Stephenson

Environmental Management Australia

BIOFILTER SURFACE ODOUR EMISSION ASSESSMENT

AP BUSINESS & TECHNOLOGY CONSULTANCY

GRAFTON, NSW

PROJECT NO.: **5901/S24902/17**

DATE OF SURVEY: **18 DECEMBER 2017**

DATE OF ISSUE: **22 DECEMBER 2017**

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Environmental Management Australia

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1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was commissioned by AP Business & Technology Consultancy to undertake an odour emission survey on the surface of a biofilter at Grafton, New South Wales (NSW). The monitoring was undertaken on the 18 December, 2017.

The objectives of the emission testing were:

- To conduct a performance test of the biofilter by determining the odour concentration;
- Calculate the mass odour emission rates;

Table 1-1 summarises the scope of work conducted during the odour assessment.

TABLE 1-1 SCOPE OF WORK

Parameter	Biofilter Outlet	Test Method
Odour concentration	1 sample from the centre of each of 4 evenly distributed quadrant sections.	NSW OEH TM-2 OM-8/OM-7/AS4323.3

2 MONITORING AND PRODUCTION CONDITIONS

AP Business & Technology Consultancy personnel considered that, on the day of testing, the biomass packing material was well dispersed. Two of the three tunnels were composting during the tests. This is the normal operating configuration. AP Business & Technology Consultancy hold all relevant production records should they be required for review.

A witches hat equilibrium odour sampling hood was used to take four odour samples at 100% flow through the biofilter. The witches hat hood is the generally preferred odour sampling hood for sampling aerated or porous surfaces with air passing through that surface.

The biofilter was divided into four equal sections and the centre of each section was tested. Refer to Appendix B for sampling locations. The biofilter measures 16 metres x 12.5 metres and the surface area of the biofilter is of the order of 200 square metres (m^2).

Figures 2.1 to 2.7 show the various components of the tunnel composting and biofiltration odour control system

