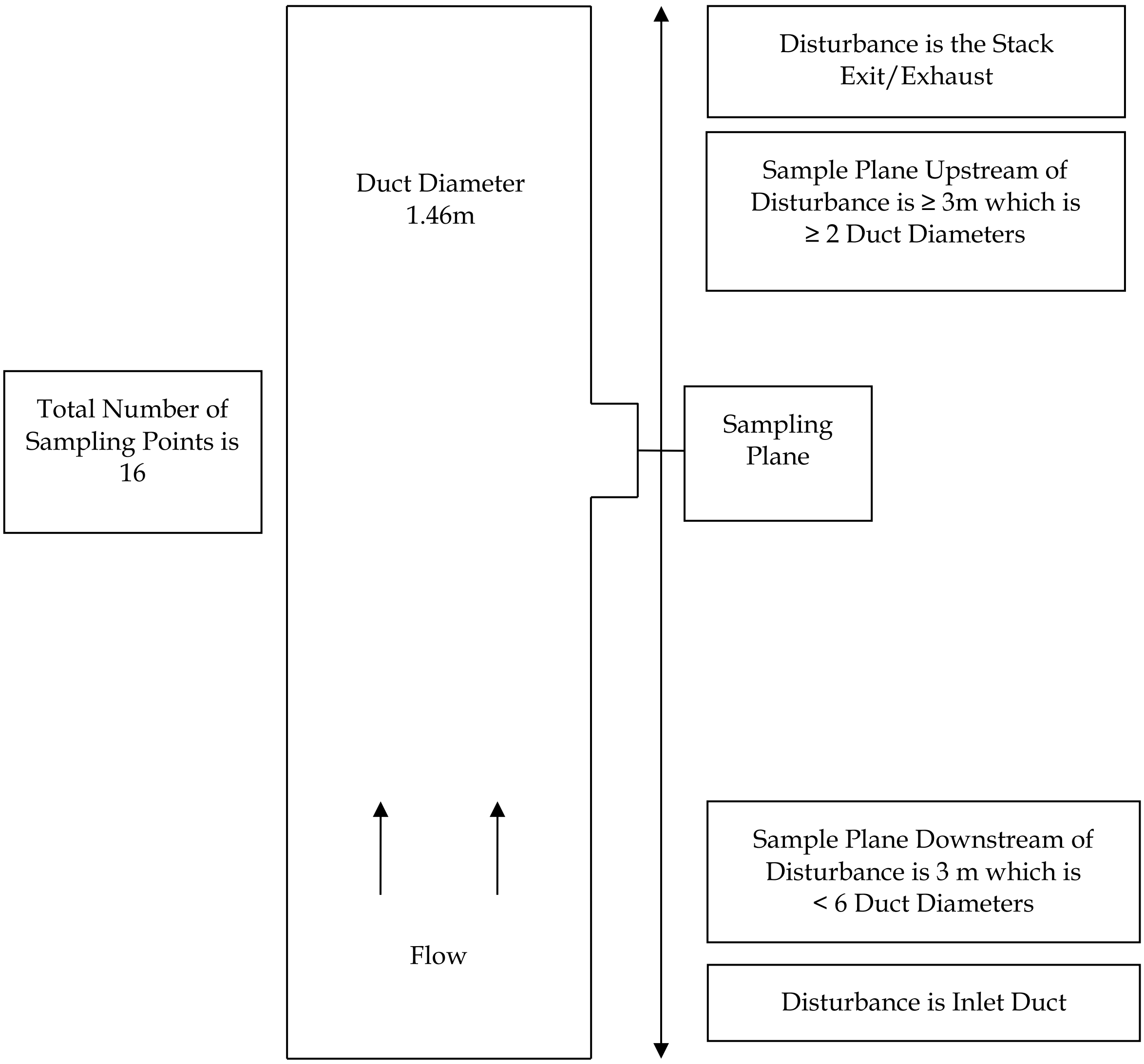
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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 3, 2020-2021

Shoalhaven Starches Pty Ltd

Bomaderry, NSW

Project No.: 7116/S25548B/20

Dates of Survey: 18 & 24 November, and 7 December 2020

Date of Report Issue: 21 December, 2020

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

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: 7116/S25548B/20

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

DATE OF REPORT ISSUE: 21 DECEMBER, 2020

P W STEPHENSON

J WEBER

M KIMBER

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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 an have EPA Identification No., was also sampled.

The quarters are defined as below:

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

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

2 MONITORING REQUIREMENTS

2.1 ENVIRONMENT PROTECTION LICENCE 883 (ISSUED 18 DECEMBER 2015)

2.1.1 CONDITION P1 LOCATION OF MONITORING/DISCHARGE POINTS AND AREAS

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

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

EPL ID. No.	Location	Odour Samples TM OM-7/8	Frequency as per M2.2 EPL 883
8	No. 1 Gluten Dryer	1	Quarterly
9	No. 2 Gluten/Starch Dryer*	1	Quarterly
10	No. 3 Gluten Dryer	1	Quarterly
11	No. 4 Gluten Dryer	1	Quarterly
12	No. 1 Starch Dryer	1	Quarterly
13	No. 3 Starch Dryer	1	Quarterly
14	No. 4 Starch Dryer	1	Quarterly
16	CO_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 (DDG Evap #1,2&3)	1	Quarterly
39A	Inlet Pipe to Biofilters A & B (DDG Evap #4)	1	Quarterly
40	Outlet of Biofilter A	2	Quarterly
41	Outlet of Biofilter B	2	Quarterly
42	Boiler No.4	1	Quarterly
44	Fermenter	1	Quarterly
45	Boiler No.2	1	Quarterly
46	DDG Pellet Plant Stack	1	Quarterly
47	No. 5 Starch Dryer	1	Quarterly

2.1.2 CONDITION M2 – MONITORING CONCENTRATION OF DISCHARGED POLLUTANTS

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

Key to Tables 2.2 to 2.5:

%	=	percent
°C	=	degrees Celsius
g/g.mole	=	grams per gram mole
kg/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.

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

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

4 ODOUR EMISSION TEST RESULTS

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

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

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

Appendix C details calibration of instruments used to take measurements.

Appendix D shows sample locations.

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

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

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

Key: ou = odour units

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

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

Key: ou = odour units

5 CONCLUSIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

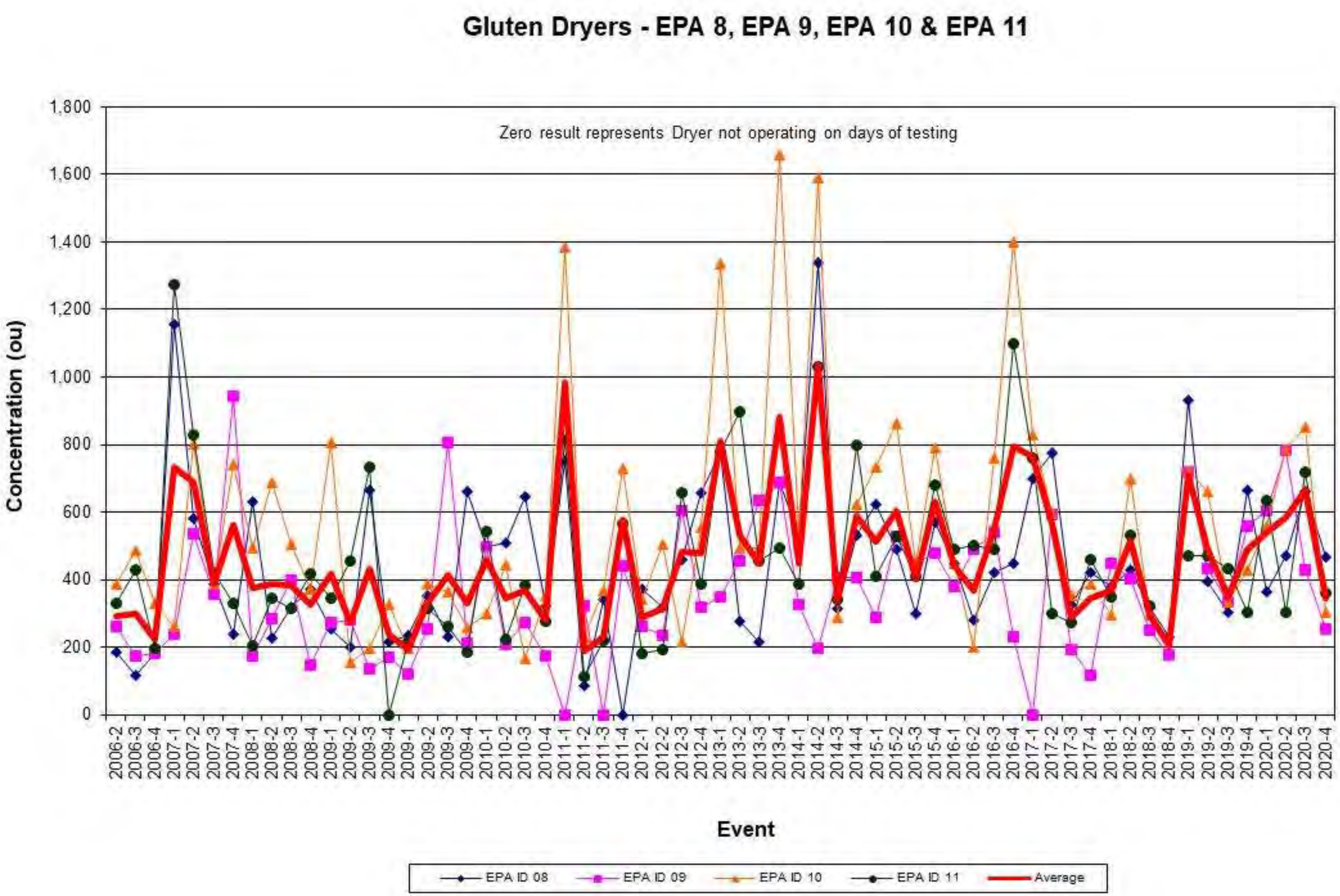


FIGURE 5-2 ODOUR EMISSION CONCENTRATIONS, STARCH DRYERS NO.1, 3 & 4 (EPA 12, 13 &14)

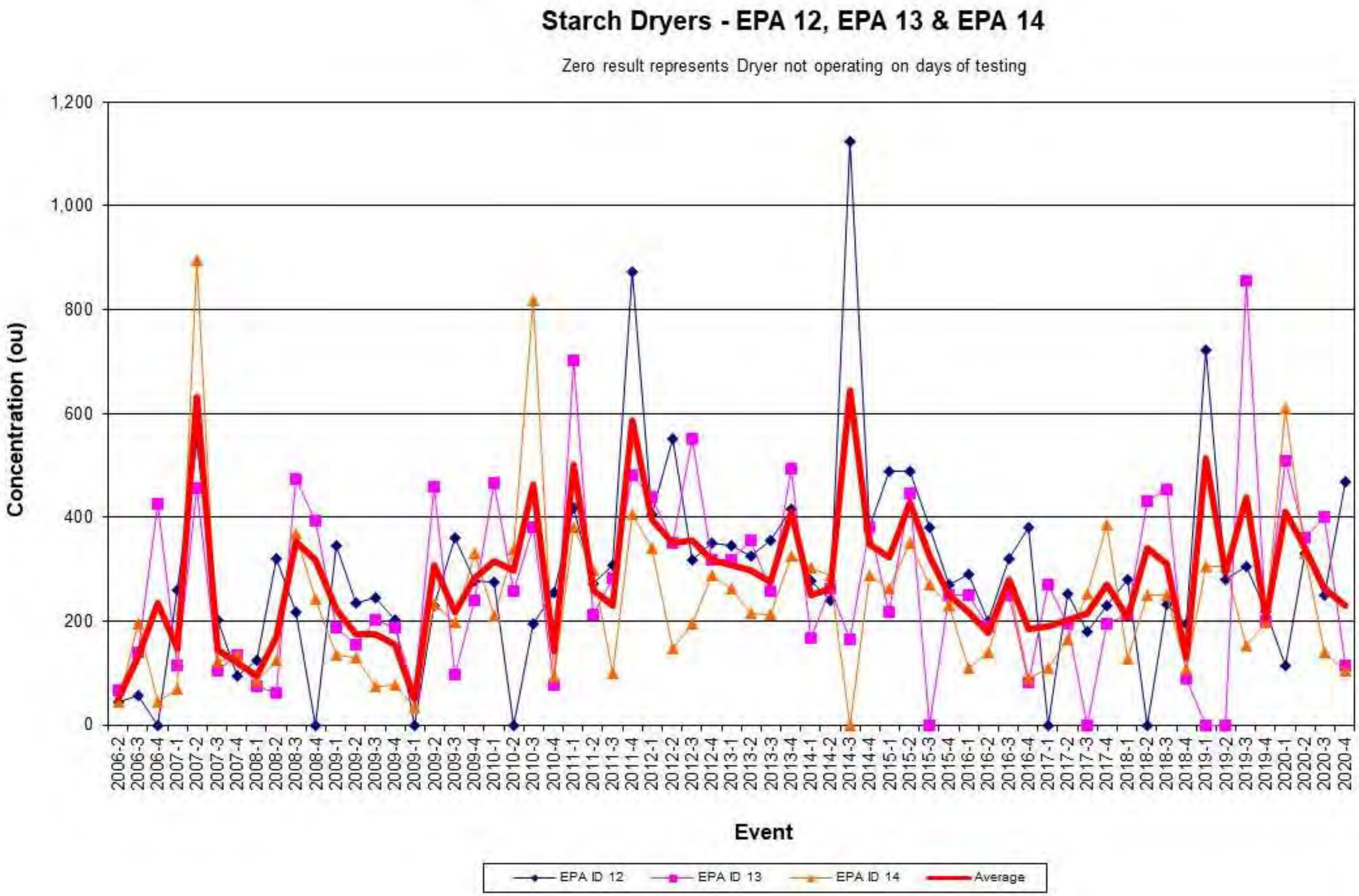


FIGURE 5-3 ODOUR EMISSION CONCENTRATIONS, STARCH DRYER 5 (EPA 47)

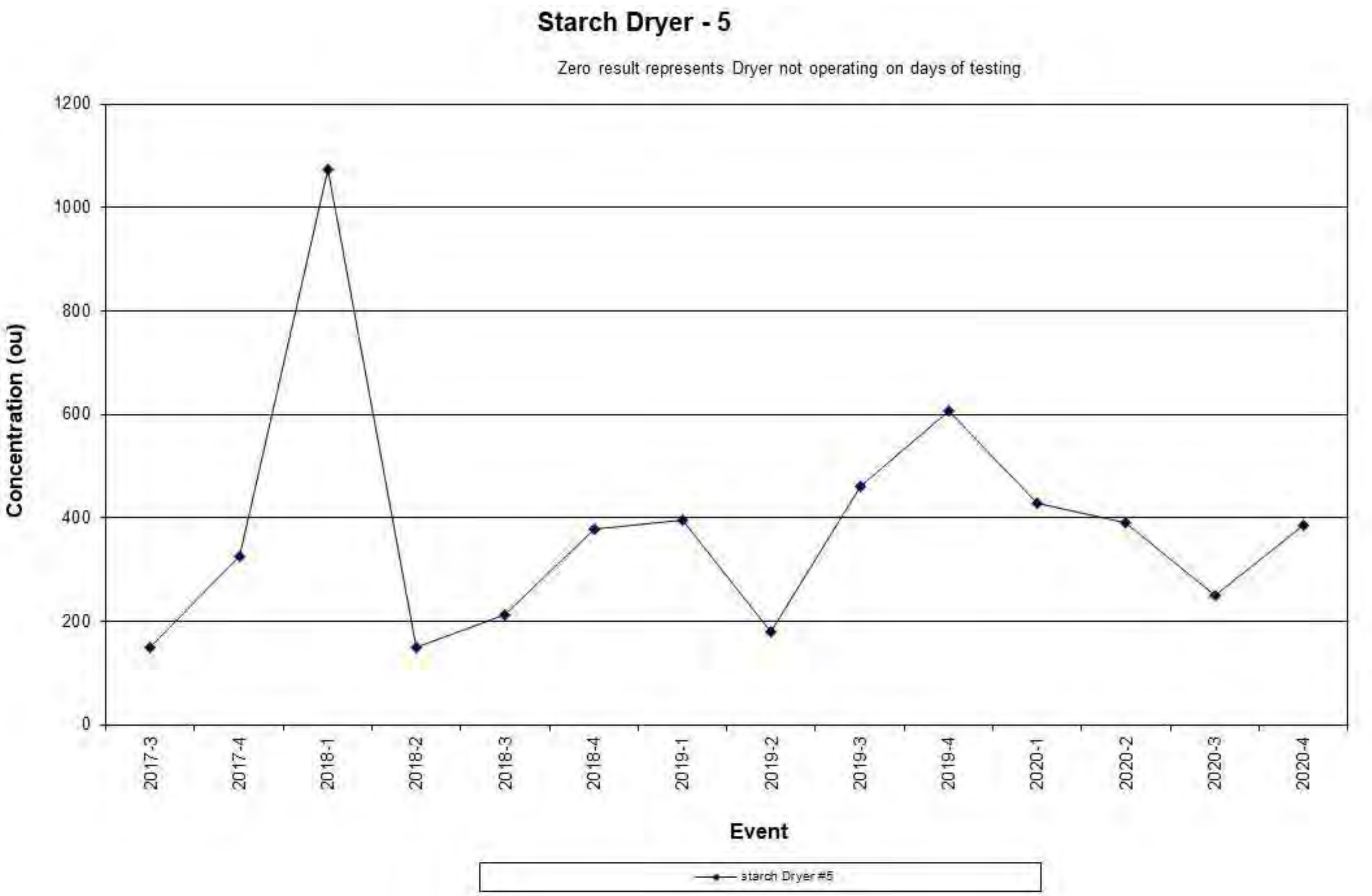


FIGURE 5-4 ODOUR EMISSION CONCENTRATIONS, FERMENTERS (EPA 44)

