AFFCO IMLAY

ANNUAL AIR DISCHARGE MONITORING REPORT – 2019 / 2020

AFFCO IMLAY WANGANUI

AIR DISCHARGE PERMIT:-
ATH-2007010926.01

MONITORING REPORT

1 MAY 2019 TO 30 APRIL 2020

COMPILED BY:
RICKY GOWAN – AFFCO IMLAY COMPLIANCE MANAGER

1.0 TABLE OF CONTENTS

APPENDICES:-

2.0 INTRODUCTION

AFFCO New Zealand Limited was granted an 'Air Discharge Permit' for a term expiring on the 1st of July 2025. The 'Air Discharge Permit' encompasses the following:-

ATH-2007010926.01:- Discharge permit to discharge odour to air (associated activities on site); and

ATH-2017201595.00:- Discharge Permit to discharge contaminates to air (Gas Fired Boiler).

Under Condition 35 the Permit Holder must prepare an Annual Report summarising performance in relation to the discharges allowed under the above resource consents. The Annual Report must be provided to the Regulatory Manager of MWRC by the 1st of June each year from the commencement of the consent.

3.0 EXECUTIVE SUMMARY

Site:	AFFCO Imlay	**Date:**	May 2020
Scope:	Air Discharge Annual Monitoring Report 2020		
Author:	Ricky Gowan		

This Report covers the period from the 1st of May 2019 to the 30th of April 2020 and summarises odour control monitoring results as required in accordance with Condition 35 of Air Discharge Permit ATH-2007010926.01 and ATH-2017201595.00.

4.0 CONSENT CONDITION 35 SUMMARY

a. An update of any actions undertaken in accordance with Condition 3:-

The Permit Holder must undertake and complete the schedule of works as detailed in the titled **AFFCO Imlay Mitigation Table** provided to MWRC on the 16 November 2017 and attached to these conditions as **Schedule 1**. A written update on the progress of these works shall be provided to MWRC within six months of the commencement of this consent and thereafter an update to the schedule shall be included in the Annual Report required under **Condition 35.**
In the updates the Permit Holder shall:

a. Indicate which works have been completed;
b. Indicate why particular works have not been completed in the stated time periods;
c. Provide new timeframes for implementation of works.

AFFCO IMLAY MITIGATION TABLE (as at 30.04.19). All Schedule 1 items plus items raised by Imlay Management and KupeTech in 2018 have been completed.

b. Summary of Bio-Filter Performance - Condition 16 and Condition 31

The back pressure within the inlet duct to each bio-filter shall be continuously recorded:-

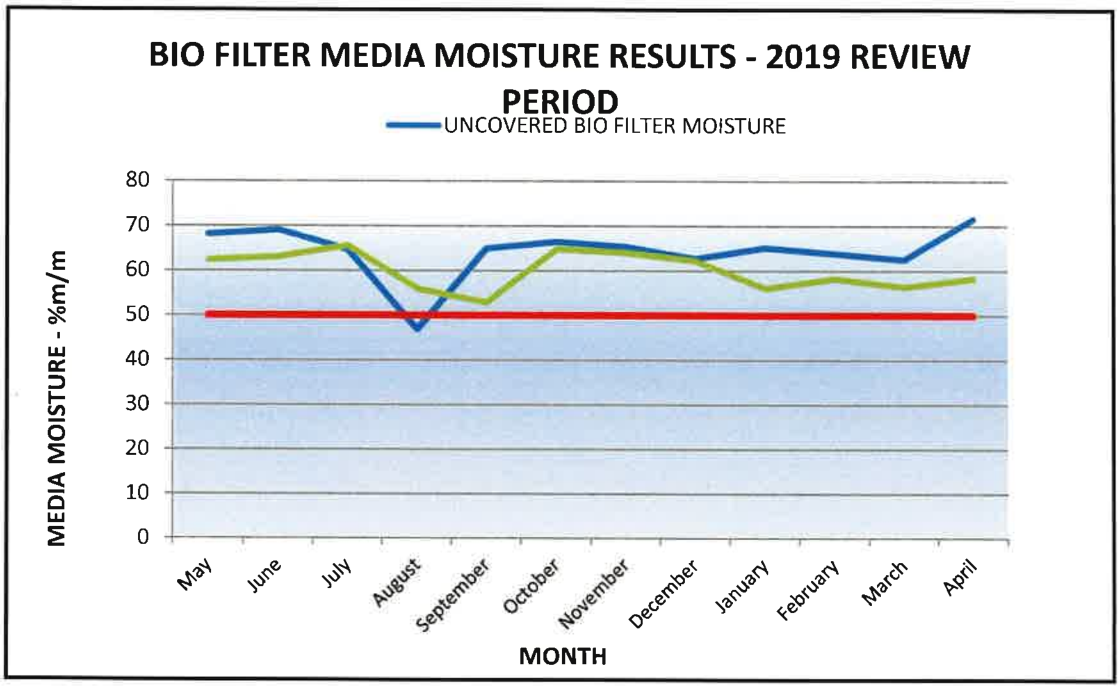
The back pressure of both covered and uncovered bio-filters are continuously recorded via the SCADA system. All recorded results in the report review period were compliant.

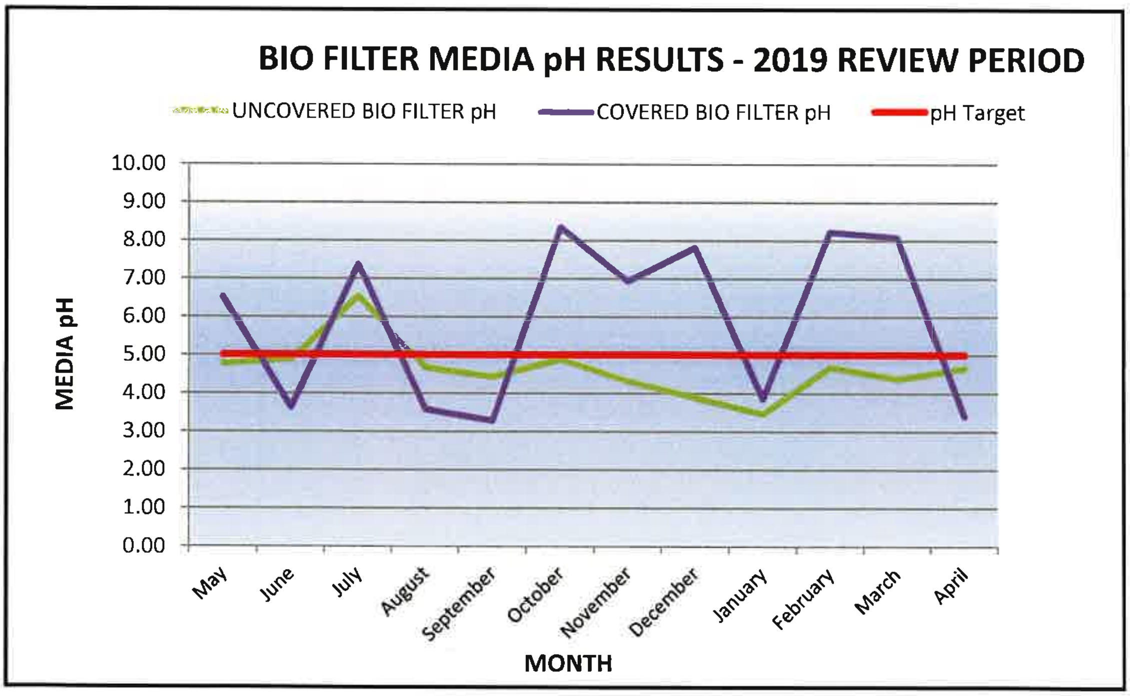
Daily manual back-pressure checks, visual inspection for moisture content, leakage and odour discharge:-

Daily inspections are performed whenever production is in progress. The above inspections are logged daily within the **'Air Odour Resource Consent Monitoring Checksheet – RMF 008'**. All daily monitoring records are held on file in the Rendering Office. **'Air Odour Resource Consent Monitoring Checksheet – RMF 008'** pdf files for the review period sent to Horizons electronically.

Moisture content and ph shall be monitored and recorded at least once a month from the commencement of this consent:-

Bio-Filter Moisture and pH Graphs for the report review period:-





As per last review period pH levels obtained via Asurequality testing are very inconsistent. John Vickerman - KupeTech – has stated in the 2020 KupeTech Annual Report that there is inconsistency with the process (collection through to sampling). Refer Appendix 3 – 2020 KupeTech Report. **NOTE:-** KupeTech findings for all samples taken to date have been compliant for pH.

Monthly inspection and recording of bio-filter condition i.e. Weeds, compaction, pugging or fissures, commencing from the date of commencement of this permit;

'Air Odour Resource Consent Monitoring Checksheet – RMF 008' pdf files for the review period sent to Horizons electronically.

Annual measurements of the bio-filter inlet flows combined with vacuum monitoring results for duct connections to equipment.

Refer Appendix 3 for 2020 KupeTech Annual Report for inlet flows and vacuum monitoring results.

Condition 31. The Permit Holder shall, annually prior to 30 March, undertake an annual audit of the rendering plant's odour control systems that considers the effectiveness of the extraction, cooling and biofilter system and its overall performance in regards to controlling odour emissions. The audit should utilise all monitoring data (manual and continuous, complaint records, any independent odour assessments) as well as include downwind odour assessments of the operational rendering plant and ancillary activities. The audit should assess the state of the odour extraction, cooling and biofilter system and taken appropriate measurements and sample for analysis required to confirm the status these systems against their design and required operating parameters. Any analysis of samples shall be undertaken by an appropriately qualified testing laboratory and sampling undertaken as specified in the OMP. Accepted methods shall be used for measurement of media properties that are certified by the Regulatory Manager of MWRC.

The audit shall be undertaken by person(s) who is independent, appropriately qualified and experienced in the operation and maintenance of air extraction, cooling and biofilter systems.

Refer Appendix 3 – 2020 KupeTech Annual Report.

c. Copy of Log required by Condition 19

Visually check for any leaks of steamy odorous vapours from all enclosed process equipment and conveyors in rendering on a daily basis on days when the plant operates; and

Daily inspections are performed whenever production is in progress. The above inspections are logged daily within the **'Air Odour Resource Consent Monitoring Checksheet – RMF 008'**. All daily monitoring records are held on file in the Rendering Office. **'Air Odour Resource Consent Monitoring Checksheet – RMF 008'** pdf files for the review period sent to Horizons electronically.

Advise the MWRC Consents Monitoring Team of any maintenance work which may result in odour release to the atmosphere at least twelve (12) hours prior to the works commencing; and

Keep a log of the above checks details in (a) and (b).

There were no incidents of planned maintenance that could result in odours released into the atmosphere during the review period. Rendering **'Work Orders'** pdf files for the review period sent to Horizons electronically.

d. A copy of the process operating temperatures for the rendering and drying equipment log as required in Condition 20

The process operating temperatures for the rendering and drying equipment shall meet the following standards:

The rendering vessels shall be operated at the lowest temperature practicable, and in any event shall not be operated above 100°C; and

The meat and bone meal dryers shall be operated at the lowest temperature practicable, which is consistent with MPI (or any future replacement regulatory body with relevant functions) sterilisation requirements, and to prevent burning of meal. The temperature of the rendering vessels and dryers shall be continuously monitored and recorded. These records shall show the correct time and date. The records shall be made available to the Regulatory Manager of MWRC or of MWRC officers on request at any time. The records must also be supplied as part of the annual report required by Condition 35.

'Rendering' equipment, other than drying equipment, does not exceed 100^{0}C. Raw material is discharged into the Stord Bartz pre-heater (indirect steam heated cooker). The raw material is agitated and heated to a controlled discharge temperature set between 88^{0}C – 95^{0}C.

The Decanter Liquid Phase process will only activate when level and temperature limits are met – 1300mm and 95^{0}C respectively.

Dryer temperatures are validated to meet Non Heat Certification and Heat Certification Meat and Bone Meal. We are currently processing to Non Heat Certification Meat and Bone Meal standards which requires the dryers to be set at ≥123^{0}C. The dryers are programmed to stop discharging product if dryer temperatures fall below that set point of ≥123^{0}C. Dryer temperatures are monitored continuously via SCADA (history saved). Daily dryer temperature monitoring is performed by Rendering Staff and recorded onto the **'Imlay Rendering Shift Report – RMF 012'**.

'Imlay Rendering Shift Report – RMF 012' pdf files for the review period sent to Horizons electronically.

e. A summary of any notifications made to MWRC in accordance with Condition 28;

The Complaints Register for 2019 / 2020 Review period can be found in Appendix 1 of this report.

f. A copy of any notes recorded during the annual meeting of the CLG under Condition 22;

The Permit Holder shall provide co-ordination and administrative support for the Community Liaison Group (CLG) including a dedicated contact point at the site, provision of a meeting point and overseeing any administration associated with the group. The general purpose of the CLG shall be for the Consent Holder to inform the CLG of:

The odour generating activities being undertaken within the Imlay site;

The current odour management processes and procedures being used for those activities; and

Any proposed alterations to those activities, processes or procedures.

A Community Liaison Group Meeting was to be held on the 25th of March 2020 however due to the Covid-19 this was cancelled. The Community Liaison Group Meeting will be held when it is safe for all participants to attend.

g. A summary of monthly odour surveys received and the outcome of any investigations and responses required by Condition 29;

29. The Permit Holder shall carry out monthly odour surveys around the boundary of the site, and shall record whether any odour attributable to AFFCO is discernible or not at each location. Monitoring shall occur when the rendering plant is fully operational. These boundary surveys shall be undertaken by the independent person identified in **Condition 7**. The methods and reporting shall be set out in the environmental management plan required by **Condition 4** that is certified by MWRC. The outcome of each monthly odour survey shall be recorded. The Permit Holder shall investigate the cause of any significant odour (intensity greater than two on the VDI 3940 intensity scale) detected during each survey, and implement any necessary remedial action within 48 hours of its detection. A record of each monthly odour survey and any remediation carried out shall be reported in the annual report required **by Condition 35**.

Monthly odour surveys are performed by an 'Independent person'. Amourguard has been contracted to provide that independent odour survey. There were no significant odour issues during those surveys.

Refer Appendix 2 for monthly surveys for the 2019 / 2020 review period.

h. Reporting undertaken as part of Condition 32 regarding the vacuum (pressure) at all enclosed equipment items;

32. The Permit Holder shall, annually **prior to 30 March**, measure and record the vacuum (pressure) at all enclosed equipment items that are extracted by the odour control systems as follows:

a. Pressure shall be measured in the head space of the equipment items that are targeted by the extraction systems. The measurements shall be undertaken by an independent appropriately qualified and experienced person following industry best practice for measurements of this type.

b. The Permit Holder shall prepare a report on the findings and critically analyse the results (including a comparison with historical data) and if required, make recommendations as to the adequacy of the extraction rates, whether pressures are sufficiently negative and whether additional sealing/enclosing of any rendering plant process area is needed to ensure adequate extraction and compliance with conditions of this consent.

This report must be submitted Regulatory Manager of MWRC as part of the annual reporting required by **Condition 35**.

Daily:-
Vacuum pressure checks of enclosed equipment is performed daily during processing. Records are logged onto **'Air Odour Resource Consent Monitoring Checksheet – RMF 008'**.

'Air Odour Resource Consent Monitoring Checksheet – RMF 008' pdf files for the review period sent to Horizons electronically.

Annually:-
KupeTech perform annual pressure checks as per Condition 32. Findings from that annual review can be found in the Appendix 3 of this report. Included in that audit report is an 'Action List' for remedial actions required on extraction systems. Refer Appendix 4 for the KupeTech Action List.

i. Records all instrument calibrations carried out on the rendering plant cooling and odour control equipment;

Fixed temperature probes located on plant cooling vessels are calibrated on a quarterly basis (in-house using a calibrated reference thermometer). Refer below to the latest calibration results.

FIXED PLANT THERMOMETERS

Serial / ID Number	Dept.	Description	Ice Point Reading	Ref. Therm.	Difference (+/-)	Steriliser Reading	Ref. Therm.	Difference (+/-)	Accept? (+/- 2.0°C)	Initial	Date of Calibration
SLAUGHTER FLOOR											
115194/1	Viscera Table	N/A	N/A	N/A	N/A	88.0	88.0	0.0	✓	CW	30/04
304724	Brisket Cutter	N/A	N/A	N/A	N/A	84.0	84.0	0.0	✓	CW	30/04
304724	Auto-hock Cutter	N/A	N/A	N/A	N/A	82.0	82.0	0.0	✓	CW	30/04
3059223	Thumb Tool (West)	N/A	N/A	N/A	N/A	82.0	82.0	0	✓	CW	30/04
301074	Thumb Tool (East)	N/A	N/A	N/A	N/A	84.0	84.0	0	✓	CW	30/04
	Hot Water Wash	*Hot Water Wash currently not in use. Carcases washed using cold water.*									
RENDERING PLANT – (Handwash Water Temperature)											
304724	Dryer Condenser	41.0 / 41.0							X / ✓	CW	30/04
300739	Odour Condensate	41.0 / 41.5							✓	CW	30/04
304724	Dryer Condensate	40.5 / 41.5							✓	CW	30/04
300739	Odour Condenser	41.5 / 42.0							✓	CW	30/04
E006481	Rendering	Yokogawa	N/A	N/A	N/A	41.8	41.9	+0.1	✓	CW	30/04
301074	Dry-side Inlet Duct	41.0 / 41.5 HRT 1							✓	CW	30/04
301074	Dry-side Outlet Duct	42.0 / 42.0 HRT 2							✓	CW	30/04
304724	Westside Cooling Tower Outlet	41.0 / 42.0							✓	CW	30/04

NOTE:-
1. Fixed Plant thermometers are replaced if they require an adjustment which is greater than 2 deg C.
2. Fixed thermometers associated with the Rendering Department are to be calibrated in handwash water only.
3. All non conforming thermometers are to be replaced with new thermometers.

