2015 Annual Environmental Report

On behalf of Greenking Composting Ltd,
Coolbeg,
Co. Wicklow

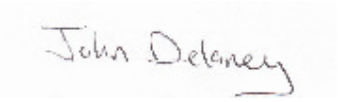
Waste Licence Number: W0218-01

Annual Environmental Report 2015

On behalf of Greenking Composting Ltd,
Coolbeg,
Co. Wicklow

greenKING composting ltd
Coolbeg, Wicklow, Co. Wicklow

Prepared By: Geoenvironmental Consultants



Report Compilation & Writing: _____

John Delaney (MSc; BSc)
Environmental Consultant
On behalf of Greenking Compost Ltd

Date: 25/3/2016

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1.0 INTRODUCTION

Geoenvironmental was commissioned by Greenking Composting Ltd to collate and compile the company's 2015 Annual Environmental Report (AER). The (AER) is prepared for the Coolbeg Composting Facility operated by King Tree Services Ltd., trading as Greenking Composting Ltd. The content of this Annual Environmental Report is based on Schedule G of Waste Licence W0218-01 and follows guidelines set out in the document '*Guidance Note for Annual Environmental Report*' published by the Agency. This AER covers the period from January 2015 to December 2015.

The composting facility at Coolbeg, Co, Wicklow has with the capacity to accept and process 40,000 tonnes of green waste per annum. King Tree Services Ltd was issued with a Waste License from the Environmental Protection Agency (EPA) on the 25th October 2005. (Ref. No. W0218-01). The facility started its operation on the 6th June 2006.

The license permits the recycling or reclamation of organic substances which are not used as solvents (including com posting and other biological processes) and the storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced prescribed under Class 2 and Class 13 of the f*ourth Schedule of the Waste Management Acts, 1996 to 2003.*

2.0 SITE DESCRIPTION

2.1 Facility Location and Layout

The waste recovery facility is located in the townland of Coolbeg, approximately 4 km south west of Wicklow Town. The site is accessed via a local road running from the N11 Regional Road at The Beehive towards Glenealy; refer to Figure 1 (Site Location Map). The land adjoining the western site boundary is occupied by non-hazardous residual waste landfill. The new M11 motorway when completed will be located close to the eastern boundary of facility.

The existing site layout includes the following facilities:

- a reception office
- a workshop located behind the reception building
- a weighbridge
- parking areas
- the waste reception area
- windrows area
- maturation area
- finished product storage area
- leachate storage lagoon.

The site office and welfare facilities are located at the reception; refer to Figure 2 (Site Layout Plan in Section 11).

2.2 Waste Types and Volume

Waste Licence W0218-01 regulates the operation of the composting facility at Coolbeg, County Wicklow. The green waste accepted at the facility comprises wood wastes generated by the King Tree Services tree surgery business, garden and park waste produced during improvement and maintenance works by landscape gardeners, grass and shrub trimmings produced by individual householders and timber and wood waste

recovered during construction and demolition works. The facility is licensed to accept 40,000 tonnes of green waste annually. GreenKing offers a green drop off facility and collection service.

The composting operations involve pre treatment of green waste, shredding and mixing, composting in open windrows, maturation and post treatment and impurities removal. All operations are carried out externally. The finished product is suitable for a range of further activities which include a range of landscaping, horticultural and agricultural use.

3.0 MANAGEMENT OF THE FACILITY

3.1 Site Management Structure

King Tree Services Ltd. currently employs full time a total of two people at their Coolbeg Facility. The organisation and management structure in Coolbeg Composting Facility is provided below. Mr. Ian Browne, the facility manager is responsible for the day to day operation of the facility.

Table 1: Organisation Structure

Staff Name	Role	Experience
Ian Browne	Facility Manager	Completed FAS Waste Management Course.
Ann Keogh	Facility Administration	Completed FAS Waste Management Course.

3.2 Environmental Management System

In accordance with Condition 2.2.1, King Tree Services Ltd. has prepared and documented a basic Environmental Management System for its Composting Facility at Coolbeg. In March 2010 the emergency response procedures were updated. The schedule of Objectives and Targets for 2015 and proposed schedule of targets for 2016 are outlined below.

Table 2: Schedule of Objectives and Targets for 2015

No	Objective	Target	Progress
1	Reduce the energy /fuel usage at the facility.	Monitor diesel and electricity usage at least annually.	Diesel Usage was reduced
3	Control litter, dust, odour, and noise nuisances.	Continue daily Facility Inspection Form to ensure any nuisances are identified and managed on a daily basis.	Ongoing
4	Maintain Environmental Management System	Maintain documentation for EMS and implement on site.	Ongoing
		Review the EMP in accordance with the Licence.	Reviewed in March 2015
7	Maintain Regular Schedule of Environmental Training	Carry out training on Environmental Awareness, Emergency Response, Waste Licence W0218-01 for all staff.	Ongoing
8	Identify measures to improve efficiency and minimise waste.	Continue to identify measures to reduce waste and use of water	Ongoing

Table 3: Schedule of Objectives and Targets for 2016

No	Objective	Target	Timescale	Responsibility
1	Reduce the energy /fuel usage at the facility.	Monitor diesel and electricity usage at least annually.	Q4 2016	Facility Manager
3	Control litter, dust, odour, and noise nuisances.	Continue daily Facility Inspection Form to ensure any nuisances are identified and managed on a daily basis.	Ongoing	Facility Manager
4	Maintain Environmental Management System	Maintain documentation for EMS and implement on site.	Ongoing Q3 2016	Facility Manager
		Review the EMP and other procedures in accordance with the Licence		
		NB: Review and update the documented Emergency Response Procedure to include a fire prevention control procedure.		
7	Maintain Regular Schedule of Environmental Training	Carry out training on Environmental Awareness, Emergency Response, Waste Licence W0218-01 for all staff.	Ongoing	Facility Manager
8	Identify measures to improve efficiency and minimise waste.	Continue to identify measures to reduce waste and use of water	Ongoing	Facility Manager

3.3 Environmental Management Programme

A comprehensive Environmental Management Programme for 2015 was implemented at Coolbeg Composting Facility. The environmental monitoring works undertaken included monitoring of dust emissions, surface water and groundwater quality monitoring, bioaerosol monitoring, odour monitoring. Results of the monitoring are provided in Section 4 of this report under Emissions Monitoring.

3.4 Staff Awareness and Training

No staff training was carried out in 2015.

3.5 Public Communications Programme

Records available for public inspection at the site office include:

- Copy of Waste Licence W0218-01
- Licence Application and Review documentation
- Monitoring records
- Complaints file
- Incidents file
- EPA Correspondence file

Visits to the Coolbeg Composting Facility can be arranged in advance by calling the Facility Manager at 0404-62422.

4.0 EMISSIONS MONITORING

An Environmental Monitoring Programme is required at the facility to assess the significance of emissions from site activities. Schedule C of Waste Licence W0218-01 specifies the required level of monitoring at the Coolbeg Composting Facility. All of the monitoring locations are shown on Figure 1 (Site Layout Plan) of this AER.

4.1 Noise Monitoring

No noise monitoring was carried out in 2015 as monitoring is due to be carried out every 2 years only. Noise monitoring will be conducted at the designated Noise Sensitive Locations in 2016.

4.2 Dust Monitoring

Dust deposition monitoring was carried out quarterly at three on site locations in 2015. The objective of the dust stations is to monitor the level of wind blown dust and other small particles which nay be generated from on-site activities. The Bergerhoff dust method was used as the dust monitoring medium to obtain dust levels at the site. The Bergerhoff method measures airborne dustfall in milligrams per square metre. The sample is collected in an open plastic jar mounted on a stand.

The dust collecting jars were left in-situ for a period of 30 days. Q4 was collected 5 days earlier than the standard 30 days due to other work commitments in the run-up to Christmas. After this period the samples were collected and delivered to ALT Ltd an INAB accredited laboratory located at Unit 4, Newbridge Industrial Estate, Co. Kildare for analysis using a gravimetric in-house method. The result obtained from the Lab with the amount of days the dust jar has been on site once calculated, will give the dustfall per mg/m^2 per day. The dust deposition results are set out in Appendix B.

Table 4.0: Summary of Dust Monitoring Results

	Period		Deposition (mg/m^2/day)			Dust Deposition Limits
Quarter	From	To	D1	D2	D3	mg/m^2/day
Q1	20/4/16	20/5/16	147	31	80	350
Q2	3/6/16	3/7/16	171	229	104	350
Q3	10/10/16	10/11/16	748	215	72	350
Q4	10/11/16	4/12/16	1	<1	<1	350

The dust monitoring results show that for the most part the results were compliant with the 350 mg/m^2/day limit with only one exceedance duing the year. The exceeedance in this case was due to the presence of organic material (ie leveas in the sample) due to the relative close proximity of the monitoring point to trees. The levels recorded during Q4 were very low. This can be explained by the high volume of rainfall that fell during the sampling period ie all 3 dust jars were full of water with little or no solids present in the sample.