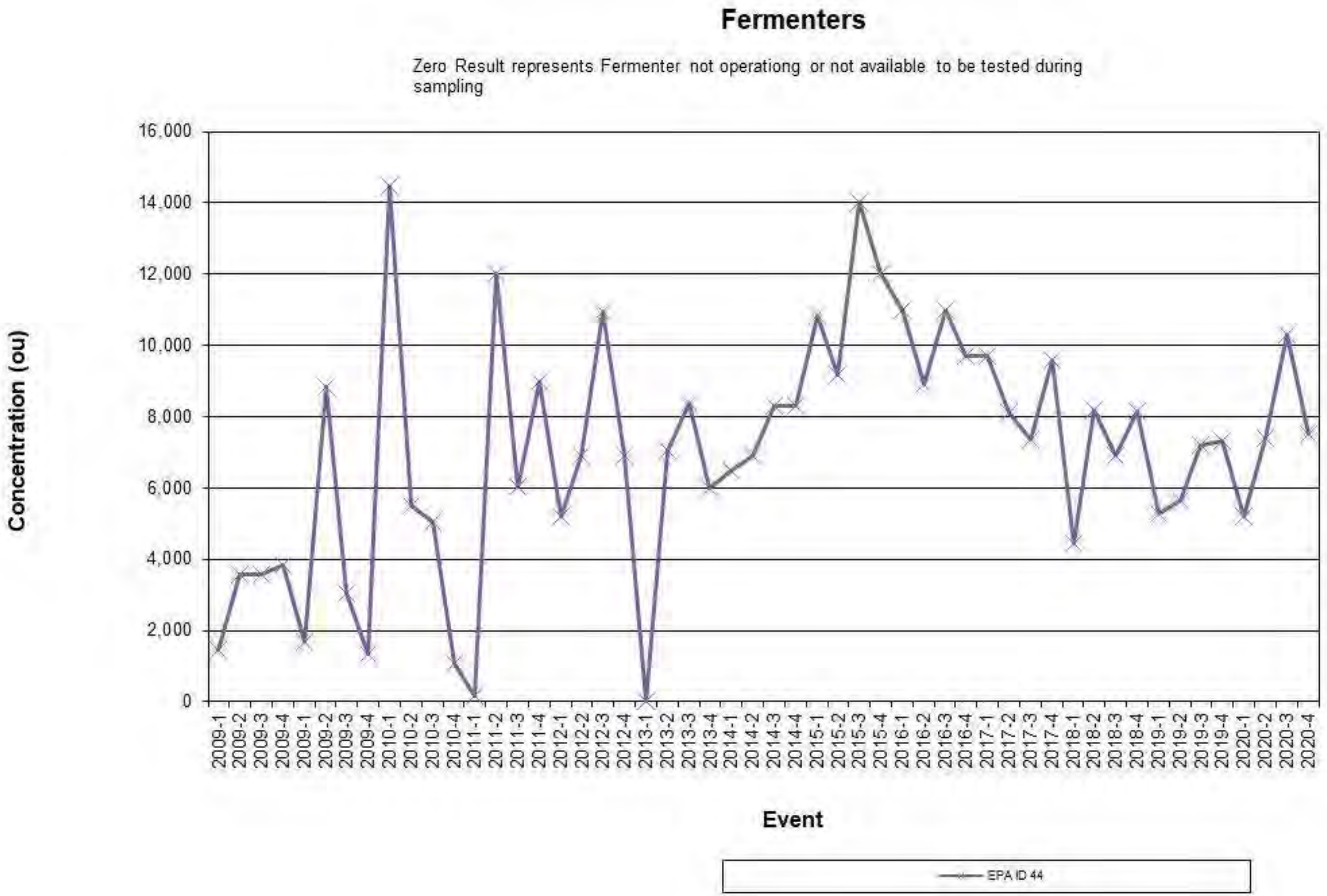


FIGURE 5-5 ODOUR EMISSION CONCENTRATIONS, CARBON DIOXIDE SCRUBBER OUTLET (EPA 16)

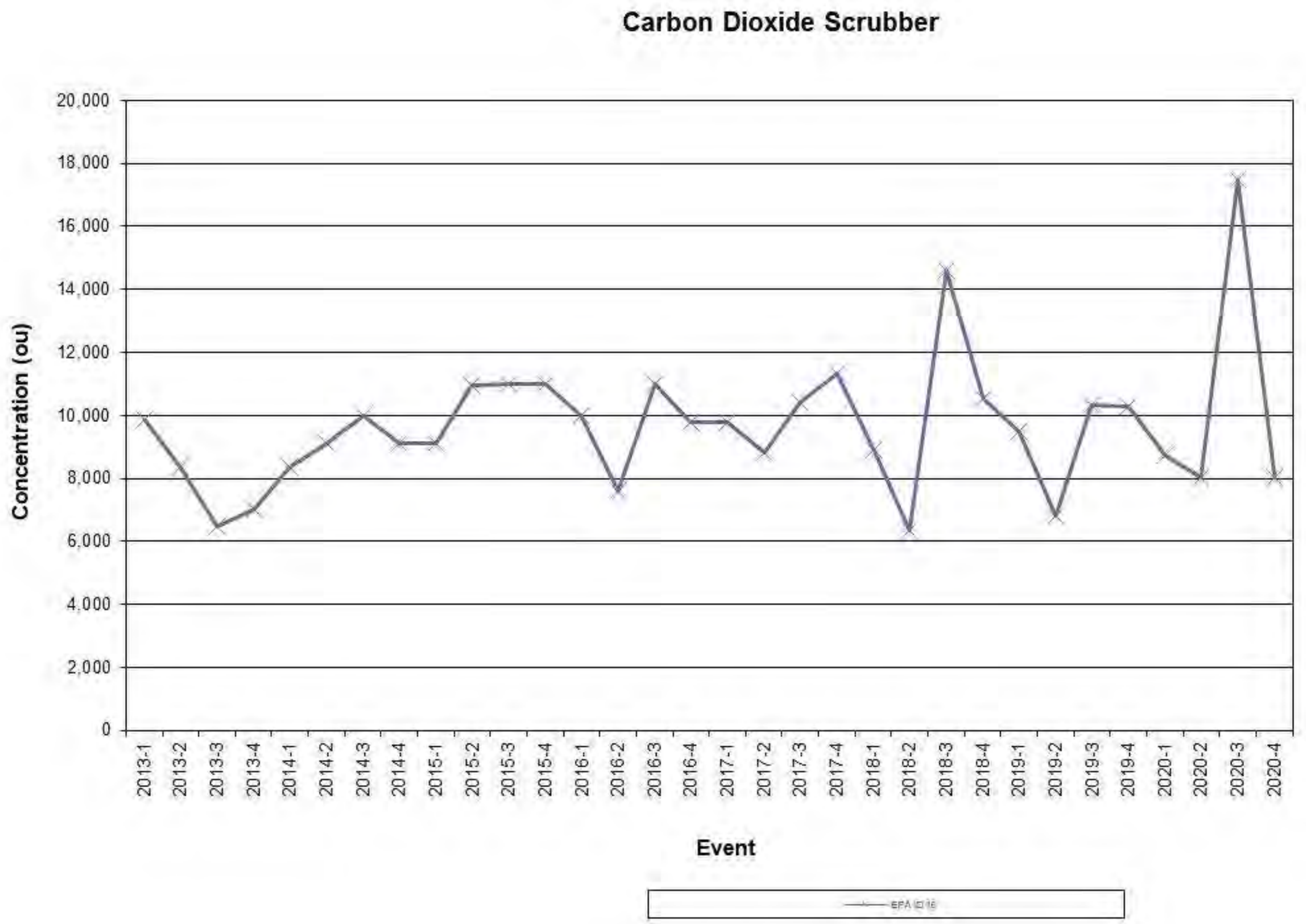


FIGURE 5-6 ODOUR EMISSION CONCENTRATIONS, COMBINED BOILER 5 & 6 STACK (EPA 35)

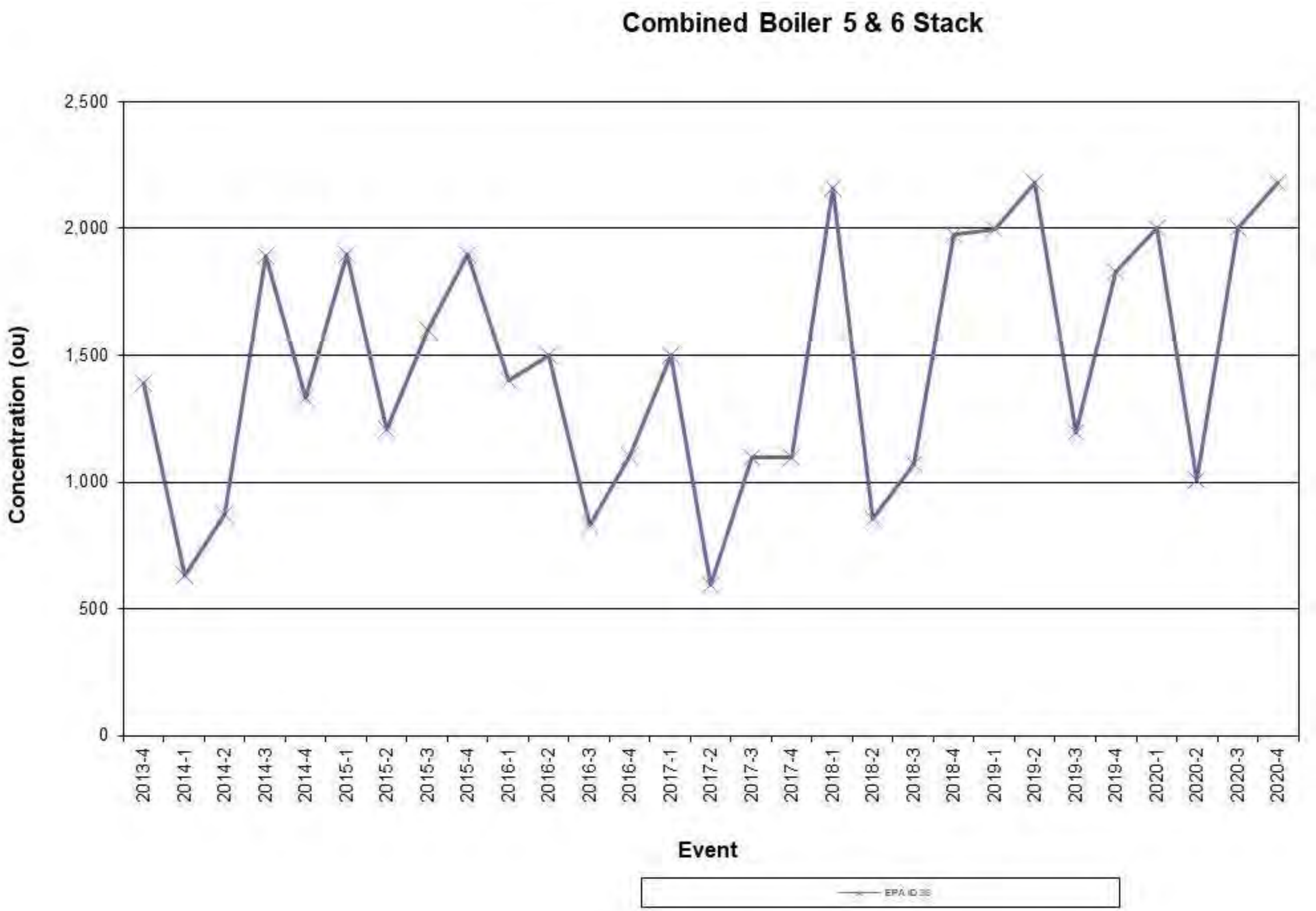


FIGURE 5-7 ODOUR EMISSION CONCENTRATIONS, BOILER 4 STACK (EPA 42)

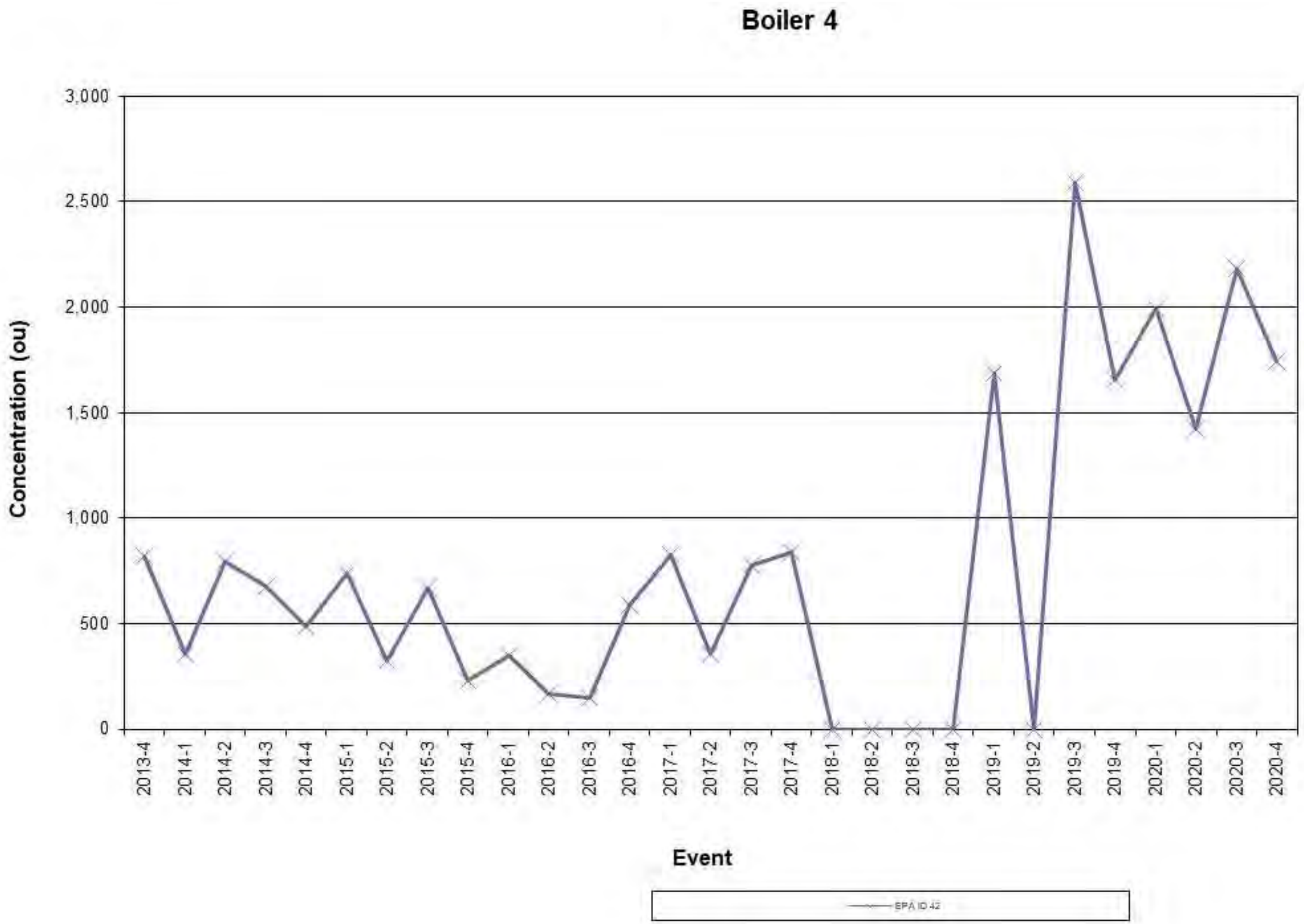


FIGURE 5-8 ODOUR EMISSION CONCENTRATIONS, BOILER 2 STACK (EPA 45)

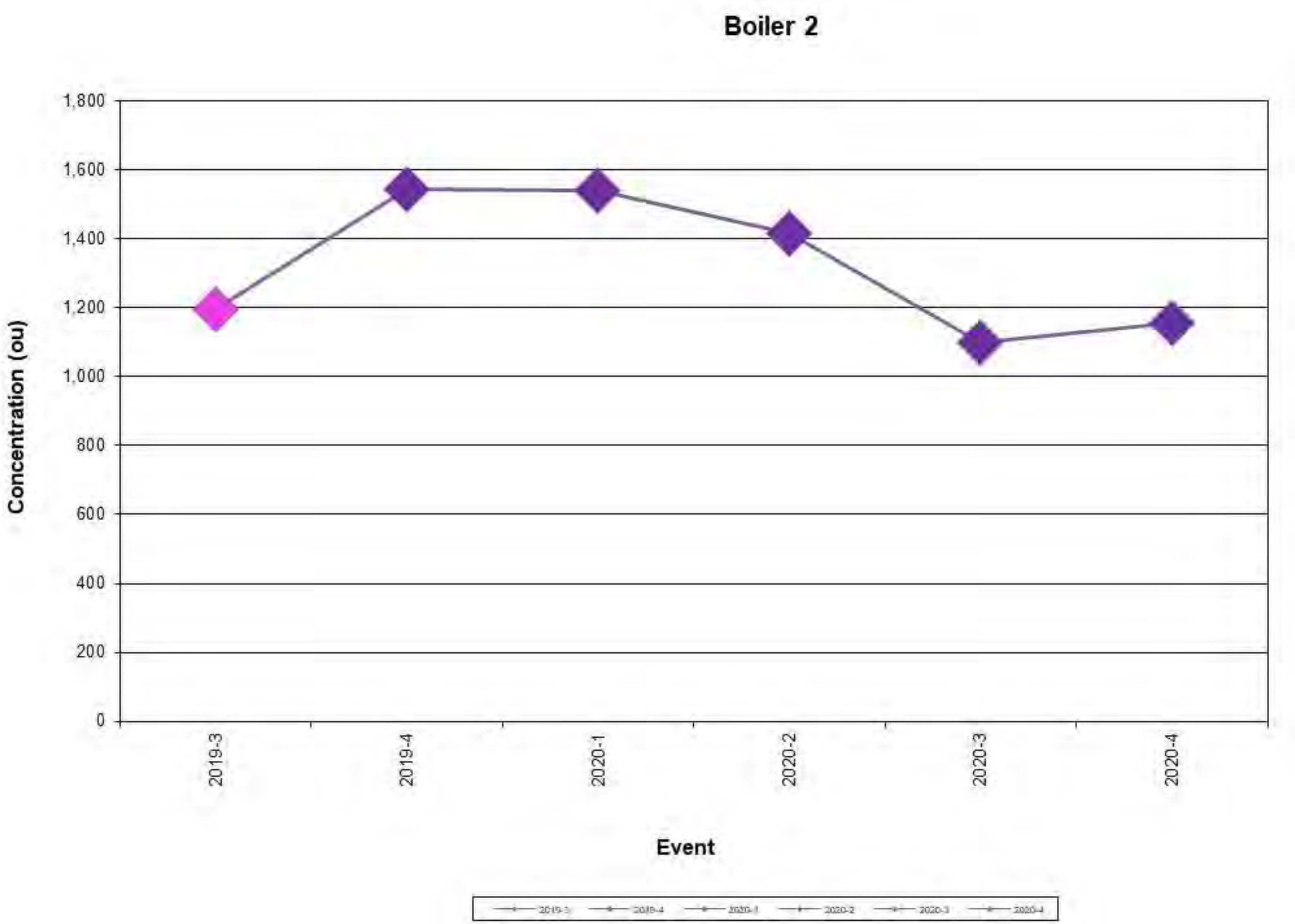


FIGURE 5-9 ODOUR EMISSION CONCENTRATIONS, BIOFILTERS (EPA 39, 40, 41)