APPENDIX 1 –

Complaints Register and Trending

Complaints Register:-

ODOUR COMPLAINTS REGISTER 2019 - 2020

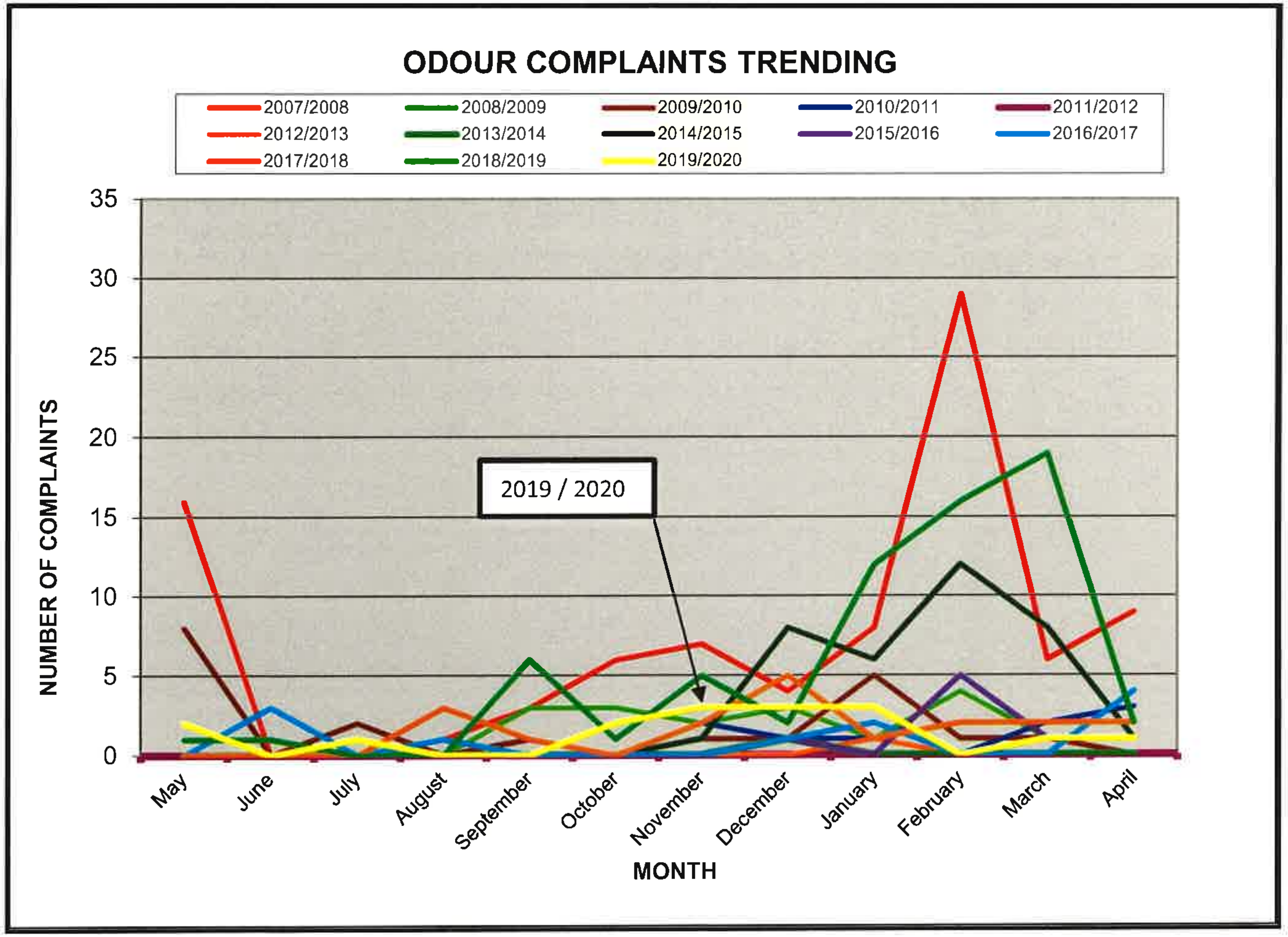
(Period from the 1st of May 2019 to 30th of April 2020)

Nº	NAME	ADDRESS	DATE	TIME	COMMENTS	SUBSTANTIATED (Ours)	UNSUBSTANTIATED
1	Iona Soulsby	1a Kings Ave	02.05.19	13:50	Terrible rotten smell coming from Imlay. Smells like dead animals	✓	
2	Horizons (John Gleeson)	53 Balgownie Ave	02.05.19	14:25	Odour reported to Horizons. Horizons performed a FIDOL Assessment. Horizons reported to AFFCO Imlay at 16:26 (Pita Kinaston contacted Ricky Gowan)	✓	
3	Horizons (John Gleeson)	36 Matipo Street	26.07.19	13:45	Odour reported to Horizons. Reported as a 4. Imlay Rep / Horizons Rep / Armourguard met at complainants address. Smell not coming from Imlay. Biscuit cooking smell.		✓
4	Horizons (Christina Mott)	6 Saunders Place	04.10.19	14:45	Odour reported to Horizons. Resident from Saunders Place stated that there was an odour coming from Imlay at 14:45.		✓
5	Horizons (Christina Mott)	53 Balgownie Ave	31.10.19	14:40	Odour reported to Horizons. Carol Henderson stated that there was a cooking odour coming from Imlay at approx. 14:35.		✓
6	Mr & Mrs Lawson	16a Bignell Street	28.11.19	18:15	Odour reported to Imlay at 17:30 stating that the odour was a rotten meat or offal or effluent smell.	✓	
7	Mr & Mrs Lawson	16a Bignell Street	29.11.19	14:40	Odour reported to Imlay at 14:40. Not a good odour coming from Imlay.		✓

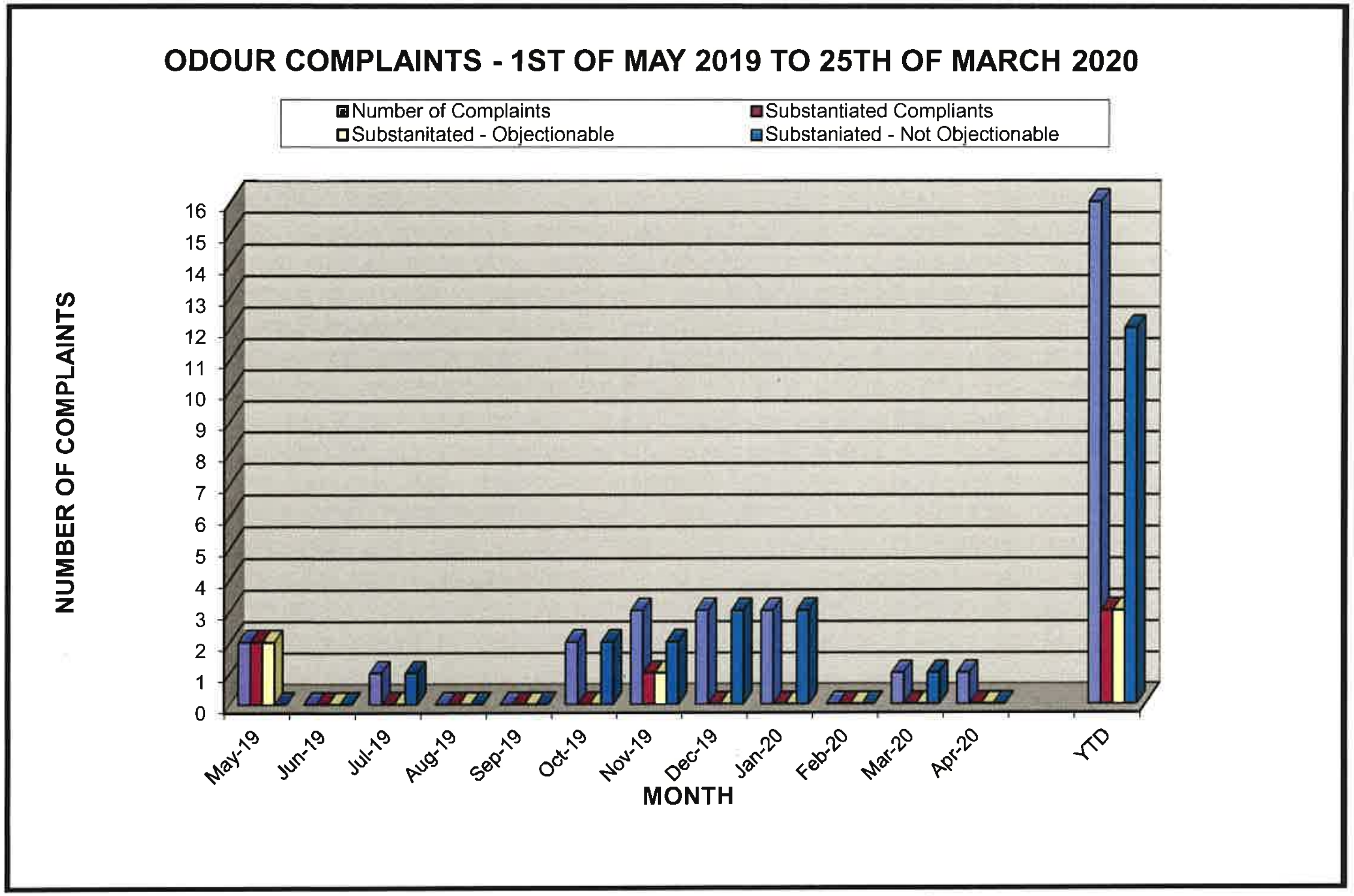
Appendix 1 - Odour Complaint Register and History

Nº	NAME	ADDRESS	DATE	TIME	COMMENTS	SUBSTANTIATED (Ours)	UNSUBSTANTIATED
8	Mr & Mrs Lawson	16a Bignell Street	29.11.19	18:25	Odour reported to Imlay at 18:25. Cooked offal odour.		✓
9	Stephen Bryson	7 Saunders Place	11.12.19	19:50	Odour reported to Imlay at 19:50.		✓
10	Dianne Atkinson	N/A	12.12.19	9:30	Odour detected while walking dog up and down Beach Road.		✓
11	Lonia Sarniak	7 Saunders Place	24.12.19	14:12	Odour coming from Imlay. Can smell it inside the house.		✓
12	Pat Marsh	10 Balgownie Ave	10.01.20	13:50	Odour coming from Imlay. Sheep wool / sheep shit smell.		✓
13	Tony (Pat Marsh)	10 Balgownie Ave	13.01.20	11:47	Odour coming from Imlay. Really bad before the rains came.		✓
14	Sandi Black (rang Christina Mott at Horizons)	71 Bignell Street	17.01.20	16:22	Odour coming from Imlay.		✓
15	Johanna O'Lerell (Visitor)	1a Kings Ave	18.03.20	17:50	Dead smell coming from Imlay		✓
16	Mr & Mrs Lawson	16a Bignell Street	01.04.20	13:59	I guess the crap stink we have been getting all day today off and on are as usual figments of our stupid imagination as usual. It is noticeable there is no noise of your fan today.		✓

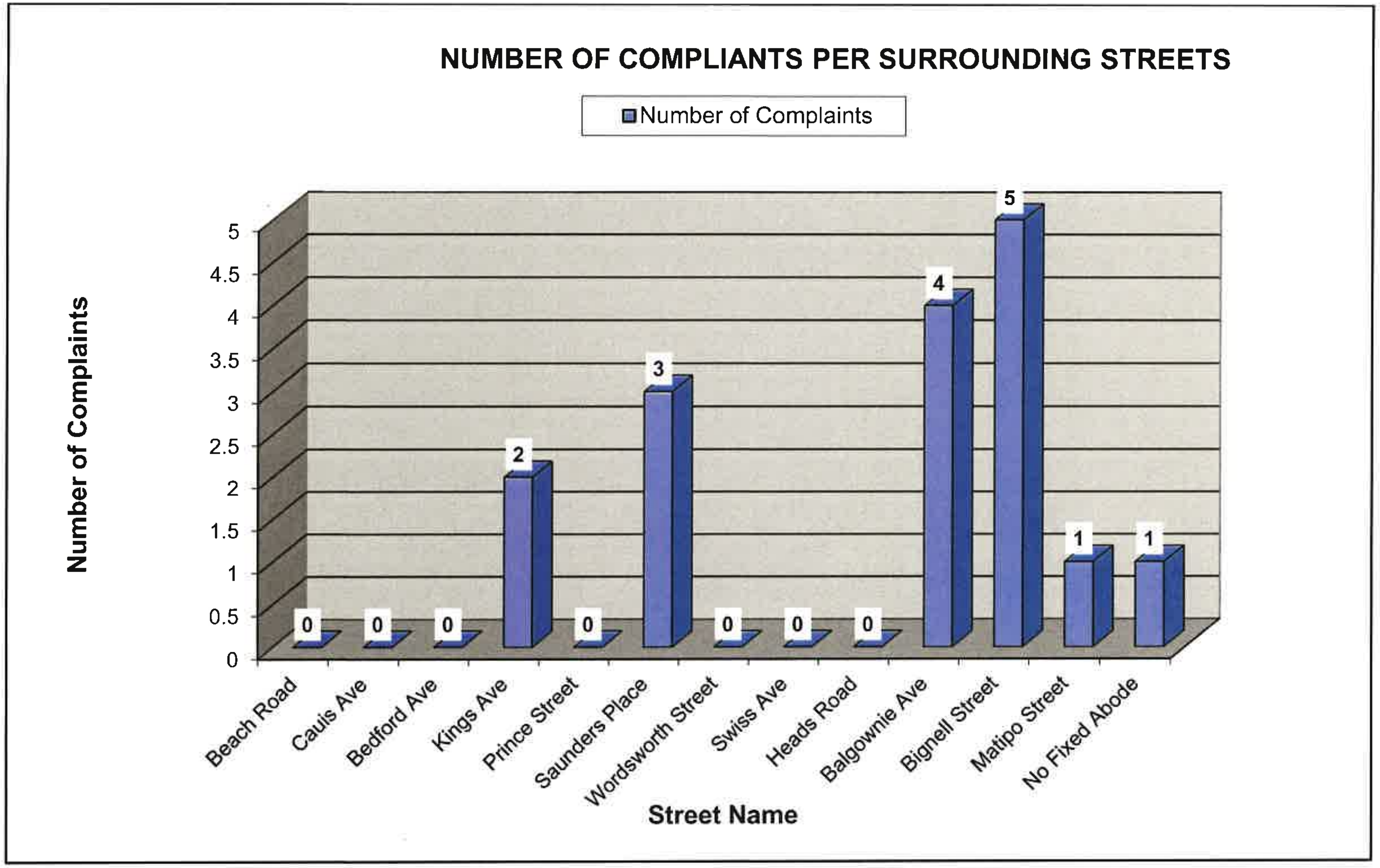
Odour Complaint Trending History to Date



Odour Complaint Outcomes



Odour Complaints by Surrounding Streets



APPENDIX 2 –

Monthly Survey Reports

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 14-5-19

ASSESSORS NAME:- Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable)

COMPLAINT ☐

ODOUR SURVEY ☑

INITIAL IMPRESSIONS:-

CHARACTER:-

TIME OF INITIAL IMPRESSION:-

GENERAL HEDONIC TONE:-

ODOUR INTENSITY:-

PLUME WIDTH (if known):-

START TIME:- 1140

Location	Minute	Sec	Intensity	Character/notes
Kings Ave	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Colqowne Ave	2nd min	0	0 1	
		10	1	Sweet
		20	1	Smell.
		30	1	
		40	1	
		50	1	
Leeds Rd	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Heath	4th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Beach Rd	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Location	Minute	Sec	Intensity	Character/notes
Karoro	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Prince St	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Prince	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- ☐ *I did not detect any odour*
- ☑ *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- ☐ *I did detect odour and consider it would not be objectionable, UNLESS it became continuous*
- ☐ *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- ☐ *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- ☐ *Upwind assessment completed. If not, detail reason:-*
- ☐ *Aerial photo showing location of assessment attached*
- ☐ *Are there potential witness statements to obtain:- YES / NO*

REMARKS:- Don't Think smell was From Affco.