4.3 Surface Water Monitoring

Surface water run-off from the composting process areas is diverted to the leachate storage lagoon located and is kept isolated from the surface water drainage system. Run-off from non-process paved areas and roof area of the building is collected and

An initial sample taken on the 24th November 2015 showed elevated iron levels within sample. This was picked up during an EPA visit on the 6th January 2016. A concentration of 2,005µg/l was recorded which is much higher than the parametric limit value of 200 µg/l.

The licencee submitted an Incident notification (Ref. No. INCI009424) on 11/01/2016 which is being assessed and monitored by the Agency. A second sample taken and analysed for iron only on 9th February 2016 showed an iron concentration of 57 µg/l and which is within the limit value. There is no plausible reason for the initial high result. No previous sample results showed elevated iron so it likely to be a single once –off exceedance. The 2nd result has been forwarded to the EPA through the EDEN licencee reporting portal system.

4.4 Groundwater Monitoring

A groundwater sample was taken from one monitoring location (PW1), as shown on Figure 2 (Site Layout Plan), on the 22nd August 2014 by John Delaney of Geoenvironmental. Samples were analysed by City Analysts an INAB accredited laboratory located at Pigeon House Road, Ringsend, Dublin 4. The certificate of analysis is provided in Appendix C. Groundwater was analysed for chemical and biological parameters specified in Schedule C of the waste licence W0218-01. The results of the analysis are summarised in Table 4.3.

Table 5.0: 2015 Groundwater Monitoring Results

Parameter	Unit	PW1 6/12/13	MAC*
Electrical Conductivity	*µS/cm*	220	
pH	*pH Units*	7.8	-
Chloride	*mg/l*	24.2	187.5
Ammonia as Nitrogen	*mg/l*	<0.02	0.175
Faecal Coliforms	*cfu/100m*	0	-
Total Coliforms	*cfu/100m*	0	-
Arsenic	*µg/l*	<0.1	7.5
Cadmium	*µg/l*	<0.1	3.75
Copper	*µg/l*	16	1500
Lead	*µg/l*	<0.1	18.75
Nickel	*µg/l*	<0.1	15
Selenium	*µg/l*	<1	-
Mercury	*µg/l*	<0.1	0.75
Zinc	*µg/l*	18	-

MAC Maximum Admissible Concentration
* European Communities Environmental Objectives (Groundwater Regulations, 2010 (S.I. No.9 of 2010) – Overall Threshold Value Range

The results of the groundwater analysis shows that tested parameters are compliant with the overall threshold values for chemical status of groundwater. All chemical and microbiological parameters are below their respective threshold limit values.

4.5 Bioaerosol Monitoring

Bioaerosol monitoring was carried out by Odour Monitoring Ireland on the 3rd December 2015, as specified in Schedule C of the waste Licence W0218-01. The results of bioaerosol monitoring are summarised in Table 4.4. The full report is included in

Appendix D. Bioaerosol monitoring locations are shown on Figure 2.1 of the Bioaerosol, Odour and Hydrogen Sulphide Impact Assessment Report.

Table 6.0: 2015 Bioaerosols concentration levels

Location ID	Average *Aspergillus fumigatus* Concentration (CUF m^{-3})[1]	Average *Mesophillic Bacteria* Concentration (CUF m^{-3})[1]	Sampling Count[2]
Loc 1	42	797	3
Loc 2	<3	1242	3
Loc 3	<3	1122	3

[1] denotes a total of 6 blanks (3 plate and 3 impactor blanks for the monitored bioaerosol) were incorporated into a sampling exercise. All blanks were negative CFU m^{-3}.
[2] denotes total number of sample counts for each parameter monitored at each location.

The bioaerosol concentration levels were determined at each sampling location in triplicate. Three sampling locations were chosen including Loc 1, 2, 3. The monitoring locations are shown on the schematic plant within the main report. Currently there are no significant bioaerosol impacts in the vicinity of Coolbeg site with all reported bioaerosol ambient air concentrations within the range of the proposed assessment criterion. The report produced by Odour Monitoring Ireland concluded bioaerosol concentrations within lower range for Aspergillus fumigatus and in the mid range for total Mesophillic bacteria.

4.6 Odour Monitoring

Odour monitoring was carried out by Odour Monitoring Ireland on the 3rd December 2015 as specified in Schedule C of the waste Licence W0218-01. The results of odour monitoring are summarised in Table 4.5. The full report is included in Appendix D. The odour monitoring locations are shown on Figure 2.1 of the Bioaerosol, Odour and Hydrogen Sulphide Impact Assessment Report.

Table 7.0: 2015 Odour Threshold Concentration and Hydrogen Sulphide Results

Date	Sample Location	Odour threshold concentration ($Ou_E\ m^{-3}$)	H_2S (ppb)	Comment
3/12/15	Loc 1	53	<3	No Distinct Odour
3/12/15	Loc 2	49	<3	No Distinct Odour
3/12/15	Loc 3	45	<3	No Distinct Odour
3/12/15	Loc 4	34	<3	No Distinct Odour
3/12/15	Loc 5	--	<3	No Distinct Odour
3/12/15	Loc 6	31	<3	No Distinct Odour
3/12/15	Loc 7	--	<3	No Distinct Odour
3/12/15	Loc 8	57	<3	No Distinct Odour

All odour sampling and analyses were performed in accordance with EN13725:2003. All ambient odour threshold concentrations were less than or equal to 57 Ou_E/m^3, therefore there is no indication of any significant odour impact. No elevated concentrations of odour or hydrogen sulphide were detected during the survey.All Hydrogen sulphide concentrations recorded at each monitoring location were less than 3 ppb in ambient air.

4.7 Compost Analysis

A sample of final compost from Greenking Composting was consigned to the ANUA testing laboratory of 6th November 2015. The sample was tested for a range of Standards for Compost Quality as set out in Schedule F Waste Licence W0218-01. The result of the analysis complies with the standard for trace elements, pathogens, bacteria and heavy metals and other contaminants as set out in the License. A copy of the analysis report is set out in Appendix E of this report.

4.7 Pollutant Release and Transfer Register

Under the European Pollution and Transfer Register Regulation King Tree Services Ltd. are required to submit information on emissions and waste annually to the EPA. A copy of the PRTR Emission Reporting Workbook for 2015 submitted to the Agency via the web- based data reporting system is set out in the Appendix F.

5.0 Site Visits and Inspections

No EPA Site Visits were carried out in 2015. The EPA carried out a site visit on the 6th January 2016. Overall the EPA concluded that the site is being well maintained however three observations were made during the site visit which either have been or are in the process of been addressed by the Licencee.

6.0 NUISANCE CONTROL

6.1 Mud, Dust, Litter

Nuisance controls at the facility include inspections of the facility and amenities immediate to the facility boundary for mud, dust and litter. These are documented in the daily facility inspection form to ensure any nuisances are identified and managed on a daily basis.

7.0 Site Developments Works

7.1 Engineering Works

No engineering works were carried out in 2015 and it is not envisaged that any works will be carried out in 2016. The Agency will be notified of future engineering works as per Condition 3.2 of the licence.

7.2 Tanks and Pipeline Testing and Inspection Report

Condition 3.17.5 of the waste licence requires that the integrity and water tightness of all bunded structures be tested by the licensee at least once in three years. All foul and surface water drains on site were cleaned and surveyed in July 2013 by Kelly Environmental Services using high pressure water jetting and IPEC CCTV equipment. All drains were found to be in good condition. The oil storage tanks were assessed by Blanchfield Oil Storage services on the 16th July 2013 and were found to be in good condition and suitable for the storage of of gas oil and kerosene. The pipelines will be surveyed and oil storage tanks re-assessed in 2016.

8.0 RESOURCE USE AND ENERGY EFFICIENCY

8.1 Energy Efficiency Audit

An Energy efficiency report was submitted as part of the 2006 AER. One of the main recommendations of the report was to install thermostat in the office building. This recommendation has been implemented and currently each radiator is fitted with a thermostatic control valve. There are only two staff members' at the facility full time

and the use of energy is very low. The main users of electricity are the office equipment. There is no electricity consumed in the compost production process on site.

8.2 Resource Consumption Summary

Table 8.1 presents an estimate of resources used on-site from January to December 2015. The water supply for the facility comes from an on-site groundwater well and it is not metered, water is used for sanitary and kitchen purposes.