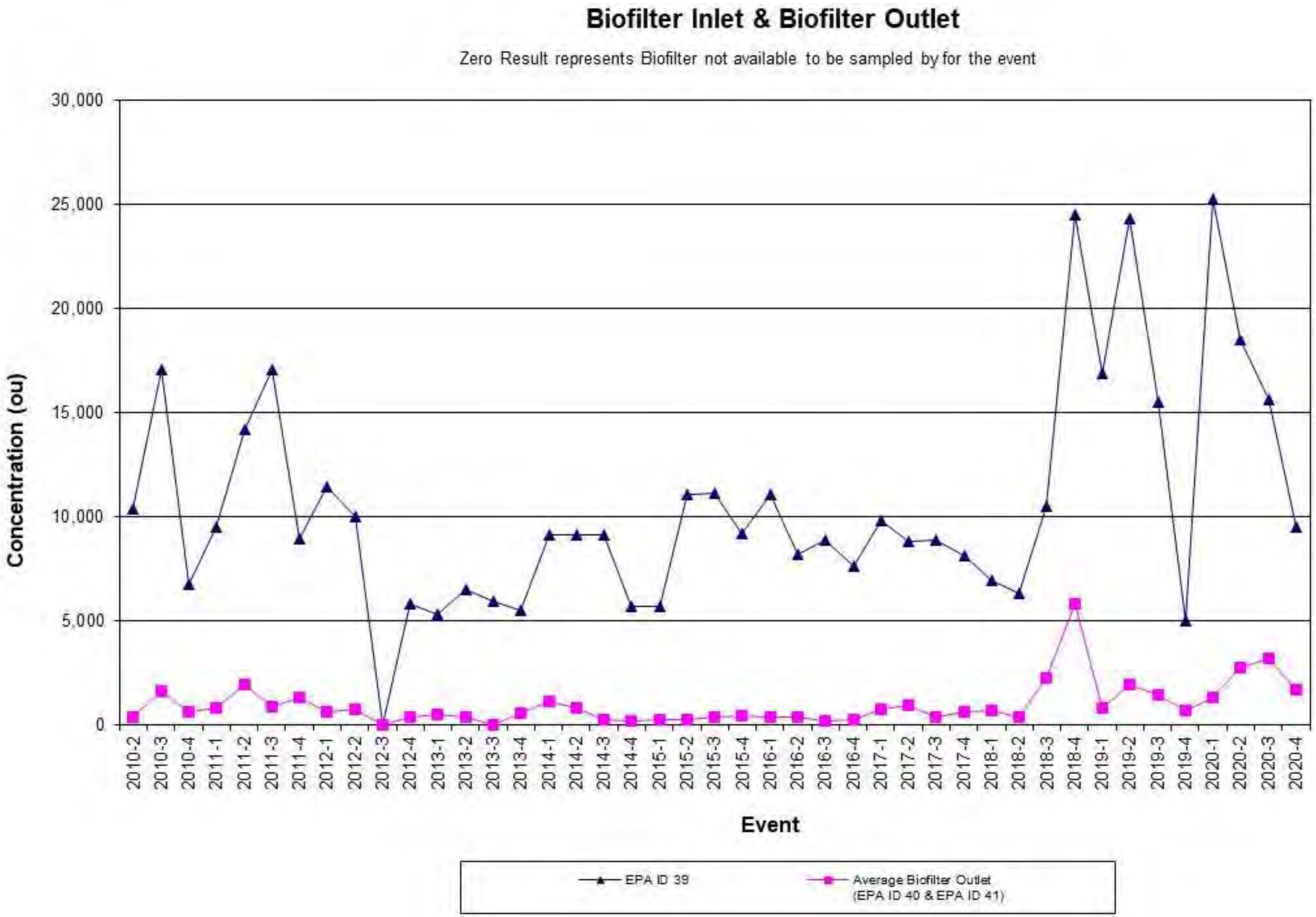


FIGURE 5-10 ODOUR EMISSION CONCENTRATIONS, DDG PELLET PLANT (EPA 46)