AFFCO IMLAY | ISSUE DATE:- March 2018

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

RMF 001

DATE:- 14-6-18 **ASSESSORS NAME:-** Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable) **COMPLAINT** [ ] **ODOUR SURVEY** [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 1415

Location	Min	Sec	Intensity	Character/notes
Heals	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Heals	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Balgownie	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Dodsworth	4th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Beach Rd	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Location	Min	Sec	Intensity	Character/notes
Leamington	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Karoro	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Prince	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignal	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignal	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [✓] *I did not detect any odour*
- [ ] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 15-7-14 **ASSESSORS NAME:-** Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable) **COMPLAINT** [ ] **ODOUR SURVEY** [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 1100

Minute	Location		Intensity	Character/notes
1st min	Nordsewd	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
2nd min	Golquhoune	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
3rd min	Neals	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
4th min	Meak	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
5th min	Beach Rd	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
6th min	Leamington	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
7th min	Karoro st	0	1	
		10	1	
		20	1	
		30	1	
		40	1	
		50	1	
8th min	Prince st	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
9th min	Bignall	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
10th min	Bignall	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-
Wind velocity:-
Cloud cover:-
Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [ ] *I did not detect any odour*
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- [ ] *I did detect odour and consider it would not be objectionable UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:- slight smell at Back of Affco

AFFCO IMLAY

ISSUE DATE:- March 2018

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

RMF 001

DATE:- 19-5-19

ASSESSORS NAME:- Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable)

COMPLAINT [ ]

ODOUR SURVEY [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 0939

Location	Minute	Sec	Intensity	Character/notes
Colquhoun	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bardwoth	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Leeds Rd	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Karoro St	4th min	0	1	Very
		10	1	Slight
		20	1	Smell
		30	1	From
		40	1	Rendering
		50	1	
Beaumonts	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Prince St	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignol	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignol	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Abbott	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Saunders Pl	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [ ] *I did not detect any odour*
- [✓] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable, UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 26-9-19 **ASSESSORS NAME:-** Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable) **COMPLAINT** [ ] **ODOUR SURVEY** [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 0946

			Intensity	Character/notes
Wordsworth St	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
20 Balgownie Ave	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
3 Balgownie	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Heads Rd	4th min	0	0	smoke only
		10	0	
		20	0	
		30	0	
		40	0	smoke only
		50	0	
Beach Rd	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

			Intensity	Character/notes
other end Karora	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Karora Rd	7th min	0	1	slight smell by rendering
		10	1	
		20	1	
		30	1	
		40	1	
		50	1	
Prince St	8th min	0	0	slight smell of smoke
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell 16	10th min	0	0	
		10	0	smoke only
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

	-4 Extremely unpleasant
	-3
	-2
	-1
	0 Neutral
	1
	2
	3
	4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [ ] *I did not detect any odour*
- [✓] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable. UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

AFFCO IMLAY

RMF 001

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

ISSUE DATE:- March 2018

DATE:- 17-10-19

ASSESSORS NAME:- Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable)

COMPLAINT [ ]   ODOUR SURVEY [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 1200

			Intensity	Character/notes
Balgownie	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
...edworth	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Leach	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
...leads	4th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
...nce St	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

			Intensity	Character/notes
Bignal	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignal	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Abbot St	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Saunders	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Gunn St	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [✓] *I did not detect any odour*
- [ ] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable. UNLESS it become continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain: YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 25-11-19

ASSESSORS NAME:- Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable)

COMPLAINT [ ] ODOUR SURVEY [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-		CHARACTER:-	
ODOUR INTENSITY:-		GENERAL HEDONIC TONE:-	
		PLUME WIDTH (if known):-	

START TIME:- 1455

			Intensity	Character/notes
Belgrave Ave	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Jacklin St	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Beach Rd	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Karoro	4th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Prince St	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	6th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Abbott	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Sowman Pl	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Grey St	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-
Wind velocity:-
Cloud cover:-
Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [✓] *I did not detect any odour*
- [ ] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable, UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 19-1-20 **ASSESSORS NAME:-** K Townsend

REASON FOR INVESTIGATION:- (✓ applicable) **COMPLAINT** [ ] **ODOUR SURVEY** [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:-

		Intensity	Character/notes
1st min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
2nd min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
3rd min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
4th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
5th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	

		Intensity	Character/notes
6th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
7th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
8th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
9th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
10th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-
Wind velocity:-
Cloud cover:-
Temperature:-

General Hedonic Tone

	-4 Extremely unpleasant
	-3
	-2
	-1
	0 Neutral
	1
	2
	3
	4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [✓] *I did not detect any odour*
- [ ] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable, UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

AFFCO IMLAY

ISSUE DATE:- March 2018

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

RMF 001

Page 1 of 2

DATE:- 17-2-22

ASSESSORS NAME:- Wayne Watson

REASON FOR INVESTIGATION:- (✓ applicable)

COMPLAINT: \

ODOUR SURVEY: ✓

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 1525

Location	Minute	Sec	Intensity	Character/notes
	1st min	0	1	
		10	1	
Balgownie		20	0	
		30	0	
		40	0	
		50	1	
	2nd min	0	0	
		10	0	
Ingestre		20	0	
		30	0	
		40	0	
		50	0	
	3rd min	0	0	
		10	0	
Heads Rd		20	0	
		30	0	
		40	0	
		50	0	
	4th min	0	1	
		10	1	Not AFFCO
Beach Rd		20	1	
		30	1	T/Ton
		40	1	
		50	1	
	5th min	0	0	
		10	0	
		20	1	
		30	1	
Karore		40	1	
		50	0	

Location	Minute	Sec	Intensity	Character/notes
	6th min	0	0	
		10	0	
Bignell		20	0	
		30	0	
		40	0	
		50	0	
	7th min	0	0	
		10	0	
Bignell		20	0	
		30	0	
		40	0	
		50	0	
	8th min	0	0	
		10	0	
Swiss		20	0	
		30	0	
		40	0	
		50	0	
	9th min	0	0	
		10	0	
Gunn		20	0	
		30	0	
		40	0	
		50	0	
	10th min	0	0	
		10	0	
		20	0	
Prince		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [ ] *I did not detect any odour*
- [x] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable. UNLESS it become continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 20-3-20 **ASSESSORS NAME:-** Wayne

REASON FOR INVESTIGATION:- (✓ applicable) **COMPLAINT** [ ] **ODOUR SURVEY** [✓]

INITIAL IMPRESSIONS:-

CHARACTER:-

TIME OF INITIAL IMPRESSION:-

GENERAL HEDONIC TONE:-

ODOUR INTENSITY:-

PLUME WIDTH (if known):-

START TIME:- 1140

Location	Minute	Sec	Intensity	Character/notes
Kings Ave	1st min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Balgownie Ave	2nd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Heads Rd	3rd min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Wordsworth	4th min	0	1	
		10	1	Not Affco
		20	1	
		30	1	sweet smell
		40	1	
		50	1	
Leamington St	5th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Karoro	6th min	0	1	
		10	1	Not Affco
		20	1	
		30	1	Possible
		40	1	4/Tan...
		50	1	
Bignell	7th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Bignell	8th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Gunn St	9th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	
Princes St	10th min	0	0	
		10	0	
		20	0	
		30	0	
		40	0	
		50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

	-4 Extremely unpleasant
	-3
	-2
	-1
	0 Neutral
	1
	2
	3
	4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [ ] *I did not detect any odour*
- [✓] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable. UNLESS it became continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-* ______
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

ODOUR MEASUREMENT RECORD SHEET (FIDOL SYSTEM)

DATE:- 15-4-20 ASSESSORS NAME:- Wayne Wat...

REASON FOR INVESTIGATION:- (✓ applicable) COMPLAINT [ ] ODOUR SURVEY [✓]

INITIAL IMPRESSIONS:-

TIME OF INITIAL IMPRESSION:-

ODOUR INTENSITY:-

CHARACTER:-

GENERAL HEDONIC TONE:-

PLUME WIDTH (if known):-

START TIME:- 1503

		Intensity	Character/notes
1st min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
2nd min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
3rd min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
4th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
5th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	

		Intensity	Character/notes
6th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
7th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
8th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
9th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	
10th min	0	0	
	10	0	
	20	0	
	30	0	
	40	0	
	50	0	

Scale of Intensity

6	Extremely strong
5	Very strong
4	Strong
3	Distinct
2	Weak
1	Very weak
0	No odour

Weather Data (see over)

Wind direction:-

Wind velocity:-

Cloud cover:-

Temperature:-

General Hedonic Tone

-4 Extremely unpleasant
-3
-2
-1
0 Neutral
1
2
3
4 Extremely pleasant

Based on your assessment on this occasion, which of the following applies:-

- [✓] *I did not detect any odour*
- [ ] *I did detect odour and consider it would not be objectionable at any location for any duration or frequency*
- [ ] *I did detect odour and consider it would not be objectionable UNLESS it become continuous*
- [ ] *I did detect odour and consider it would be objectionable if it occurred on a regular or frequent basis*
- [ ] *I did detect odour and consider it would be objectionable even if in periods of short duration*

FINAL CHECKLIST:-

- [ ] *Upwind assessment completed. If not, detail reason:-*
- [ ] *Aerial photo showing location of assessment attached*
- [ ] *Are there potential witness statements to obtain:- YES / NO*

REMARKS:-

APPENDIX 3 –

KupeTech Annual Report

AFFCO Imlay Whanganui Rendering Plant

Audit of Odour Control Systems

AFFCO New Zealand Ltd

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Document prepared by:

KupeTech®

Kupe Technologies Ltd
PO Box 13 416
Johnsonville
Wellington
New Zealand 6440

T +64 29 939 4877
E jv@kupetech.co.nz

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Approval			
Author signature	JVickerman	Approver signature	JVickerman
Name	J Vickerman	Name	J Vickerman

Contents

Appendix

Imlay Rendering Plant Biofilter Systems Inspection

This report summarises results from inspection of the Rendering Plant odour extraction and biofilter systems at the Imlay meat works on 12 to 14 February 2020 and 19 to 21 February 2020.

1. Background

Under the recently renewed Resource Consent to AFFCO New Zealand Limited (AFFCO) for the discharge of contaminants into air there is a Condition 31 which says:

> *The Permit Holder shall, annually … undertake an annual audit of the rendering plant's odour control systems that considers the effectiveness of the extraction, cooling and biofilter system and its overall performance in regards to controlling odour emissions. The audit should utilise all monitoring data (manual and continuous, complaint records, any independent odour assessments) as well as include downwind odour assessments of the operational rendering plant and ancillary activities. The audit should assess the state of the odour extraction, cooling and biofilter system and taken appropriate measurements and sample for analysis required to confirm the status these systems against their design and required operating parameters. Any analysis of samples shall be undertaken by an appropriately qualified testing laboratory and sampling undertaken as specified in the OMP. Accepted methods shall be used for measurement of media properties that are certified by the Regulatory Manager of MWRC.*
>
> *The audit shall be undertaken by person(s) who is independent, appropriately qualified and experienced in the operation and maintenance of air extraction, cooling and biofilter systems.*

There is also a Consent Condition 32 which says:

> *The Permit Holder shall, annually … measure and record the vacuum (pressure) at all enclosed equipment items that are extracted by the odour control systems as follows:*
>
> a. *Pressure shall be measured in the head space of the equipment items that are targeted by the extraction systems. The measurements shall be undertaken by an independent appropriately qualified and experienced person following industry best practice for measurements of this type.*
>
> b. *The Permit Holder shall prepare a report on the findings and critically analyse the results (including a comparison with historical data) and if required, make recommendations as to the adequacy of the extraction rates, whether pressures are sufficiently negative and whether additional sealing/enclosing of any rendering plant process area is needed to ensure adequate extraction and compliance with conditions of this consent.*

This report presents the results of investigation, inspection and measurement carried out to meet the above objectives.

2. Recent Inspections

The last inspection and report at Imlay prior to 12 February 2020 was on 16 May 2019.

3. Figures and Tables in the Appendix

In Figures 1, 2 and 3 numbers in balloons have been given for identification of the extraction point sources in this report.

Figure 1 provides a schematic of the wet side point source extractions.

Figure 2 provides a schematic of the dry area point source extractions.

Figure 3 provides a schematic of the outside dry side, wet side and drier air extraction systems feeding the biofilters. Typical air flows (A) ranging from 1,000 to 31,000 m^3/h, static pressures in Pascals (Pa) and temperatures in degrees centigrade (°C) are given in a few locations. Tags for some instruments in the SCADA system are also given for reporting reference.

Fig 4a provides a key for symbols used in Figs 1 to 3.

Fig 4b provides a diagram of the bed pressure test port locations on the uncovered biofilter.

Table 1 in the Appendix summarises the measured data for the Drier to Covered Biofilter in Fig 3.

Table 2 in the Appendix summarises measured data for the Wet Side to Uncovered Biofilter in Fig 3.

Table 3 in the Appendix summarises the point source extraction measurements.

Table 4 in the Appendix provides a snapshot of the building internal temperatures and humidity.

Table 5 in the Appendix provides an overview of historical measured data since 2012 for comparison. Note the 2019 biofilter airflow measuring instrument and locations have changed to be compliant with ISO 10780 but testing so far has indicated only minor difference between new and old and less than annual variations.

Table 6 has the list of issues for improvement or corrective action provided with the 2019 report with further comment and some added items.

4. System Description

With reference to Figure 1:

a) Air in the factory Wet Side is drawn into air extraction ducting at locations where process equipment is known to emit odour. Sufficient air extraction at these locations prevents odour transfer to the working environment. The point source extraction system (PSES) is widely accepted as an energy efficient effective method for containing fugitive odours and providing a safe working environment in a low temperature rendering plant (LTRP). Numbers in balloons refer to vacuum measurement locations used with the AFFCO Air Odour Resource Consent Monitoring Checksheet (RMF 008). Further ports used in the annual measurement have also been numbered. An "f" suffix after the number indicates it is an airflow measuring port.

b) Air is also extracted from drier feed conveyor head space and the drier discharge conveyor headspace on the Dry Side.

With reference to Figure 2:

c) Factory air on the Dry Side is extracted at what has been called the "Dust Filter" but is merely a coarse screen covering flow control louvres at the intake. The extraction duct also collects head space air from the Ground and Unground Meal Bins along the way before entering the scrubber outside.

d) Vapour from the driers is conveyed in a separate line to the trash vessel outside. Although the extracted vapours are at slightly less than atmospheric pressure they can be slightly superheated above 100°C.

With reference to Figure 3:

e) Dry Side air passes through a spray tower (Dryside Air Scrubber in Fig 3) to a common induced draught fan 14.1 (was also known as ID1) which discharges into the uncovered biofilter. The primary function of the spray tower is to remove dust particles and protect the biofilter from clogging. Cooling and humidification are other benefits. Air extraction from the outside raw material reception bin (point source 1); the underground conveyor well; and the feed conveyor (point source 21) is also combined with the inflow to the scrubber.

f) Wet Side air and vapour is cooled in the Wet Side heat exchangers HX1, HX2 and HX3 and some water is removed. The Wet Side gas then passes to the common 14.1 fan which discharges into the uncovered biofilter.

g) Drier gas and vapour pass through the Drier Trash Vessel which removes entrained water and trash, then to a stickwater waste heat evaporator where heat from the drier gas transfers to the stickwater. The cooled Drier gases and non-condensable gases from the evaporator vacuum pump then pass through two heat exchangers (Gardiner HX and Potter HX) which further cool the gas and vapour and remove condensed water from the gas stream. After cooling and water removal the Drier gas passes to fan 9.3 (formerly known as ID2) and then discharges to the covered biofilter.

h) Water in the Dry Side Air Scrubber (previously called the Dry Process heat exchanger) is recirculated by a pump (14.2) with a small make up water flow.

5. Process Measurements

The biofilter gas and vapour systems temperatures and gas velocities were measured by calibrated thermocouple, ISO10780 compliant pitot tube and micro-anemometer (Schiltknecht MiniAir20 Micro) by removing plugs and inserting instruments at:

- Two new 32 NB measurement ports (27) located 33m downstream from fan 9.3.
- The gas ductwork inlet to the Dry Side Air scrubber (26) at a temperature gauge port adjacent instrument HRT1.
- The gas outlet ductwork from Wet Side Heat Exchangers HX1, HX2 and HX3 (24), prior to the connection with ductwork from the Dry Process scrubber and prior to the 14.1 fan.
- The gas outlet duct from the 14.1 fan at two 50 NB ports (25) 13m downstream of the fan.
- Static pressure measurements made at five locations around the uncovered biofilter distributor ducting ends as shown in Fig 4b.
- Temperature and pH measurement of the biofilter media in samples taken from the quadrants at 150 mm depth.
- New flow measurement ports in reception bin and feed conveyor air extraction ducting (22, 21,1).
- New flow measurement ports in the wet area at inside raw material bin (2f), preheater (3f) and separator feed tank air extraction ducting (14f).

6. Comments on Flowrates, Pressure and Temperatures

Tables 1 and 2 show the results of flowrate and temperature measurements taken over six days in February 2020 which were characterised by warm summer temperatures and moderate to light south to south-west winds.

From the data in Tables 1 and 2:

6.1 Covered Biofilter Airflow

The air flow to the covered biofilter was 920 - 1100 m^3/h or 1.1 – 1.3 tonnes/hour (tph) which was consistent with that found in 2019.

Following installation of the evaporator in 2015 - 2016 the flow to the covered biofilter from fan 9.3 was reduced (to limit drier vapour vacuum at the evaporator to -200 Pa) to aid evaporator operation.

The fan 9.3 was then also replaced with one having a different characteristic. This is why the flow to the covered biofilter changed between 2016 and 2018 in the Table 5 historical data.

Both driers were operating normally and the drier vapour duct vacuum at point 33 was consistently between 150 - 164 Pa. In 2019 it was learned that the vacuum at point 33 could fall as low as 22 Pa without causing drier puffing. On all occasions during the 2020 inspection there was not the slightest hint of any drier puffing. The extraction of drier vapours from drier to evaporator and discharge of non-condensable gases from evaporator to covered biofilter was working well.

6.2 Uncovered Biofilter Airflow

The air flow to the uncovered biofilter was 30,0000 - 33,000 m³/h or 34 – 37 tph and was based on measurements made on two different days at new measuring ports 13 m downstream of fan 14.1. Each flow measurement required a total of ten dynamic pressure measurements and ten static pressure measurements, made in two radial directions at right angles to each other, with a pitot tube, all compliant with ISO 10780. In addition, measurements were made with a micro-anemometer inserted into the duct but modification of this is needed to be able to extend to the full depth needed across the large duct. This will be done for future measurement, but even with the limitation the independent instruments gave a similar result. One difficulty with all measurements is that the flow to the biofilter is not constant and in the time it takes to get the 20 measurements some of the earlier measurements will have changed. The micro-anemometer gives faster measurement of air velocity and enables velocity measurement in small ducts. Possible causes of the flow variation are opening/closing of the reception bin cover and varying amounts of heated vapour drawn into the extracted air.

The measured flow is similar to that found previously in 2019 but lower than in earlier years. Explanation for the difference appears mainly due to change in test method – the previous flow measuring port used was closer to fan 14.1; only one radial direction could be sampled; there was significant variation in velocity across the duct; and a different averaging method is now used. Some reduction will also come from restriction of the point source extractions where the flow has been too high.

From Figure 3 and Table 2 it can be seen that a total flow of around 31,000 m³/h is made up of 12,000 m³/h wet side air and vapour and 19,000 m³/h dry side air (34 tph made up of 13 tph of wet side air and vapour and 21 tph of Dry Side Air). Of the dry side air: 6,800 m³/h comes from the reception bin and feed conveyor; 9,100 m³/h comes from the dry-side air intake (30 Fig 2) and the 3,100 m³/h balance comes from the Dry Side via the un-ground and ground meal bins. The wet side vapour flow is less than what it has been in the past as also was the dry side gas. The mass of measured Dry Side gas + Wet Side gas is unusually close the measured mass of air going to the biofilter. The new measuring ports installed since the 2019 inspection have been of assistance in resolving variations in flow and limitations of the earlier measuring ports.

