



Department of
Environment and
Heritage Protection

Enquiries: Ashleigh Fowler
Phone: 07 3330 5670
Our ref: SOR/117766(Pt1)

05 March 2013

Mr John Homewood
Ace Waste Pty Ltd
491 Gooderham Road
WILLAWONG QLD 4110

Dear Mr Homewood,

I am writing to you in relation to the bypass events experienced frequently by Ace Waste Pty Ltd (Ace Waste) located at 491 Gooderham Road, Willawong. As you may be aware, Ace Waste experienced thirteen (13) bypass events between January 2011 and January 2013. Ten (10) of these bypass events were caused by loss of mains power supply while the remaining three (3) resulted from equipment failure. These bypass events ranged in duration from two (2) minutes to one hundred and ninety seven (197) minutes, with the average duration being seventy four (74) minutes.

The Department of Environment and Heritage Protection (the department) acknowledges that these bypass events have mostly been caused by loss of mains power supply and that this is outside the control of Ace Waste. However, the department would like to remind you that section 319 of the *Environmental Protection Act 1994* states that a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm. As such, the department requests that Ace Waste develop contingency plans and install all infrastructure necessary to minimise the frequency and duration of bypass events. This may include, but is not limited to, the procurement of a standby generator or an additional underground electrical feeder cable from Energex. The department would like to organise an urgent meeting with Ace Waste to discuss these requirements in more detail.

If you have any questions regarding the contents of this letter or wish to organise the meeting, please do not hesitate to contact Ashleigh Fowler on (07) 3330 5670.

Yours sincerely,

sch4p4(6) Personal information

Peter Vassel
Manager
Brisbane South
Southern Region
Department of Environment and Heritage Protection



ACE WASTE PTY LTD ABN 79 010 750 839
ACEWASTE

SOLVING TOMORROW'S WASTE PROBLEMS - TODAY
DEHP
SOUTHERN REGION

BRISBANE

491 Gooderham Road
Willawong Qld 4110
Phone 07 - 3372 6666
Fax 07 - 3372 3777

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64 Ordish Road
Dandenong South Vic 3175
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- 6 MAR 2013

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LVL 8 400G

5th March 2013

Department of Environment and Heritage Protection Queensland
GPO Box 2454
BRISBANE QLD 4001

ATTENTION: Ashleigh Fowler
Senior Environmental Officer

Dear Ashleigh

Ace Waste wishes to apply for an extension to the report due date for the incineration waste trial as approved under SR0209; BST369v1.

The report was due to be lodged by 15 March 2013. An extension to 12 April 2013 is requested.

Your assistance in this matter is appreciated.

Kind regards

ACE WASTE PTY LTD

sch4p4(6) Personal information

JOHN HOMEWOOD
Managing Director

RECEIVED / REGISTERED	
Dept of Environment and Heritage Protection ESA Southern Region 400G	
6 MAR 2013	
File #:	SR 117766
Item #:	2044147

All correspondence to PO Box 400 Acacia Ridge Qld 4110 Free Call 1300 850 901
Email mail@acewaste.com.au www.acewaste.com.au

A Proud Australian Company

DATE OF REPORT: 19TH MARCH, 2013

Mr Kevin Maddick
Operations Supervisor
Ace Waste Pty Ltd
PO Box 400
Acacia Ridge QLD 4110



TEST REPORT No. JAN13005

**MONITORING OF AIR EMISSIONS
FROM THE ACE WASTE INCINERATOR
STACK IN WILLAWONG, QLD**

DATE OF SAMPLING: 17TH – 18TH JANUARY, 2013

ACCREDITATION:



This laboratory is accredited by the National Association of Testing Authorities (NATA)
NATA Accredited Laboratory Number: 15463
Accredited for compliance with ISO/IEC 17025:2005
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AUTHORISATION:



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LABORATORY MANAGER

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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Ace Waste Pty Ltd to monitor stack emissions leaving the Biomedical Waste Incinerator situated at Willawong for the following parameters:

- Temperature, Gas Velocity and Volume Flow Rate
- Concentration of Water Vapour (Moisture Content)
- Concentration of Oxygen and Carbon Dioxide
- Concentration and Mass Emission Rate of:
 - Carbon Monoxide
 - Total Solid Particulates
 - PM₁₀
 - PM_{2.5}
 - Hydrogen Halogens and Halides (expressed as HCl)
 - Nitrogen Oxides (expressed as NO₂)
 - Hydrogen Sulfide
 - Fluorides (expressed as HF)
 - Total Volatile Organic Compounds (TOC)
 - Sulfur Dioxide and Sulfur Trioxide
 - Heavy metals (antimony, arsenic, cadmium, lead, mercury, vanadium and their compounds)
 - Dioxins and Furans

All of the above samples were collected on the 17th - 18th January 2013.