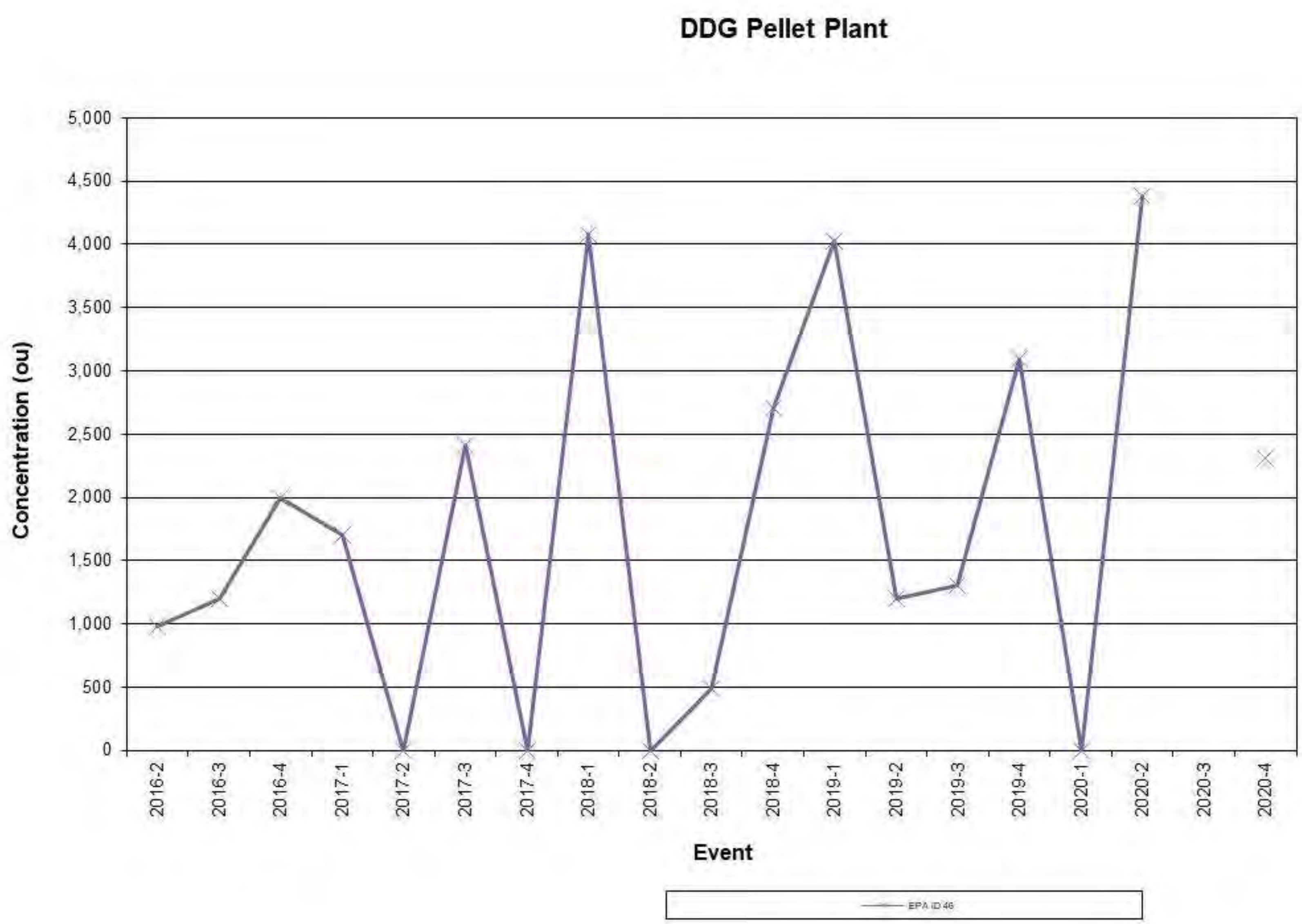


FIGURE 5-11 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 1

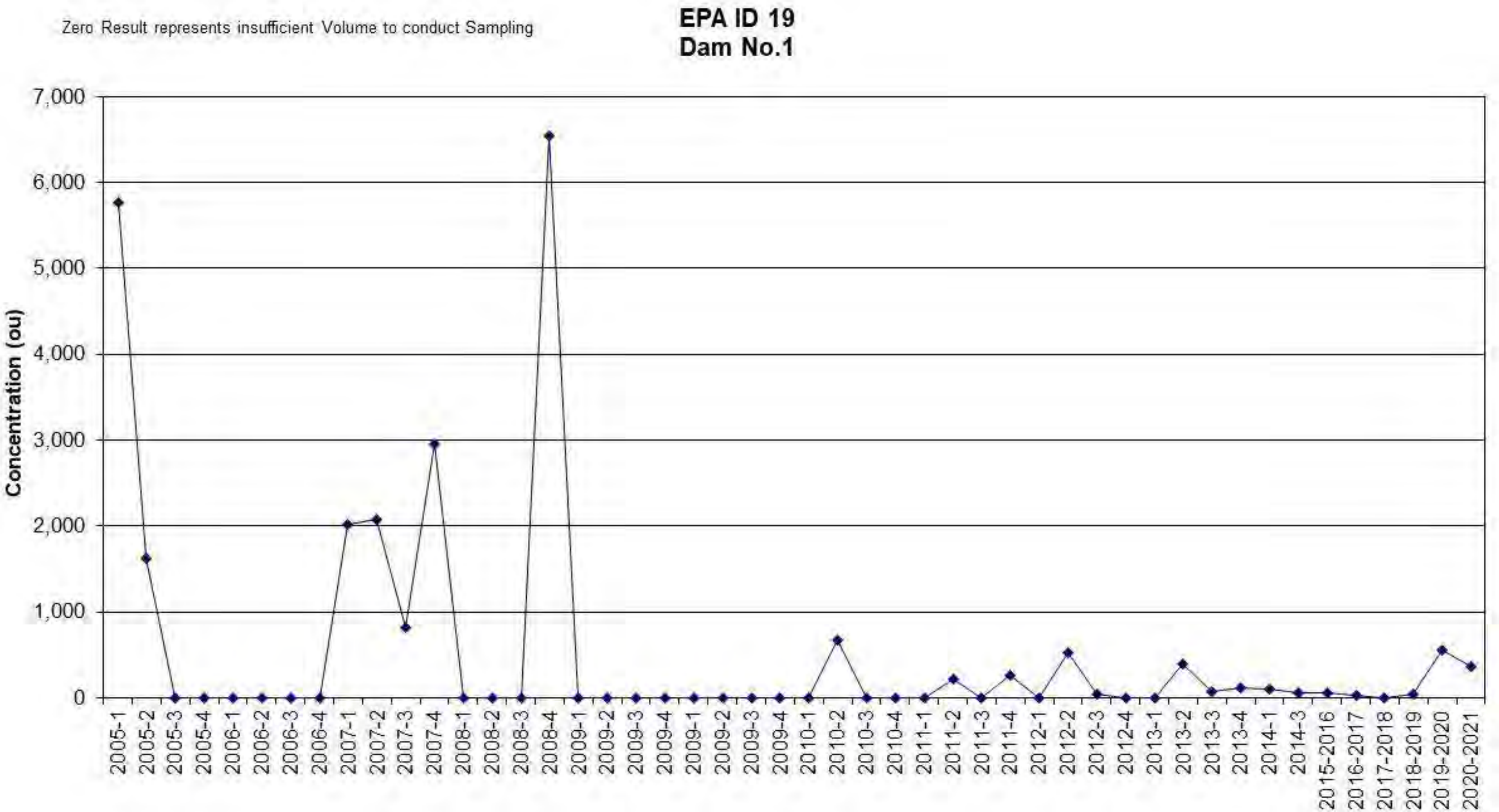


FIGURE 5-12 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 3

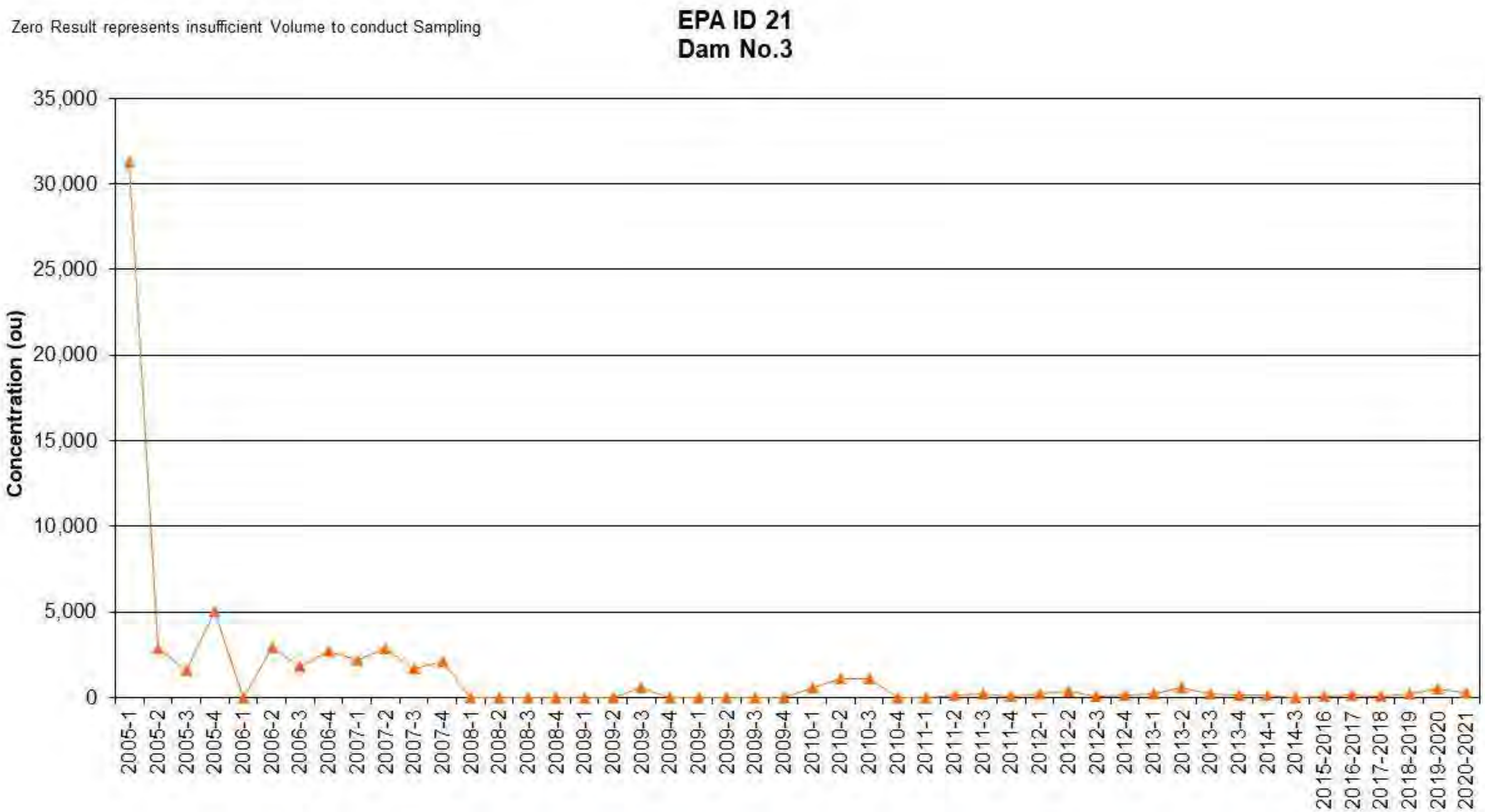


FIGURE 5-13 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 5

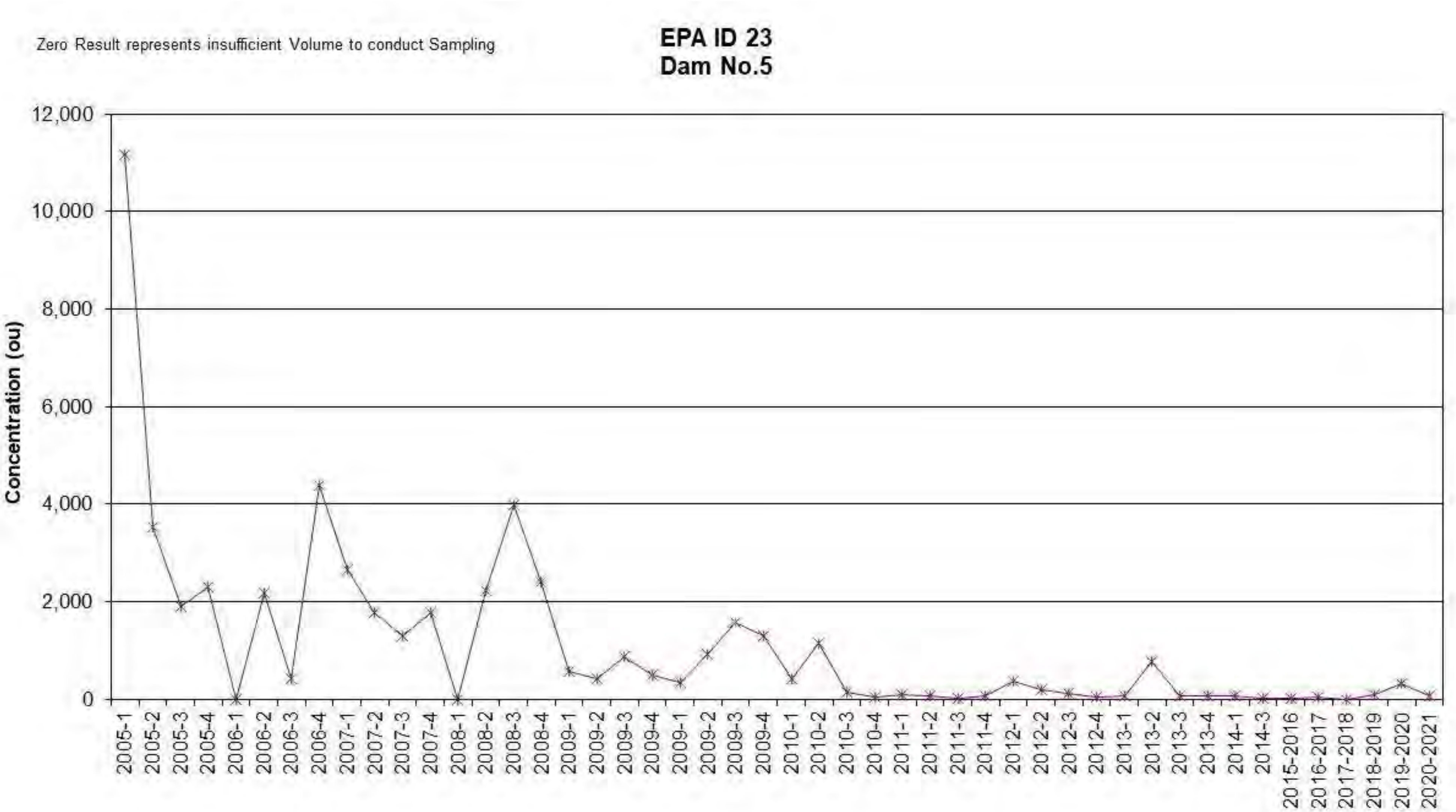


FIGURE 5-14 ODOUR EMISSION CONCENTRATIONS, EFFLUENT STORAGE DAM 6

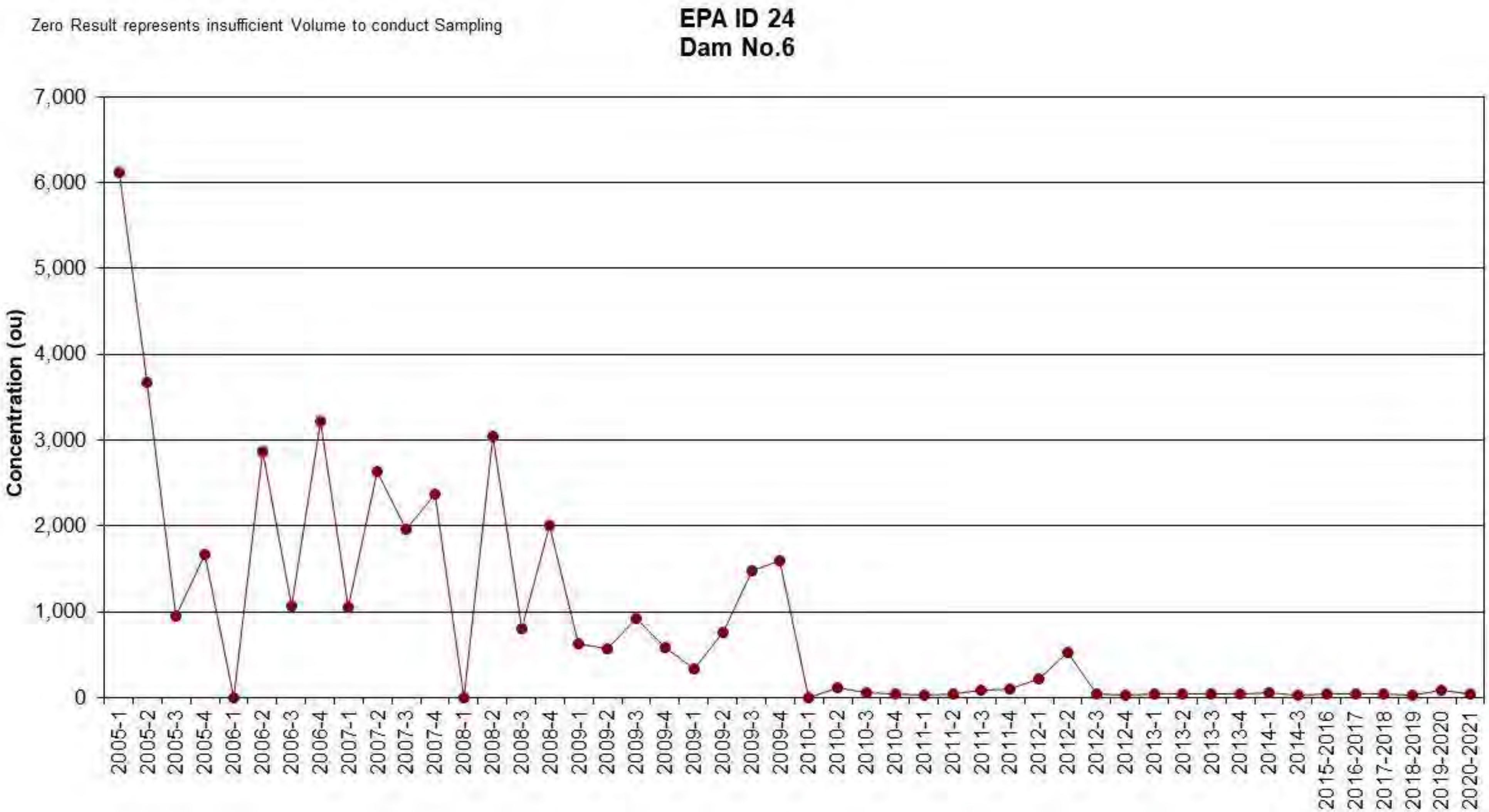
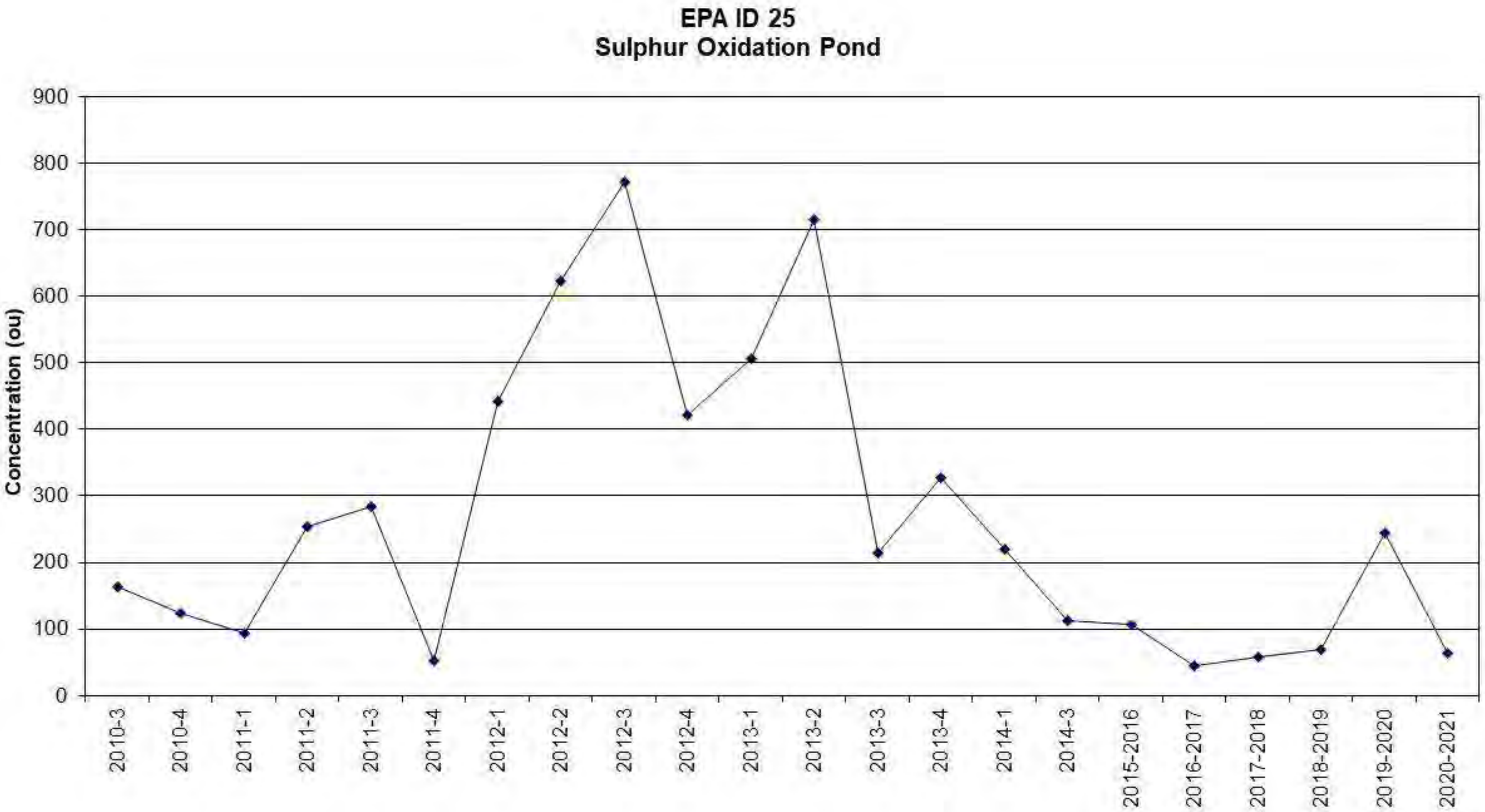


FIGURE 5-15 ODOUR EMISSION CONCENTRATIONS, SULPHUR OXIDATION POND



6 TEST METHODS

6.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

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

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

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

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

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

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

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows could be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows could be different from the other two flows and is able to: ▪ 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
^{o}C	=	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 $0^{0}C$ and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at $0^{o}C$ 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	**7116**			
Project Name	**Shoalhaven Starches**			
Test Location	**EPA ID 8 Gluten Dryer 1***	**EPA ID 9 Gluten Dryer 2**	**EPA ID 10 Gluten Dryer 3**	**EPA ID 11 Gluten Dryer 4**
Date	18-Nov-20	18-Nov-20	18-Nov-20	18-Nov-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:07	13:48	14:46	14:26
Flow Stop Time (hrs)	12:24	14:06	15:57	14:48
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	65.3	63.0	73.5	74.3
Stack Cross-Sectional area (m^2)	1.431	1.094	4.410	2.310
Average Stack Gas Velocity (m/s)	13.7	17.0	11.5	15.7
Actual Gas Flow Volume (am^3/min)	1,179	1,114	3,040	2,173
Total Normal Gas Flow Volume (m^3/min)	915	794	2,293	1,633
Total Normal Gas Flow Volume (m^3/s)	15.2	13.2	38.2	27.2
Total Stack Pressure (kPa)	102.5	93.4	102.8	102.5
Moisture Content (% by volume)	5.01	4.77	5.69	5.57
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/m^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	5446	5447	5448	5449
SEMA Number	728138	728139	728140	728141
Sample Start Time (hrs)	12:58	13:53	14:57	14:38
Sample Finish Time (hrs)	13:08	14:06	15:07	14:48
Odour Concentration (As Received) (ou)	468	254	302	359
Odour Concentration (Final) (ou)	**470**	**250**	**300**	**360**
Normal MOER (As Received) (ou m^3/s)	7,136	3,362	11,540	9,768
Normal MOER (Final) (ou m^3/s)	7,136	3,362	11,540	9,768
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

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

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

Emission Test Results				
Project Number	**7116**			
Project Name	**Shoalhaven Starches**			
Test Location	**EPA ID 12 Starch Dryer 1**	**EPA ID 13 Starch Dryer 3**	**EPA ID 14 Starch Dryer 4**	**EPA ID 47 Starch Dryer 5**
Date	18-Nov-20	18-Nov-20	18-Nov-20	24-Nov-20
	Dry			
Run	1			
Method	TM-1, TM-2 & TM-22			
Flow Start Time (hrs)	12:47	15:26	15:25	13:19
Flow Stop Time (hrs)	13:09	15:48	16:47	13:40
Inlet/Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	41.4	40.1	39.5	64.4
Stack Cross-Sectional area (m^2)	2.250	1.000	1.000	4.524
Average Stack Gas Velocity (m/s)	7.3	20.2	21.0	14.9
Actual Gas Flow Volume (am^3/min)	980	1,214	1,258	4,047
Total Normal Gas Flow Volume (m^3/min)	812	1,004	1,046	3,020
Total Normal Gas Flow Volume (m^3/s)	13.5	16.7	17.4	50.3
Total Stack Pressure (kPa)	102.47	102.53	102.54	101.11
Moisture Content (% by volume)	5.75	6.22	5.99	7.61
Molecular Weight Dry Stack Gas (g/gmole)	28.8	28.8	28.8	28.8
Dry Gas Density (kg/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	5445	5450	5451	5457
SEMA Number	728137	728142	728143	728148
Sample Start Time (hrs)	12:59	15:38	16:37	13:30
Sample Finish Time (hrs)	13:09	15:48	16:47	13:40
Odour Concentration (As Received) (ou)	470	116	106	386
Odour Concentration (Final) (ou)	**470**	**120**	**110**	**390**
Normal MOER (As Received) (ou m^3/s)	6,358	1,942	1,848	19,428
Normal MOER (Final) (ou m^3/s)	6,358	1,942	1,848	19,428
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days	2 days
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

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

Emission Test Results			
Project Number	**7116**		
Project Name	**Shoalhaven Starches**		
Test Location	**EPA ID 35 Boilers 5&6**	**EPA ID 42 Boiler 4**	**EPA ID 45 Boiler 2**
Date	24-Nov-20	24-Nov-20	24-Nov-20
	Dry		
Run	1		
Method	TM-1, TM-2 & TM-22		
Flow Start Time (hrs)	11:38	10:43	10:00
Flow Stop Time (hrs)	12:00	11:05	10:20
Inlet/Exhaust	Exhaust	Exhaust	Exhaust
Stack Temperature (^{o}C)	135.2	164.6	214.0
Stack Cross-Sectional area (m^2)	3.142	1.057	0.950
Average Stack Gas Velocity (m/s)	16.5	18.7	8.3
Actual Gas Flow Volume (am^3/min)	3,117.3	1,187.5	475.9
Total Normal Gas Flow Volume (m^3/min)	1,973.7	702.2	254.5
Total Normal Gas Flow Volume (m^3/s)	32.895	11.704	4.242
Total Stack Pressure (kPa)	101.11	101.23	101.23
Moisture Content (% by volume)	5.15	5.15	4.54
Molecular Weight Dry Stack Gas (g/gmole)	30.080	29.840	30.080
Dry Gas Density (kg/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	5455	5454	5453
SEMA Number	728146	728145	728144
Sample Start Time (hrs)	11:50	10:55	10:10
Sample Finish Time (hrs)	12:00	11:05	10:20
Odour Concentration (As Received) (ou)	2,181	1,742	1,156
Odour Concentration (Final) (ou)	**2,200**	**1,700**	**1,200**
Normal MOER (As Received) (ou m^3/s)	71,745	20,388	4,904
Normal MOER (Final) (ou m^3/s)	71,745	20,388	4,904
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days	2 days
Calculations entered by	JW	JW	JW
Calculations checked by	PWS	PWS	PWS

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

Emission Test Results		
Project Number	**7116**	
Project Name	**Shoalhaven Starches**	
Test Location	**EPA ID 44 Fermenter 16**	**EPA ID 16 CO_2 Scrubber outlet**
Date	18-Nov-20	18-Nov-20
	Dry	
Run	1	
Method	TM-1,TM-2 & TM-22	
Flow Start Time (hrs)	10:36	11:02
Flow Stop Time (hrs)	10:57	11:22
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (^oC)	32.2	28.4
Stack Cross-Sectional area (m^2)	0.071	0.196
Average Stack Gas Velocity (m/s)	6.1	7.6
Actual Gas Flow Volume (am^3/min)	25.7	90
Total Normal Gas Flow Volume (m^3/min)	22.4	79
Total Normal Gas Flow Volume (m^3/s)	0.373	1.320
Total Stack Pressure (kPa)	102.51	102.51
Moisture Content (% by volume)	3.80	3.45
Molecular Weight Dry Stack Gas (g/gmole)	29.620	31.204
Dry Gas Density (kg/m^3)	1.32	1.39
Oxygen (%)	0.5	0.1
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5442	5443
SEMA Number	728134	728135
Sample Start Time (hrs)	10:47	11:12
Sample Finish Time (hrs)	10:57	11:22
Odour Concentration (As Received) (ou)	7,516	8,035
Odour Concentration (Final) (ou)	**7,500**	**8,000**
Normal MOER (As Received) (ou m^3/s)	2,804	10,609
Normal MOER (Final) (ou m^3/s)	2,804	10,609
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample storage prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