Measurement of air flow into the scrubber in Table 2 (F) did have an issue. One measurement using the pitot tube (as was also the case last year) gave a higher flowrate and static pressure known to be too high compared to nearby measurements. The only available measuring port is where the thermometer is mounted and the gas flow measurement has to be made crosswise at the inlet bend to the scrubber. Close upstream to the bend is a tee where air from the reception bin and feed conveyor enters the duct from the dry-side. One explanation for the high reading is that there is turbulent (swirling) flow in this part of the duct. As the ISO 10780 L-type pitot tube has the static pressure measuring ports at a different location to the nose – the static pressure ports are likely getting some velocity head from the turbulence.

As part of the 2019 action plan a new port 23 (Fig 3) was installed in the large duct from the dry area where the air flow is steady, but the port does not have a permanent or temporary small working area platform nearby from which the flow measurements can be made. Piping had been extended from port 23 to enable a static pressure measurement to be made at ground level but this does not allow flow measurement. Action point 35 in Table 6 has been added to provide two new flow measuring ports at the scrubber inlet bend which are accessible from ground level – these can be used with modified equipment to get a more consistent and accurate result if provision of a small work platform at port 23 is too difficult. Detail of a flow measuring port is provided in photo 101 in the appendix – for flow measurement the 20BSP plug is interchanged with a test plug gland through which the micro-anemometer is inserted for velocity measurement.

The measured total airflow to the biofilter is around the 32,000 m^3/h recommended guideline of Table 4 in the Air Discharge Consent application.

In 2019 a significant leak was found downstream of the fan 14.1 where the stainless steel duct joins the concrete pipe. It is noted that a permanent full circumferential skirt secured by tensioned bands has now been installed (Photo 102) to withstand the vibration from the fan. There was no leakage at this location but it was observed that the thick rubber sheet used was not able to accommodate the difference in pipe diameters and has gathered as seen in the photo. Packing (not visible) may also have been used but there is potential for leakage to occur inside the tensioning bands at the bottom. Regular inspection for leakage is needed and if necessary a tapered skirt of thinner coated fabric installed to achieve the seal.

6.3 Covered Biofilter Media

It is noted part of Consent condition 31 says "*Any analysis of samples shall be undertaken by an appropriately qualified testing laboratory and sampling undertaken as specified in the OMP. Accepted methods shall be used for measurement of media properties that are certified by the Regulatory Manager of MWRC.*" As part of the AFFCO OMP samples have been taken on a monthly basis and tested in an appropriately qualified testing laboratory. AFFCO have reported on this. As an independent check the media moisture test results given in Tables 1 and 2 are the results of our own lab testing. The media moisture content of all testing is consistent.

In 2019 comment was made on the variation of the pH test results including an observation that pH changes in a biofilter bed occur slowly and that the monthly rise and fall pattern seen in the qualified lab test results was unusual.

Recalling the variation of pH from the 2019 testing, ten samples were taken from the uncovered biofilter and eight from the covered biofilter, all at 150 mm depth (in the top 2/3 layer) for the moisture and pH testing. There were two samples from each quadrant plus two from a central zone for the uncovered biofilter.

From these samples, 10g sub-samples were taken and mixed with 50g demin water, stirred for 60s and allowed to settle. pH of clarified water was measured after 3h settling. (This is the method referred to in the notes to Table 4 in the discharge consent application). Other methods exist for different purposes e.g. use of 0.01M $CaCl_2$ instead of demin water and give a lower pH. The pH of the clarified water was determined using Macherey-Nagel Pehanon pH 4.0 to 9.0 indicator strips. These are accurate, quick and not influenced by the colour of the clarified water sub-samples. Additional further measurement was carried out using a Hanna 2-point calibrated membrane pH meter.

The results with the indicator strips were repeatable without variation. Results with the pH meter were not stable and in the case of the uncovered biofilter media gave a pH of 1 to 2 lower than what the strips gave. When the electrode was returned to one of the calibrating buffer solutions, the correct pH was stable and quickly attained. What was surprising was the covered biofilter media gave similar pH results for both pH measuring methods except for the samples from the south-west quadrant. We have no immediate explanation for the difference and need to do further testing with fresh samples to confirm what was found. What is important to note is that a decision to replace biofilter media should not be based on pH alone if that pH determination method is not repeatable and accurate.

The pH of the covered biofilter north side media samples were found to be 7.0 – 7.5 whereas the south-east quadrant samples were 6.5 – 7.0. The south-west quadrant samples were 5.5 – 6.0. A core sample was taken from the bottom of the biofilter in the south-west quadrant (anticipating the pH would be lower than near the surface), but it was slightly higher at 6.5 – 7.0. The pH meter gave 7.12 – 7.15. These results indicate that the pH of the covered biofilter media has risen slightly since the 2019 testing and is not a trend earlier seen in this biofilter. On two of five occasions a trace of ammonia was sensed (judged to be 5 - 10 ppmv) and the minor pH elevation could be related to this. On one occasion when the driers were not operating but air was being discharged from the biofilter, a very unpleasant distinct odour was momentarily sensed – possibly a polyamine but not one associated with any of the normal odours in the dry or wet processing areas.

At the south-west corner of the covered biofilter some earlier heavy rain had carried some silt from the edge of the biofilter onto the bark surface. This corner of the biofilter has had media issues in the past so a core sample was taken from the base of the bed close by. The base sample had a moisture content of 63.3% w/w wet basis and pH 6.5 – 7.0 so nothing remarkable there.

No issue is seen with pH in both biofilter beds. Further investigation and discussion is needed into the sampling and testing method by all involved in order to understand and reduce methodological variation in the formal results.

The moisture content of the bark media in the covered biofilter at 150mm below the surface in each quadrant was found to be between 59 and 65% w/w (wet basis). This is within the guidelines of Table 4 of the Consent Application. The air loading on the biofilter of 11 m^3/h of air per m^3 of media is below the Table 4 guideline maximum of 35 m^3/h of air per m^3 for soil-bark beds.

This loading is based on a media depth of 0.54m which was determined by averaging the depth of auger sampling holes in each bed quadrant. It is noted that the recommended depth from the Consent application was that it be increased to the original design value of 0.6m. From the downwind odour checks it is believed that some meal odour is breaking through the covered biofilter despite the low loading. In 2019 it was recommended that a further 150 to 200mm of bark-10% soil be added to the present bed (not implemented yet). Since then the bed has shrunk and the measured back pressure was only 3Pa at the sump. This is very low but not unexpected from the low flow, large bed area and low bed depth.

Temperatures in the bed at 200mm depth ranged between 22 and 25°C. Examination of the SCADA record for temperature transmitter HRT14 at entry to the biofilter revealed a tendency for the temperature to rise steadily during the processing day and level out – this is all well controlled. Later when drier load eases and prior to drier shutdown, high temperature peaks can occur (perhaps due to control overshoot) such as occurred on the evening of 3 Feb 2020. This is unlikely to have affected the bed but potential exists with air channelling to kill a portion of the bacteria in the bed from a spike in temperature prior to shut down. Consideration should be given to whether operating practice can be modified to reduce the peaks.

A question remains as to whether part of the bed might be stagnant in relation to the slightly elevated pH and hint of ammonia. This is unlikely. It is recalled that the narrow slots in the biofilter distributor tubing got regularly blocked with fat prior to evaporator installation but has not been an issue to the same degree since. As these accreted or condensed fats will still be produced by the driers is there an evaporator cleaning procedure which removes accreted matter from the shell side of the heating tubes? If so could the hint of ammonia be related to this?

There has been a tendency for clay from the sides of the covered biofilter to be washed onto the biofilter during bed watering particularly in the south-west corner. It is understood work is planned to retain the clay so this does not occur.

The following points are noted:

a) When the biofilter was built the airflow was three times what it is now. Later installation of the evaporator has significantly reduced the biofilter loading (from around 30 m^3 air/h per m^3 of media to around 10 at present).

b) Compared to many other biofilters, the AFFCO biofilters have a large surface area for the treated airflow (5 m^3/h air per m^2 of covered biofilter surface and 24 m^3/h per m^2 of uncovered biofilter surface – others are known in the range 60 to 90).

c) Bed pressure drop is primarily determined by bed cross-section area (depth to a lesser extent) hence the AFFCO biofilters have low pressure drop compared with many others.

d) Low bed pressure drop and low bed depth over a large area will result in variable permeability with channelling (greater airflow through some parts of the bed than others).

e) The low bed loading typically corresponds to that for bark beds without any added topsoil so any added media could be just 10 – 25mm graded bark.

Apart from insufficient bed depth as evidenced by a slight breakthrough of meal odour, the covered biofilter is within its design and operating parameters.

6.4 Uncovered Biofilter Media

As with the covered biofilter AFFCO has had bed samples tested on a monthly basis for moisture and pH. In independent check testing, the moisture content measurements in the uncovered biofilter ranged from 50 to 66% moisture w/w wet basis which corresponds with the guideline.

Temperatures measured in the bed ranged from 21°C to 29°C and met the consent guidelines. Examination of the SCADA system temperature transmitter HRT14 data shows that air going to the biofilter builds up daily to a controlled plateau well within the guidelines.

In 2019 it was noted that the temperature of the air from the Wet Side heat exchangers HX1 to HX3 was higher than it had been. The reason for this was thought to be increased heat extraction from the point sources which went with the new Resource Consent Monitoring Checksheet where the aim was to achieve a vacuum of ≥ 100Pa in the ducting between the slide valve and the equipment it was connected to. In the 2020 inspection, with flow measurement in some of the heat source ducts, flows have been moderated reducing the heat input to the biofilter but more work remains to achieve a good balance.

The biofilter loading at 48 - 59 m^3/h of air per m^3 of media, based on an average bed depth of 0.44m determined by the core sampling, is above the recommended guideline of 35 m^3/h of air per m^3 of media recommended in the Consent application. As the flowrate to the biofilter is around the recommended 32,000 m^3/h, the high loading is due to low bed depth and a bed surface that is slowly dropping through compaction and media breakdown. The recommended depth is 0.7m.

If we were designing a biofilter for the duty we would do so based on a loading of 35 m^3/h of air per m^3 of media. If asked whether the biofilter is working at its current loading the answer would be that having walked around the uncovered biofilter in both calm and varying wind conditions many times, we have not been able to detect any of the odours that are able to be detected when in the building wet and dry areas. Air exiting the biofilter could be sampled and sent away for a qualitative VOC screening scan using direct injection – Selected Ion Flow Tube Mass Spectrometry. This would likely list many compounds in concentrations undetectable to a trained human nose, but the test is whether there are odours present causing an adverse effect on the environment. We were not able to detect any and the recent lack of substantiated odour complaints suggests others can't either.

Is it unusual for a biofilter to be working satisfactorily at this loading? We are aware of others in city locations that are. Odour compounds in meat and fish rendering extracted air, absorbed onto moist bark surfaces, are very effectively converted by bacteria. Issues can arise with biofilters where a component in the air is toxic to the bacteria, but this is unlikely with the AFFCO uncovered biofilter air. Compared to many biofilters, the AFFCO uncovered biofilter has a large surface area, assisting temperature stability and buffering. In the absence of reports that odour is breaking through, we are reluctant to state that the bed depth has to be increased to achieve the design 35 m^3/h air per m^3 threshold but advise that it would be good practice to do so.

There is another aspect to be considered that with such large surface area and small depth there is obvious variation in permeability across the bed. Varying bed pressure drops at different bed locations (Table 2 (J) and Fig 4b) are indicative of this (but these could also be indicative of a potential distributor design issue). Variation in water vapour emission in cool early morning air can also be observed. The permeability variation gives a loading that is higher is some parts and less in others. With increased bed depth, the variation in permeability would be reduced.

The uncovered biofilter bark bed was replaced in mid-late 2017 and cost and availability of bark has changed considerably since widespread use of biofilters occurred in NZ. While this should not influence the decision whether a bark bed needs to be replaced, it does make it a difficult decision if substantive reason for doing so is not seen. From what is known at present, there is still good life in the existing bark but increased depth is needed.

In the recent Air Discharge Consent renewal application, recommended guidelines for operation and monitoring of the biofilter included biannual testing of the media for microbial density, mass-size distribution, and organic carbon nitrogen ratio. This would inform any decision needing to be made on bed replacement. Also any issues around pH determination as in 6.3 above should first be resolved.

The media pH in quadrant samples and centre from 150mm depth (in the top 2/3 layer) were found to range between 5.5 and 6.5 (more acid than the covered biofilter media). As discussed in 6.3 above use of a membrane pH meter to confirm pH determination gave a lower pH particularly for the samples from the centre and south-west quadrant and requires further investigation.

The air static pressure at the new test point downstream of the 14.1 fan has increased to around 520 Pa from last year but is to be expected from bed breakdown and compaction. Bed pressure drop at the five biofilter manometers (identified in Fig 4b) ranged from 5 to 44 Pa. This has increased slightly since 2019 but is still low.

7. Point Source Extraction System (PSES)

The point source extraction system (PSES) is widely accepted as an energy efficient effective method for containing fugitive odours and providing a safe working environment in a low temperature rendering plant (LTRP). Complementary to the PSES is cooling of the extracted air, then passage through the uncovered biofilter to remove odour prior to discharge to atmosphere.

As in section 6.2 above, with reference to Table 2, the total airflow going to the uncovered biofilter was found to be around 31,000 m^3/h. Table 3 of the Resource Consent application listed concentrated odour sources in the LTRP (other than the drier vapour) with recommended design extraction air flows for each. The total of the recommended point source design flows was 17,450 m^3/h which is well below the total air flow to the biofilter.

The optimal actual operating rate for each point source extraction is determined by the minimum required to contain the process emission and this should be well below the recommended design flow. Too much hot air extracted is unnecessary energy lost but also material being processed can be carried into the ducting such as fine solids and fat aerosol which can eventually block the ducting.

One obvious test for whether process emissions are being contained is whether any steamy discharges can be seen around equipment handling hot matter. Another is whether there is vacuum in the extraction ducting headspace close to connection with the equipment.

In the new consent application, a useful guideline was advanced for indicating that the PSES was likely to be working effectively if a minimum vacuum of 100 Pa g was maintained at ducting connections to equipment. Hence AFFCO developed the Air Odour Resource Consent Monitoring Checksheet RMF 008 where in Section 1 fourteen wetside odour extraction monitoring points were adopted for achieving a target of ≥ 100 Pa vacuum in order to comply with Consent Conditions 18a; 19a; 19c. Similarly, in Section 2 for five Dry Side monitoring points. Fig 1 illustrates the location of the wetside points and includes two dry side points because they are connected to the wetside extraction duct. Fig 2 illustrates the dryside monitoring points. Note the 20 and 30 series numbers do not exist on the RMF008 checksheet but have been provided for identification of the points in this report. As in Table 3 there have been 15 wetside monitoring points but more numbers have now been provided in Fig 1 to include future points needed. The suffix "f" on a monitoring point e.g. 2f indicates it is a flow measuring port whereas a vacuum monitoring port could simply be a 6.5mm hole in a conveyor air extraction box.

Some boxes on the checksheets are filled in daily and others only on a particular day of the week. As reported in 2019, issues were seen around what was being recorded and whether an accurate indication of the extraction was being conveyed. Following this, AFFCO has purchased a more accurate, reliable and easier to read differential pressure monitoring meter and has been steadily working to improve what is able to be monitored.

Vacuum at the AFFCO monitoring points for this report were measured using a calibrated Kane differential pressure meter, model 3500-1. The results are given in Table 3 in the Appendix.

From the measurements taken on 13 Feb 2020, with concerns around the temperature of the air at the wet process heat exchangers, it was apparent too much air was being extracted from hot sources. Where additional ports (ports as in photo 101 in the appendix) had been installed in an accessible location, the flow was measured. With knowledge of the flowrate and the vacuum, the air extracted was able to be reduced at two of the known hot sources (3 and 14). As these reduced flows affected the vacuum at other ports a further set of vacuum measurements was made on 19 Feb 2020 and given in Table 3. Where flows associated with this later measurement are known they too are given in Table 3. Scope remained to further restrict these hot sources but the inability to measure flows at other hot sources (press and separators) dictated caution and no further changes be taken without a full view of the system.

The 100 Pa target vacuum was a good starting guide but, in many cases, cannot be achieved or results in too much air extraction. As air velocity in a duct increases the static vacuum also increases. Slide valves in the duct can result in high velocity air on one side of the duct and low on the other, giving a misleading indication of the average static pressure at a measuring port. With the exception of the blood decanter (port 5) all the point source air extractions are working and a vacuum less than 100Pa at the measuring port does not indicate the extraction is inadequate.