FIGURE 2-1 PLAN - BIOFILTER, HUM & PWT STRUCTURES, TUNNEL COMPOSTING, GRAFTON

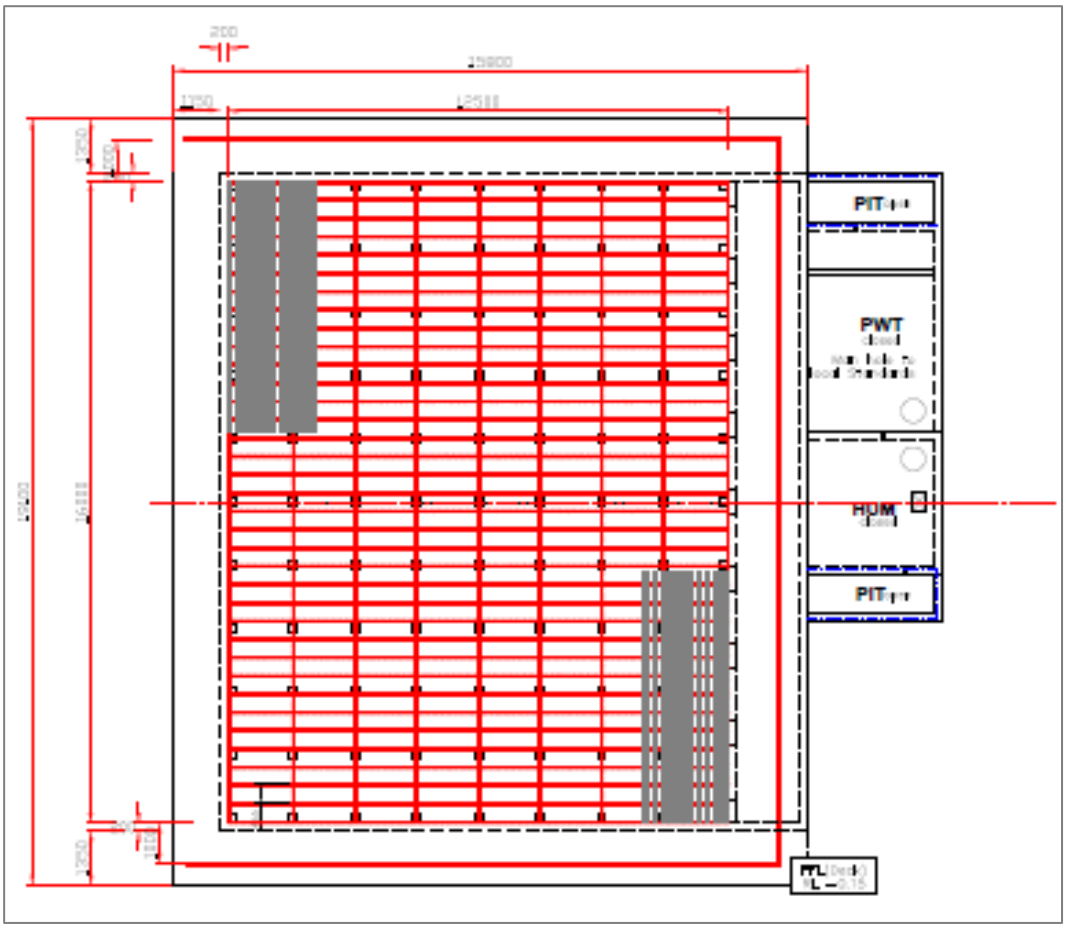

FIGURE 2-2 BIOFILTER, TUNNEL COMPOSTERS AND SHREDDING BUILDINGS

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FIGURE 2-7 SAMPLING LOCATIONS BIO 3 AND BIO 4 FROM THE SIDE

3 EMISSION TEST RESULTS

3.1 INTRODUCTION

SEMA undertook the monitoring. SEMA is NATA accredited for the this, accreditation No.15043. Odour Research Laboratories Australia (ORLA), a subsidiary of Peter W Stephenson and Associates Pty Ltd, completed the odour analysis, ORLA is NATA accredited to ISO-17025 for this analysis, accreditation No.15043. Results are discussed in Section 3.2 and conclusions, discussion and recommendations are in Section 4. Refer to Appendix A for the Certificates of Analysis. The sampling location is shown graphically in Appendix B.

3.2 ODOUR CONCENTRATIONS AND EMISSION RESULTS

The odour concentrations ranged from 230 to 460 odour units (ou). Refer Table 3.1. It is not appropriate to average odour emission concentrations because they are empirical ratios. However, MOER's can be averaged. Thus, from the average MOER the average odour concentration can be calculated to be 330 ou.

The MOER for all samples was determined to be in the range of 324 ou.m^3/s to 648 ou.m^3/s. The MOER was calculated using the following formula:

MOER = Odour concentration (ou) x Witches Hat Equilibrium Hood Velocity (m/s) x total area of the Biofilter (m^2);

Equilibrium Hood Velocity = Velocity of air discharged from the 100 mm diameter discharge vent stack serving Witches Hat Equilibrium Hood in metres per second;

Total surface area = Cross sectional area of the Biofilter in square metres (m^2);

Odour Concentration = As per Table 3-1

TABLE 3-1 ODOUR EMISSIONS RESULTS – BIOFILTER

Sample Description	**Odour Concentration** (ou)	**MOER** (ou.m^3/s)
N –North (Bio 1)	230	324
E – East (Bio 2)	275	360
W –West (Bio 3)	357	456
S – South (Bio 4)	460	648
Average	**330 ***	**447**
Total	**--**	**1788**

Key:

ou	=	odour units
MOER	=	mass odour emission rate
ou.m^3/s	=	odour unit cubic metres per second
*	=	back calculated from MOER

4 CONCLUSIONS

From the data presented and test work conducted during normal production conditions, Table 3-1 has summarised the assessment data.

The odour emission concentration of the samples collected during emission monitoring of the biolfilter, under normal operating conditions, were less than 500 ou and the average mass odour emission rate (MOER) per quadrant was less than 450 ou.m^3/s or 1788 ou.m^3/s total emission for the four quadrants across the surface of the biofilter.

5 TEST METHODS

5.1 ODOUR MEASUREMENT/DYNAMIC OLFACTOMETRY

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

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

Odorous gas for analysis was drawn through a Teflon (PTFE) sample probe. The gas then passes through a Teflon (PTFE) tube connected to the Nalophane sampling bag. The sampling pump is connected to the airtight plastic container to provide a sample gas flow-rate of approximately two litres per minute. After the required volume has been sampled, the pump was stopped and the bag was sealed.

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

This diluted sample was then presented to a panel of AS 4323.3 screened panellists. The panellists then recorded if they could detect any odour and from which port. The other two flows through the olfactometer supply port were discharging odour free air. The distribution of air or sample to the port is randomly selected by the computer controlling the olfactometer. Neither the panel operator or panellist has control over the random selection.

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

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows may be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows may be different from the other two flows and is able to: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the colour, as in 'it smells like …' *Note: that the Recognise level concentration and Hedonic Tone and Odour descriptors are obtained with the diluted odour, panellists are not exposed to the full strength odour.*

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

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

The sampling and the dilution procedures used were in accordance with OEH NSW Method OM-7 and OM-8, which are based on Standards Association of Australia, AS4323.3 and AS 4323.4.