Table 8.0: Resource Consumption Summary

Energy Stream	Annual Quantity	Units	Period
Electricity	**10698**	**kWh**	**2015**
Diesel	**10714**	**Litres**	**2015**
Heating Oil	**759**	**Litres**	**2015**
Hydraulic and Engine Oil	**20**	**Litres**	**2015**

9.0 WASTE RECEIVED AND CONSIGNED FROM FACILITY

9.1 Waste Management Records

Table 9-1 shows the total quantities of waste received at the waste facility in 2015. A breakdown of the waste types is provided in accordance with the European Waste Catalogue and Hazardous Waste List. The total of green waste accepted at the facility between January 2015 and December 2015 was 750 tonnes. The volume of green waste received at the facility has reduced significantly from 3,377 tonnes in 2008 to just 750 tonnes in 2015.

Table 10.0: Waste Received in 2015

EWC	Description	Waste in (tonnes)
20 02 01	Green Waste	750
	Total Received	750

Table 9.2 shows the quantities of waste received in previous years.

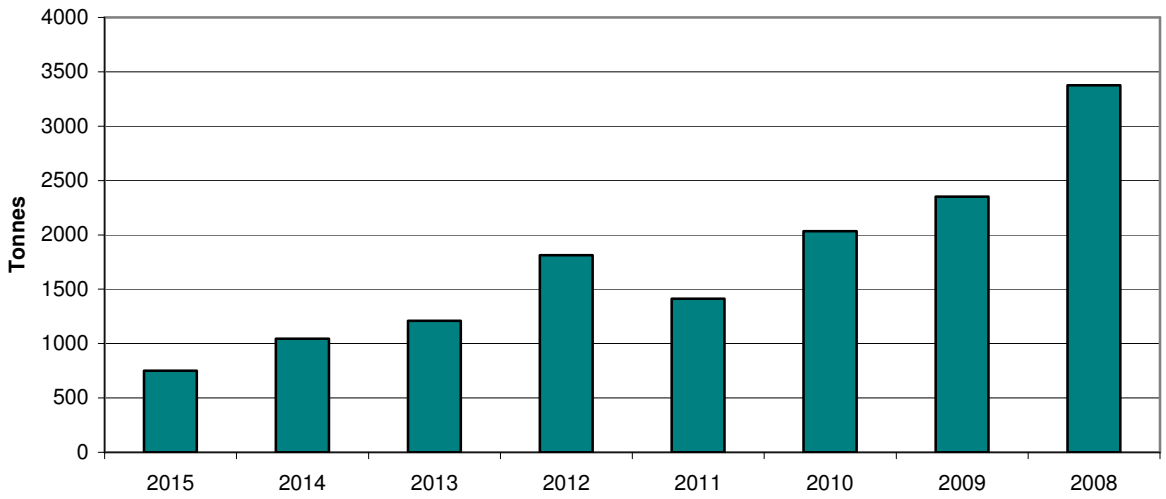
Table 11.0: Waste Received during 2008 to 2014

EWC	Description	2014	2013	2012	2011	2010	2009	2008
20 01 01	Green Waste		1210	1,814	1,413	2,034	2,351	3,377
	Total Received		1210	1,814	1,413	2,034	2,351	3,377

Table 12.0: Compost Quantities Consigned in 2015

EWC	Description	Waste (tonnes)
20 02 01	Compost	526
	Total	526

Figure 1: Green Waste Quantities Received 2008 - 2015



9.2 Waste Recovery Report

All waste received at the facility was used to produce compost, therefore the facility had a 100% recovery rate in 2015.

10.0 ENVIRONMENTAL INCIDENTS AND COMPLAINTS

10.1 Incidents Summary

King Tree Services Ltd. maintains register of incidents. There were no environmental incidents during the reporting period of 2015.

10.2 Register of complaints

King Tree Services Ltd. maintains register of complaints. No complaints were received during the reporting period.

11.0 OTHER REPORTS

11.1 Statement of Measures in Relation to the Prevention of Environmental Damage and Remedial Actions

Green waste composting is a relatively low impact waste management activity. The potential sources of environmental damage and the measures employed to prevent pollution are listed below:

Kerosene and Diesel tanks outside the Maintenance Shed – These are self-bunded tanks and are protected from impact by a strong steel fence.

Hydraulic and other oils in the Maintenance Shed – These are stored on bunded pallets.

Waste materials – These are stored and processed on paved surfaces with run-off directed to the leachate lagoon.

Leachate Lagoon – This is contained by a lining system, monitored regularly and serviced as required.

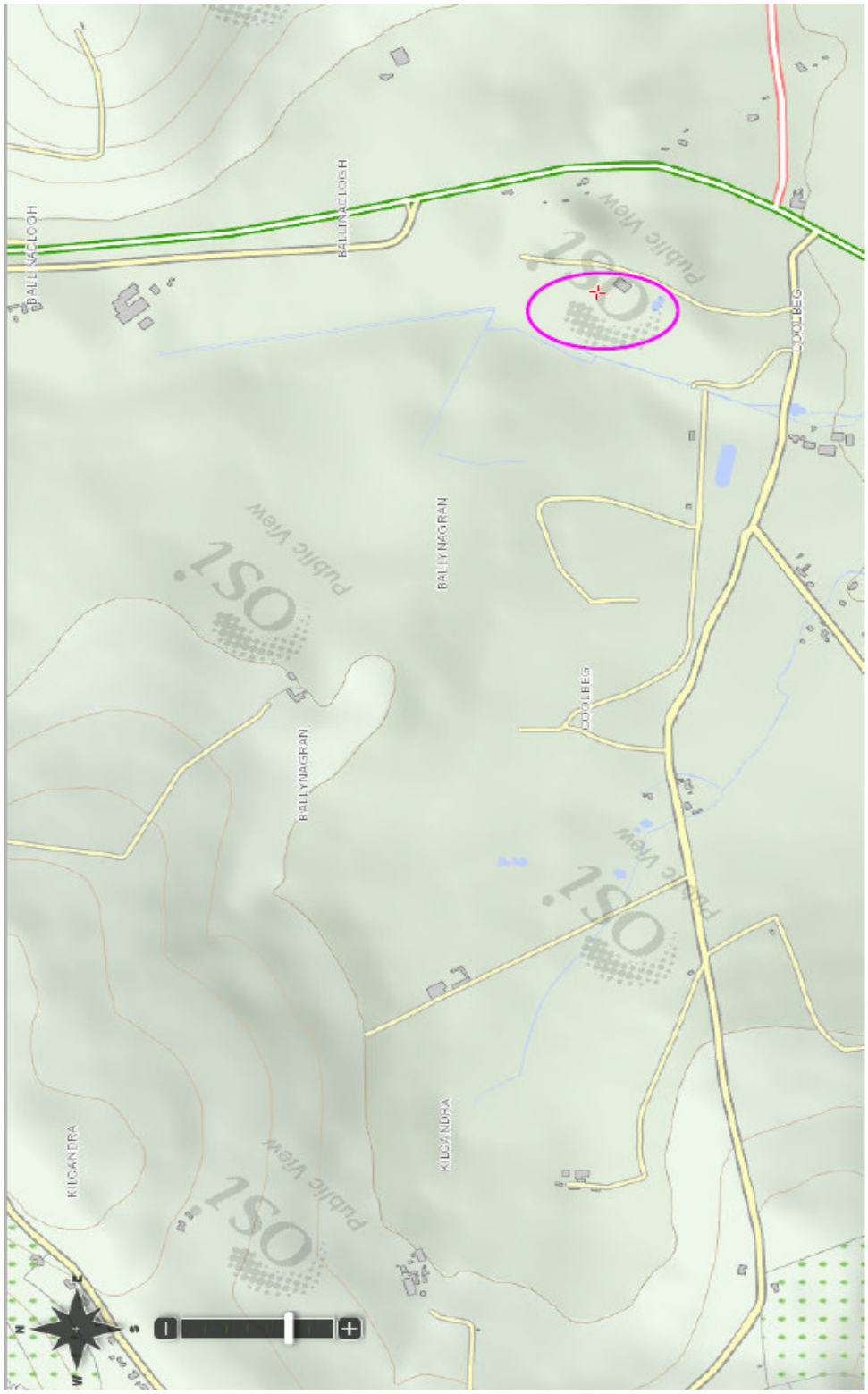
Sewage from the office – Municipal wastewater generated on site is treated by on on-site biocycle wastewater treatment unit that is serviced regularly.

Dust and other air emissions – The composting piles are regularly sprayed with water, particularly during dry periods and this prevents excessive wind-blown dust and other material such as spores.

Noise – Noise at the facility is primarily caused by shredding of green waste. This is periodic and is mitigated by the relatively long distance between site operations and the nearest sensitive receptors. There are no noise sensitive receptors within 150m of site boundary.

The site monitoring in 2015 has shown that the prevention measures employed at the site are currently operating effectively.