The following comments are made in relation to vacuum measuring ports:

a) **Test Port Size:** Some of the ducts where vacuum is to be measured are not accessible from ground or walkway and have extended tubing to enable measurement. In 2019 the 6mm diameter tubing used for the extension tended to block. It is noted that AFFCO have since increased the size of the lines to 8mm. All extended ports were found to be working.

b) **Location of Test Ports:** In 2019 some of the vacuum test ports were located downstream of flow adjusting slide valves (Ports 5, 6, 7, 8, and Ground Meal Bin (west)). Work done to provide monitoring ports upstream of the slide valves (i.e. on the equipment being monitored side) is acknowledged. In a few cases it is not practical to achieve this due to the proximity of the slide valve to the equipment. In some cases the slide valve is near an open hatch (photo

108 in the Appendix photos) - although there is a port 7 above the slide valve it would be better to make port 7 the small 6mm hole in the duct connection box (see purple arrow 'New 7' in the photo) even though the vacuum will be low. With accessible duct connection boxes all that is needed is a hole through which 6mm tube can be inserted with a close fit.

c) **Outside Reception Bin and Feed Conveyor (Ports 1, 21, 22):** Installation of new flow measuring ports 21 and 22 has enabled air flow from this part of the system to be determined with greater certainty. Air flow into the reception bin when the cover is closed is around 5200 m^3/h; 380 m^3/h is drawn in from the conveyor well and 1240 m^3/h is drawn in from the feed conveyor. This totals 6,800 m^3/h which would otherwise be drawn into the scrubber from the dry-area. With this flow and the bin cover closed there is low risk of fugitive emission.

d) **Inside Raw Material Bin (2, 2a)**: The hatch is normally left open during processing. If the hatch is closed vacuum in the bin is 12 Pa. With the hatch open 560 m^3/h is drawn in; 360 m^3/h is drawn up the conveyor from the hogger; resulting in a total of 920 m^3/h being drawn from the day bin into the extraction system. This is close to the recommended design flow of 1000 m^3/h.

e) **Preheater (Ports 3, 3a):** The 2019 report commented that the new 250 mm diameter air extraction leg without a slide valve had greater air extraction capacity than was needed and appeared to be drawing unnecessary heat and organic volatiles into the extraction system. Since then AFFCO has installed a slide valve and flow measuring port. Table 3 of the consent application recommended a design flow of 1000 m^3/h. Initially the measured flow was well above this so the slide valve was closed a little finally resulting in a flow of 950 m3/h with corresponding port 3f vacuum 96 Pa. It was also established that this vacuum can reduce to 65 Pa without any hot vapour puffing back into the inlet conveyor. The reduced extraction did reduce the air temperature at HX1-3 but not as much as anticipated indicating other hot sources were significant.

f) **Preheater Discharge (Port 4):** In normal operation the hatch (photo 107 in the background) is normally open. As there is no port below the slide valve a 6.5mm hole in the side of the connecting box would enable consistent vacuum measurement. Vacuum above the slide valve was 200Pa. Airflow through the hatch and partially up from the open drainer conveyor hatch seen in the foreground in photo 107 was 1250 m^3/h. This exceeds the recommended flow of 400 m^3/h in the consent application but is considered a good flow in the interim.

g) **Blood Decanter (Port 5):** As reported in 2019 significant steamy discharge occurs from the conveyor under the blood decanter. There is good vacuum in the larger 150mm diameter extraction duct leg but inadequate headspace in the conveyor to draw the vapour from the decanter along to the duct. Another leg of 76mm dairy tube has been added to collect vapour at the east end of the conveyor but this is too small for the vapour flow. Either a larger conveyor or a larger extraction duct to the conveyor east side is required. Alternatively, a lightweight raiseable hood with flexible duct connection to the extraction system could collect much of the vapour.

h) **Drainer Conveyor (Port 6)**: The vacuum measurement should be made through the hole in the side of the duct connection box below the slide valve. The vacuum of 36 Pa is too low for drawing in air and vapour from the open hatch seen in the foreground of photo 107. There is a zone ¼ to ½ way along the hatch where air is not being drawn in to either the drainer conveyor extraction or the preheater discharge extraction. The slide valve needs to be opened further once the hot sources have been better balanced.

i) **Drainer Conveyor to Press Conveyor (Port 7)**: Measurement needs to be made at hole in the side of the duct connecting box (see arrow in photo 108). The hatch is normally open during processing but a vacuum of 14Pa at the box was sufficient for inflow through the hatch.

j) **Press Feed Conveyor (Top End, Port 8):** Vacuum measured by tube extension (see 8 in photo 112). The port is located above the slide valve and should be moved to below it. There are no immediate concerns in relation to Port 8.

k) **Tallow Separator Discharge Chambers 3x (Port 9) and Decanter Solids Discharge Conveyor (Port 12):** Port 12 is seen in photo 109 "Old 12" above the slide valve to the decanter solids discharge conveyor below. As illustrated in Fig 1 the extraction duct from the separator discharge chambers (port 9) is connected to the same duct port 12 is in and up to the air extraction manifold above. Both ports have good vacuum. The increased vacuum of 321 Pa on 19 Feb 20 will be due to reduction of air extracted from the decanter and separator liquid feed tanks which are connected to the same air extraction manifold (Fig 1). It had also been found that air was not being drawn into the hatch cover at the end of the Press-Decanter Solids Conveyor in the Dry-Area (Photo 110 and 12a in Fig 1) and that odour from it was sensed. Minimum adjustment of the slide valve seen in the bottom of photo 109 was made to draw in air at the conveyor end to contain the odour. Further adjustment is desirable, but we would first like a new vacuum measuring port (a 6.5 mm diameter hole) made in the box wall, labelled 'New 12' in the photo; and a flow measuring port (photo 101) installed in the duct at the port labelled 'Old12' which will then become new port 12f. We would also like a further flow measuring port installed (16f in Fig 1) above where the branch from the separators joins the duct. This will need to be at a location that can be directly accessed, with the aid of a step ladder if necessary.

l) **Decanters Liquid Discharge Screen Box (Port 10):** On the monitoring Checksheet RMF008 port 10 was listed as the "Sub-manifold to Decanter and Separators" but we have never been able to identify this measurement point. It seems it may have been removed when the decanters were last replaced. In its place air extraction from the decanter liquid screen box, upstream of being pumped to the separator feed tank, was measured. As this had no 6.5 mm hole in the 76 mm diameter air extraction line for vacuum measurement, the air velocity entering the duct was measured. If and when a new flow measuring port 16f is installed above port 12 as in (k), this would be the ideal equivalent of the former port 10.

m) **Drier Feed Conveyor (Port 11):** This is just a corroded slot in the top plate of the conveyor beside the duct connection box at the top end. The measured vacuum of 18Pa is that in the conveyor headspace and is sufficient to retain odour from the solids. Air flow measurement indicated that flow into the extraction duct was at least 250 m^3/h.

n) **Press and Press Solids Discharge Conveyor (Port 13):** The press entry feed hopper has been modified (including an added 100 mm dia air extraction duct – see Fig 1 and photo 112). The press is now operated with the east side covers open (photo 103 – feed hopper is in the background) so the screen and casing can be regularly cleaned and kept fresh during operation. The vacuum of 6 Pa at port 13 is now lower than what it was (22 Pa). In photo 112 three air extraction ducts are identified with purple arrows. Two of these come from the press body and the third draws air from the solids conveyor. To get a full view of what is happening with the hot sources and in the press-decanter solids conveyor, the air flows in these ducts needs to be known hence flow measuring ports 13f, 17f and 18f (fig 1) and in photo 112 have been identified for future installation in the action list. Also 6.5mm holes in the side of duct connection boxes to provide new vacuum measuring ports 17 and 18 have been labelled in Fig 1. Note existing port 13 is on the far side of the box seen in the photo and remains as is.

o) **Decanter and Separator Liquid Feed Tanks (Port 14):** A new flow measuring port (14f, fig 1) has been installed in the air extraction Y-leg to the separator feed tank. The legs to both tanks have a butterfly valve at entry to each duct which are set at 45°. Vacuum measurement ports in both legs were reading the same so it has been assumed that the measured flow at 14f indicates the same flow in the decanter tank leg. Total flow in both legs is determined by the slide valve above where the legs join. Flow measured on 13 Feb 2020 was 1800 m^3/h in each leg. The recommended flow in the consent application was 300 m^3/h for each tank. The temperature of the air at the time of measurement was 63°C but this rises to above 90°C during processing.

   Following measurement of the high flow, on 20 Feb the slide valve was closed in reducing vacuum increments as measured at port 14. Flow in the duct was measured at vacuums of 114, 100, 91, and 36 Pa. This showed that with a vacuum of 36 Pa at port 14 the flow was 470 m^3/h. There was reluctance to make the full change possible in the limited time available without knowing what flows in other nearby sources such as the press were, so vacuum at port 14 was left at 110 Pa which corresponded to a flow of 750 m^3/h from each tank.

p) **Drier meal discharge conveyor duct (15):** In 2019 the duct had been disconnected from the conveyor and an airflow into the duct was measured at 500 m^3/h. With reconnection there was no 6.5mm hole to measure the vacuum so airflow was measured at a gap in the conveyor lid which was 250 m^3/h.

q) **Dry-side Air Intake (30 Fig 2):** Unlike 2019 when the intake was found significantly blocked, the screen was relatively clean. Air extraction was measured at 9,100 m^3/h and vacuum at port 30 was 64 Pa. Flow recommended in the consent application was 5,000 m^3/h, but with the building roof fan ventilation system no longer being used - to aid negative pressure in the processing areas – the higher air extraction to the biofilter is needed. Table 4 provides a snapshot of what the building working environment was on 12 February. Noted sources of heat in the dry area were the uninsulated sides of the driers; open screening of the meal and sides of the meal storage bins. The marginally highest measured temperature was air being drawn into the air intake. Although the intake is not located at the highest point in the dry area, a convective flow pattern must be carrying warm air down towards the intake. The 3,100 m^3/h balance known to be coming from the dry-side will be from the un-ground and ground meal bins, some of which will be air drawn up the conveyors.

In Summary:

- The Imlay LTRP is capable of achieving effective point source extraction. Most of the odour producing processing steps are carried out in equipment that has been built to be closed, with venting into the air extraction system and discharge through the biofilter.

- Material (offal and bone) received for processing is being processed as soon as possible while fresh, to minimise odour production. This necessitates being able to readily monitor the movement of material during processing, equipment stopping and starting and keeping equipment clean inside and out. Hence covers at critical observation locations which could be closed to aid performance of the PSES are kept open. While having a cover or hatch open carries risk of odour release into the factory airspace; the risk of odour production from blockage and late detection of equipment breakdown or malfunction is also significant. From what was seen of current operations a good balance is being achieved and the cleanliness of the processing areas is remarkable.

- To an observer it is readily evident that odour is migrating into the factory airspace by the difference between being inside and outside the building. Some of this will be from the blood decanter; the decanter screen box; and the sump area near the hogger where air extracted from the feed conveyor and the decanter/separator feed tanks are the nearest extraction points.

- With the open hatches in the conveyors and the press side open, the vacuum measured at some monitoring points will be low but this does not automatically mean the air extraction from the equipment is inadequate. The test is whether there is enough air being drawn into openings in the equipment shell to prevent odour getting out. Openings that do not serve a particular purpose should be closed. What is enough air varies from point source to point source. Some extractions can be local in their effect while the effect of others extends far through multiple equipment items. Air flow rate in a particular extraction duct in comparison with other extraction ducts according to emission control need is what primarily determines a good balance. The known air flow rate can then be related to an easily measured particular vacuum at the established vacuum monitoring points.

The Imlay Odour Management Plan along with recorded data and the Consent Monitoring Checksheet RMF008, show the intent to be compliant. While the point source monitoring target of ≥100Pa vacuum in the checksheet was adopted to ensure compliance, there should be no concern about lower vacuums if the extractions are working and vacuums observed should continue to be recorded. As further flow measuring ports are installed (as recommended) further flow balancing can be carried out. With each adjustment in a point source extraction, others are affected so the process is an iterative one where the point sources will require multiple adjustments, but ultimately arriving at a better balance overall. Some adjustments were made during the February inspections as reported above, but there is further work to be done to achieve a better balance overall.

We acknowledge the efforts of the leadership and operators' teamwork to minimise the uncaptured odours in the factory air. Further balancing work will complement this effort.

8. Independent downwind odour assessment

On all days: 12 – 14 February and 19 – 21 February 2020 with winds light to moderate south to south-west and fine summer weather, odour assessment was regularly made: early morning, during the day and in the evening. At no time was any distinctive rendering plant odour sensed outside the boundary of the Imlay site.

Within the site, traverses were made north of the biofilters across the extent of the rendering plant and beyond. Again, no distinctive odour from the rendering plant was sensed. In the lane between the biofilters and the rendering plant, it was remarkable that 'normal odour of the past' was not apparent there either.

The only odour sensed was very localised:

a) At the downwind side of the covered biofilter a dry meal odour was recognized. An assessment on Intensity and Hedonic tone rated it I = 3; H = -1. The sump was well sealed but there was very weak leakage at the location shown in photo 105 – this is not an issue but needs to be watched for further deterioration.
b) Covered bins of dry blood stored outside were emitting some odour but could not be sensed further than 5m away.

c) The stickwater drain beside the evaporator occasionally had some odour which could only be sensed directly above the drain.
d) Beside the biofilter fan 14.1 very weak wet-side odour was sensed within 1m from the fan but it was not coming from the joint between the stainless steel duct and concrete pipe.
e) On 19 February when the wind was moderate west, ovine odours from the pens could be sensed at the site entry office.

No odour other than that of fresh washed down surfaces was sensed in the vicinity of the reception bin and the Save-Alls. In 2019 strong ovine odours were being carried in the wind from the Save-Alls but no distinctive odours were present during the 2020 inspections. Material from the rotary screen into the open top skip had no distinct odour and was predominantly grass stalk with small distributed fat globules.

9. Operation of the LTRP under negative pressure:

On 14 and 20 February with the wind light-moderate south to west, differential pressure was measured between outside the building and the workspace inside.

Peak differential pressure was 20 – 25 Pa positive on the south (windward side) compared to that in the wet and dry areas. Around the same time the building north side the pressure was 0 – 4 Pa positive i.e. the pressure in the wet and dry areas was a vacuum of 0 – 4 Pa. This was with all roller doors closed. Although the vacuum was not much it was plainly sufficient to retain the odour inside.

In the 2019 report, the use of the radial fans in the north wall and roof to push air into the wet and dry areas to the extent that the air inside is at positive pressure relative to outside was commented on. It is noted that the use of these fans has been discontinued – and with it the lack of substantiated odour complaints; and not being able to sense any wet or dry side odour in the lane outside the north side of the rendering plant building.

There are still openings in the north wall of the wet area, for example where ducting and pipes penetrate the wall but the neutral or slight vacuum inside appears to be sufficient to stop odour from inside getting out. Further blocking of unneeded holes in the building wall can only improve the vacuum.

Without the building ventilation system operating, the building working environment as seen in Table 4 is demanding to work in. With further balancing work referred to in section 7 there is a possibility of slightly more air being able to be extracted from the dry area, but a more dominant influence on what can be drawn from the dry-area is determined by the air drawn from the reception bin and feed conveyor.

As in 2019 what is currently needed is the twofold approach: one focusing on improving the point source extraction; and the other doing all that is practically possible to achieve negative pressure (vacuum) in the workspace. With the new installed flow measurement ports it is becoming possible to balance the point source extractions better than ever before. Progressive reduction of unneeded openings in the building shell will assist achievement of greater vacuum in the wet and dry areas.

10. SCADA Issues

The SCADA logged consent related data for the past year has been reviewed. Daily logged temperature peaks in air going to the covered biofilter has already been commented on above.

In 2019 a number of errors with the display were itemised in the Summary of Issues and Potential Solutions list (Action List, Table 6). It is noted that all these have been remedied.

At first sight some displayed temperature data may appear wrong at times in the heat exchangers. As seen in Fig 3, the control valve 9.6A admits cooling water to the shell side of the Wet-side Process heat exchangers HX1 to HX3 based on temperature sensed at HRT9 (downstream of the Gardiner heat exchanger which is cooling drier air). Hence changes in air temperature can occur such as no water being admitted to HX1 to HX3 combined with a drop in temperature of air going through HX1 to HX3, resulting in warmer water than the air. This is not frequent and the temperature of the air going to the uncovered biofilter is being well controlled as commented on above.

11. Action Points

A summary of the 2019 action points with comment and further action points for consideration arising out of the audit are given in Table 6 in the Appendix.

Following issue of the 2019 report it is understood Horizons commissioned Pattle Delamore Partners (PDP) to conduct a technical review of the KupeTech report. As a result of that some further recommended action points were made. These have been added to the Action List in Table 6 as items 28 to 34.

Comment in relating to most of the technical points has been touched on in this report and the previous report even though it may not have become a recommended action point. Commenting briefly:

a) **Increased bed depth (to 0.7m) for the uncovered biofilter to achieve a loading of 35 m^3/h of air per m^3**: The loading was commented on in section 6.4 above. This was recommended by Golder Associates in the consent application and PDP in their review. We would also use it as a basis for design. We have also noted that the current low depth is resulting in channelling due to varying permeability across the bed. However, even with these known deficiencies, we are unaware of any evidence that the biofilter is emitting odour compounds present in the factory wet processing area.

b) **Repair of the inlet works to the uncovered biofilter**: We are unsure whether this referring to the same issue as in action point 19. We assume that it is as no issues with the underground piping have come to our attention. Repairs for action point 19 have been carried out and commented on in section 6.2 above.

c) **Investigation of the cause of inefficiencies of the cooling heat exchangers on the hot sources to the biofilter**: this is largely covered by former action point 26. A thorough inspection of the top plenum chamber of the heat exchangers is still to be done to confirm that no bypassing is occurring around chamber baffles and that all the tubes are clear. Potential explanation for perceived inefficiency is that the total tube surface area is low and (as commented in section 10 above) the water flow to the heat exchangers can stop and start independently of what the airflow is doing due to control sensing of the water temperature from the Gardiner heat exchanger. Also, with the rebalancing work being carried out, the heat in the air is reducing.

d) **Install an enclosed raw material receival hall with building air extraction:** If putrid material was being received for processing an enclosed receival hall would reduce risk of unpleasant odour going beyond the AFFCO boundary. During the inspection days the material being received was fresh and the locally produced material was being transported and transferred without any cover. With an airflow of 5600 m^3/h being drawn into the extraction system at the reception bin, the risk and duration of unpleasant odour emission beyond the northern boundary when the cover is retracted is very low. If there was a need to increase the reception bin extraction beyond the current level, an enclosed receival hall would likely contain odour more efficiently than could be done with modification of the present extraction system with consequent further reduced dry-area extraction.

e) **Install building air extraction and/or improve the building cladding to maintain better negative pressure:** Installing [additional] building air extraction necessitates increased biofilter or air scrubbing capacity which would be a significant cost. Current progress towards a better balance of the point source extractions should be continued together with sealing of unnecessary wall apertures. This will incrementally achieve better negative pressure.

f) **Covering all slaughterhouse bins and full (non-operational) contrashear bins which are not stored in an enclosed area:** At the time of the inspections it was rare to see a full bin not promptly removed. It is understood to be a standard operating practice that should removal of bins be delayed for any reason; they would be covered.

g) **Investigate options and implement mitigation measures to reduce odours from the Save-alls**: At the time of the April 2019 inspection strong ovine odours together with an unpleasant amine component was being picked up by the wind from the Save-Alls. It is not known whether that time happened to coincide with a major clean of the pens; but the intensity of odour and duration has not been observed since. Some of the recent wind conditions would have matched those in April 2019 but no odour was evident downwind.