5.1.1 ODOUR PANEL SELECTION

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

Panellists are tested against n-Butanol before every panel session to ensure they are in compliance. Panellists should not suffer from respiratory complaints, nor should they eat or smoke or drink anything but water during the half hour preceding or during the test period and their person and clothing should be odour free and have not been exposed to an odorous environment before testing.

5.1.2 ODOUR TERMINOLOGY

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

APPENDIX A – CERTIFICATES OF ANALYSIS

Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd
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Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

Client	Organisation:	AP Business and Technology Consultancy
	Address:	PO Box 79, 3130 Blackburn, Victoria
	Contact:	Andreas Pichler
	Sampling Site:	704 Armidale Road, Grafton 2460, NSW
	Telephone:	(03) 9802 5013
	Email:	andreas.pichler@apbtech.com.au
Project	ORLA Report Number:	5901/ORLA/01
	Project Manager:	Peter Stephenson
	Testing operator:	Peter Stephenson
	ORLA Sample number(s):	4833 to 4836 inclusive
	SEMA Sample number(s):	726744 to 726747inclusive
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of AP Business and Technology
	Date of order:	18 December 2017
	Order number:	4833
	Telephone:	02 9737 9991
	Signed by:	Margot Kimber
	Order accepted by:	Jay Weber
Report	Date of issue:	21 December 2017

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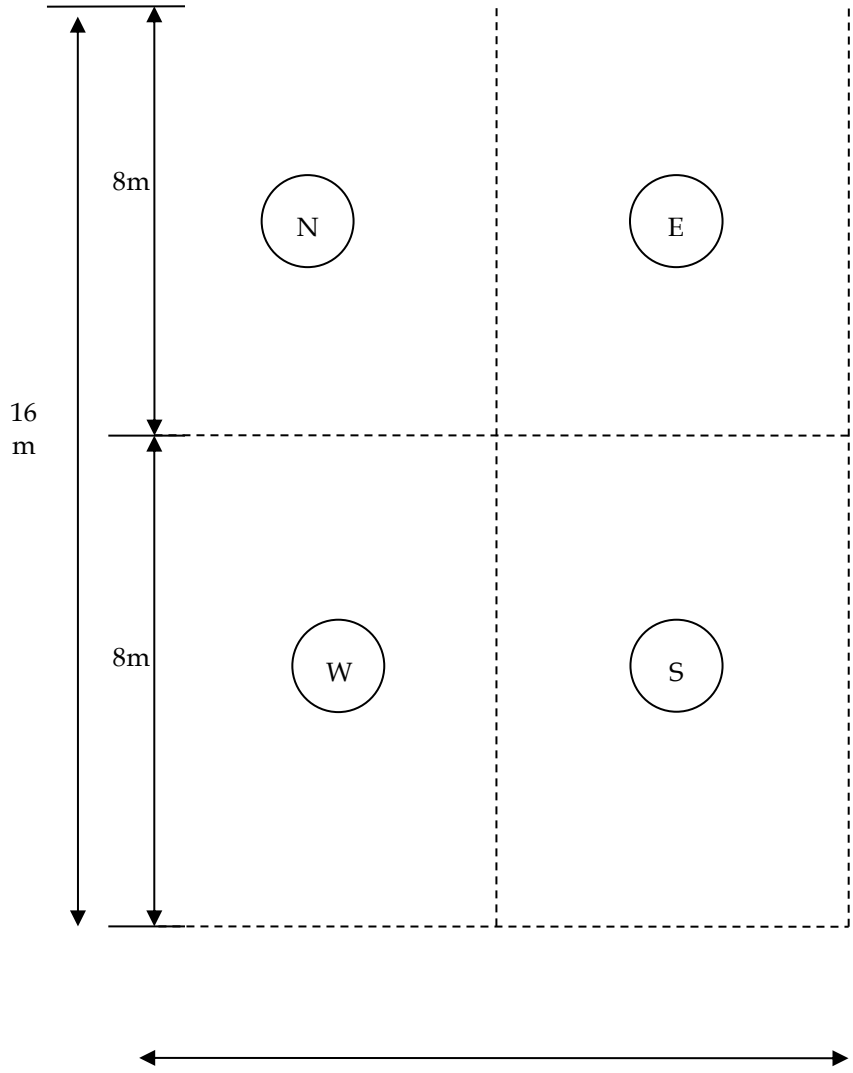
NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025.

APPENDIX B – SAMPLING LOCATION

FIGURE B - 1 BIOFILTER SAMPLE LOCATIONS

COMPOSTING TUNNELS



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