QUALITY STATEMENT

AirLabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to and continuous improvement of all our processes and test work. Our goal is to meet or exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to insure that all data generated is scientifically valid.

TEST METHODS

Gas Velocity, Volume Flow Rate and Temperature

Gas velocity and volumetric flow rate were determined in accordance with USEPA Method 2 'Determination of stack gas velocity and volumetric flow rate (type s pitot tube)'. In accordance with this method pressure differential and temperature profiles were obtained across the sampling plane at transverse points specified by AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions'. Gas velocity and volume flow rates were then calculated in accordance with USEPA Method 2.

The estimated measurement uncertainty for temperature measurement is $\pm 1\%$. The estimated measurement uncertainty for gas velocity and volume flow rate is $\pm 10\%$.

Water Vapour (Moisture Content)

Stack gas moisture content was determined in accordance with USEPA Method 4 'Determination of Moisture Content in Stack Gases'. A measured volume of stack gas was aspirated through a series of chilled impingers each containing 100 mls of water and then drawn through a silica gel tube. The total change in volume of water in the impingers and the weight change of the silica gel tube were used to calculate the percentage moisture in the stack.

The estimated measurement uncertainty is $\pm 5\%$.

Oxygen and Carbon Dioxide

Oxygen (O₂) and carbon dioxide (CO₂) concentrations were monitored in accordance with USEPA Method 3A 'Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and portions were conveyed to a Paramagnetic O₂ analyser and a Non Dispersive Infrared (NDIR) CO₂ analyser.

Each analyser was zeroed using dry nitrogen and calibrated in accordance with the method using ambient air for O₂ as well as NATA certified span gases for O₂ and CO₂. The estimated measurement uncertainty is $\pm 2\%$.

Carbon Monoxide

Carbon monoxide (CO) was monitored in accordance with USEPA Method 10 'Determination of Carbon Monoxide Emissions from Stationary Sources'. The sample gas was withdrawn continuously from the gas stream and conveyed to a Non Dispersive Infrared (NDIR) CO analyser. The instrument was calibrated using NATA certified CO span gas and zeroed with dry nitrogen. The estimated measurement uncertainty is $\pm 5\%$.

Total Solid Particulates

Monitoring for solid particles was conducted in accordance with Australian Standard 4323.2 - 1995 'Stationary Source Emissions, Method 2: Determination of Total Particulate Matter - Isokinetic Manual Sampling - Gravimetric Method'.

Stack gas was withdrawn isokinetically through a nozzle, which had a sharp and tapered leading edge. Particulate matter was collected on a pre-weighed glass fibre filter located in a holder downstream of the nozzle. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The weight change of the filter was determined using an Ohaus electronic balance and this figure used to calculate the concentration of particulate matter.

The estimated measurement uncertainty is $\pm 15\%$.

PM₁₀ and PM_{2.5} Particulate Matter

Monitoring for PM₁₀ and PM_{2.5} particulate matter was conducted in accordance with USEPA Method CTM 040 'Method for the Determination of PM₁₀ and PM_{2.5} Emissions (Constant Sampling Rate Procedures)'. This method is used to determine particulate matter emissions equal to or less than a nominal aerodynamic diameter of 10µm (PM₁₀) and 2.5µm (PM_{2.5}) in stationary source emissions

In accordance with this method, a sample of stack gas was extracted at a predetermined constant flow rate through a cascade impactor. This in-stack sizing device separated particles with nominal aerodynamic diameters of PM_{10} and $PM_{2.5}$. To minimize variations in the isokinetic sampling conditions, testing was conducted within well-defined limits. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The particulate mass for each size fraction was determined using gravimetric analysis.

The estimated measurement uncertainty is $\pm 15\%$.