12. Conclusions

12.1 AFFCO has a comprehensive monitoring Checksheet as part of its odour management plan. The Checksheet was based on the consent application recommending that all point source extractions meet a ≥ 100 Pa vacuum target between the slide valve and the equipment it is connected to. While this is an easy test, achieving a vacuum pressure target, it can be a misleading indication of an appropriate air extraction flowrate from the equipment connected. Ports for measuring flowrate in a duct have been being installed and this is enabling determination of an appropriate vacuum target for each measuring point. This work is continuing and a better overall balance of flowrates in the wet-area is in the process of being achieved.

12.2 Since the 2019 inspection, exemplary teamwork has developed around an objective of keeping the wet and dry processing areas clean and fresh and processing received material as soon as possible. Minimising production of unpleasant odour is playing a significant part in the good odour control currently being achieved.

12.3 Ceasing use of the wall and roof fans to ventilate the building workspace is greatly assisting achievement of marginally negative pressure in the building under varying wind conditions. Although openings in the building walls remain, odour is being contained inside the building. Unneeded openings in the building walls should continue to be eliminated and doors kept closed as much as practicable especially in south to west wind conditions.

12.4 Both biofilters have less than the recommended depth of media. Uneven discharge flow across both biofilters is evident and would be assisted by greater depth reducing the variation in permeability. Even so there is no evidence that environmentally adverse odour is breaking through the uncovered biofilter. With the covered biofilter some drier-meal odour break-through is apparent and increased media depth is recommended.

13. Independent person qualification and experience:

John Vickerman has a NZ Certificate in Mechanical Engineering and is Registered Engineering Associate No. 3980 under the Engineering Associates Registration Act 1961. Study to the 3rd Professional year for a Bachelor of Engineering was made in Chemical and Materials Engineering at Auckland University in the late 1960's. Process engineering work experience began at that time in the pulp mill at Kinleith and then in the Department of Scientific and Industrial Research Chemical Engineering section. Around 1999 to 2004 operating and design experience was gained in fish rendering at NZ Fish Products. Since then he has worked under contract to Process Developments in Lower Hutt, which later merged with Connell Wagner which later became Aurecon NZ Ltd. This latter work has included investigation, design and monitoring of odour control systems in fish rendering, meat rendering, mushroom growing media composting and municipal green waste composting. In one case before the Environment Court, through work with Connell Wagner, John Vickerman was asked to provide details of odour control system design for scrutiny by other parties. Process Developments, Connell Wagner and Aurecon were contracted to do monitoring at AFFCO Imlay, in which John has done the monitoring work for around 11 years. There was a recent change in Aurecon policy (driven from Australia) preventing the AFFCO work continuing however John has continued to do the work through Kupe Technologies Ltd. John still does work for Aurecon NZ as a Senior Mechanical Engineer.

Bruce McHardy has a Bachelor of Engineering Degree in Chemical and Materials Engineering from Auckland University.
He worked as a graduate engineer at Imperial Chemical Industries NZ for five years on the design, construction and installation of new plants for Wood Panel Resins, Water Gel Explosives and a Pharmaceutical Disinfectant. He then moved to production supervision and spent 23 years in Operational management in the Wood Resins, Paint Resins, Solvent Adhesives and Paint manufacturing industries.
After a period of running his own business he has been employed at Aurecon Engineering Consultants for twelve years as a Process Engineer working on a diverse range of projects.

Appendix

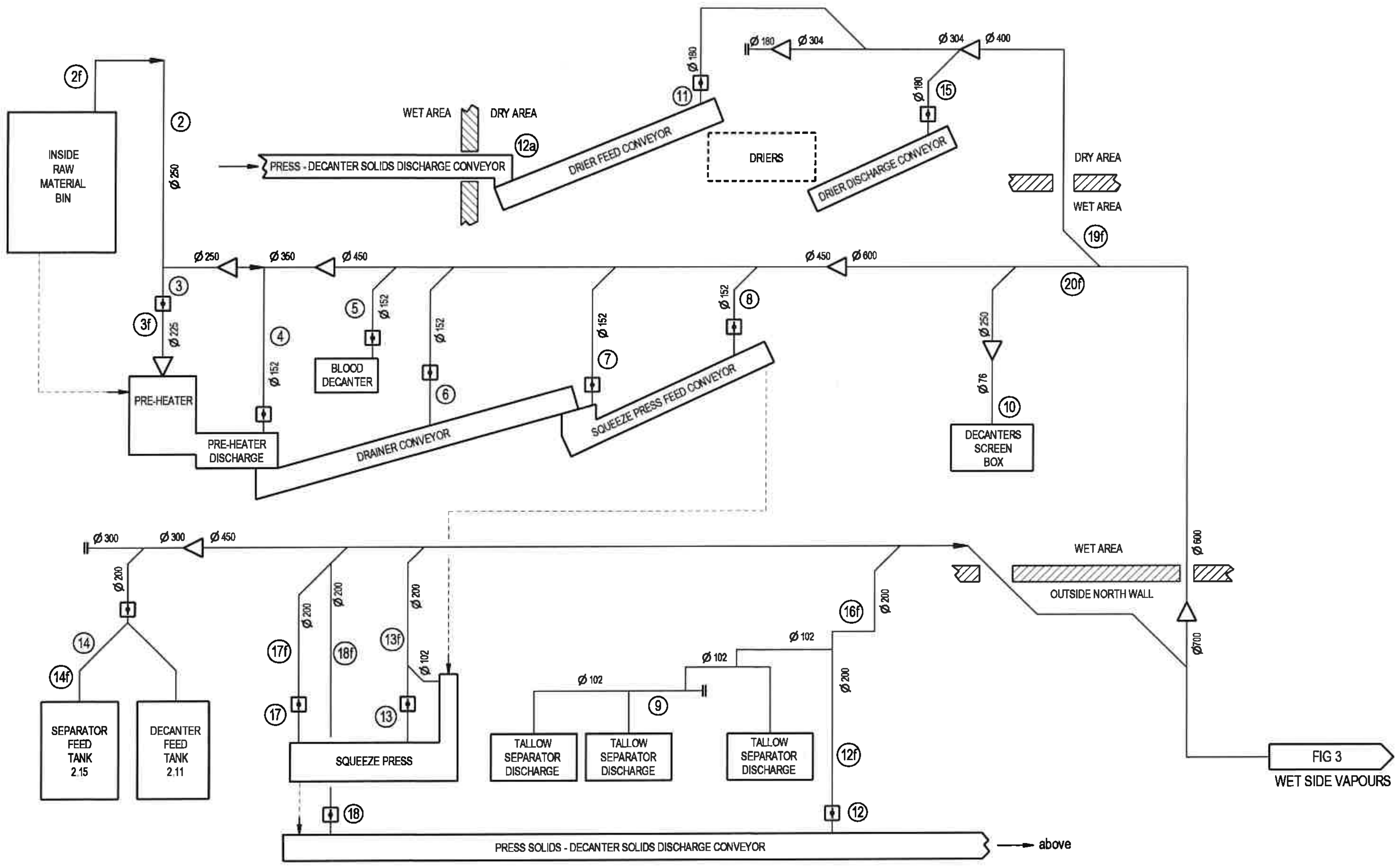


Fig 1. Wet Area Point Source Extractions at AFFCO Imlay Plant Feb 2020

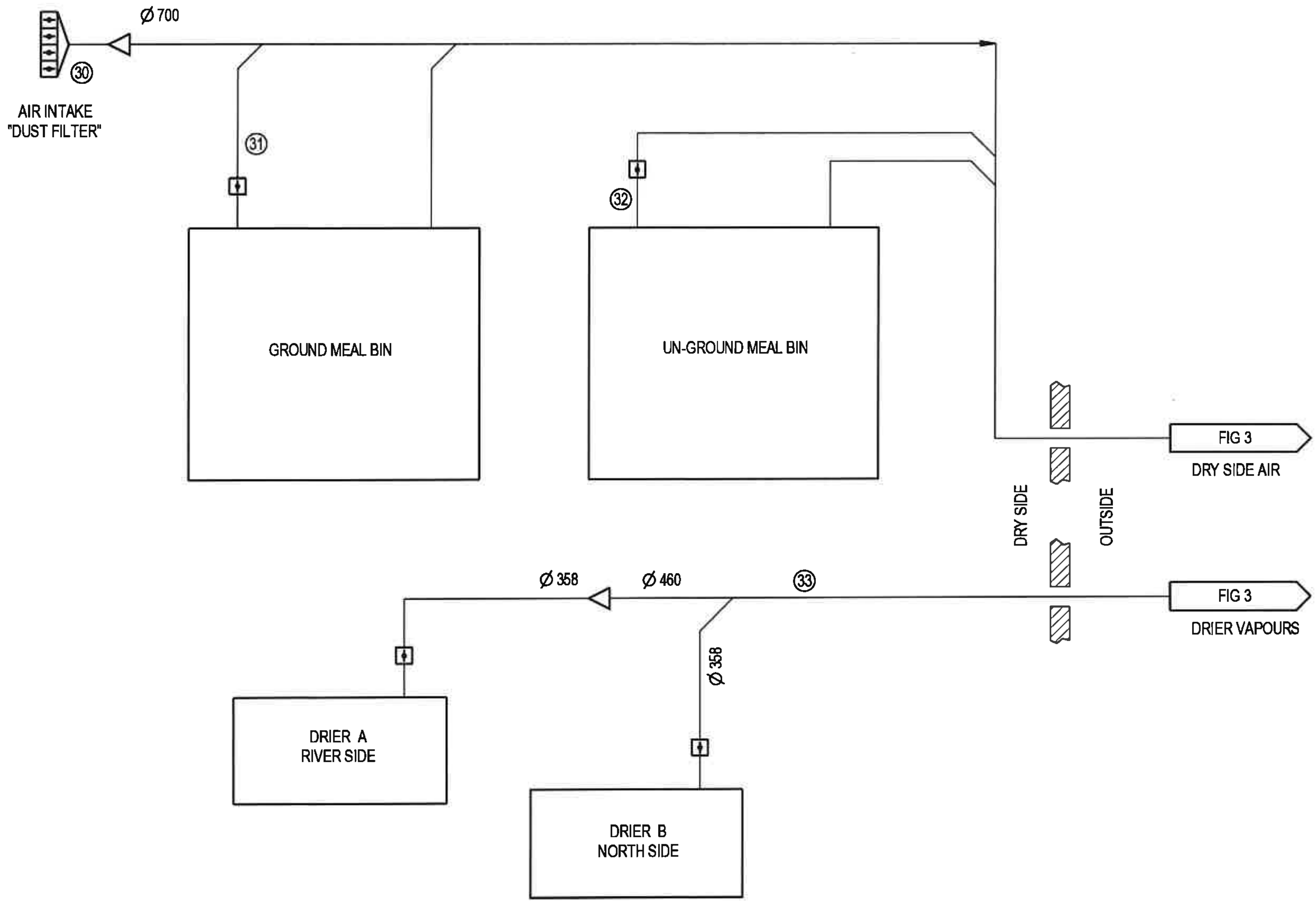


Fig 2. Dry Area Point Source Extractions at AFFCO Imlay Plant Feb 2020

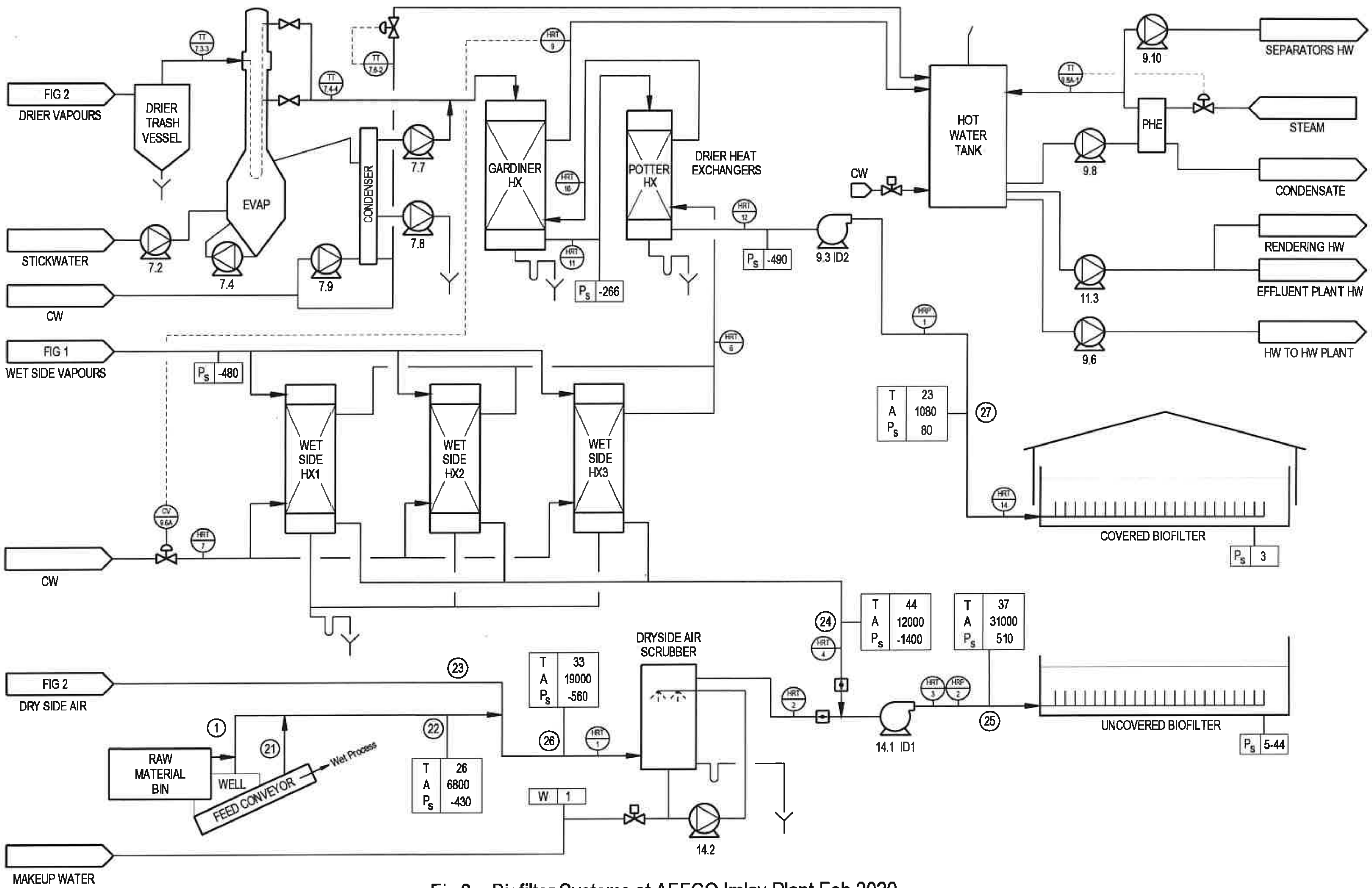


Fig 3. Biofilter Systems at AFFCO Imlay Plant Feb 2020

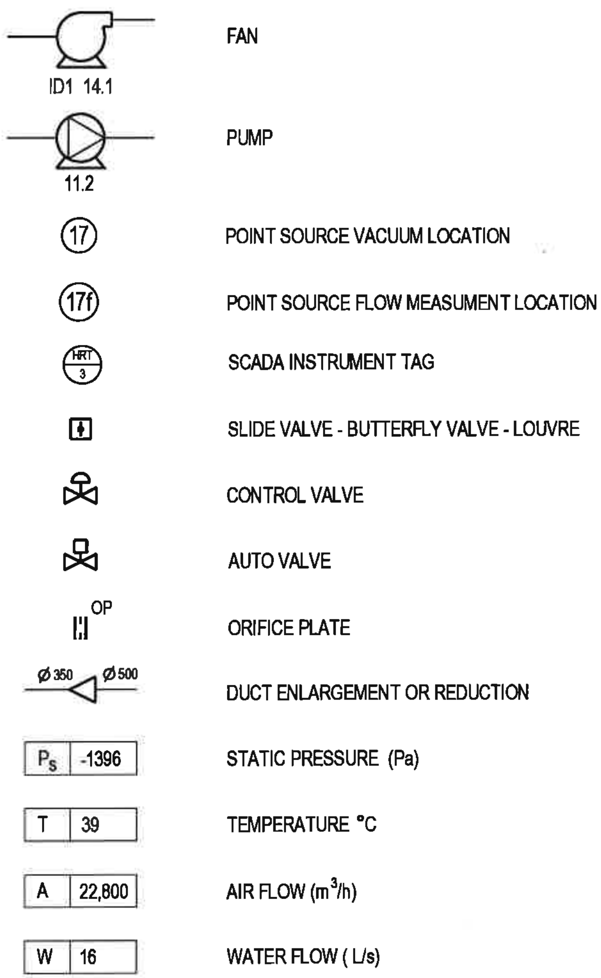


Fig 4a. Key to Symbols used in Figures 1 to 3

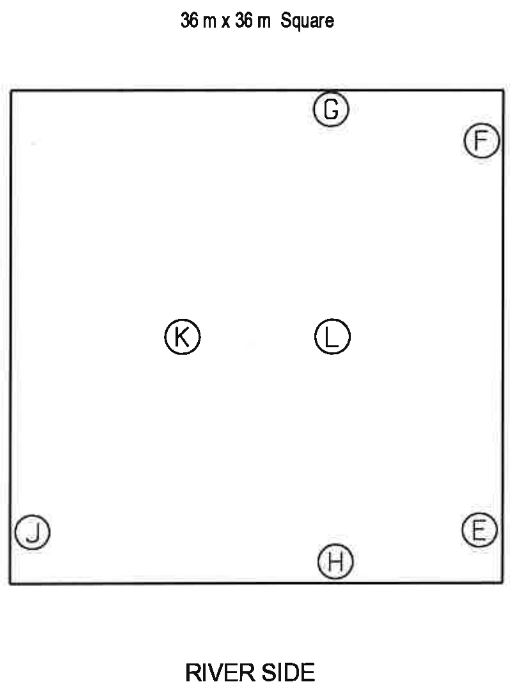


Fig 4b. Uncovered Biofilter Test Port Locations

Table 1: AFFCO Imlay - Covered Biofilter

Performance Assessment	12-Feb-20	13-Feb-20	14-Feb-20	20-Feb-20

A Ambient Conditions

	12-Feb-20	13-Feb-20	14-Feb-20	20-Feb-20
On site temperatures (open air)	19 to 25 °C	18 to 21 °C	15 to 19 °C	20 to 23 °C
Humidity (site open air)	65 to 77 %RH	64 to 74 %RH	66 to 86 %RH	63 to 71 %RH
Atmospheric pressure	101.9 to 102. kPa	101.9 kPa	102.2 kPa	101.3 kPa
Wind	Light S to SW to W	Light NW to Mod W to Light SW	Light to Mod S	Mod to Light W
	2 to 3 m/s	2 to 6 m/s	3 to 7 m/s	2 to 5 m/s
Occasional wind gust	6 m/s	10 m/s	10 m/s	8 m/s