11.0 FIGURE 2: SITE LOCATION AND ENVIRONMENTAL MONITORING LOCATIONS




N
E
S
W
0
20
40
60
80m
120
160
200
N3L1
Bio5
D1
D2
D3
SW1
PW1
Bio1
Bio2
COOLBEG
LEGEND
DUST MONITORING LOCATION
NOISE MONITORING LOCATION
NOISE SENSITIVE LOCATION
GROUNDWATER MONITORING WELL (PW)
SURFACE WATER MONITORING LOCATION (SW)
BASELINE BIOAEROSOL MONITORING

12.0 APPENDICES

Appendix A: 2015 Dust Monitoring Report

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: 1-150520-04669

Report Number: **99054**

Date Issued: **26-May-2015**

Attention: **John Delaney**
Client: **Geoenvironmental**
Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

Results in this report relate only to the items tested.
Reports may not be reproduced in full without the approval of **Advanced Laboratory Testing**.
All queries regarding this report should be addressed to the Technical Manager at the address above.
Non Accredited in the comments section signifies that **Advanced Laboratory Testing** are NOT INAB accredited for this method.
Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 282794 **Sample Type:** Others
Date Received: 20/05/2015 **Date Tested:** 21/05/2015
Client ID: D1 - Q1 30 Day Dust Bergenhoff Sample from Greenking Compost, Coolbeg,Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	147	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

ALT ID: 282795 **Sample Type:** Others

Date Received: 20/05/2015 **Date Tested:** 21/05/2015

Client ID: D2 - Q1 30 Day Dust Bergenhoff Sample from Greenking Compost, Coolbeg,Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	31	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

ALT
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ADVANCED LABORATORY TESTING

Client: **Geoenvironmental**

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: **1-150520-04669**

Report Number: **99054**

Date Issued: **26-May-2015**

Order Number:

ALT ID: 282796 **Sample Type:** Others

Date Received: 20/05/2015 **Date Tested:** 21/05/2015

Client ID: D3 - Q1 30 Day Dust Bergenhoff Sample from Greenking Compost, Coolbeg,Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	80	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: 1-150703-00938

Report Number: **110523**

Date Issued: **10-Jul-2015**

Attention: **John Delaney**
Client: **Geoenvironmental**
Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

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Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 312342 **Sample Type:** Others
Date Received: 03/07/2015 **Date Tested:** 07/07/2015
Client ID: D1 - 30 Day Bergerhoff Dust Sample @ Greenking Compost, Coolbeg, Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	171	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

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ADVANCED LABORATORY TESTING

Client: **Geoenvironmental**

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: **1-150703-00938**

Report Number: **110523**

Date Issued: **10-Jul-2015**

Order Number:

ALT ID: 312343 **Sample Type:** Others

Date Received: 03/07/2015 **Date Tested:** 07/07/2015

Client ID: D2 - 30 Day Bergerhoff Dust Sample @ Greenking Compost, Coolbeg, Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	229	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

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ADVANCED LABORATORY TESTING

Client: **Geoenvironmental**

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: **1-150703-00938**

Report Number: **110523**

Date Issued: **10-Jul-2015**

Order Number:

ALT ID: 312344 **Sample Type:** Others

Date Received: 03/07/2015 **Date Tested:** 07/07/2015

Client ID: D3 - 30 Day Bergerhoff Dust Sample @ Greenking Compost, Coolbeg, Co.Wicklow.

Test	Result	Unit(s)	Method	Comments
Dust depostion	104	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: 1-151110-03013

Report Number: **150118**

Date Issued: **17-Nov-2015**

Attention:

Client: **Geoenvironmental**

Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

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Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 402357 **Sample Type:** Air
Date Received: 10/11/2015 **Date Tested:** 11/11/2015
Client ID: D1 30 Day Bergerhoff Dust Sample @ Greenking Compost Coobeg, Co. Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	748	mg/m2/day	ECTM014	

ALT ID: 402358 **Sample Type:** Air
Date Received: 10/11/2015 **Date Tested:** 11/11/2015
Client ID: D2 30 Day Bergerhoff Dust Sample @Greenking Compost Coobeg, Co. Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	214	mg/m2/day	ECTM014	

ALT ID: 402359 **Sample Type:** Air
Date Received: 10/11/2015 **Date Tested:** 11/11/2015
Client ID: D3 30 Day Bergerhoff Dust Sample @ Greenking Compost Coobeg, Co. Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	72	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: **1-151204-01567**

Report Number: **158945**

Date Issued: **14-Dec-2015**

Attention:

Client: **Geoenvironmental**

Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

Results in this report relate only to the items tested.
Reports may not be reproduced in full without the approval of **Advanced Laboratory Testing**.
All queries regarding this report should be addressed to the Technical Manager at the address above.
Non Accredited in the comments section signifies that **Advanced Laboratory Testing** are NOT INAB accredited for this method.
Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 421844 **Sample Type:** Air
Date Received: 04/12/2015 **Date Tested:** 07/12/2015
Client ID: D1 - Greenking Compost, Coolbeg,Co.Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	1	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

ALT ID: 421845 **Sample Type:** Air

Date Received: 04/12/2015 **Date Tested:** 07/12/2015

Client ID: D2 - Greenking Compost, Coolbeg,Co.Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	<1	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

ALT
TRUST | SCIENCE
ADVANCED LABORATORY TESTING

Client: **Geoenvironmental**

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: **1-151204-01567**

Report Number: **158945**

Date Issued: **14-Dec-2015**

Order Number:

ALT ID: 421846 **Sample Type:** Air

Date Received: 04/12/2015 **Date Tested:** 07/12/2015

Client ID: D3 - Greenking Compost, Coolbeg,Co.Wicklow

Test	Result	Unit(s)	Method	Comments
Dust depostion	<1	mg/m2/day	ECTM014	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

Appendix B: 2015 Groundwater Certificate of Analysis

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: 1-151204-01570

Report Number: **160413**

Date Issued: **18-Dec-2015** **Page 1 of 1**

Attention:

Client: **Geoenvironmental**

Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

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Non Accredited in the comments section signifies that **Advanced Laboratory Testing** are NOT INAB accredited for this method.
Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 421851 **Sample Type:** Other waters
Date Received: 04/12/2015 **Date Tested:** 04/12/2015
Client ID: Groundwater Sample Ref: Grrenking Compost, Coolbeg,Co.Wicklow

Test	Result	Unit(s)	Method	Comments
Ammonia	<0.02	mg/l NH3-N	ECTM001B	
Chloride	24.2	mg/l Cl	ECTM001C	
Conductivity	220	µScm	ECTM002	
pH	7.8	-	ECTM007	
Water metals	See attached	-	SUBCON	

The results in this report were authorised by:

Name	Title
Denis Kent	Laboratory Manager - Chemistry

Denis Kent

Advanced Laboratory Testing Ltd
Unit 4, Newbridge Industrial Estate,
Newbridge, Co. Kildare, Ireland
Tel: 045-434355 Web: www.altesting.ie

TEST CERTIFICATE

Document Reference: QMF021 Revision 1

Final Report

Project: 1-151204-01575

Report Number: **156188**

Date Issued: **05-Dec-2015** **Page 1 of 1**

Attention:

Client: **Geoenvironmental**

Address: Knocklas
Coolcotts
Co.Wexford

Order Number:

Conditions

Results in this report relate only to the items tested.
Reports may not be reproduced in full without the approval of **Advanced Laboratory Testing**.
All queries regarding this report should be addressed to the Technical Manager at the address above.
Non Accredited in the comments section signifies that **Advanced Laboratory Testing** are NOT INAB accredited for this method.
Sample type refers to INAB P9 classification system for testing and calibration.
Results reported as cfu/cm2 are calculated based on information supplied by the relevant customer regarding the specific area

ALT ID: 421854 **Sample Type:** Water - Bacteriological condition of environmental waters
Date Received: 04/12/2015 **Date Tested:** 04/12/2015
Client ID: Groundwater Sample Ref: Grrenking Compost, Coolbeg,Co.Wicklow

Test	Result	Unit(s)	Method	Comments
Presumptive Coliforms	0	cfu/100mL	MTM025	
Presumptive Escherichia coli	0	cfu/100mL	MTM025	

The results in this report were authorised by:

Name	Title
Mirona Socha Jacob	Senior Microbiologist

Mirona Socha-Jacob

Our Ref: EXR/211085 (Ver. 1)
Your Ref:

December 16, 2015

Environmental Chemistry
ESG
Bretby Business Park
Ashby Road
Burton-on-Trent
Staffordshire
DE15 0YZ

Telephone: 01283 554400
Facsimile: 01283 554422

Mr D Kent
Advanced Laboratory Testing Ltd
Unit 4
Newbridge Industrial Estate
Newbridge
CO. Kildare
Ireland

For the attention of Mr D Kent

Dear Mr Kent

Sample Analysis - Water Analysis

Samples from the above site have been analysed in accordance with the schedule supplied.
The sample details and the results of analyses for these samples are given in the appended report.

An invoice for this work will follow under a separate cover.

Please be aware that our policy for the retention of paper based laboratory records and analysis reports is 6 years.

The work was carried out in accordance with Environmental Scientifics Group Ltd (Multi-Sector Services) Standard Terms and Conditions of Contract.