Nitrogen Oxides

Nitric oxide (NO) and nitrogen dioxide (NO_2) concentrations were monitored in accordance with USEPA Method 7E 'Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and a portion was conveyed to a NO/ NO_2 / NO_x Chemiluminescent analyser. Total nitrogen oxides (NO_x) are expressed as NO_2 . The estimated measurement uncertainty is $\pm 5\%$.

Acid Gases

Sampling for acid gases was conducted in accordance with USEPA Method 26 – 'Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Non-Isokinetic Method'.

Each sample was drawn through a heated probe and filters into a dilute sulphuric acid and dilute sodium hydroxide solutions, which collected the gaseous hydrogen halides and halogens, respectively. Sodium thiosulphate was added in excess to the alkaline solution to ensure complete reaction. The filter was not recovered for analysis. The halide ions in the separate solutions were measured by ion chromatography. Acid gases are expressed as hydrogen chloride (HCl). The estimated measurement uncertainty is $\pm 20\%$.

Hydrogen Sulfide

Monitoring for hydrogen sulfide (H_2S) was conducted in accordance with USEPA Method 15 'Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources'. Stack gas was withdrawn from the emission source and diluted with clean dry air using a mass flow controlled Dynamic Diluter device. An aliquot of the diluted sample was then analysed for H_2S using a Gas Chromatograph with a Flame Photometric Detector (GC-FPD). The estimated measurement uncertainty is $\pm 5\%$.

Total (Volatile) Organic Compounds

Sampling and analysis were performed in accordance with USEPA Method 18 'Measurement of Gaseous Organic Compound Emissions by Gas Chromatography – Adsorption tube procedure'.

A measured volume of stack gas was drawn through an activated carbon tube, trapping organic compounds present in the gas. Samples were extracted with carbon disulphide and analysed using gas chromatography/mass spectrometry. The summation of individual VOCs is reported.

The estimated measurement uncertainty is $\pm 20\%$.

Fluorides

Sampling for gaseous and particulate fluorides was conducted in accordance with US EPA Method 13B - Determination of Total Fluoride Emissions from Stationary Sources. Stack gas was withdrawn isokinetically through a nozzle having a sharp and tapered leading edge.

Particulate matter was collected on a low fluoride ($< 0.01 \text{ mg F/cm}^2$) $0.2 \mu\text{m}$ organic membrane filter located in a holder in a heated box. This was followed by an impinger train situated in an ice bath. The first two impingers each contained 100 ml of deionised distilled water. The third impinger was empty to collect any carry-over liquid, and the fourth impinger contained 250 g of silica gel to dry the gas stream prior to metering.

The filter retained particulate fluorides and gaseous fluorides were absorbed in the deionised distilled water. The two fractions were analysed separately utilising ion chromatography. Fluorides are expressed as hydrofluoric acid (HF). The estimated measurement uncertainty is $\pm 20\%$.

Sulfur Dioxide and Sulfur Trioxide

Testing for sulfuric acid mist/sulfur trioxide and sulfur dioxide was performed in accordance with USEPA Method 8 'Determination of Sulfuric Acid Mist & Sulfur Dioxide Emissions from Stationary Sources'. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources.

A measured volume of stack gas was withdrawn isokinetically from the stack through a series of four Greenburg Smith impingers connected in series. The first and second impingers were separated by a glass fibre filter. The first impinger contained an aqueous solution of 80% isopropanol. This was used to remove sulfuric acid mist and sulfur trioxide from the gas stream. The second and third impingers each contained an aqueous solution of 3% hydrogen peroxide for the collection of sulfur dioxide, with the final impinger was empty to collect any carry-over solution.

After sampling, the concentration of sulfuric acid mist / sulfur trioxide was determined from an aliquot of the isopropanol solution (containing the filter) using the barium-thorin titration method. The concentration of sulfur dioxide was determined from an aliquot of the hydrogen peroxide solution using the barium-thorin titration method. The estimated measurement uncertainty is $\pm 20\%$.

Heavy Metals

Monitoring for antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), vanadium (V) and their compounds was performed in accordance with USEPA Method 29 'Determination of Metal Emissions from Stationary Sources'. A stack sample was withdrawn isokinetically from the source. Particulate matter was collected in the probe and on a heated filter, and gaseous emissions in an aqueous acidic solution of hydrogen peroxide and an aqueous acidic solution of potassium permanganate.