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

Emission Test Results		
Project Number	**7116**	
Project Name	**Shoalhaven Starches**	
Test Location	**EPA ID 39 Biofilter Inlet DDG Dryers 1, 2 & 3**	**EPA ID 39A Biofilter Inlet DDG Dryer 4**
Date	24-Nov-20	24-Nov-20
	Dry	Dry
Run	1	1
Method	TM-1,TM-2 & TM-22	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	14:50	14:50
Flow Stop Time (hrs)	14:50	15:12
Inlet/Exhaust	Exhaust	Exhaust
Stack Temperature (°C)	41.8	30.1
Stack Cross-Sectional area (m^2)	0.283	0.049
Average Stack Gas Velocity (m/s)	13.6	8.5
Actual Gas Flow Volume (am^3/min)	231	25
Total Normal Gas Flow Volume (m^3/min)	178	22
Total Normal Gas Flow Volume (m^3/s)	3.0	0.4
Total Stack Pressure (kPa)	96.42	101.39
Moisture Content (% by volume)	6.90	3.93
Molecular Weight Dry Stack Gas (g/gmole)	28.836	28.836
Dry Gas Density (kg/m^3)	1.287	1.287
Oxygen (%)	20.9	20.9
Analysis	**Odour**	**Odour**
Method	**AS4323.3**	**AS4323.3**
ORLA Number	5462	5463
SEMA Number	728153	728154
Sample Start Time (hrs)	14:16	15:02
Sample Finish Time (hrs)	14:26	15:12
Odour Concentration (As Received) (ou)	9,495	70,388
Odour Concentration (Final) (ou)	**9,500**	**70,400**
Normal MOER (As Received) (ou m^3/s)	28,146	25,522
Normal MOER (Final) (ou m^3/s)	28,146	25,522
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit	No Limit
Sample Storage prior to disposal	2 days	2 days
Calculations entered by	JW	JW
Calculations checked by	PWS	PWS

TABLE A-6 EMISSION TEST RESULTS DDG PELLET PLANT

Emission Test Results	
Project Number	**7116**
Project Name	**Shoalhaven Starches**
Test Location	**EPA ID 46 DDG Pellet Plant Stack**
Date	24-Nov-20
	Dry
Run	1
Method	TM-1,TM-2 & TM-22
Flow Start Time (hrs)	11:24
Flow Stop Time (hrs)	11:47
Inlet/Exhaust	Exhaust
Stack Temperature (^oC)	45.0
Stack Cross-Sectional area (m^2)	1.674
Average Stack Gas Velocity (m/s)	12.5
Actual Gas Flow Volume (am^3/min)	1,255.6
Total Normal Gas Flow Volume (m^3/min)	1,051.8
Total Normal Gas Flow Volume (m^3/s)	17.530
Total Stack Pressure (kPa)	101.07
Moisture Content (% by volume)	2.20
Molecular Weight Dry Stack Gas (g/gmole)	28.836
Dry Gas Density (kg/m^3)	1.29
Oxygen (%)	20.9
Analysis	**Odour**
Method	**AS4323.3**
ORLA Number	5456
SEMA Number	728147
Sample Start Time (hrs)	11:24
Sample Finish Time (hrs)	11:47
Odour Concentration (As Received) (ou)	2,307
Odour Concentration (Final) (ou)	**2,300**
Normal MOER (As Received) (ou m^3/s)	40,442
Normal MOER (Final) (ou m^3/s)	40,442
Mass Odour Emission Rate Limit (ou m^3/s)	No Limit
Sample Storage prior to disposal	2 days
Calculations entered by	JW
Calculations checked by	PWS

TABLE A- 7 EMISSION TEST RESULTS – BIOFILTER OUTLETS

Emission Test Results				
Project Number	7116			
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	24-Nov-20	24-Nov-20	24-Nov-20	24-Nov-20
	Dry	Dry	Dry	Dry
Run	1	1	1	1
Method	TM-2 & TM-22			
Sample Start Time (hrs)	15:37	16:32	15:32	16:15
Sample Stop Time (hrs)	15:47	16:42	15:42	16:25
Inlet/Exhaust	Exhaust			
Stack Temperature (°C)	39.1	37.8	39.5	36.4
Proportion of Inlet air flow	**0.26**	**0.24**	**0.24**	**0.26**
Calculated from inlet flow Actual Gas Flow Volume (am³/min)	65.4	62.2	62.2	66.8
Calculated from inlet flow Total Normal Gas Flow Volume (m³/min)	50.90	48.36	48.36	52.0
Analysis	Odour			
Method	AS4323.3			
ORLA Number	5458	5460	5459	5461
SEMA Number	728149	728151	728150	728152
Sample Start Time (hrs)	15:37	16:32	15:32	16:15
Sample Stop Time (hrs)	15:47	16:42	15:42	16:25
Odour Concentration (As Received) (ou)	1,242	1,679	2,004	1,830
Odour Concentration (Final) (ou)	1,200	1,680	2,000	1,830
Normal MOER (As Received) (ou m³/s)	1054	1353	1615	1586
Normal MOER (Final) (ou m³/s)	1054	1353	1615	1586
Calculations entered by	JW	JW	JW	JW
Calculations checked by	PWS	PWS	PWS	PWS

APPENDIX B – CERTIFICATES OF ANALYSIS

Odour Research Laboratories Australia

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

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

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, 3, 5 & 6, SO Basin Pond, Starch Dryers 1, 3, 4 & 5, Gluten Dryers 1, 2, 3 & 4, Boiler 2, Boiler 4, Boilers 5&6, Biofilter A outlets, Biofilter B outlets, Biofilter inlet from DDG Evaporators No. 1, 2, 3,& 4, CO_2 Scrubber inlet & outlet, Fermenter 16, DDG Pellet Plant stack
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	7116/ORLA/01
	Project Manager:	Margot Kimber
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	5441 to 5469
	SEMA Sample number(s):	728134 to 728159
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	18 November 2020
	Order number:	5175
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Peter Stephenson
Report	Date of issue:	18 December 2020

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NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025 - Testing

ODOUR CONCENTRATION MEASUREMENTS RESULTS 7116/ORLA/01

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq \chi \leq 92{,}102$ ou. . If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between ± 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.

18 December, 2020

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results – 7116/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone^ *
Location	ID No.	Date/Time	ORLA No.					(ou) 1*	(ou) 2*	
Sample ID: Fermenter No.16	728134	18/11/2020 10:50	5442	19/11/2020 10:55	4	8	Nil	7500	7500	Strawberry Yoplait, oily, vinegar, sharp, alcohol, sweet, veggie oil, glue, gas, ink pen (-1)^
Sample ID: CO_2 scrubber outlet	728135	18/11/2020 11:12	5443	19/11/2020 11:26	4	8	Nil	8000	8000	Vinegar, sharp, sweet, glue, oily, veggie oil, strawberry, slight decay, decomposing fruit, alcohol (-1)
Sample ID: CO_2 scrubber inlet	728136	18/11/2020 11:14	5444	19/11/2020 11:54	4	8	Nil	10600	10600	Fruity, faint strawberry, oily, sweet, sharp, alcohol, veggie oil, vinegar (-1)^
Sample ID: Starch Dryer 1	728137	18/11/2020 12:59	5445	19/11/2020 12:25	4	8	Nil	470	470	Swampy, woody, earth, weet-bix, yeast, fresh bread, starchy, banana, vinegar (-0)^
Sample ID: Gluten Dryer 1	728138	18/11/2020 12:58	5446	19/11/2020 13:40	4	8	Nil	470	470	Earth, natural gas, wheat, grain, fresh bread, starchy vegetables, yoghurt (0)^
Sample ID: Gluten Dryer 2	728139	18/11/2020 13:53	5447	19/11/2020 14:09	4	8	Nil	250	250	Fermenting yoghurt, Yoplait , banana, fresh bread, plastic, vacuum cleaner dust (-1)^
Sample ID: Gluten Dryer 3	728140	18/11/2020 14:57	5448	19/11/2020 15:07	4	8	Nil	300	300	Plastic, yeast, slight sour, strawberry, yoghurt, cereal, plastic taste, fast food potato and gravy (0)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7116/ORLA/01

Sample				Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone^ *
Location	ID No.	Date/Time	ORLA No.					(ou) 1 *	(ou) 2 *	
Sample ID: Gluten Dryer 4	728141	18/11/2020 14:38	5449	19/11/2020 14:38	4	8	Nil	360	360	Nestle Quik, caramel, vanilla, earth, chocolate, slight coffee, cocoa (2)^
Sample ID: Starch Dryer 3	728142	18/11/2020 15:38	5450	19/11/2020 15:38	4	8	Nil	120	120	Musty, dust, earth, mushroom, gas, peat, cereal, hops (-1)^
Sample ID: Starch Dryer 4	728143	18/11/2020 16:37	5451	19/11/2020 15:41	4	8	Nil	110	110	Hops, cereal, earth, peat, plastic, musty, potato (-1)^
Sample ID: Boiler 2	728144	24/11/2020 10:10	5453	25/11/2020 10:55	4	8	Nil	1200	1200	Acid, chalk, ammonia, earthy, moss exhaust, household gas, swamp gas, dirty, mould, dusty, fireplace heater, (-2)^
Sample ID: Boiler 4	728145	24/11/2020 10:55	5454	25/11/2020 11:25	4	8	Nil	1700	1700	Acid, lime, citrus, gas, burnt jet fuel, swamp gas, earth, mushroom, chlorine, bleach (-1)^
Sample ID: Boiler 5&6	728146	24/11/2020 11:50	5455	25/11/2020 11:54	4	8	Nil	2200	2200	Chlorine, acid, oil, burnt kerosene or jet fuel exhaust gas, swampy, natural gas (-2)^
Sample ID: DDG Pellet	728147	24/11/2020 11:37	5456	25/11/2020 12:24	4	8	Nil	2300	2300	Yeast, baking bread, herbs, powdered cheese, vegemite, bitter (1)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7116/ORLA/01

Sample				Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone^ *
Location	ID No.	Date/Time	ORLA No.					(ou) 1*	(ou) 2*	
Sample ID: Starch Dryer 5	728148	24/11/2020 13:30	5457	25/11/2020 13:55	4	8	Nil	390	390	Wet towel, musty, mould, mushroom, yeast, baking bread, dirty socks, coal, oil, plastic, paint (-1)^
Sample ID: Biofilter A East outlet	728149	24/11/2020 13:37	5458	25/11/2020 14:25	4	8	Nil	1200	1200	Smelly sandshoes, smelly socks, garbage, septic, dirt, soil, plastic paint, vinegar, sour, tannin from decayed vegetable matter and mangroves (-3)^
Sample ID: Biofilter B East outlet	728150	24/11/2020 15:32	5459	25/11/2020 14:53	4	8	Nil	2000	2000	Garbage, smelly socks, sewerage, methylated spirits, rotten vegetables, faeces, decomposed matter, tyres (-3)^
Sample ID: Biofilter A West outlet	728151	24/11/2020 16:32	5460	25/11/2020 15:22	4	8	Nil	1680	1680	Decomposing starch, garbage, yeast, rotten vegetables, faeces, coal, tar, roadworks (-3)^
Sample ID: Biofilter B West outlet	728152	24/11/2020 16:15	5461	25/11/2020 15:51	4	8	Nil	1830	1830	Decomposing vegetation, ammonia,faeces, garbage, stinky socks, rubber, coal, tar (-3)^
Sample ID: Bio inlet DDG Evap. 1,2,3	728153	24/11/2020 14:16	5462	25/11/2020 17:23	4	8	Nil	9500	9500	Cocoa, chocolate, coffee, cereal, wheat, green wheat, corn bread, squishy rubber toys (1)^

Odour Research Laboratories Australia

Odour Olfactometry Results – 7116/ORLA/01

Sample				Analysis Date/Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration		Odour Character & Hedonic Tone^ *
Location	ID No.	Date/Time	ORLA No.					(ou) 1 *	(ou) 2 *	
Sample ID: Bio inlet DDG Evap. 4	728154	24/11/2020 15:02	5463	25/11/2020 17:27	4	8	Nil	70400	70400	Compost, wheat, plastic playdough (-2)^
Sample ID: Pond 1	728155	07/12/2020 15:00	5465	08/12/2020 10:25	4	8	Nil	360	360	Earthy, mushrooms, yoghurt, yeast, vegemite, dirty, floral, creek, chicken salt, 2-minute noodles, slight motor oil (-1)^
Sample ID: Pond 3	728156	07/12/2020 16:13	5466	08/12/2020 11:13	4	8	Nil	280	280	Earthy, grass, mushrooms, corn, very faint sharp musty odour, styrofoam, 2-minute noodles, plastic (-1)^
Sample ID: Pond 5	728157	07/12/2020 17:38	5467	08/12/2020 11:49	4	8	Nil	63	63	Grain, tobacco leaf, earthy, coffee, mushroom, powered beef stock, decomposing logs, wood, wet forest, air from rubber tube, slight plastic (-2)^
Sample ID: Pond 6	728158	07/12/2020 18:19	5468	08/12/2020 12:22	4	8	Nil	38	38	Dry grass, reeds, dirt, decaying wet wood, earthy, mushrooms, bark, drain water with unperfumed soap (-2)^
Sample ID: SO Basin	728159	07/12/2020 20:00	5469	08/12/2020 14:17	4	8	Nil	63	63	Musty, stale, sports shoes, vinegar, peppermint, sweet dried tobacco, menthol cigarettes, dirt, pen ink (1)^

Odour Research Laboratories Australia

Odour Panel Calibration Results – 7116/ORLA/01

Reference Odorant	ORLA Sample No.	Date	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	5441	19/11/2020	62.0	1236	50.2	Yes
n-butanol	5452	25/11/2020	62.0	1264	49.1	Yes
n-butanol	5464	08/12/2020	62.0	1269	48.9	Yes

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

Notes from Odour Olfactometry Results:

[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 ≤ χ ≤ 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:

19/11/2020: SR = 46.9, PR = 61.3, MB = 54.1, JW= 42.4

25/11/2020: SR = 46.9, PR = 59.3, TL = 31.1, JW = 43.8, MB = 52.4

08/12/2020: SR = 48.5, PR = 57.3, TL = 31.1, JW = 45.3, MB = 51.8

^ 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	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	13-Nov-20	13-Nov-21
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	02-Sep-20	02-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	16-Nov-20	16-Nov-21
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

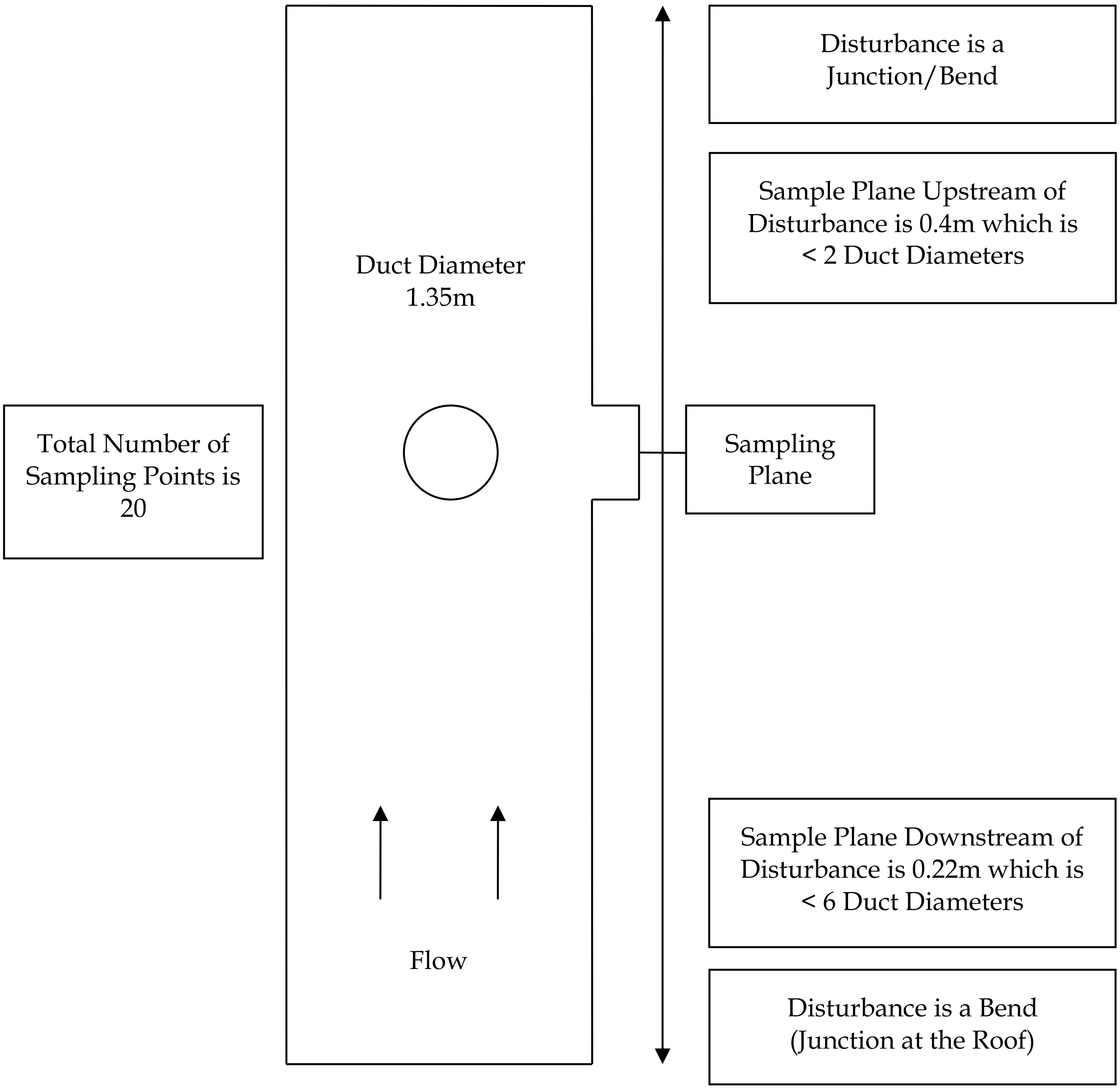
SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
920	Thermocouple	19-Oct-20	19-Apr-21
805	Thermocouple	19-Oct-20	19-Apr-21
815	Digital Manometer	13-Nov-20	13-Nov-21
726	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
183	Pitot	17-Mar-20	17-Mar-2021 Visually inspected On-Site before use
946	combustion analyzer	02-Sep-20	02-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
832	Personal Sampler	26-Feb-20	26-Feb-21
753	Personal Sampler	12-Mar-20	12-Mar-21
613	Barometer	16-Nov-20	16-Nov-21
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- 3 INSTRUMENT CALIBRATION DETAILS DAY 3