If I can be of any further assistance please do not hesitate to contact me.

Yours sincerely

for ESG

S Stone
Project Co-ordinator
01283 554463

TEST REPORT

Report No. EXR/211085 (Ver. 1)

Advanced Laboratory Testing Ltd
Unit 4
Newbridge Industrial Estate
Newbridge
CO. Kildare
Ireland

Site: Water Analysis

The 1 sample described in this report were registered for analysis by ESG on 12-Dec-2015. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 16-Dec-2015

The following tables are contained in this report:

On behalf of
ESG :
Declan Burns

Managing Director
Multi-Sector Services

Date of Issue: 16-Dec-2015

Tests marked '^' have been subcontracted to another laboratory.

Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected. ESG accepts no responsibility for any sampling not carried out by our personnel.

Units :			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l							
Method Codes :			ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT	ICPMSWT							
Method Reporting Limits :			0.001	0.001	0.0001	0.001	0.001	0.002	0.001	0.0001	0.001							
LAB ID Number EX/	**Client Sample Description**	**Sample Date**	**Nickel as Ni (Total)**	**Chromium as Cr (Total)**	**Cadmium as Cd (Total)**	**Copper as Cu (Total)**	**Lead as Pb (Total)**	**Zinc as Zn (Total)**	**Arsenic as As (Total)**	**Mercury as Hg (Total)**	**Selenium as Se (Total)**							
1647008	421851	**04-Dec-15**	<0.001	<0.001	<0.0001	0.016	<0.001	0.018	<0.001	<0.0001	<0.001							

ESG

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

Tel +44 (0) 1283 554400

Fax +44 (0) 1283 554422

Client Name	**Advanced Laboratory Testing Ltd**
Contact	Mr D Kent

Water Analysis

Sample Analysis

Date Printed	**16-Dec-2015**
Report Number	**EXR/211085**
Table Number	**1**

Where individual results are flagged see report notes for status.

Sample Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

W211085

Customer Advanced Laboratory Testing Ltd
Site Water Analysis
Report No W211085

Consignment No W97242
Date Logged 12-Dec-2015

Report Due 18-Dec-2015

ID Number	Description	Matrix Type	Sampled	MethodID	CUSTSERV	ICPMSWT							
					Report A	Nickel as Ni MS (Total)	Chromium as Cr MS (Total)	Cadmium as Cd MS (Total)	Copper as Cu MS (Total)	Lead as Pb MS (Total)	Zinc as Zn MS (Total)	Arsenic as As MS (Total)	Mercury as Hg MS (Total)	Selenium as Se MS (Total)
EX/1647008	421851	Unclassified	04/12/15										

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Water	ICPMSWT	As Received	Determination of Total Metals in water samples using nitric acid digestion and ICPMS quantitation

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile **TR** Denotes Tremolite
CR Denotes Crocidolite **AC** Denotes Actinolite
AM Denotes Amosite **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols. This may have resulted in deterioration of the sample(s) during transit to the laboratory. Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : Advanced Laboratory Testing Ltd
Site : Water Analysis
Report Number : W21_1085

Lab ID Number	Client ID	Description
EX/1647008	421851	Unclassified

Appendix C: 2015 Bioaerosols and Odour Monitoring Report

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YEAR 2015 - BIOAEROSOL, ODOUR AND HYDROGEN SULPHIDE IMPACT ASSESSMENT AT GREEN KING COMPOSTING LTD, COOLBEG, CO. WICKLOW

PREPARED BY: Dr. Brian Sheridan
ATTENTION: Mr. Ian Browne
DATE: 16th Dec. 2015
REPORT NUMBER: 2015512(1)
DOCUMENT VERSION: Version 1
REVIEWERS:

TABLE OF CONTENTS

Document Amendment Record

Client: ***Kings Trees Limited***

Title: Year 2015 - Bioaerosol, Odour and H_2S Impact Assessment at Green King Composting Ltd, Coolbeg, Co. Wicklow

Project Number: 2015512(1)			**Document Reference:** Year 2015 - Bioaerosol, Odour and H_2S Impact Assessment at Green King Composting Ltd, Coolbeg, Co. Wicklow		
2015512(1)	Document for review	B.A.S.	JMC	B.A.S	16/12/2015
Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

1. Introduction

Odour Monitoring Ireland was commissioned to perform a bioaerosol, odour and hydrogen sulphide (H_2S) assessment in the vicinity of Green King Composting Ltd, Coolbeg, Co. Wicklow. The bioaerosol assessment was carried out in accordance with the guidance document established by the UK Composting Association "Standardised protocol for the testing and enumeration of micro organisms". Total Mesophillic bacteria and Aspergillus *fumigatus* sampling was performed using equivalent Andersen single stage impactors. Triplicate sampling was performed at each of the three identified sampling locations within and in the vicinity of Green King Composting facility located at Coolbeg, Co. Wicklow.

The odour assessment was carried out in accordance with EN 13725:2003. Hydrogen sulphide (H_2S) sampling and analysis was carried out using a Gold leaf Jerome ppb analyser.

The bioaerosol concentration levels were determined at each sampling location in triplicate. Three sampling locations were chosen including Green 1, 2 and 3. Currently, there are no significant bioaerosol impacts in the vicinity of Green King Composting facility located at Coolbeg, Co. Wicklow with all reported bioaerosol ambient air concentrations within the range of the assessment criterion. All odour sampling and analysis was performed in accordance with EN13725:2003. All ambient odour threshold concentrations were less than 57 Ou_E/m^3. Hydrogen sulphide concentrations recorded at each monitoring location were less than the lower level of detection of 3 ppb in ambient air.

1.1 Aims of the study

The main aims of the study were:

- To enumerate the ambient air concentration of two bioaerosols groups namely: Aspergillus *fumigatus* and Total Mesophillic bacteria during operation of the composting facility at Coolbeg, Co. Wicklow. These are the two most frequently requested bioaerosols to be monitored for composting plants.
- To ascertain ambient odour and H_2S concentrations levels in the vicinity of the composting facility.

2. Materials and methods

This section describes in detail the materials and methods used throughout the study period.

2.1 Sampling locations and residential locations

Figure 2.1 and *Table 2.1* illustrates the location of the facility in relation to local residents.

Table 2.1. Monitoring locations and parameters monitored.

Location ID	Parameter monitored	Location details
Loc 1	Total Mesophillic bacteria and Aspergillus fumigatus, Odour[1], H_2S	Upwind of site
Loc 2	Total Mesophillic bacteria and Aspergillus fumigatus, Odour[1], H_2S	Beside green waste, downwind of site
Loc 3	Total Mesophillic bacteria and Aspergillus fumigatus, Odour[1], H_2S	Downwind of site at entrance
Loc 4	H_2S, Odour[1]	Western boundary
Loc 5	H_2S	Upwind of site
Loc 6	H_2S, Odour[1]	Upwind of site
Loc 7	H_2S	Downwind of site
Loc 8	H_2S Odour[1]	Downwind on entrance road