The probe, filter, and aqueous acidic solution of hydrogen peroxide was analysed for all metals (including Hg). The aqueous acidic solution of potassium permanganate was analysed only for Hg. The recovered samples were digested, and the appropriate fractions analysed for Hg by cold vapour atomic absorption spectroscopy (CVAAS) and for other metals by inductively coupled argon plasma emission spectroscopy - mass spectrometry (ICAP-MS). The estimated measurement uncertainty is $\pm 20\%$.

Dioxins and Furans

Sampling for Polychlorinated Dibenzo-*p*-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) was performed in accordance with NSW EPA TM-18, directly incorporating USEPA Method 23 - "Determination of Polychlorinated Dibenzo-*p*-Dioxins and Polychlorinated Dibenzofurans from Stationary Sources", using a USEPA Modified Method 5 sampling train.

The XAD-2 resin was spiked prior to sampling with isotopically labelled PCDD/PCDF surrogate standards. In the laboratory, PCDD and PCDF recovery standards were added to the sample components. The filter, resin and impinger solutions were extracted with organic solvents and the extract purified by chemical treatment and solid phase chromatographic techniques.

Measurement of PCDDs and PCDFs was performed by NMI using high resolution gas chromatography with high resolution electron impact mass spectrometry in accordance with USEPA Method 1613A.

The total toxic equivalent (TEQ) for each PCDD/F congener was calculated using NATO international toxic equivalency factors (TEFs). All results as presented in the tables are expressed to 2 significant figures for PCDDs, PCDFs. The estimated accuracy for the determination of PCDDs and PCDFs in stationary source emissions is $\pm 25\%$.

OPERATING CONDITIONS

The following plant operating conditions were noted during the testing program:

Fuel Consumption	The average consumption of fuel (natural gas) was 0.0 GJ/hr.
Chamber Temperatures	Primary 2 Temperature = 1,057°C average Primary 3 Temperature = 1,064°C average Secondary Temperature = 1,231°C average

Table 1: Waste Composition

Waste Type	Kg's Loaded Per Hour (Average)	% of Average Hourly Load
Clinical and Infectious (R100)	1,160 Kg	87.88%
Quarantine Wastes	100 Kg	7.58%
Pharmaceutical Waste (R120/R140)	30 Kg	2.27%
Ink/Paint Wastes (F100) **	15 Kg	1.13%
Resins/Adhesives (F110) **	5 Kg	0.38%
Waste Containers (N100) **	5 Kg	0.38%
Photographic Chemicals (T120)**	5 Kg	0.38%
TOTALS	1,320 Kg	100.00%

Those wastes marked ** are waste incinerated under the Waste Stream Trial reference: SR0209; BST369v1.

DEFINITIONS

'PCDDs'	Polychlorinated Dibenzo-p-Dioxins.
'PCDFs'	Polychlorinated Dibenzofurans.
'PAHs'	Polycyclic Aromatic Hydrocarbons.
'VOCs'	Volatile organic compounds.
'NATO'	North Atlantic Treaty Organisation.
'WHO'	World Health Organisation.
'CARB'	California Air Resources Board.
'OEHHA'	Office of Environmental Health Hazard Assessment (US).
'BaP-PEF'	Benzo(a)pyrene Potency Equivalent Factor.
'BaP-TEQ _{PAH} '	Benzo(a)pyrene Toxic Equivalents.
'NATO ₈₉ I-TEF'	International Toxic Equivalency Factor (NATO 1989 basis).
'NATO ₈₉ I-TEQ'	International Toxic Equivalent based on the 2,3,7,8-TCDD congener (NATO 1989 basis).
'WHO ₀₅ TEF'	International Toxic Equivalency Factor (WHO 2005 basis).
'WHO ₀₅ TEQ'	International Toxic Equivalent based on the 2,3,7,8-TCDD congener (WHO 2005 basis).
'STP'	Standard temperature and pressure (0°C and 101.3 kPa).
'K'	Absolute temperature in Kelvin (°C + 273).
'Am ³ '	Actual gas volume in cubic metres at stack conditions.
'm ³ '	Gas volume in dry cubic metres at STP.
'<'	Less than. The value stated is the limit of detection.
'g'	Grams.
'mg'	Milligrams (10 ⁻³ grams).
'µg'	Micrograms (10 ⁻⁶ grams).
'ng'	Nanograms (10 ⁻⁹ grams).
'g/m ³ '	Grams of substance per dry cubic meter of gas at STP.
'g/min'	Grams of substance emitted per minute.
'N/A'	Not applicable.
'TCDF'	Tetrachlorodibenzofuran.
'TCDD'	Tetrachlorodibenzo-p-dioxin.
'PeCDF'	Pentachlorodibenzofuran.
'PeCDD'	Pentachlorodibenzo-p-dioxin.
'HxCDF'	Hexachlorodibenzofuran.
'HxCDD'	Hexachlorodibenzo-p-dioxin.
'HpCDF'	Heptachlorodibenzofuran.
'HpCDD'	Heptachlorodibenzo-p-dioxin.
'OCDF'	Octachlorodibenzofuran.
'OCDD'	Octachlorodibenzo-p-dioxin.

RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 17th January, 2013
Sampling Period 10:00 – 14:20
Testing Officers L. Taylor & L. Brown

Table 2: Test Conditions for the Incinerator Stack- 17th January 2013

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	398 (125°C)
Average velocity at sampling plane (m/s)	10.9
Average velocity at point of discharge (m/s)	11.7
Actual gas flow rate (Am ³ /min)	1,680
Average moisture content (% v/v)	9.10
Dry gas flow rate at STP (m ³ /min)	1,050
Average carbon dioxide concentration, dry (% v/v)	2.24
Average oxygen concentration, dry (% v/v)	18.2
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	204
Dry gas flow rate at STP and 11% O ₂ (m ³ /min)	286

RESULTS CONTINUED**Table 3:** Test Results for the Incinerator Stack- 17th January 2013

Parameter	Concentration (g/m ³) ^a	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Acid Gases as HCl	0.00020	0.05	0.21	10.2
Carbon Monoxide	<0.001	0.15	<1	30.6
Oxides of Nitrogen (as NO ₂) <i>Actual at STP: At 7% O₂:</i>	0.041 0.21	N/A 0.35	43	71.4
Total Organic Compounds	<0.00009	0.03	<0.09	6.1
Heavy Metals ^b	0.00059	0.01	0.62	2.0
Cadmium	0.000058	0.001	0.060	0.2
Mercury	0.0000020	0.002	0.0021	0.4
Hydrogen Sulfide	<0.0003	0.005	<0.3	1.0
PCDD/Fs (I-TEQ) ^c	0.16 ng/m ³	1.0 ng/m ³	0.046 µg/min	N/A

^a Unless otherwise stated.^b Total of Sb, V, As, Cd, Pb, Hg and their compounds.^c Including half LOD values. The PCDD/F concentration is referenced to 11% O₂.

RESULTS CONTINUED**Table 4:** Concentration of Individual Metals and their Compounds- 17th January 2013

Metal/Metal Compound	Concentration (g/m³)	Release Limit (g/m³)	Emission Rate (g/min)	Release Limit (g/min)
Antimony (Sb)	0.000026	N/A	0.027	N/A
Arsenic (As)	0.0000011	N/A	0.0011	N/A
Beryllium (Be)	<0.0000002	N/A	<0.0002	N/A
Cadmium (Cd)	0.000058	0.001	0.060	0.2
Chromium III (Cr)	0.0000046	N/A	0.0048	N/A
Chromium VI (Cr)	0.0000057	N/A	0.0059	N/A
Copper (Cu)	0.00018	N/A	0.19	N/A
Lead (Pb)	0.00029	0.003	0.30	0.6
Mercury (Hg)	0.0000020	0.002	0.0021	0.4
Magnesium Oxide (MgO)	0.000020	N/A	0.021	N/A
Nickel (Ni)	0.0000025	N/A	0.0026	N/A
Vanadium (V)	<0.0000001	N/A	<0.0002	N/A
Total of As, Cd, Hg, Pb, Sb, V and their compounds	0.00059	0.01	0.62	2.0