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
857	Digital Temperature Reader	19-Oct-20	19-Apr-21
605	Thermocouple	19-Oct-20	19-Apr-21
607	Thermocouple	19-Oct-20	19-Apr-21
753	Personal Sampler	12-Mar-20	12-Mar-21
835	Personal Sampler	26-Feb-20	26-Feb-21
613	Barometer	16-Nov-20	16-Nov-21

APPENDIX D – SAMPLE LOCATIONS

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



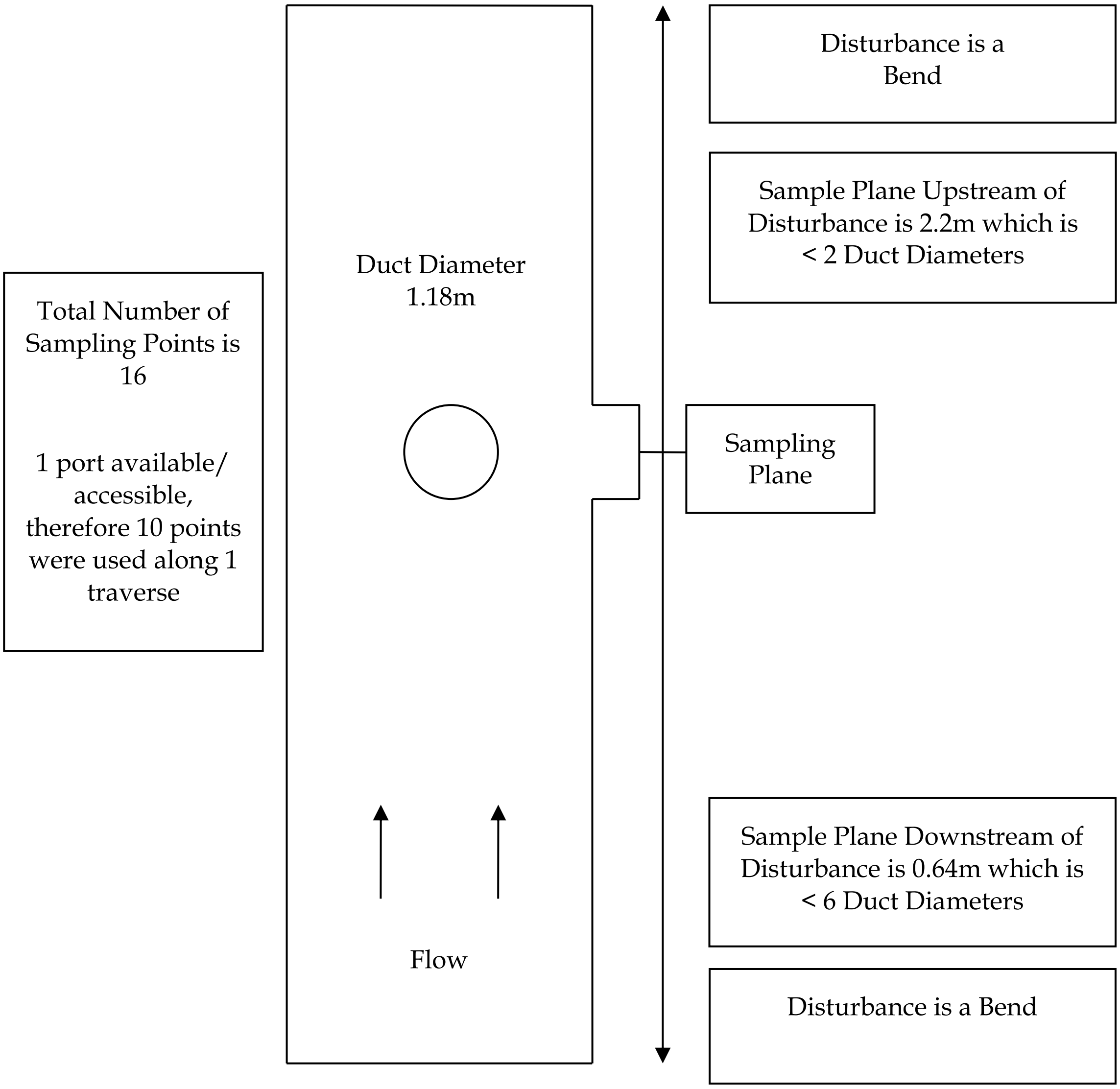
In the absence of cyclonic flow activity ideal sampling plane positions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to 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 would most likely comply with AS4323.1 temperature, velocity and gas flow profile criteria for sampling; once the sampling ports are replaced in the new duct work.

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

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



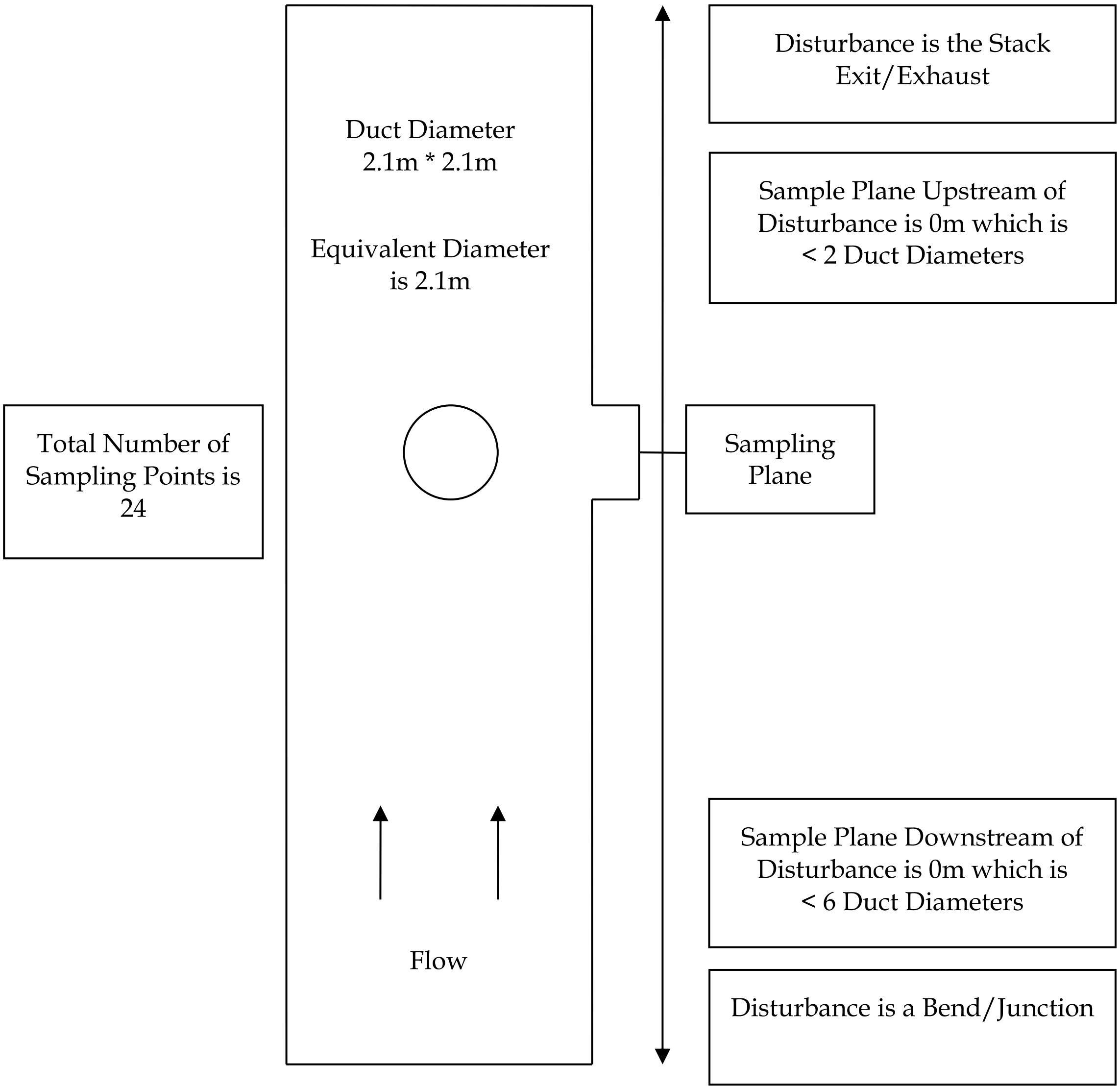
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

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

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

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

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



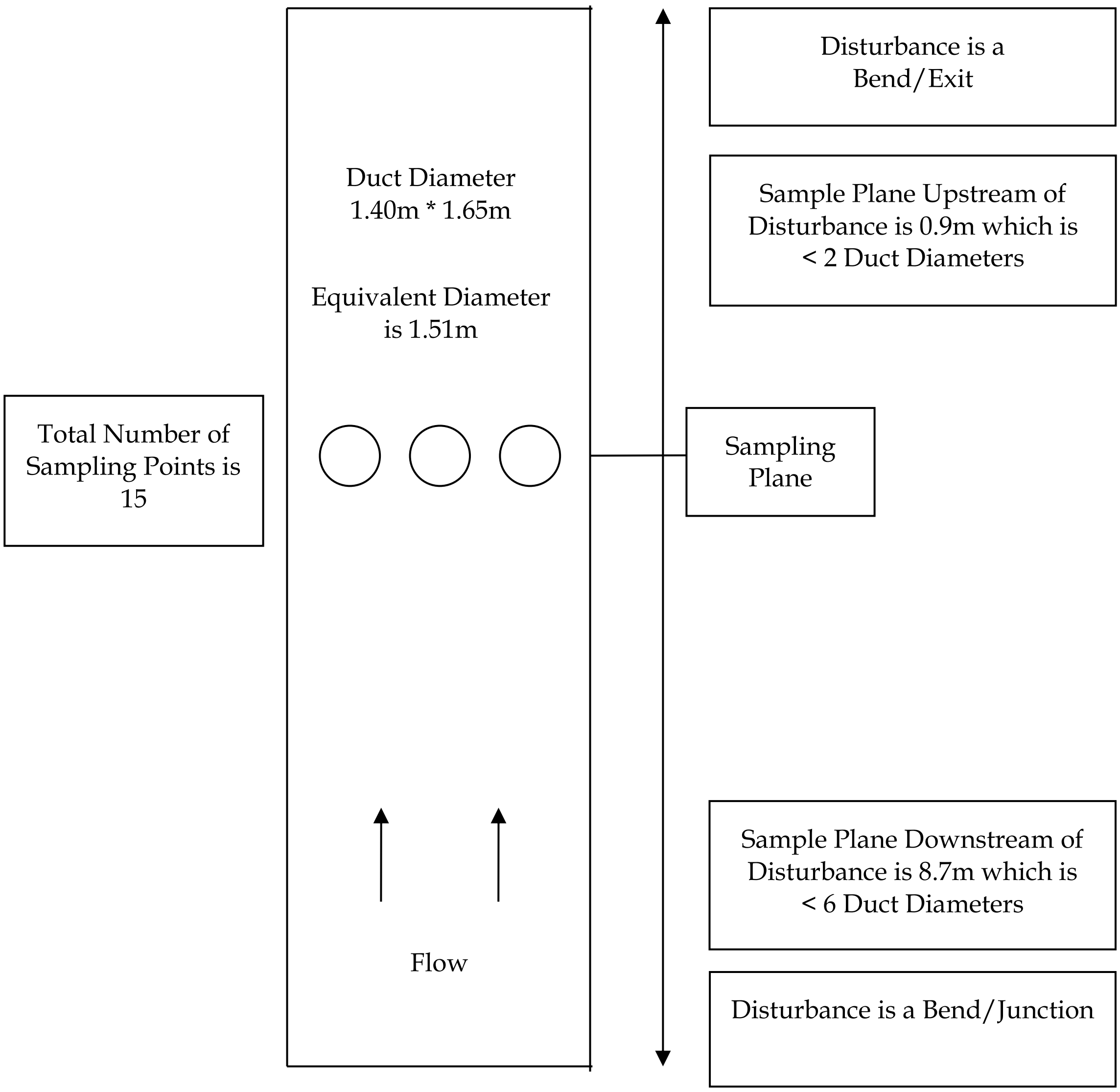
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

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

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

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

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



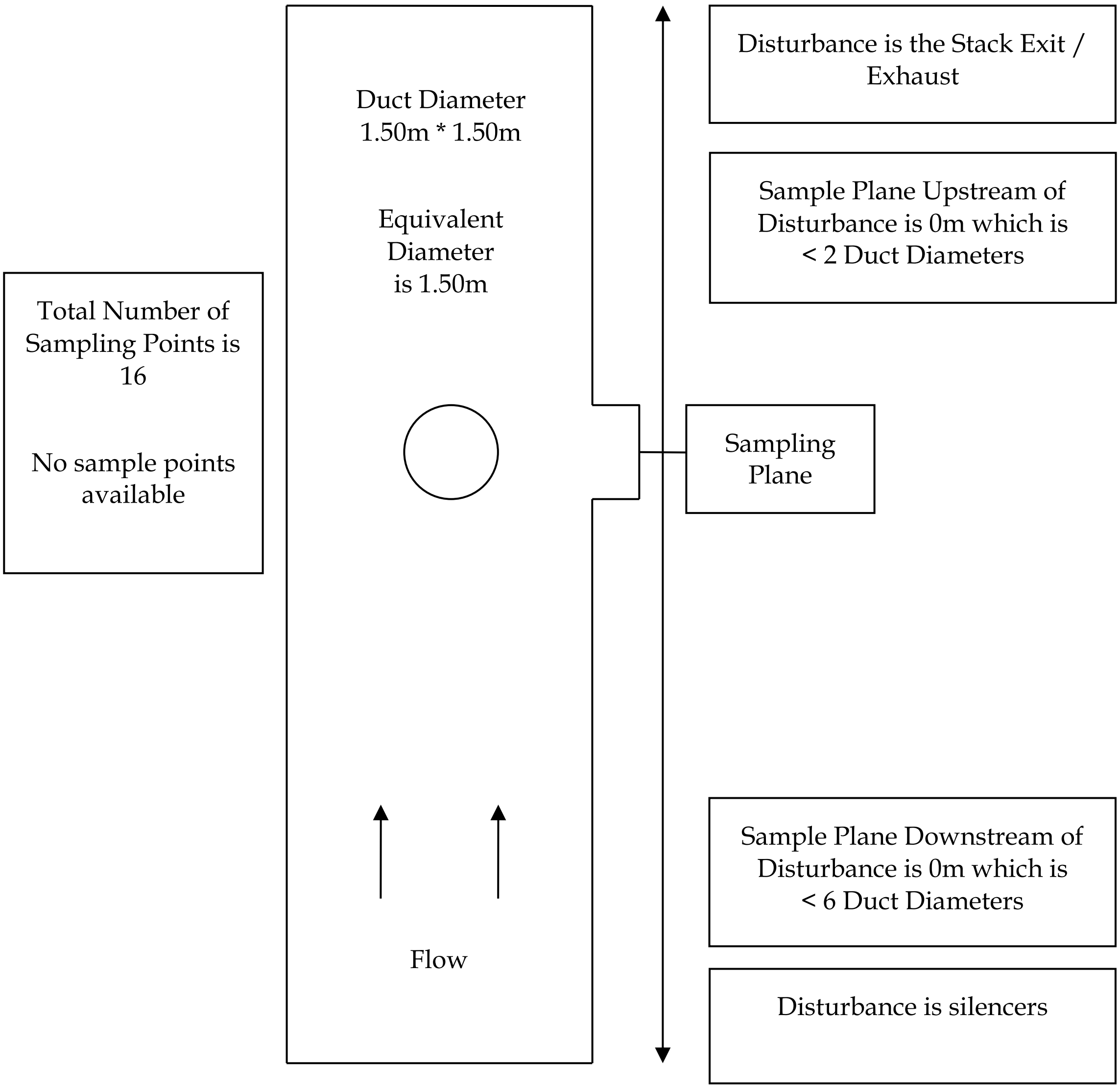
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

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



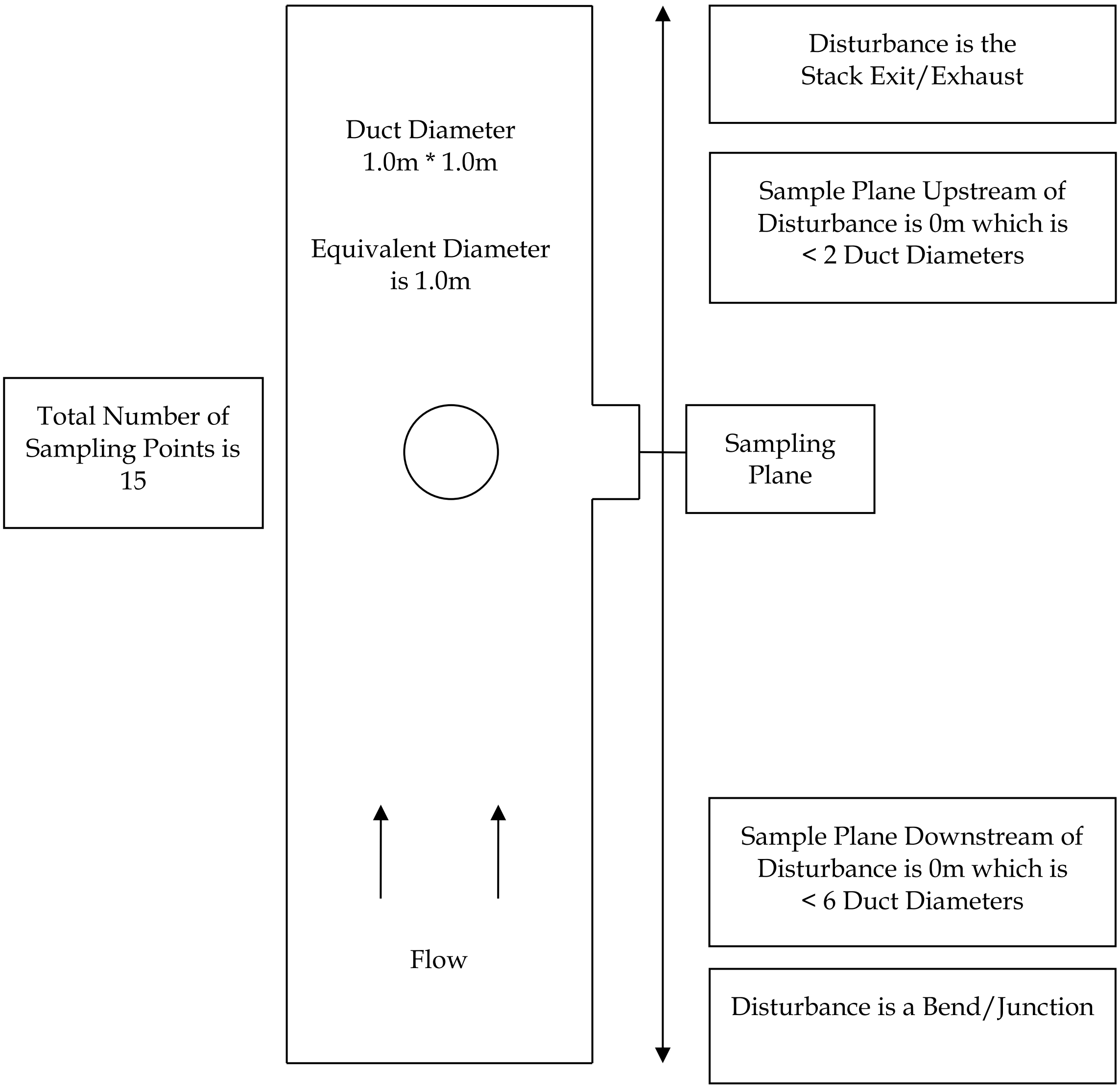
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