B Measured Air Flow to Covered Biofilter

At 32NB measuring ports (location 27 in Fig 3) and according to ISO 10780

Test Sheet Ref		Duct Diameter mm	Static Head Pa	Dynamic Head pitot Pa	Air °C	Manometer Water °C	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200212	12/02/20	302	58		32.5		102.0		1.14	3.7	941	0.30	1.1
B200213	13/02/20	302	61		24.4		101.9		1.18	3.6	936	0.31	1.1
20011	14/02/20	302	61	11.3	29.4	19	102.2	0.99	1.16	4.3	1,118	0.36	1.3
20013	20/02/20	302	61		28.8		101.3		1.15	3.6	915	0.29	1.1

Measurement was with both driers and evaporator operating

C Covered Biofilter Characteristics

Length	14.8 m
Width	13.0 m
Av media depth	0.54 m
Media bed area	192 m^2
Media volume	104 m^3

Media Moisture Analysis

%w/w (wet basis)

NW	65.4	60.4	NE
SW	60.9	58.7	SE

River Side

Media Temperature

°C at 200 mm depth

NW	22.4	23.0	NE
SW	23.4	24.8	SE

River Side

Media Depth (m)

NW	0.48	0.55	NE
SW	0.60	0.54	SE

Media pH

NW	7.0 - 7.5	7.0 -7.5	NE
SW	5.5 - 6.0	6.5 - 7.0	SE

D Biofilter Loading

9 to 11 m^3/h air per m^3 media

E Duct Static Pressure

9.3 (ID2) Fan Inlet static head	-485 Pa
9.3 (ID2) Fan Outlet static head	82 Pa
Biofilter end manhole static head	3 Pa

Table 2: AFFCO Imlay - Uncovered Biofilter

Performance Assessment	12-Feb-20	13-Feb-20	14-Feb-20	20-Feb-20

A Ambient Conditions

	12-Feb-20	13-Feb-20	14-Feb-20	20-Feb-20
On site temperatures (open air)	19 to 25 °C	18 to 21 °C	15 to 19 °C	20 to 23 °C
Humidity (site open air)	65 to 77 %RH	64 to 74 %RH	66 to 86 %RH	63 to 71 %RH
Atmospheric pressure	101.9 to 102.0 kPa	101.9 kPa	102.2 kPa	101.3 kPa
Wind	Light S to SW to W	Light NW to Mod W to Light SW	Light to Mod S	Mod to Light W
	2 to 3 m/s	2 to 6 m/s	3 to 7 m/s	2 to 5 m/s
Occasional wind gust	6 m/s	10 m/s	10 m/s	8 m/s

B Measured Air Flow to Uncovered Biofilter

At 50NB measuring ports 13m downstream of fan 14.1 (location 25 in Fig 3) and according to ISO 10780

Test Sheet Ref		Duct Diameter mm	Static Head Pa	Dynamic Head pitot Pa	Air °C	Manometer Water °C	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200212	12/02/20	898	540		35.3		102.0		1.13	11.9	27,133	8.50	30.6
B200213	13/02/20	898	542		37.6		101.5		1.12	12.2	27,817	8.62	31.0
20010B	14/02/20	898	529	122	37.2	22	102.2	0.99	1.12	14.4	32,819	10.21	36.8
20012A	20/02/20	898	510	125	37.2	23	101.3	0.99	1.11	14.6	33,370	10.29	37.0
20012B	20/02/20	898	513	118	36.7	23	101.3	0.99	1.11	14.2	32,395	10.02	36.1
20012C	20/02/20	898	517	108	36.6	23	101.3	0.99	1.11	13.6	30,987	9.58	34.5

C Uncovered Biofilter Characteristics

Length	36.0 m
Width	35.7 m
Av media depth	0.44 m
Media bed area	1285 m^2
Media volume	565 m^3

Media Moisture Analysis

%w/w (wet basis)

NW	50.9		62.2	NE
		62.7		
SW	63.6		65.8	SE
		River Side		

Media Temperature

°C at 200 mm depth

NW	21.1		25.5	NE
		26.7		
SW	26.1		28.7	SE
		River Side		

Media pH

NW	6.0 - 6.5		6.0 - 6.5	NE
		5.5 - 6.0		
SW	5.5 - 6.0		6.0 - 6.5	SE

Samples for moisture and pH analysis taken 21/02/20 1100h

Table 2 continued: AFFCO Imlay - Uncovered Biofilter

D **Biofilter Loading** 48 to 59 m^3/h air per m^3 media

E **Measured Air flow from Wet Process Heat Exchangers** (Location 24 in Fig 3)

Test Sheet Ref		Duct Size W x H mm		Static Head Pa	Dynamic Head pitot Pa	Air °C	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200213	13/02/20	645	790	-1187		47.1	101.9		1.05	6.5	11,997	3.51	12.6
20012	20/02/20	645	790	-1400		43.2	101.3		1.06	6.6	12,052	3.56	12.8

F **Measured Air Flow into Dry Gas Scrubber** (Location 26 in Fig 3)

Test Sheet Ref		Duct Diameter mm	Static Head Pa	Dynamic Head pitot Pa	Air °C	RH %	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200213	13/02/20	702	-551		37.7	36	101.9		1.13	12.7	17,696	5.56	20.0
20012	20/02/20	702	-716	133	32.1	38	101.3	0.99	1.13	15.1	20,988	6.57	23.7
20012	20/02/20	702	-560		30.8	35	101.3		1.13	13.0	18,128	5.71	20.5

Measurement issues with ISO 10780 pitot tube. Static head too high (should be around -560 Pa from nearby independent measurement). Likely due to tee close upstream and inlet bend to scrubber directing airflow unevenly resulting in higher measured flow without compensation from lower flow areas unable to be measured due to lack of cross port.

Table 2 continued: AFFCO Imlay - Uncovered Biofilter

G **Measured Air Flow from Outside Raw Material Bin and Feed Conveyor** (Location 22 in Fig 3)

Test Sheet Ref		Duct Size W x H mm		Static Head Pa	Dynamic Head pitot Pa	Air °C	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200213	13/02/20	400	400	-431		26.9	101.9		1.16	11.9	6,854	2.21	8.0
B200220	20/02/20	400	400	-436		24.1	101.3		1.17	11.8	6,780	2.20	7.9

H **Measured Air Flow from Raw Material Feed Conveyor** (Location 21 in Fig 3)

Test Sheet Ref		Duct Diameter mm	Static Head Pa	Dynamic Head pitot Pa	Air °C	Manometer Water °C	Barometric Pressure kPa	Pitot Coefficient	Duct Moist Air Density kg/m^3	Air Velocity m/s	Air Flow m^3/h	Air Flow kg/s	Air Flow tph
B200213	13/02/20	200	-176		26.7		101.9		1.17	11.6	1,312	0.43	1.5
B200220	20/02/20	200	-185		25.4		101.5		1.17	10.4	1,176	0.38	1.4

J **Static Pressures**

	Pa
ID1 Fan Inlet static head	-1234 to -1540
ID1 Fan Outlet static head	510 to 580
Biofilter H branch end static head	5
Biofilter J branch end static head	22
Biofilter G branch end static head	28
Biofilter F branch end static head	22
Biofilter E branch end static head	44

Table 4: Building Environment

Measured on 12/02/20 between 1330 h and 1510 h

Outdoor conditions near building 21.5°C, 65% RH, light S wind 2 - 5 m/s

Location Inside Building	°C	Relative Humidity (RH) %
Dry Area		
Walkway between driers	37.0	33.8
Ground level (west of driers)	33.4	38.7
Ground level (east of driers)	33.1	37.8
Top of steps by sifters	37.5	33.5
NE corner finished meal bin walkway	38.4	30.8
N side walkway by finished meal bin	38.8	29.6
NW corner finished meal bin walkway	39.9	28.3
Air intake dry-side	40.2	26.8
S side walkway finished meal bin	39.9	28.1
Top of steps by finished meal bin	39.9	29.2
Offices		
Control room air inlet	25.2	47.1
Lunch room at air inlet	15.2	76.1
Lunch room stove/fridge mid-height	18.4	68.6
Office	21.6	57.4
Wet Area		
Walkway above blood tanks	32.8	52.4
Walkway day bin N side W	33.8	47.2
Walkway day bin N side E	34.0	46.6
Day bin hatch (air in)	34.7	44.8
Mid-level walkway by pre-heater	34.3	45.7
Above preheater feed conveyor	34.1	45.5
Bottom of steps by preheater	31.6	52.0
By blood tanks roller door	31.4	49.6
By workshop door	32.0	50.8
Separator floor	35.2	44.6
Separator floor by press	33.5	46.6
By decanters stickwater screen box	33.4	84.0
By sump door	29.6	55.4

Table 5: AFFCO Imlay - Rendering Plant Historical Air Extraction Data

	2013	2015	2016	2018	2019	2020
Drier Vapours						
Fan 9.3 (ID2) inlet static pressure (Pa)	-1971	-3923	-3864	-569	-490	-485
Fan 9.3 (ID2) outlet static pressure (Pa)	1334	127	226	108	80	82
Fan 9.3 (ID2) outlet air temperature (°C)	26	23	20	16	23	29
Covered Biofilter inlet total pressure (Pa)	824	78	59	NP	6	3
Flow to Covered Biofilter (m^3/h)	3,100	1,600	2,400	1700	1080	1000
Mass flow to Covered Biofilter (tonnes/h)	3.6	1.9	2.9	2.1	1.2	1.2
Biofilter Loading (m^3/h air per m^3 media)	33	19	28	20	12	11
Non-Drier Vapours						
Dry Side Air						
Scrubber Inlet Static Pressure (Pa)	-863	-775	-971	-1059	-710	-560
Scrubber Inlet Temperature (°C)	30	32	31	29	26	36
Inflow to Scrubber (m^3/h)	28,000	22,800	22,300	23,500	23,700	19,000
Including Reception Bin + Feed Conveyor (m^3/h)						6,800
Mass flow to Scrubber (tonnes/h)	31.7	26.6	25.2	27.4	27.2	21.4
Wet Side Vapours from HX1 - HX3						
Static pressure (Pa)	-1059	-1226	-1451	-1559	-1380	-1400
Temperature (°C)	39	46	44	21	46	44
Flow (m^3/h)	14,400	19,400	19,200	15,900	14,300	12,000
Mass flow (tonnes/h)	15.8	20.3	20.3	16.9	15.3	12.7
Uncovered Biofilter						
Fan 14.1 (ID1) outlet static pressure (Pa)	510	441	314	196	320	525
Air temperature to Uncovered Biofilter (°C)	31.2	34	35	19	32	37
Flow to Uncovered Biofilter (m^3/h)	43,200	41,800	41,400	39,900	33,200	31,000
Mass flow to Uncovered Biofilter (tonnes/h)	49	46	46	47	38	34
Biofilter Loading (m^3/h air per m^3 media)	62	59	59	57	52	53

Table 6. Summary of Issues and Potential Solutions from 2019 and 2020

No	Item	Issue	Comment
1	SCADA HMI	On 'Biofilter and Heat Recovery' page, line from fan 9.3 to instruments HRP1 and HRT14 needs to be taken out of Wet Side Vapour HX and run above the HX. There is no connection to the HX - it is entirely separate.	Done
2	SCADA HMI	On 'Biofilter and Heat Recovery' page, sensor HRT13 reading 100°C does not relate to line shown. Intrument HRT14 is located at inlet to the covered biofilter but is not shown on the SCADA page.	Done
3	SCADA HMI	On 'Evaporator' page tag 7.6-1 needs to be moved for obvious association with the cold water temperature balloon.	Done
4	SCADA HMI	On 'Biofilter and Heat Recovery' page, instrument HRP1 should be located between HRT13 (which should be HRT14) and the 9.3 fan.	Done
5	SCADA HMI	On 'Evaporator' page, pump 7.5 needs to be labelled 'Concentrate Pump' and envelope at end of line needs to change 'Drive' to 'Driers'.	Done
6	SCADA HMI	On 'Evaporator' page tag 7.3-4 is a temperature transmitter in the drier vapour stream immediately downstream of the evaporator. On the 'Heat Recovery Trends' page in the table on the right, this same transmitter appears to have the tag 7.4-4 as neither tags are in both places. This should be corrected to avoid confusion.	Done
7	Vacuum Measurement	Existing Dwyer Magnehelic gauge being used is sensitive to orientation and not easily read. It is recommended that a Kane 3500-1 differential pressure meter be purchased from Teltherm Instruments. All extraction system air pressures are within instrument range of ± 8000Pa. Training to keep in range and only using (-) sensing tube for differential pressure measurement will give reliable reading and good life.	Kane 3500-1 meter purchased. Instructions were missing but now available. Training and familiarisation with the instrument active.
8	Outside Raw Material Bin Flow Measurement	Difficult to reliably measure. Installation of capped 20 BSP (3/4" BSP) ports in bottom centre of extraction air duct and centre of north side, about 5m back from entry to scrubber inlet duct would allow measurement of total flow from outside raw material bin and feed conveyor. Port needs to be at location where covered biofilter air line can be stood on to make the port accessible or a platform provided. (See Item 9)	Done. Now Port 22 in Fig 3. North side of duct only. Used for measuring total flow from reception bin, conveyor well and feed conveyor. Port as in Photo 101 only needed hence installed port extension line and valve can be removed.
9	Scrubber Air Flow Measurement	Temperature gauge port on inlet bend currently used but error seems likely due to flow variation at bend. Two 20BSP capped ports at right angles upstream of the outside raw material bin entry duct would greatly assist flow measurement. A small length of walkway at higher level giving access to both outside raw material bin extraction duct and dryside duct for flow measurement would solve issues 8 and 9. If this is able to be done the flow measuring port in the raw material bin extraction air duct would be put in the top side of the duct.	Type photo 101 port at 23, Fig 3, installed in bottom of duct. Good location for flow measurement but no platform to access port direct. Has extension piping for static pressure measurement and this was useful. Need to consider how ports 22 and 23 can be safely accessed (temporary support or permanent).
10	Outside Raw Material Bin Discharge Conveyor	A 6.5mm diameter hole for vacuum measurement and preferably a M16 hole plugged with a short M16 SS bolt or polymer plug for flow measurement in the DN175 PVC pipe would allow the conveyor air extraction to be measured.	Type photo 101 port installed. Good flow measurement achieved.
11	Dry Area Dust Filter	Screen needs cleaning monthly or more often if air meal dust loading is high.	Screen found in good clean condition.
12	Dry Area Dust Filter	Walkway needs extension out and step-up to dust filter to enable safe regular cleaning. Louvre mechanism needs be freed to enable closure during cleaning but also able to be positively clamped in the open operating position.	Walkway extension platform installed. Great for maintenance and air flow measurement.
13	Unground Meal Bin	Air extraction lines need to be checked for build up of solids.	Extraction air flows for both meal bins good. Need closer inspection of individual ducts.
14	Unground Meal Bin	Fabric cover needs to be positioned to cover all of the open top of bin.	Meal bin covers in place.
15	Unground Meal Conveyor from Driers	Currently no air extraction from entire drier meal discharge conveyor because vacuum in unground meal bin is too low. If currently disconnected duct (15, Fig 1) is not connected because conveyor access is needed at connection location then the duct should be repositioned to connect with the conveyor head space further downstream. It may be more appropriate to install a new Ø150 extraction duct from conveyor to Dry Area air duct nearer the Unground Meal bin.	Former extraction duct reconnected to conveyor. A 6.5mm hole in the side of the air extraction connection box on the conveyor needed (like the hole labelled 'New 7' in photo 108) for repeatable point location vacuum measurement.
16	pH sampling and test method	Monthly results from qualified lab testing are too variable. There is either a problem with the sampling or test method or both. Further investigation needed.	See comment in section 6.3. KupeTech willing to follow up and clarify the issues.
17	Covered Biofilter media depth	Bark-soil bed depth is less than the recommended guideline. With sensed break through of meal odour, the depth should be increased by 150mm to 200mm to minimise this.	See report section 6.3. Unlikely that meal odour would be eliminated. Current worst odour not able to be sensed at site boundaries.
18	Wet Side Extraction Air Temperature	Temperature has crept up and little margin to biofilter max temperature remains at daily peak. Require an accessible plugged 20 BSP flow measuring ports installed in extraction ducts with hot emissions to accurately and repeatably determine the minimum extraction flow necessary to contain the emissions.	New ports 3f and 14f (Fig 1) installed. Flow measurement has enabled hot emissions to be reduced. Scope for further reduction but require flow measurement on other hot sources e.g. section 7(k) and (n).
19	Fan 14.1 Discharge Duct Sealing	Stainless steel discharge duct from fan 14.1 frequently leaks at junction with concrete pipe due to inability of flexible sealant to cope with vibration. A circumferential sealing skirt secured with tensioned bands each side of the joint is needed to provide a more permanent seal.	New rubber skirt installed but need to regularly check for sealing. See section 6.2 page 8.