Notes: [1] denotes duplicate odour samples taken

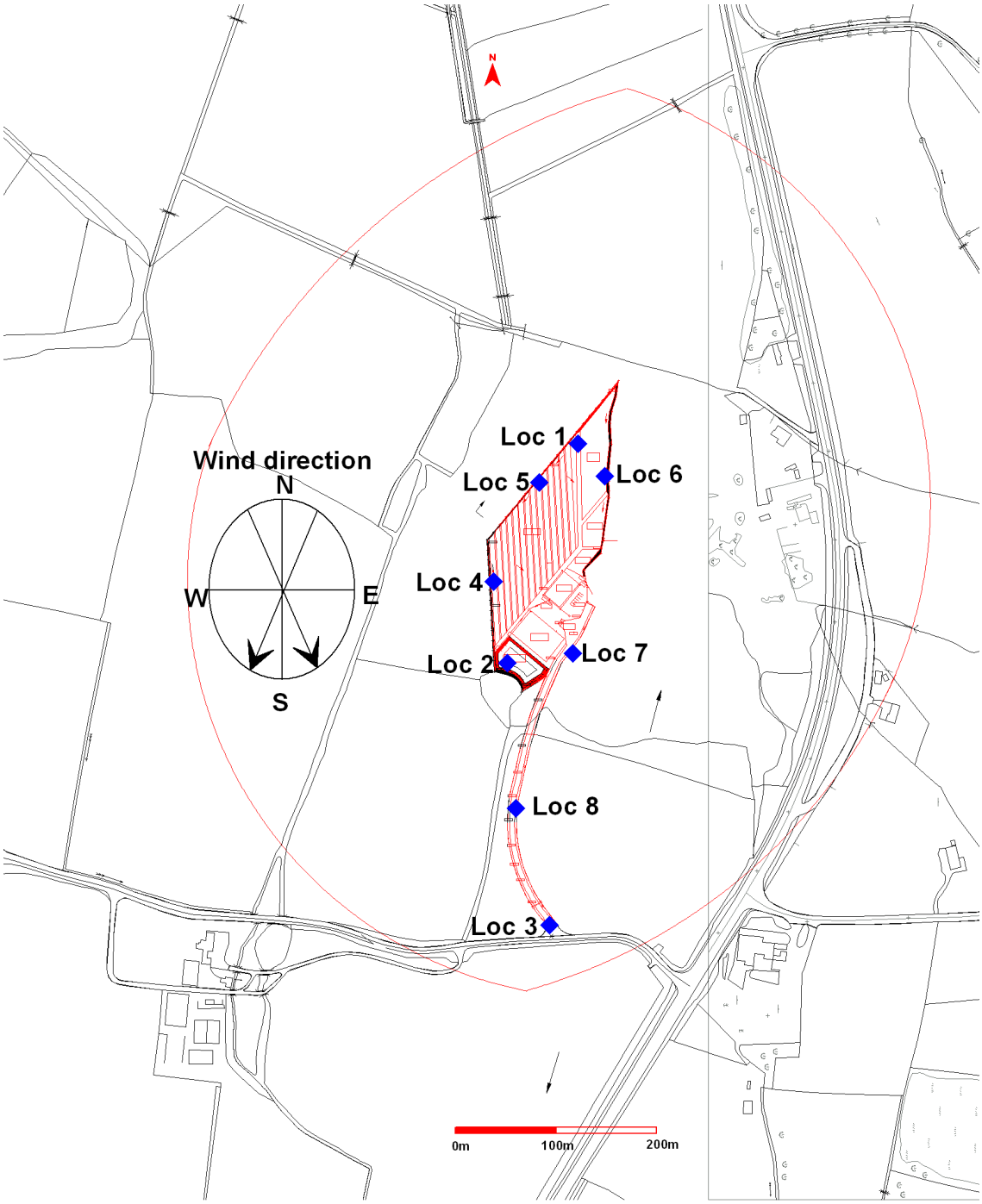

Figure 2.1. Schematic overview of Bioaerosol, Odour and H_2S monitoring locations.

2.2 Meteorological data

Table 2.2 illustrates the average wind direction during the one-day monitoring period. Average wind speed was low during the monitoring. Barometric pressure was approximately 1007 mbar. Relative humidity was 70% while temperature was low from 7 degrees Celsius. This would be typical for this time period of the year in Southern Ireland.

Table 2.2 Meteorological conditions during the one-day monitoring period.

Parameter	**Monitoring event 03/12/2015**
Wind direction (From)	NNW
Wind speed (knots)	8
Barometric pressure	1007
Temperature (^{0}C)	7
Relative humidity (%)	70

2.3 Bioaerosols monitoring

Monitoring of bioaerosols was performed in strict accordance with available information and advice including the sources:

1. Standardised Protocol for the Sampling and Enumeration of Airborne Micro-organisms at Composting Facilities. (1999). The UK Composting Association.
2. Macher, J. (1999). Bioaerosol assessment and control. American Conference of Government Industrial Hygienists, Kemper Woods Centre, 1330 Kemper Meadow Drive, Cincinnati, OH.
3. Direct Laboratories, (formerly ADAS), Woodthorne, Wergs Road, Wolverhampton, WV6 8QT.
4. SKC Inc, 863 Valley View Road, Eighty-four, PA, 15330.

Impactor plate sampling was carried out in accordance with the document “Sampling Protocol for the Sampling and Enumeration of Airborne Micro-organisms at Composting facilities”, The Composting Association, UK.

One sampling technique was employed namely:

- Biostage single stage 400 hole impactor (SKC Inc, PA)- This is directly equivalent to the Andersen N6 single stage impactor and meets the requirements of NIOSH 0800 and NIOSH 0801 biological sampling standards (i.e. this impactor is a direct copy of the Andersen N6 impactor with added benefits including the Surelok system which prevents any air leakages. This was an inherent problem of the Andersen N6 single stage impactor).

Generally, sampling times of 10 to 15 minutes were used to assess ambient background levels using the impactor plates as longer sampling times can lead to desiccation of the plate and impacted microbes. Sampling times of 10 minutes were used for the duration of this study.

The Biostage (i.e. Andersen N 6 equivalent impactor) was calibrated using a Bios Primary flow calibrator to a volumetric flow rate of 28.3 *litres* min^{-1} and Hi Flow 30 battery operated automatically timed pumps were used for suction airflow.

The Biostage impactors were fixed to tripods ensuring an adjustable sampling height of between 0.40 to 1.90 metres. The sampling height was fixed at 1.50 metres. Two Biostage impactors were used throughout the study period. The use of correctly designed sampling equipment ensured correct operation at all times throughout the study period.

The Irish Equine Centre (ISO 17025 accredited) tested two medias including Malt Extract Agar media (MEA) for Aspergillus *fumigatus*, and standard plate count agar (TVC) for total Mesophillic bacteria. MEA media facilitates the sporulation of Aspergillus *fumigatus*, which is used to identify the species. Sterile fresh 90mm plates were supplied by Cruinn Diagnostics accredited laboratory services and placed in sealed coolers. Fresh plates were used to eliminate the formation of a skin upon the plate upper surface (i.e. develops with age). It was thought that this may cause problems while using an impaction method (i.e. particle bounce off).

2.4. Transport of bioaerosol samples

All sampling plates during monitoring were allowed to equilibrate to ambient temperature before sampling. This allowed for the development of less harsh conditions upon impacted bioaerosols. It was also noticed that cooled plates (approximately 5^0C) formed an outer “skin” which could facilitate particle bounce. Following equilibration, it was apparent from observation, better “knitting” of impactor plates occurred. Before each sampling event, the Biostage impactors were sterilised using cotton wool and 70% iso-proponal. The impactors were autoclaved for complete sterilisation before sampling. Once sampled, all agar plates were inverted, sealed with parafilm, placed within a flexible plastic container, and neatly stacked within a mobile cooler for delivery to Irish Equine Centre laboratory located in Kill, Co. Kildare. Once received, they were incubated at the appropriate temperatures of 30^0C for Total viable counts (i.e. Mesophillic bacteria) and 37^0C for Aspergillus *fumigatus* by the laboratory technician. Results were received within 10 to 15 days following sampling.

2.5. Odour sampling

In order to obtain air samples for odour assessment, a static sampling method was used where air samples were collected in 60 litre pre-conditioned Nalophan^{NA} bags using a vacuum sampling device over a ten to twenty minute period. The sampler operates on the 'lung principle', whereby the air is removed from a rigid container around the bag by a battery powered SKC vacuum pump at a rate of 3 to 5 *l* min^{-1}. This caused the bag to fill through a stainless steel and PTFE tube whose inlet is placed in ambient air, with the volume of sample equal to the volume of air evacuated from the rigid container. All odour-sampling bags were pre-conditioned and flushed with odourless lab air to remove any interference from the sample material.

2.6. Olfactometry

Olfactometry using the human sense of smell is the most valid means of measuring odour (Dravniek et al, 1986) and at present is the most commonly used method to measure the concentration of odour in air (Hobbs et al, 1996). Olfactometry is carried out using an instrument called an olfactometer. Three different types of dynamic dilution olfactometers exist:

- Yes/No Olfactometer
- Forced Choice Olfactometer
- Triangular Forced Choice Olfactometer.

In the dynamic dilution olfactometer, the odour is first diluted and is then presented to a panel of screened panellists of no less than four (CEN, 2003) Panellists are previously screened to ensure that they have a normal sense of smell (Casey et al., 2003). According to the CEN standard this screening must be performed using a certified reference gas *n*-butanol. This screening is applied to eliminate anosmia (low sensitivity) and super-noses (high sensitivity). The odour analysis has to be undertaken in a low odour environment such as an air-conditioned odour free laboratory. Analysis should be performed preferably within 8 to 12 hours of sampling.

2.7. Odour measurement in accordance with EN13725:2003

An ECOMA TO8 dynamic yes/no olfactometer was used throughout the measurement period to determine the odour threshold concentration of the sample air. The odour threshold concentration is defined as the dilution factor at which 50% of the panel can just detect the odour. Only those panel members who pass screening tests with n-butanol (certified reference gas, CAS 72-36-3) and who adhered to the code of behaviour were selected as panellists for olfactometry measurements (CEN, 2003). Odour measurement was carried out in an odour free laboratory in accordance with EN13725:2003.

2.7.1 What is an odour unit?

The odour concentration of a gaseous sample of odourant is determined by presenting a panel of selected screened human panellists with a sample of odourous air and varying the concentration by diluting with odourless gas, in order to determine the dilution factor at the 50% detection threshold. The Z_{50} value (threshold concentration) is expressed in odour units ($Ou_E\ m^{-3}$).