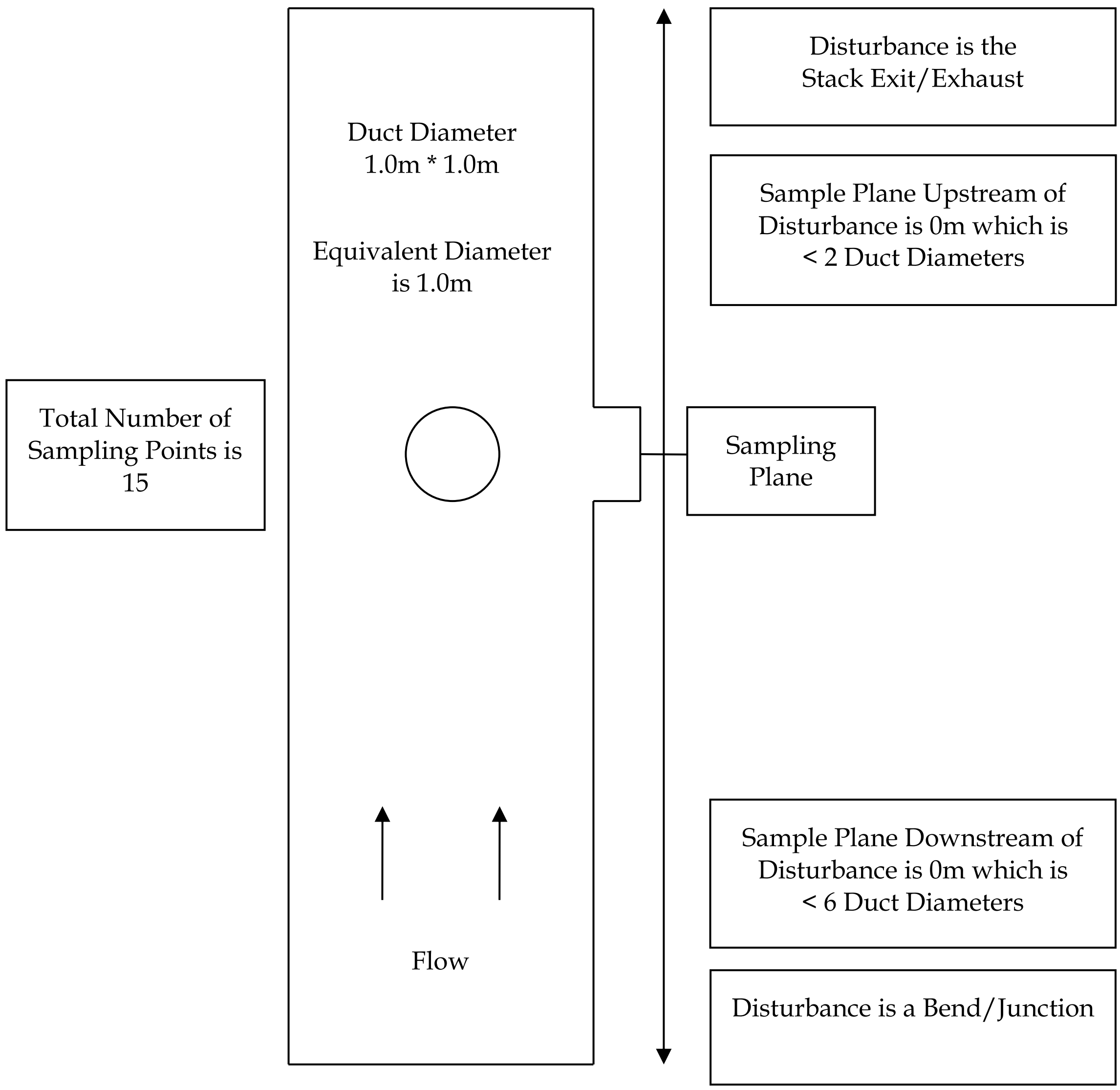
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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



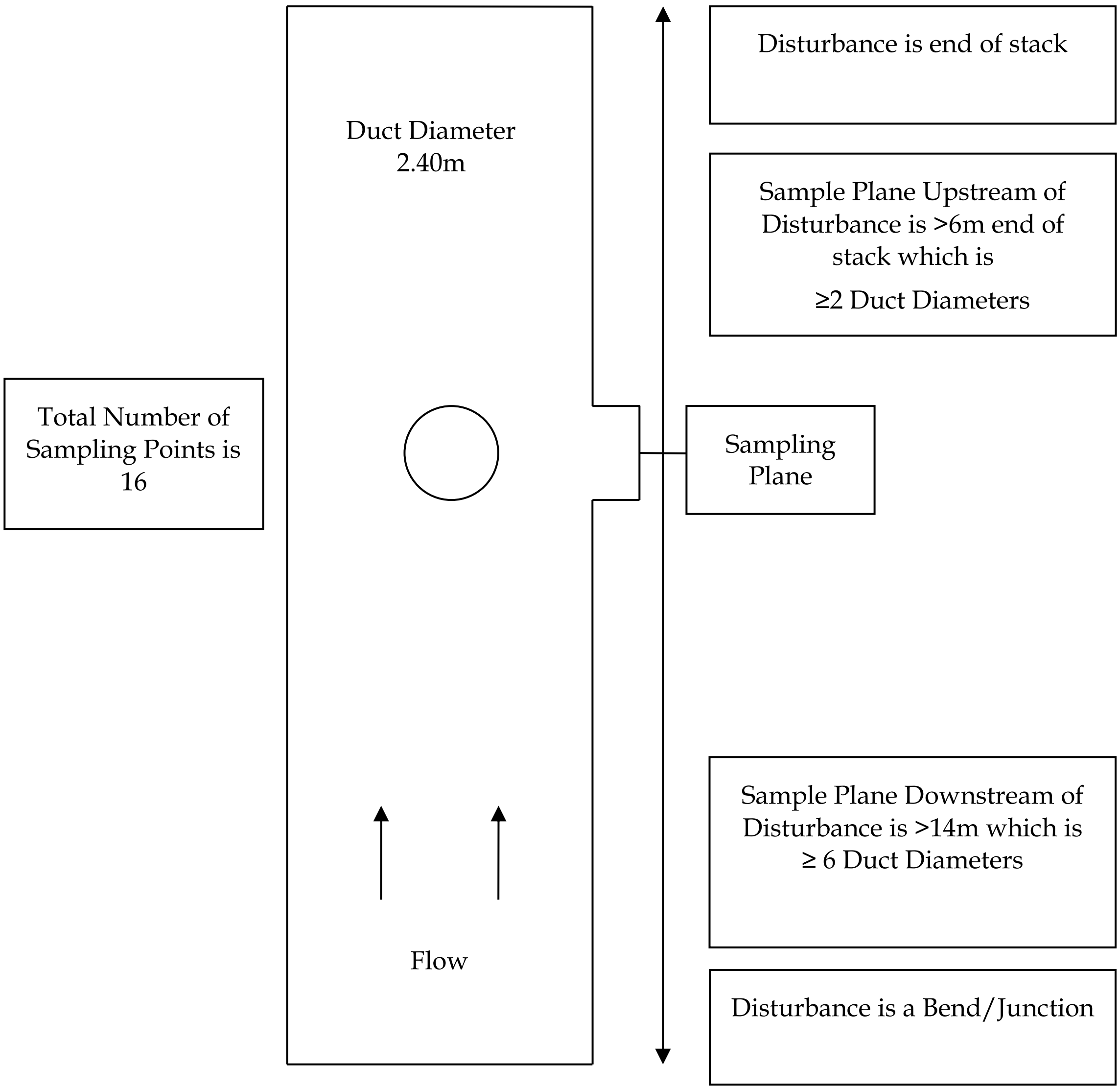
In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as the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

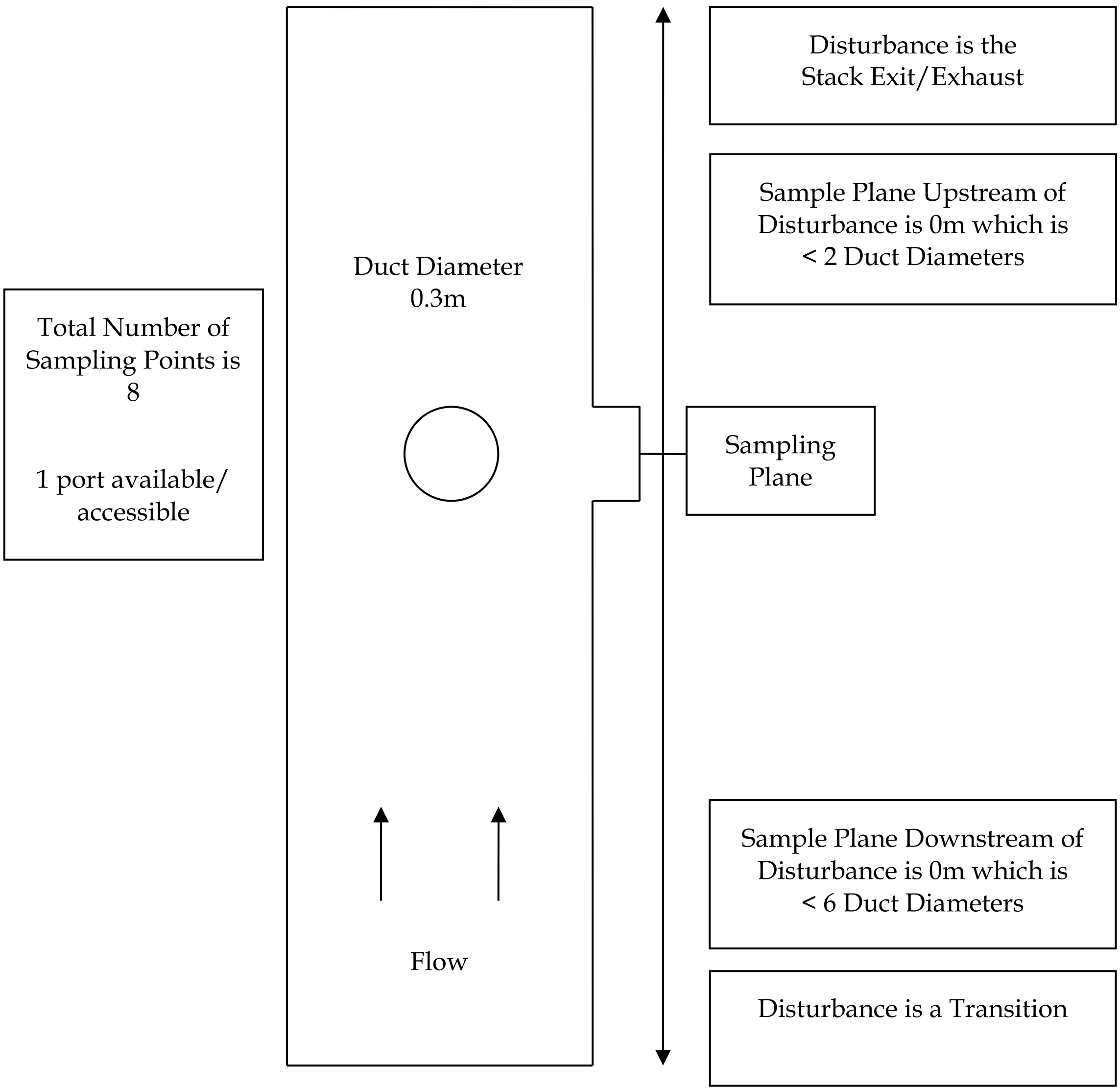


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion. .

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.

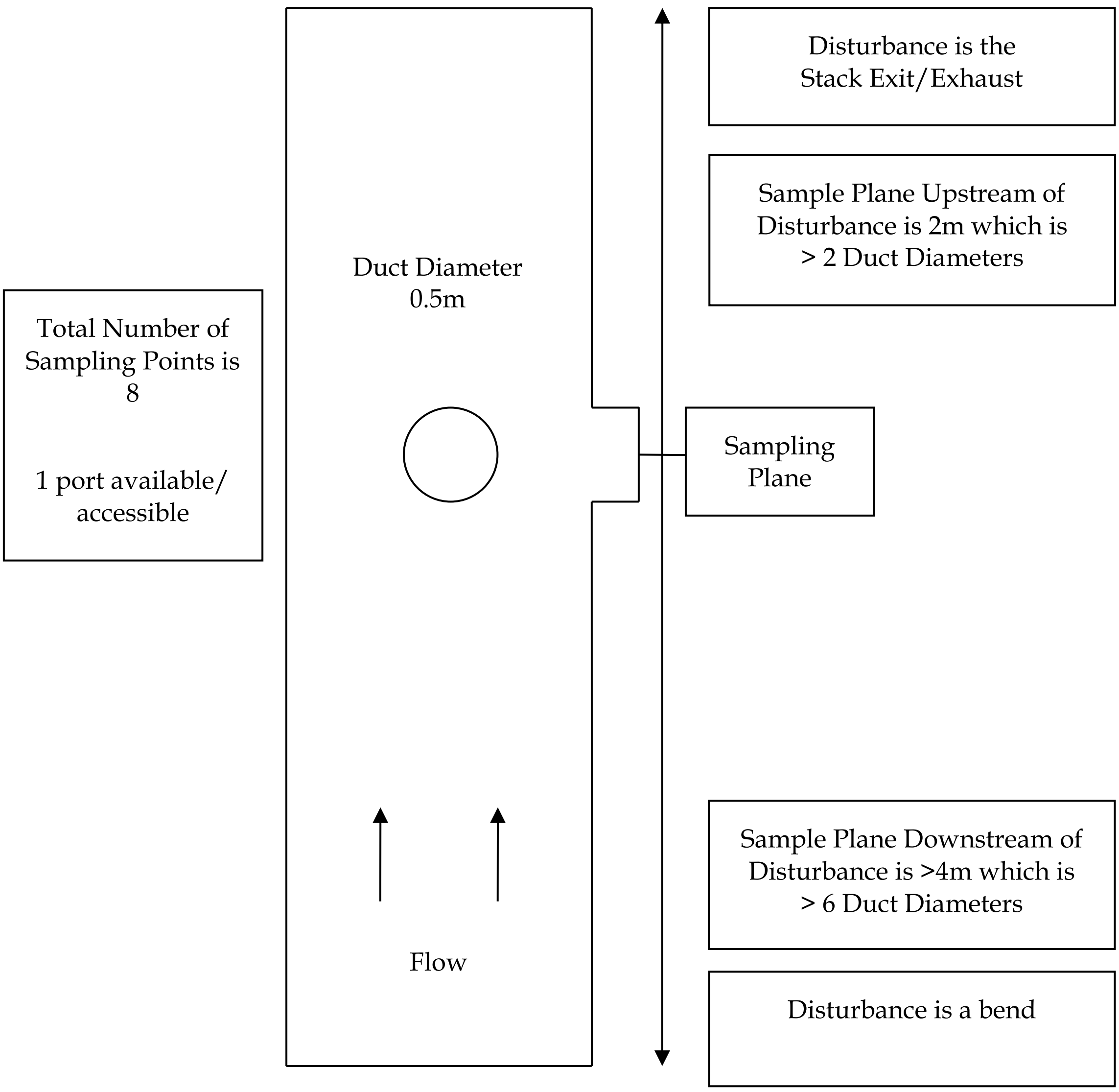
However the sample plane also does not meet the minimum sampling plane position; sampling plane position will be found to exit at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance. A suitable sampling plane should be sought fitting these criteria.