RESULTS CONTINUED

Table 5: PCDD/F Congener Profile- 17th January 2013

PCDD/F Congeners	Concentration (ng/m ³)	WHO ₀₅ TEF	WHO ₀₅ TEQ contribution (ng/m ³)	NATO ₈₉ I-TEF	NATO ₈₉ I-TEQ contribution (ng/m ³)
2378 TCDF	0.021	0.1	0.0021	0.1	0.0021
2378 TCDD	<0.005	1	0.0026	1	0.0026
12378 PeCDF	0.087	0.03	0.0026	0.05	0.0043
23478 PeCDF	0.094	0.3	0.028	0.5	0.047
12378 PeCDD	0.012	1	0.012	0.5	0.0058
123478 HxCDF	0.24	0.1	0.024	0.1	0.024
123678 HxCDF	0.24	0.1	0.024	0.1	0.024
234678 HxCDF	0.23	0.1	0.023	0.1	0.023
123789 HxCDF	0.014	0.1	0.0014	0.1	0.0014
123478 HxCDD	0.015	0.1	0.0015	0.1	0.0015
123678 HxCDD	0.016	0.1	0.0016	0.1	0.0016
123789 HxCDD	0.014	0.1	0.0014	0.1	0.0014
1234678 HpCDF	1.7	0.01	0.017	0.01	0.017
1234789 HpCDF	0.23	0.01	0.0023	0.01	0.0023
1234678 HpCDD	0.14	0.01	0.0014	0.01	0.0014
OCDF	1.4	0.0003	0.00041	0.001	0.0014
OCDD	0.64	0.0003	0.00019	0.001	0.00064

PCDD/F Homologue Groups	Concentration (ng/m ³)
Total TCDF isomers	1.1
Total TCDD isomers	0.11
Total PeCDF isomers	1.5
Total PeCDD isomers	0.16
Total HxCDF isomers	3.4
Total HxCDD isomers	0.38
Total HpCDF isomers	2.9
Total HpCDD isomers	0.29

PCDD/F Summary Results	Concentration (ng/m ³)	Rate of Emission (µg/min)
Sum of PCDD/F congeners (Total of all tetra to octa congeners)		
Excluding LOD values	12	3.4
WHO ₀₅ TEQ (Total of WHO ₀₅ TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.14	0.040
Including half LOD values	0.14	0.040
NATO ₈₉ I-TEQ (Total of NATO ₈₉ I-TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.16	0.046
Including half LOD values	0.16	0.046

RESULTS

Company Ace Waste Pty Ltd

Site 491 Gooderham Road, Willawong

Source Tested Biomedical Waste Incinerator Stack

Date of Test 18th January, 2013

Sampling Period 09:50 – 15:40

Testing Officers T. Dare & L. Taylor

Table 6: Test Conditions for the Incinerator Stack- 18th January 2013

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	415 (142°C)
Average velocity at sampling plane (m/s)	11.6
Average velocity at point of discharge (m/s)	12.4
Actual gas flow rate (Am ³ /min)	1,790
Average moisture content (% v/v)	8.70
Dry gas flow rate at STP (m ³ /min)	1,080
Average carbon dioxide concentration, dry (% v/v)	2.35
Average oxygen concentration, dry (% v/v)	18.1
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	218

RESULTS CONTINUED**Table 7:** Test Results for the Incinerator Stack- 18th January 2013

Parameter	Concentration (g/m ³) ^d	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Total Solid Particulates <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0094 0.047	N/A 0.05	10.2	10.2
PM ₁₀ <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0074 0.037	N/A	8.0	N/A
PM _{2.5} ^e <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0042 0.021	N/A	4.5	N/A
Fluorides as HF	<0.0002	0.025	<0.2	5.1
Sulfur Dioxide & Trioxide	0.0016	0.1	1.7	20.4

^d Unless otherwise stated.^e PM_{2.5} is a subset of PM₁₀.

TO: DEPARTMENT OF ENVIRONMENT AND HERITAGE
PROTECTION

ATTENTION: ASHLEIGH FOWLER

FAX NO: 3330 5754

FROM: ACE WASTE PTY LTD
491 GOODERHAM ROAD
WILLAWONG QLD 4110
(HOLDER OF ENVIRONMENTAL AUTHORITY)

AUTHORISED PERSON: KEVIN MADDICK

TELEPHONE: 3372 6666

FAX: 3372 3777

ENVIRONMENTAL AUTHORITY NUMBER: SR0209

SUBJECT: APCS BYPASS EVENT NOTIFICATION

NAME OF SHIFT OPERATOR: ADAM CRANE

DATE: 4th April 2013 TIME: 0033 hrs DURATION: 1 minute

CAUSE OF APCS BYPASS:

LOSS OF MAINS POWER

ENVIRONMENTAL EFFECT RESULTING FROM RELEASE:

The secondary and primary temperatures were maintained above licence levels.