The European odour unit is that amount of odourant(s) that, when evaporated into one cubic metre of neutral gas (nitrogen), at standard conditions elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM) evaporated in one cubic meter of neutral gas at standard conditions. One EROM is that mass of a substance (n-butanol) that will elicit the Z_{50} physiological response assessed by an odour panel in accordance with this standard. *n*-Butanol is one such reference standard and is equivalent to 123µg of n-butanol evaporated in one cubic meter of neutral gas at standard conditions (CEN, 2003).

2.8. H_2S measurement

A Jerome real time data-logging H_2S gold leaf analyser (measurement range 3 ppb to 50ppm) was also used for the measurement of ambient hydrogen sulphide levels in order to ascertain any elevations in ambient H_2S concentrations. This was used, as H_2S is commonly associated with composting operations and is a good indicator gas for the assessment of significant odour nuisance in the vicinity of compost facilities.

2.9 Bioaerosol assessment criteria

Table 2.2 illustrates the assessment criterion which is used for comparison of results during operation to ascertain ambient bioaerosol air quality in the vicinity of the Green King Composting facility located at Coolbeg, Co. Wicklow.

Table 2.2. Assessment criteria for the ambient bioaerosol air quality in the vicinity of Green King Composting facility Coolbeg, Co. Wicklow.

Assessment criteria	Reference concentration range	Notes	Reference
Total fungi (includes Aspergillus *fumigatus*)[1]	500 to 5,000 CFU m^{-3}	Environment Agency proposed concentration level, Reported concentration range in Swan, 2003 & Sheridan et al., 2004	McNeel et al., 1999 Wheeler et al., 2001, Swan et al., 2003 Sheridan et al., 2004
Mesophillic bacteria[1]	5,000 to 10,000 CFU m^{-3}	Environment Agency proposed concentration level, Reported concentration range in Swan, 2003 and Sheridan et al., 2004	Gorny and Dutkiewicz (2002) Wheeler et al., 2001 Swan et al., 2003 Dutch Occupational Health Association NWA 1989. Sheridan et al., 2004

Notes: [1] denotes the values of CFU m^{-3} refers to Colony Forming Unit per cubic metre of air sampled.

2.10 Ambient Bioaerosol air quality

Table 2.3 illustrates the results from bioaerosol air quality monitoring. Both Aspergillus *fumigatus* and Total Mesophillic bacteria were assessed on the day of sampling 03rd December 2015.

Table 2.3. Bioaerosols concentration levels within and in the vicinity of the recycling facility

Location ID	Average Aspergillus *fumigatus* concentration (CFU m^{-3})[1]	Average Mesophillic bacteria concentration (CFU m^{-3})[1]	Sample count[2]
Loc 1	42	797	3
Loc 2	<3	1242	3
Loc 3	<3	1122	3

Note: [1] denotes a total of 6 blanks (3 plate and 3 impactor blanks for the monitored bioaerosol) were incorporated into the sampling exercise. All blanks were negative CFU m^{-3}.
[2] denote total number of sample counts for each parameter monitored at each location.

Table 2.3 illustrates the ambient bioaerosol air quality within and in the vicinity of the Green waste composting facility. As can be observed, Aspergillus *fumigatus* concentrations are low and at expected ambient concentration levels. Total mesophillic bacteria concentration levels at monitored location Loc 2 were elevated but dissipated rapidly with distance to monitoring location Loc 3 (approx. 50 to 90m downwind). The dissipation in concentrations of total mesophillic bacteria from Loc 2 to Loc 3 would be indicative of results obtained from international literature where bioaerosol concentrations greatly dissipate with distance from the source (i.e. within 80 to 200 metres).

Following a review of literature, it is reported that concentration levels of bioaerosols in ambient environment range from 0 to 400 CFU m^{-3} for Aspergillus *fumigatus*, 0 to 15,673 CFU m^{-3} for Total fungi and 79 to 3204 CFU m^{-3} for Total bacteria. The data set measured is within the lower end of this range.

In accordance with the assessment criteria reported in *Table 2.2*, bioaerosol concentrations within lower range for Aspergillus fumigatus and in the mid range for total Mesophillic bacteria.

2.11. Odour and H_2S results

Table 2.4 and 2.5 illustrates the odour threshold concentration and hydrogen sulphide results obtained during the monitoring period. All sampling and analysis for odour was performed in accordance with EN13725:2003. No elevated concentrations of odour or hydrogen sulphide were detected during the survey.

Table 2.4. Odour threshold concentration and Hydrogen sulphide results following monitoring of Green King Composting Ltd, Coolbeg, Co. Wicklow.

Date	Sample Location	Odour threshold conc. (OuE m^{-3})	H_2S (ppb)	Comment
03/12/2015	Loc 1	53	<3	No distinct odour
03/12/2015	Loc 2	49	<3	No distinct odour
03/12/2015	Loc 3	45	<3	No distinct odour
03/12/2015	Loc 4	34	<3	No distinct odour
03/12/2015	Loc 5	--	<3	No distinct odour
03/12/2015	Loc 6	31	<3	No distinct odour
03/12/2015	Loc 7	-	<3	No distinct odour
03/12/2015	Loc 8	57	<3	No distinct odour

3. Conclusions

The following conclusions may be drawn from the study;

1. The bioaerosol concentration levels were determined at each sampling location in triplicate. Three sampling locations were chosen including Loc 1, 2, 3. Currently, there are no significant bioaerosol impacts in the vicinity of Green King Composting facility located at Coolbeg, Co. Wicklow with all reported bioaerosol ambient air concentrations within the range of the proposed assessment criterion.
2. All odour sampling and analysis was performed in accordance with EN13725:2003.
3. All ambient odour threshold concentrations were less than 57 Ou_E/m^3, therefore there is no indication of any significant odour impact.
4. All Hydrogen sulphide concentrations recorded at each monitoring location were less than 3ppb in ambient air.

Appendix D: 2015 Compost Certificate of Analysis Report

BORD NA MÓNA

Analysis Report

Project Code : 15-47140 **Report Unique ID:** 53418

Report Date : 17-Feb-2016 **Commen. Date:** 13/11/2015

Customer: **IAN BROWNE**

COOLBEG
WICKLOW
CO WICKLOW

Contact Details:
ian@greenking.ie

Approved by : **Laura Corrigan**
Scientist

Sample Number : 436351 Client ID: Composted Green Waste 05/11/15

Sample Type:Solid Received: 06/11/2015 10:17 Condition: Good

Analysis	*Component*	*Specification*	*Result*	*Units*
e.Coli**	e.Coli **	-	<10	cfu/100 ml
Fraction Analysis	Particle size >31.5mm (%)	-	1	%
	Particle size >16mm (%)	-	0	%
	Particle size >8mm (%)	-	0.2	%
	Particle size >4mm(%)	-	8.0	%
	Particle size >2mm (%)	-	25.1	%
	Particle size >1mm (%)	-	31.3	%
	Particle size <1mm (%)	-	33.97	%
	Total Glass in Sample	-	0	%
	Total Metal in Sample	-	0	%
	Total Plastic in Sample	-	0	%
	Total Stone and Other Inorganics	-	2.40	%
Cress Test	Cress germination compared to control	-	78.57	%
	Root Index compared to control	-	46	%
	MLVI compared to control	-	46	%
	% Sample diluted with peat	-	100	%
C:N Ratio	C:N Ratio	-	12.4	
Density	Density	-	580.01	g/l
Moisture Content	Moisture Content	-	51.0	%

BORD NA MÓNA

Analysis Report

Project Code : 15-47140 **Report Unique ID:** 53418

Sample Number : 436351 Client ID: Composted Green Waste 05/11/15

Sample Type:Solid Received: 06/11/2015 10:17 Condition: Good

Analysis	*Component*	*Specification*	*Result*	*Units*
Heavy Metals**	Cd (Dry Wt Basis)**	-	1.38	mg/kg
	Cr (Dry Wt Basis)**	-	17.0	mg/kg
	Cu (Dry Wt Basis)**	-	117	mg/kg
	Ni (Dry Wt Basis)**	-	16.9	mg/kg
	Pb (Dry Wt Basis)**	-	45.5	mg/kg
	Zn (Dry Wt Basis)**	-	283	mg/kg
	Hg (Dry Wt Basis)**	-	0.41	mg/kg
	% Dry Matter Content	-	49.04	%
Oxygen Uptake Rate	Oxygen Uptake Rate (OUR)	-	7.1	mmolO2/kg OS/h
% NPK **	Total Nitrogen (N) **	-	1.80	% wt/wt
	Total Phosphorus (P) **	-	1.28	% wt/wt
	Total Potassium (K) **	-	0.69	% wt/wt
pH	pH reading	-	7.00	
	pH	-	7.00	
	Temperature	-	18.0	
pH	pH reading	-	7.01	
	pH	-	7.01	
	Temperature	-	18.0	
Salmonella	Salmonella**	-	<1.0	spp/25g
Self Heating	Self Heating Test	-	20	°C
	Control	-	23	°C
% SOL NUTRIENTS **	NH4 - N **	-	6	mg/l
	NO3 - N **	-	84	mg/l
	N **	-	90	mg/l
	PO4 - P **	-	7	mg/l
	K **	-	260	mg/l
Weed Germination **	** Weed Germination Test	-	0.7	Weeds/Litre