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

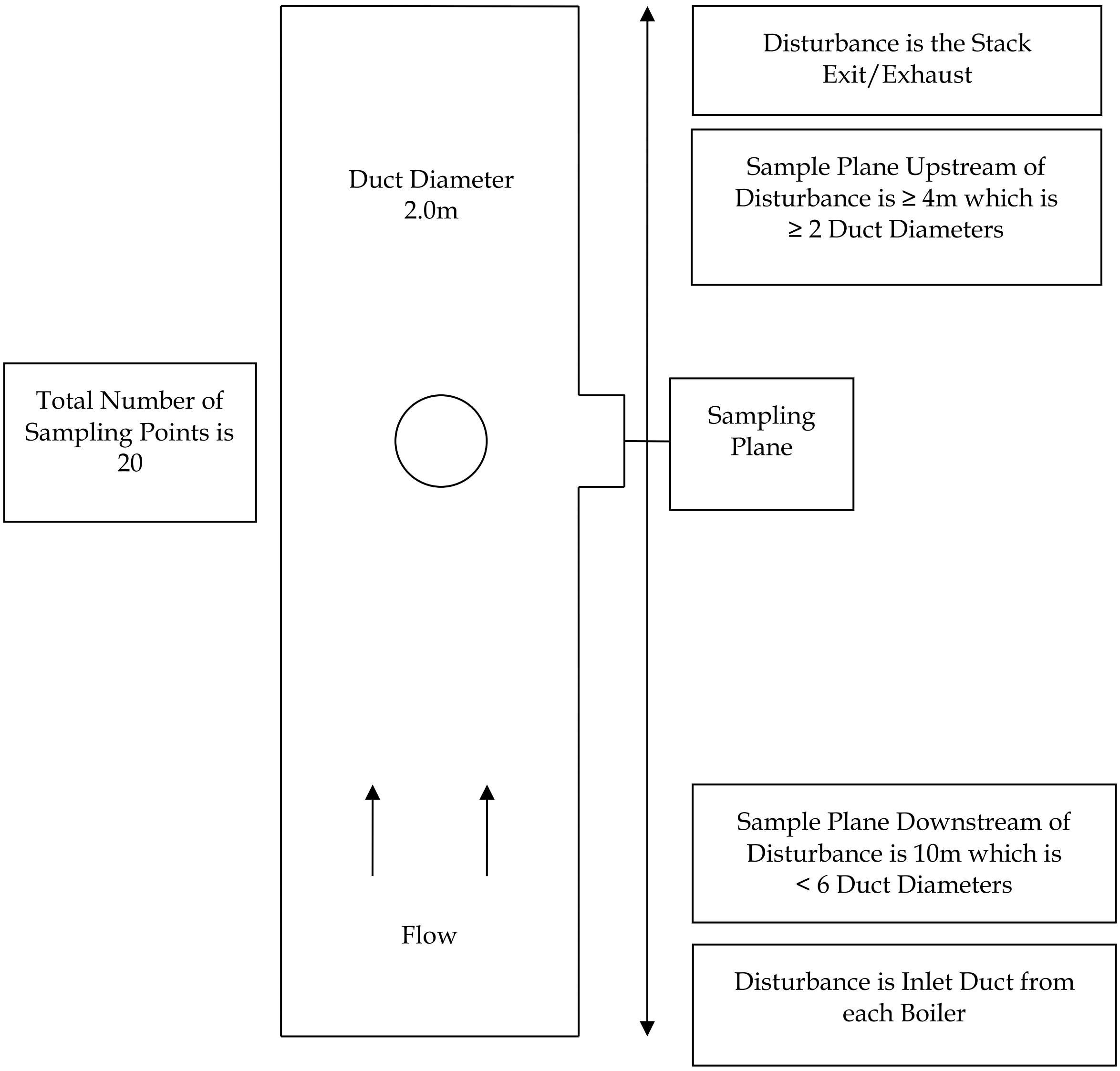


In the absence of cyclonic flow activity ideal sampling plane position will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does meet this criterion.

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



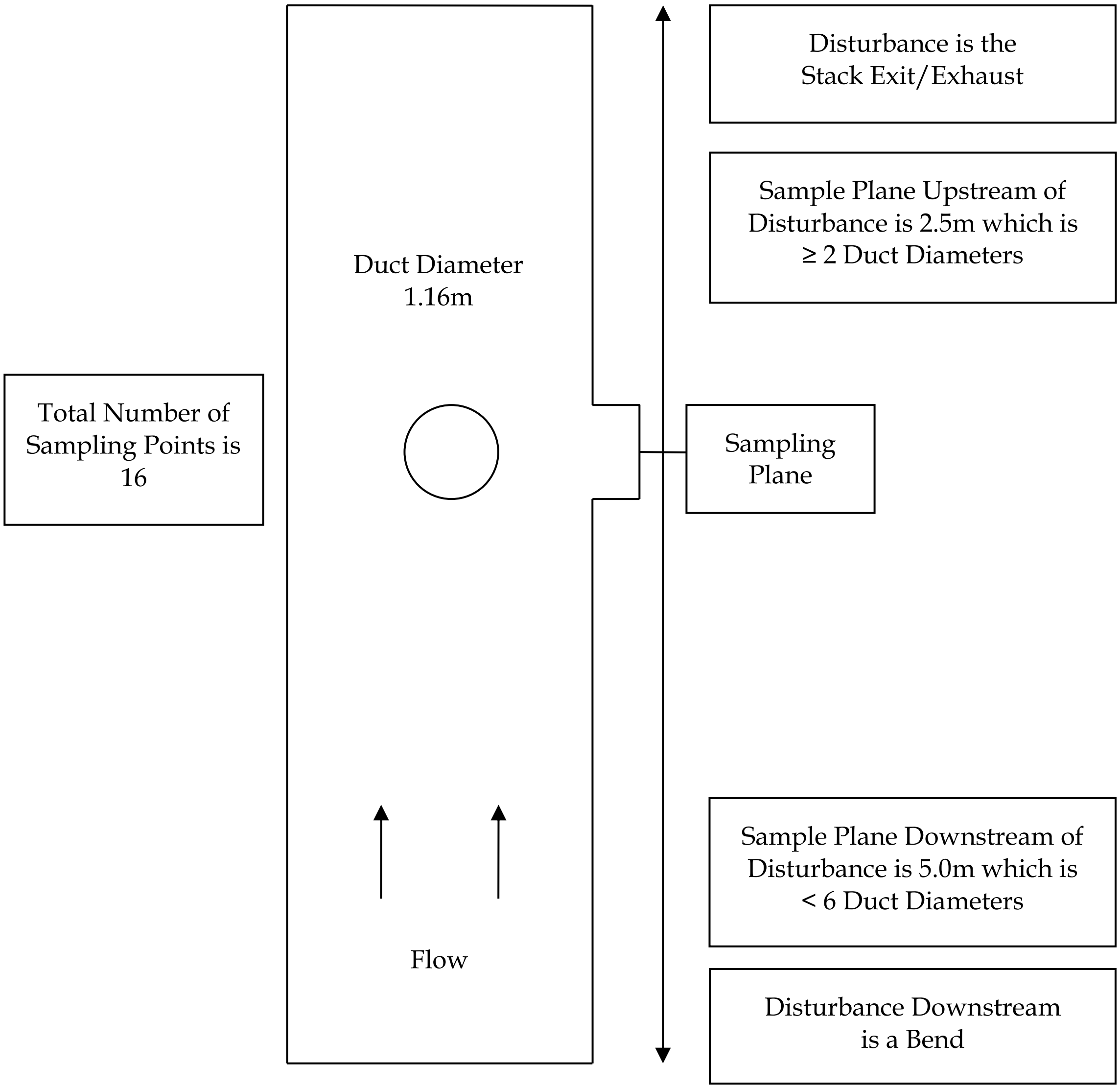
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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



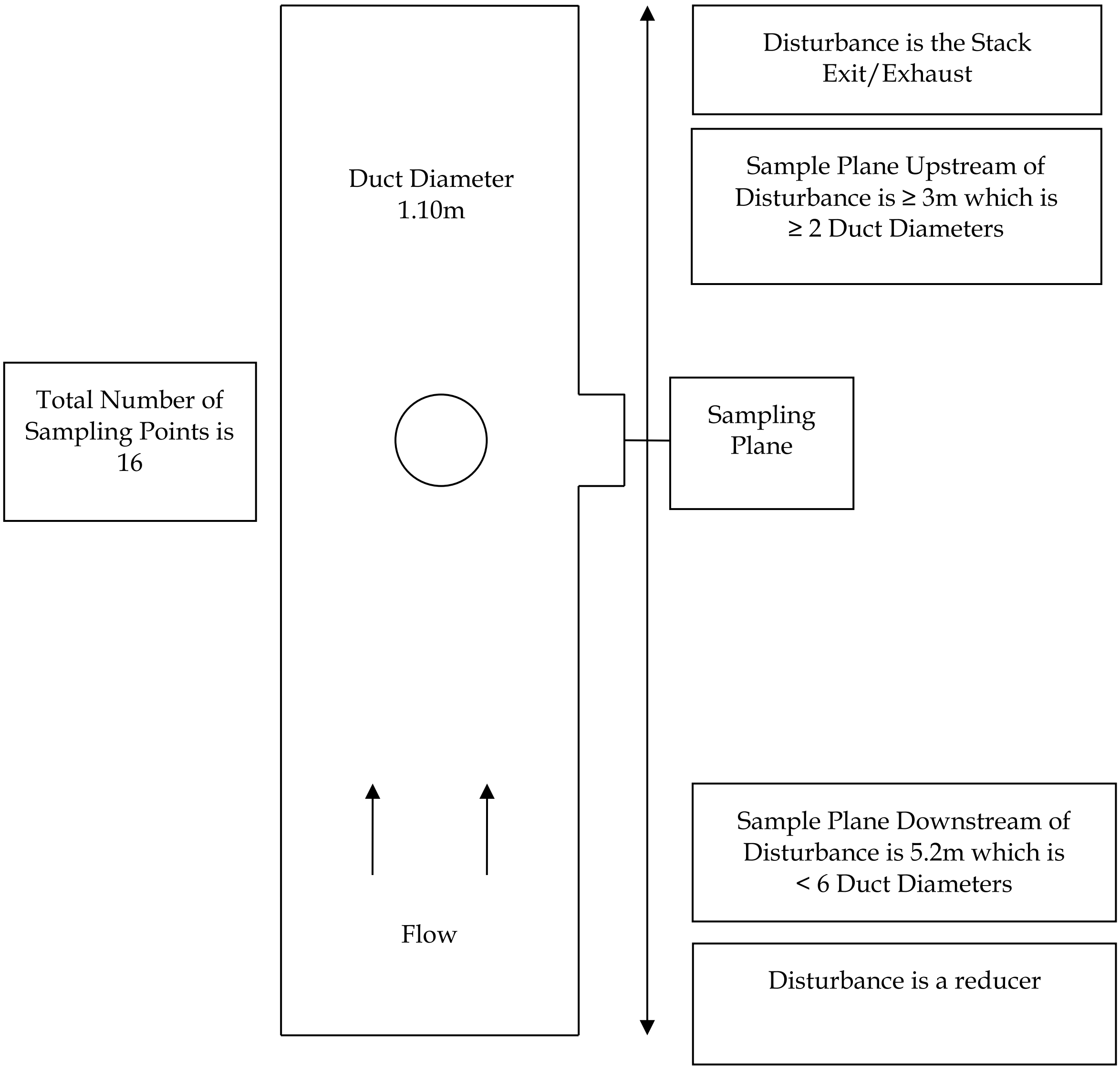
In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

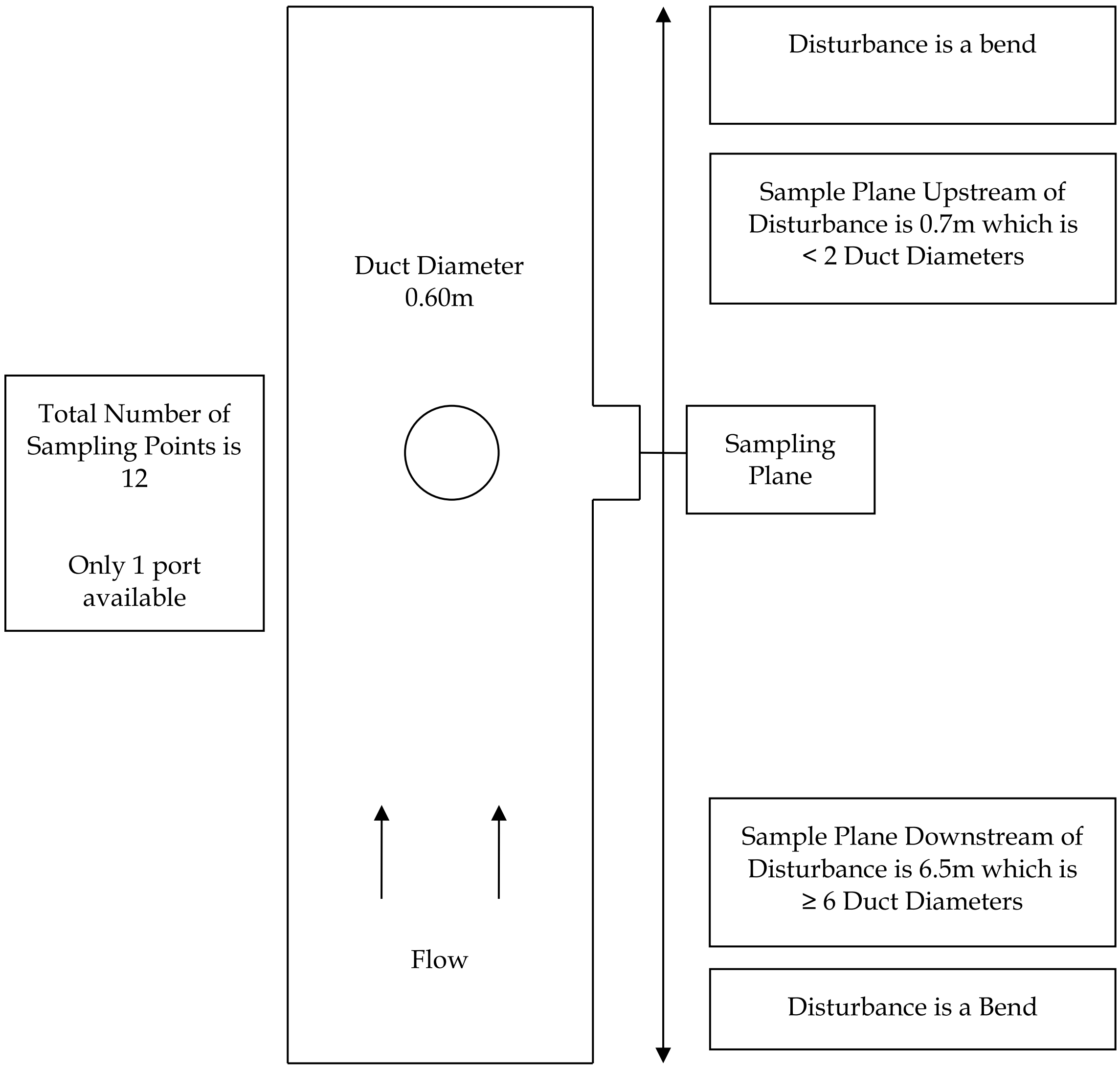


In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were used in compliance with AS4323.1 as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

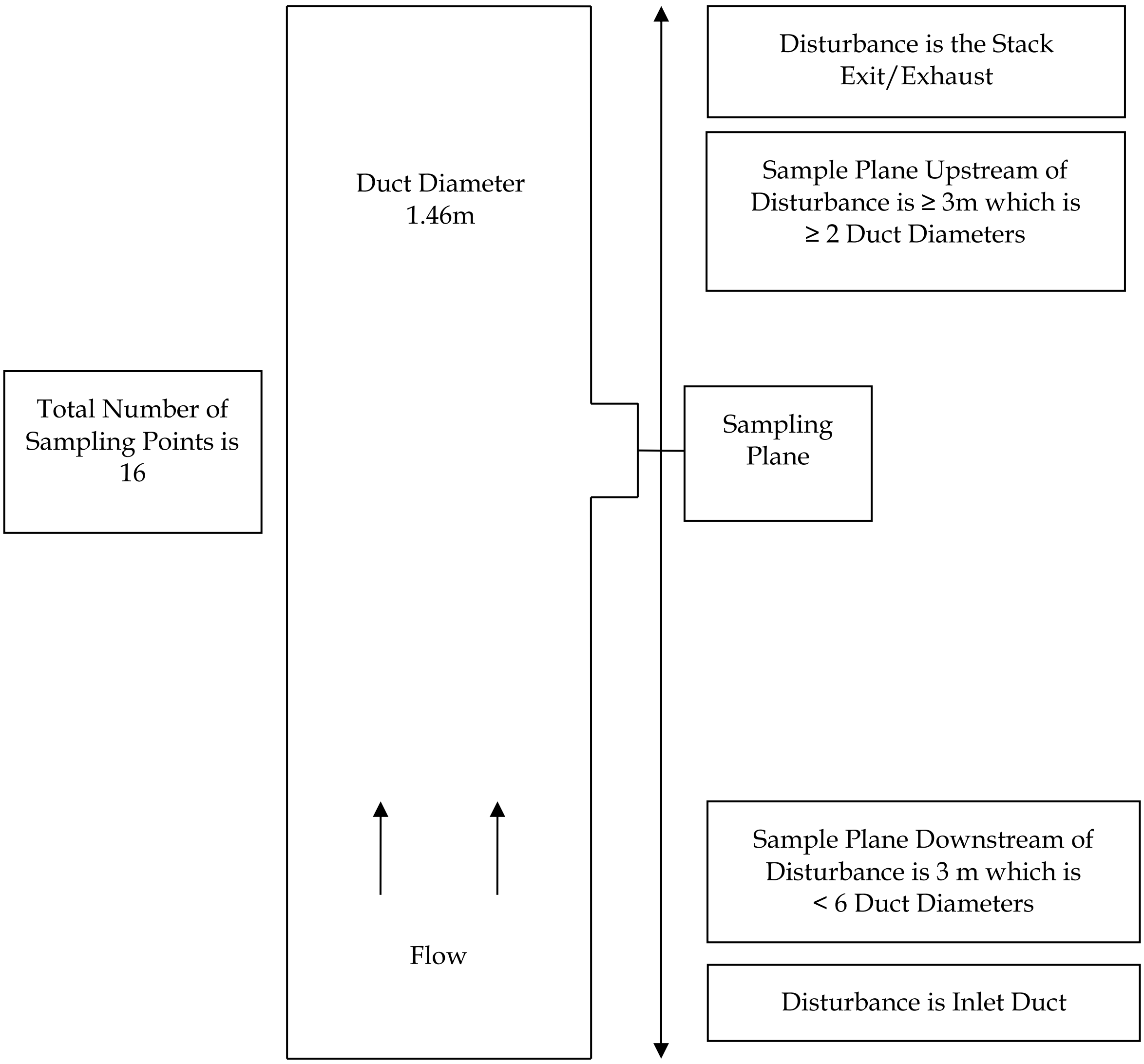
The sample plane also does not meet the minimum number of access points required. Additional sample points were used in compliance with AS4323.1.

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

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