Table 6 Continued

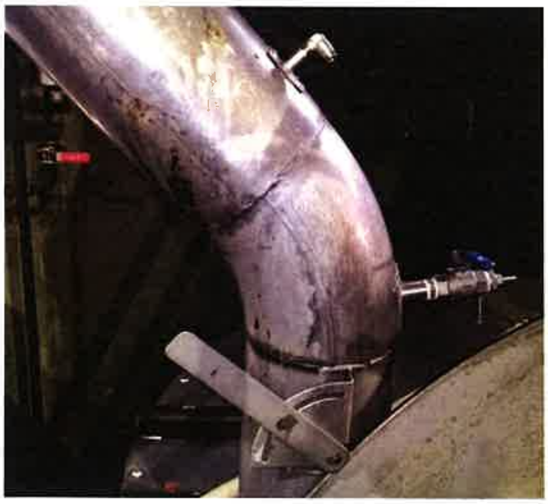
20	Preheater Extraction Duct	New installed 250mm diameter duct has no means of restricting flow e.g. no slide valve. Nearby breaker to inside raw material bin conveyor has no extraction air. Raw material bin only has about a third of recommended flow but should match that of the preheater extraction. Consideration should be given to providing a larger duct with slide valve to the raw material bin which will draw more air via the breaker to raw material bin conveyor. Advantages: 1) reduced flow from preheater due to reduced vacuum at the tee, 2) cooler air going into the mix, 3) location of flow adjusting slide valve away from preheater duct where blockage is a risk, and 4) potential to draw some of the hot humid air that builds up in summer above the raw material bin.	Slide valve installed with flow measuring port 3f below (Fig 1). Preheater extraction reduced to 950 m3/h with 96Pa at same port. Air extraction from inside day bin 920 m3/h including 360 m3/h from bin feed conveyor. This is in line with recommended design flow. Further adjustment to 3f likely which with other adjustments will increase flow from bin further.
21	Liquid phase tanks	Extraction vacuum is so high too much vapour is being removed. A working slide valve in the common leg is needed to reduce the vacuum in the tank headspace or alternatively some additional extraction air could be drawn from the sump, breaker and MD belt area nearby to moderate the vacuum.	Flow significantly reduced by adjustment of slide valve above 'Y' leg. See report section 7 (o). Flow of 750 m3/h in each leg still too high. Will be reduced together with adjustment of other hot sources.
22	Blood Decanter	Air extraction is inadequate to collect vapour emissions. Either the conveyor is too small i.e. not enough headspace for vapour transport along the screw to the larger extraction duct, or the 76 mm diameter dairy tube duct needs to be increased in size. Size of conveyor may be determined by specific blood properties requiring the conveyor to be small.	See 7 (g) page 13. Extraction inadequate. If existing decanter conveyor is to be retained a raisable hood with flexible duct connection to the extraction system appears to be one solution.
23	Drier Discharge Conveyor Extraction Duct	Disconnected Discharge Conveyor extraction duct should be blanked off and a new duct higher up the discharge conveyor provided with connection to the dryside air duct above. (i.e. provided higher up because seemingly the present connection point inhibits access to the conveyor for clearing blockage). Before doing so, the need to have extraction from the unground meal bin and the vibrating meal screen should all be considered.	Former extraction duct reconnected to conveyor. A 6.5mm hole in the side of the air extraction connection box on the conveyor needed (like the hole labelled 'New 7' in photo 108) for repeatable point location vacuum measurement. (Similar to Item 15).
24	Drier Feed Conveyor	Patch corroded slot admitting air beside the extraction air intake at the top of the conveyor, but leave a 16mm diameter hole for flow measurement.	Corroded slot still used for air flow and vacuum measurement.
25	Flow measurement platform for wet area big ducts	Platform with ladder access and flow measuring ports where big wet area ducts penetrate north wall would be helpful but does not look practical given the congested piping in the area.	The photo 113 to AFFCO (in 2019) identified locations for new ports 18 and 19 except these are now shown as 20f and 19f in the photo and Fig 1. Difficulty of installing ladder and small platform recognised. New flow ports as in items 35 to 37 below would be of more immediate benefit for balancing flows and are more accessible.
26	Wet Process Heat Exchangers	Top air chamber should be inspected for clear ducting and tubes. Capped ports on top of the three cover plates are seized and need freeing to enable pressure measurement.	Still to be done. See section 11 (c). Need to check baffles in top plenum chamber to make sure inlet air is not short circuiting to the outlet.
27	Roller Doors on Building South Side	While installation of an airlock entry to the Wet Area on the south side looks impractical consideration should be given to installation of robust quick opening doors to minimise door open time.	Ceasing use of building ventilation fans has reduced the adverse affect that briefly openned doors caused. Still an item for consideration.
28	Uncovered biofilter loading	PDP recommended action: Increase uncovered biofilter bed depth to reduce the loading to 35 m^3 air/h per m^3 bed media.	See report section 11 (a). Increased depth of bed recommended but no evidence of existing bed not working.
29	Inlet ducting to uncovered biofilter downstream of fan	PDP recommended action: Repair inlet works.	Repaired. See Item 19 and report section 6.2 page 8.
30	Air cooling heat exchangers HX1 to HX3	PDP recommended action: Investigate causes of heat exchanger inefficiencies.	Still to be done. See Item 26 and report section 11 (c). Need to check baffles in top plenum chamber to make sure inlet air is not short circuiting to the outlet.
31	Raw material reception	PDP recommended action: Install an enclosed raw material receival hall with building air extraction.	See report section 11 (d).
32	Building air extraction	PDP recommended action: Install [increase] building air extraction and/or improve building cladding to maintain a negative pressure in the rendering building	See report section 11 (e).
33	Slaughterhouse bins and contrashear bins	PDP recommended action: Cover all slaughterhouse bins and full (non-operational) contrashear bins, which are not stored within an enclosed area.	Understood to be adopted as a standard operating procedure.
34	Save-All odour reduction	PDP recommeded action: Investigate options and implement mitigation measures to reduce odours from the Save-alls	Investigation open on extent and duration of odour from Save-alls. Not the issue that it was.
35	Scrubber air inlet flow measuring ports	See Item 9 above. While port 23 remains inaccessible for flow measurement, need two new type photo 101 ports in next mitre segment back (upstream) from the temperature gauge and HRT1. This is location 26 in Fig 3. One port is needed on same side of the bend as the temperature gauge and the other port is at 90° to it on the outer side of the bend segment. See also report section 6.2 (second to last paragraph on page 7).	
36	Press flow measuring ports	New type photo 101 ports needed at locations 13f, 17f and 18f in Fig 1. See report section 7 (n) on page 14.	
37	Separators - solids conveyor flow measuring ports	New type photo 101 ports needed at locations 12f and 16f in Fig 1. See report section 7 (k) on page 14.	

Photographs

101: Flow Measuring Port Detail

102: Fan 14.1 Discharge Duct Seal

103: Press Open Side



104: Separator Feed Tank Ports 14 – 14a

105: Covered Biofilter Sump

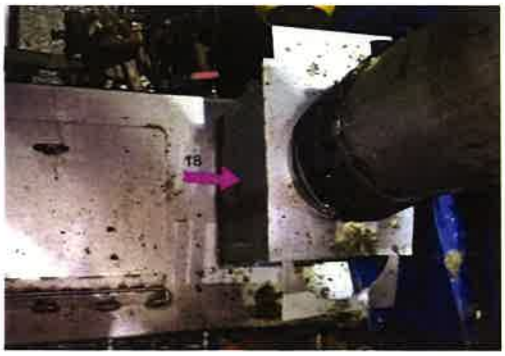
106: Blood Decanter Centrifuge

107: Drainer Conveyor Hatch

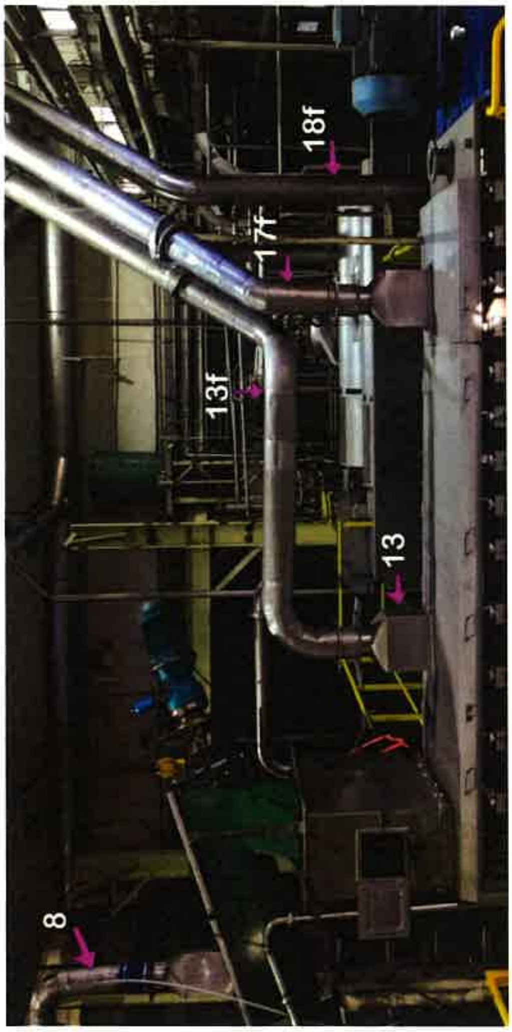
108: Press Conveyor Feed Box

109: Port 12

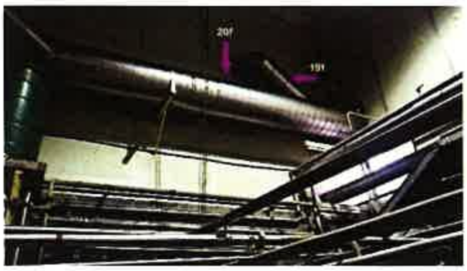
110: End of Press-Decanter Solids Conveyor in Dry Area



111: Press Solids Conveyor Extraction Box



112: Press Extraction Ducts

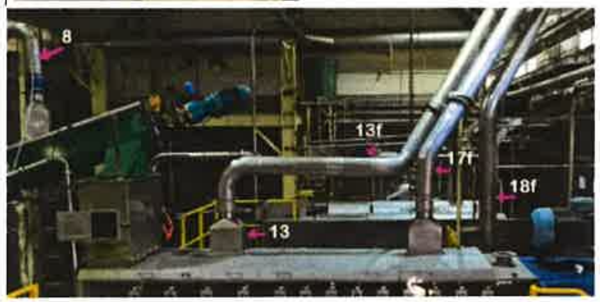


113: Wet-area north-west

APPENDIX 4 –

KupeTech Action List - 2020

Table 6 - Summary of Issues and Potential Solutions - 2020

No	Item	Issue	Responsibility	Target Date
WETSIDE ISSUES				
1	Preheater Extraction Duct	New installed 250mm diameter duct has no means of restricting flow e.g. no slide valve. Nearby breaker to inside raw material bin conveyor has no extraction air. Raw material bin only has about a third of recommended flow but should match that of the preheater extraction. Consideration should be given to providing a larger duct with slide valve to the raw material bin which will draw more air via the breaker to raw material bin conveyor. Advantages: 1) reduced flow from preheater due to reduced vacuum at the tee, 2) cooler air going into the mix, 3) location of flow adjusting slide valve away from preheater duct where blockage is a risk, and 4) potential to draw some of the hot humid air that builds up in summer above the raw material bin.	Further adjustments to flows to be made by John Vickerman.	Post COVID-19
2	Liquid phase tanks	Extraction vacuum is so high too much vapour is being removed. A working slide valve in the common leg is needed to reduce the vacuum in the tank headspace or alternatively some additional extraction air could be drawn from the sump, breaker and MD belt area nearby to moderate the vacuum.	Further adjustments to flows to be made by John Vickerman.	Post COVID-19
3	Blood Decanter	Air extraction is inadequate to collect vapour emissions. Either the conveyor is too small i.e. not enough headspace for vapour transport along the screw to the larger extraction duct, or the 76 mm diameter dairy tube duct needs to be increased in size. Size of conveyor may be determined by specific blood properties requiring the conveyor to be small.	Port 5:- Extraction inadequate. If existing decanter conveyor is to be retained a raisable hood with flexible duct connection to the extraction system appears to be one solution.	Post COVID-19
4	Squeeze Press	Squeeze Press flow measuring ports required.	New 101 type ports needed at locations 13f, 17f and 18f.  	Post COVID-19

5	Separators - solids conveyo flow measuring ports	Squeeze Press flow measuring ports required.	New 101 type ports needed at locations 12f and 16f.  	Post COVID-19
DRYSIDE ISSUES				
6	Unground Meal Bin	Air extraction lines need to be checked for build up of solids.	Need closer inspection of individual ducts.	Post COVID-19
7	Unground Meal Conveyor from Driers and Drier Discharge Conveyor Extraction Duct	Currently no air extraction from entire drier meal discharge conveyor because vacuum in unground meal bin is too low. If currently disconnected duct (15, Fig 1) is not connected because conveyor access is needed at connection location then the duct should be repositioned to connect with the conveyor head space further downstream. It may be more appropriate to install a new Ø150 extraction duct from conveyor to Dry Area air duct nearer the Unground Meal bin.	Former extraction duct reconnected to conveyor. A 6.5mm hole in the side of the air extraction connection box on the conveyor needed (like the holes labelled 'New 7' in photo 108) for repeatable point location vacuum measurement.	
8	Drier Feed Conveyor	Patch corroded slot admitting air beside the extraction air intake at the top of the conveyor.	External Contractors. Damon to organise.	Post COVID-19

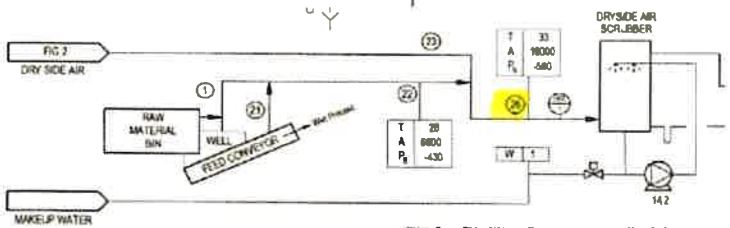
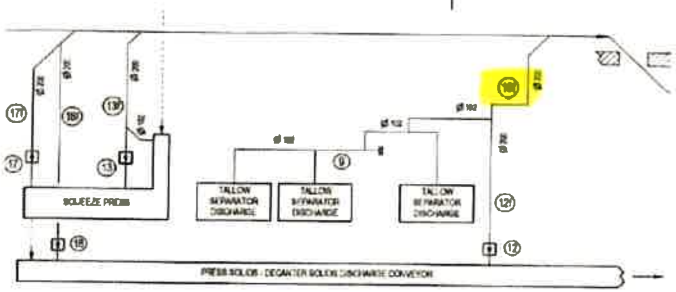
<table>
<tr><th colspan="5">OUTSIDE DUCTING / COOLING SYSTEM</th></tr>
<tr>
<td>9</td>
<td>Scrubber Air Flow Measurement</td>
<td>Temperature gauge port on inlet bend currently used but error seems likely due to flow variation at bend. Two 20BSP capped ports at right angles upstream of the outside raw material bin entry duct would greatly assist flow measurement. A small length of walkway at higher level giving access to both outside raw material bin extraction duct and dryside duct for flow measurement would solve issues 21and 22. If this is able to be done the flow measuring port in the raw material bin extraction air duct would be put in the top side of the duct.


Fig 3 Biofilter Systems at AFFCO Imlay</td>
<td>Photo 101 type, Port 23 Fig 3 installed in bottom of duct. Good location for flow measurement but no platform to access port direct. Has extension piping for static pressure measurement and this was useful. <u>Need to consider how Ports 22 and 23 can be safely accesssed Temp support or permanent). Need 2 x Type 101 Photo ports in next mitre segment back (upstream) from the temp gauge and HRT1. This location 26 in Fig 3. One port is needed on the same side of the bend as the temp gauge and the other port is at 90degs to it on the outer side of the bend segment.</u></td>
<td>101 Type Port

</td>
</tr>
<tr>
<td>10</td>
<td>Wet Side Extraction Air Temperature</td>
<td>Temperature has crept up and little margin to biofilter max temperature remains at daily peak. Need to get accessible plugged 20 BSP flow measuring ports installed in extraction ducts with hot emissions to accurately and repeatably determine the minimum extraction flow necessary to contain the emissions.

</td>
<td>New ports 3f and 14f (Fig1) installed. Flow measurement has enabled hot emissions to be reduced. Sope for further reduction but want flow measurement on other hot sources:- BOX WALL:- (NEW 12f); ABOVE BRANCH FROM SEPARATORS JOINING DUCT (NEW 16f)</td>
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11	Fan 14.1 Discharge Duct Sealing	Stainless steel discharge duct from fan 14.1 frequently leaks at junction with concrete pipe due to inability of flexible sealant to cope with vibration. A circumferential sealing skirt secured with tensioned bands each side of the joint is needed to provide a more permanent seal.	**Instal a tapered skirt of thinner coated fabric to achieve the seal.**	
12	Flow measurement platform for wet area big ducts	Platform with ladder access and flow measuring ports where big wet area ducts penetrate north wall would be helpful but does not look practical given the congested piping in the area.	**The photo 113 to AFFCO (in 2019) identified locations for new ports 18 and 19 except these are now shown as 20f and 19f in the photo and Fig 1. Difficulty of installing ladder and small platform recognised. New flow ports as in items 35 to 37 below would be of more immediate benefit for balancing flows and are more accessible.**	**Refer to New Ports #4 & #5**
13	Wet Process Heat Exchangers	Top air chamber should be inspected for clear ducting and tubes. Capped ports on top of the three cover plates are siezed and need freeing to enable pressure measurement.	**Still to be done. See section 11 (c). Need to check baffles in top plenum chamber to make sure inlet air is not short circuiting to the outlet.**	**Post COVID-19**
BIO FILTERS				
14	Covered Biofilter media depth	Bark-soil bed depth is less than the recommended guideline. With sensed break through of meal odour, the depth should be increased by 150mm to 200mm to minimise this.	**CAPEX currently at Head Office waiting for approval.**	**Post COVID-19**
15	Uncovered Bio Filter	The biofilter loading at 50 - 55 m3/h of air per m3 of media is above the recommended guideline of 0.5m but in a couple of tests a depth of only 0.44 m to the stone was found. Further core sampling is needed to confirm the present depth. **Accurate measurement required.**	**CAPEX currently at Head Office waiting for approval.**	**Post COVID-19**
16	Uncovered Bio Filter	Remove manometer tubes and replace with fitting so that the Kane 3500-1 can be attached for measuring.	**External Contractors. Damon to organise.**	**Post COVID-19**