BORD NA MÓNA

Analysis Report

Project Code : 15-47140 **Report Unique ID: 53418**

Methods of Analysis

Analysis Name:	Method:
Self Heating	FprEN 16087-2
Cress Test	FprEn 16086-2
Fraction Analysis	PAS 100:2005 Annex E
pH	based on I.S.EN13037
C:N Ratio	Inhouse Calculation based on % C & % N
Heavy Metals**	I.S EN 13650 & Hg -ISO 16772
% NPK **	%N: I.S EN 13554-1 %P: I.S EN 13650 %K: I.S EN 13650
Moisture Content	*G/86 Determination of % moisture in Fuels based on ISO 589-2003
Oxygen Uptake Rate	based on PrEN 16087-1
Density	Gravimetric analysis
e.Coli**	G/72 MPN based on IDEXX defined substrate method
Moisture	*G/86 Determination of % moisture in Fuels based on ISO 589-2003
Weed Germination **	BGK e.V.2006
Salmonella	Based on I.s.EN ISO 6579
% SOL NUTRIENTS **	I.S EN 13652

Notes

* = INAB accredited test ** = subcontracted test *** = outside accredited range

Conditions

1. Reports shall not be reproduced except in full, without the expressed approval of Bord Na Mona Technical Services Analytical Laboratory
2. Results contained in this report relate only to the items tested.
3. All Comments concerning this report or its contents should be forwarded to the Laboratory Manager

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Appendix E: 2015 Surface Water Monitoring Results

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Michael O'Sullivan
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Public Analyst's Laboratory
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Lower Grand Canal Street
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Fax. (01) 662 8532
www.publicanalystdublin.ie

Date of this Report: 21/12/2015

Report of the Public Analyst's Laboratory

Sample of:	Drinking Water	**Date Sampled:**	24/11/2015
Marked:	Greenking Composting, Coolbeg, Wicklow, Co. Wicklow.	**Lab. Ref. No.:**	07899/15/253 WP
		Your Ref.:	
Received on:	24/11/2015		
Report to:	Ian Browne Greenking Composting Coolbeg Wicklow Co. Wicklow	**Analysis:**	Priv C & B - XCP

This report is issued subject to the conditions at the end of the report.

Report No.: 07899/15/253 WP /1

Sample integrity on receipt: Intact.

Microbiological Examination

Date Work Commenced: 24/11/2015

SOP	Parameter	Result	Units
PALM0102	Enterococci	16	cfu per 100ml
PALM0108	Coliforms	>201	MPN per 100ml
PALM0108	Escherichia coli	9	MPN per 100ml

">" indicates "greater than" the value quoted.

Authorised By: Rachel Hewitt

Rachel Hewitt
Executive Analytical Chemist (Microbiology)

Chemical Analysis

Date Work Commenced: 24/11/2015

SOP	Parameter	Result	Parametric Value	Units
PALCW0020	Turbidity	9.12	-	NTU
PALCW0022	Hydrogen Ion (pH)	7.7	6.5 - 9.5	pH Units
PALCW0022	# pH measured at	17.0	-	°C
PALCW0019	Conductivity @ 20°C	205	2500.0	µS/cm
PALCW0021	Ammonium (as NH4)	0.08	0.30	mg/L
PALCW0021	Nitrate (as NO3)	17.97	50.00	mg/L
PALCW0021	Nitrite (as NO2)	<0.164	0.500	mg/L
PALCW0021	Chloride	18.5	250.0	mg/L
PALCW0021	Colour	62.0		mg/L Pt-Co
PALCW0021	# Colour measured on lab filtered sample ?	Yes	-	None
PALCW0021	Sulphate	<8	250.0	mg/L
PALCW0021	Total Hardness (as Ca)	35.0	-	mg/L

212100/143080

Chemical Analysis

Date Work Commenced: 24/11/2015

SOP	Parameter	Result	Parametric Value	Units
PALCW0021	Total Hardness (as CaCO3)	87.5	-	mg/L
PALCW0005	Fluoride	<0.10	0.80	mg/L
PALCW0006	Boron	<0.1	1.0	mg/l
PALCW0006	Sodium	14	200.0	mg/l
PALCW0006	Aluminium	<50	200	µg/L
PALCW0006	Chromium	<4	50.0	µg/L
PALCW0006	Manganese	48	50.0	µg/L
PALCW0006	Nickel	3.3	20.0	µg/L
PALCW0006	Copper	<0.1	2.0	mg/L
PALCW0006	Cadmium	<2.0	5.0	µg/L
PALCW0006	Arsenic	<2.0	10.0	µg/L
PALCW0006	Selenium	<2.0	10.0	µg/L
PALCW0006	Lead	<2.0	10.0	µg/L
PALCW0006	Antimony	<2.0	5.0	µg/L
PALCW0006	# Iron	**2055**	200.0	µg/L

"<" indicates less than the Limit of Quantitation for that parameter.
# indicates a result not accredited by the Irish National Accreditation Board (INAB).
A Chemical Analysis result in **bold** indicates that the Parametric Value is exceeded.

Authorised By:

Ken McCartney
Executive Analytical Chemist

"Parametric Value" indicates the maximum admissible concentration as implemented in S.I. No. 122 of 2014, The European Union (Drinking Water) Regulations 2014.

Sample Observations

Appearance	Dull; Some suspended particles
Odour	None

Remarks

The Parametric Values for fluoride are 0.8mg/l for a fluoridated water supply & 1.5mg/l for naturally occurring fluoride.

The concentration of iron exceeds the EC Parametric Value for drinking water. Iron is excessive and should be removed. The level of iron could render the water unsuitable for culinary and laundry purposes and could impart an astringent metallic taste to the water. The water is moderately soft.

Opinion

Based on the analysis performed, the water is not fit for human consumption.

212100/143080

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Michael O'Sullivan
Public Analyst
H.S.E. Dublin Mid-Leinster
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www.publicanalystdublin.ie

Date of this Report: 16/02/16

Report of the Public Analyst's Laboratory

Sample of: Drinking Water
Marked: Greenking Composting Ltd, Coolbeg, Wicklow, Co. Wicklow

Date Sampled: 09/02/2016
Lab. Ref. No.: 00853/16/41 WPC
Your Ref.:

Received on: 09/02/16
Report to: Greenking Composting Ltd
Greenking Composting Ltd
Coolbeg
Wicklow
Co. Wicklow

Analysis: Special Customer Request

This report is issued subject to the conditions at the end of the report.

Report No.: 00853/16/41 WPC /1

Chemical Analysis

Date Work Commenced: 11/02/16

SOP	Parameter	Result	Parametric Value	Units
PALCW0006	Iron	57	200.0	µg/L

Authorised By:

David Browne
Executive Analytical Chemist

"Parametric Value" indicates the maximum admissible concentration as implemented in S.I. No. 122 of 2014, The European Union (Drinking Water) Regulations 2014.

Sample Observations

Opinion.
Based on the analysis performed, in my opinion the sample complies with the parametric values for drinking water for the parameter(s) tested.

Judgement
A microbiological examination of the water is required to determine if it is fit for human consumption.

216823/144386

Appendix F: 2015 PRTR Submission

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2015

1. FACILITY IDENTIFICATION

Parent Company Name	Kings Tree Services Limited
Facility Name	Kings Trees Services Composting Facility
PRTR Identification Number	W0218
Licence Number	W0218-01

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Coolbeg
Address 2	Wicklow
Address 3	
Address 4	
	Wicklow
Country	Ireland
Coordinates of Location	-6.09863 52.9559
River Basin District	IEEA
NACE Code	3832
Main Economic Activity	Recovery of sorted materials
AER Returns Contact Name	Ian Browne
AER Returns Contact Email Address	ian@greenking.ie
AER Returns Contact Position	Facility Manager
AER Returns Contact Telephone Number	0404 62433
AER Returns Contact Mobile Phone Number	0868382004
AER Returns Contact Fax Number	040468846
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	2
User Feedback/Comments	Quantity of biodegradable waste accepted on site has been reducing significanly year on year since 2008
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
50.1	General
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	No
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	

This question is only applicable if you are an IPPC or Quarry site

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0218 | Facility Name : Kings Trees Services Composting Facility | Filename : W0218_2015.xls | Return Year : 2015 | 25/03/2016 14:06

Please enter all quantities on this sheet in Tonnes 3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	20 02 01	No	750.0	biodegradable waste	R3	M	Weighed	Onsite of generati	King Tree Services Ltd. ,W0218-01	Coolbeg,Coolbeg,Wicklow,Co Wicklow,Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button