ACTION TAKEN TO REMEDY ANY ENVIRONMENTAL EFFECT:

-LOADING OF WASTE CEASED DURING BYPASS EVENT
-PRIMARY CHAMBER WAS NOT DISTURBED.

(6)

Fowler Ashleigh

From: John Homewood <JHomewood@acewaste.com.au>
Sent: Wednesday, 10 April 2013 12:13 PM
To: Fowler Ashleigh
Cc: Urs Etterli; Kevin Maddick
Subject: FW: Qld EPA Waste Trial Report

Hi Ashleigh,

Please find below email from Chris Clunies-Ross requesting additional time to 10th May for finalisation of Waste Trial Report to DEHP.

We would appreciate your favourable consideration in granting the Extension of Time Request and will continue to push to have the Report completed by this date.

Thanking you for your attention to this matter.

Best regards,
John H

John R Homewood | Managing Director | Ace Waste Pty Ltd

P: 07 3372 6666 | F: 07 3372 3777 | M: [REDACTED] (6) Personal information

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QLD: 491 Gooderham Road Willawong QLD 4110 | PO Box 400 Acacia Ridge QLD 4110

VIC: 64 – 68 Ordish Road Dandenong South VIC 3175



WASTE → ENERGY

From: Chris Clunies-Ross [<mailto:chris@airlabsenv.com.au>]

Sent: Wednesday, 10 April 2013 11:24 AM

To: John Homewood

Subject: Qld EPA Waste Trial Report

Dear John

As discussed, I need to spend some more time on your Waste Trial report, as I don't believe it currently contains enough information for the EPA to make an assessment. I'm caught up at the moment with some waste trials in NSW and VIC right through until the 21st and then I have to participate in a workshop in Gladstone on the 22nd and 23rd. As such, I was hoping that we could obtain an extension until 10th May.

Cheers

Chris

.....
Chris Clunies-Ross *PhD(Chem.Eng.)*

Laboratory Manager & Director | Airlabs Environmental Pty Ltd

P: (07) 3801 3762 | F: (07) 3801 4645 | M: [REDACTED]

149 Bryants Road (P.O Box 3076) Loganholme QLD 4129



Department of
**Environment and
Heritage Protection**

Enquiries: Ashleigh Fowler
Phone: 07 3330 5670
Our ref: SOR/117766(Pt1)

22 April 2013

Mr John Homewood
Ace Waste Pty Ltd
491 Gooderham Road
WILLAWONG QLD 4100

Dear Mr Homewood,

I refer to our meeting on 19 March 2013 to discuss the frequency and duration of bypass events recently experienced by the Ace Waste incinerator located at 491 Gooderham Road, Willawong. As discussed, the Department of Environment and Heritage Protection (the department) wishes to advise Ace Waste that Development Approval SR0209 does not permit a relaxation of air emission release limits during periods of bypass. The department therefore requests that Ace Waste develop a comprehensive plan which identifies a range of different options to address the bypass issue. This plan is to be developed and submitted to the department for review and comment by 30 June 2013.

Should you have any further enquiries, please contact Mr Ashleigh Fowler, Senior Environmental Officer, of the department on telephone 07 3330 5670.

Yours sincerely,

sch4p4(6) Personal information

Peter Vasel
Manager
Brisbane South
Southern Region
Environmental Services and Regulation
Department of Environment and Heritage Protection

3

Our Ref CLO 121001
Your Ref

23 April 2013

Peter Vasel
Department of Environment and Heritage Protection **By Email:** peter.vasel@ehp.qld.gov.au

cc Ashleigh Fowler
Department of Environment and Heritage Protection **By Email:** ashleigh.fowler@ehp.qld.gov.au

OUR CLIENT: STOCKLAND DEVELOPMENT PTY LTD

We act for Stockland Development Pty Ltd, the developer of the proposed Paradise Wetlands Master Planned Community at 261 Gooderham Road, Pallara.

We understand you are familiar with our client's proposed development and its location in the vicinity of the Ace Waste incinerator facility.

Our client has recently received a number of documents in response our client's application under the *Right to Information Act 2009* (Qld) to your Department. Those documents indicate that on a number of occasions the Ace Waste facility has gone into "bypass mode". Our client is concerned that this action constitutes a breach of Ace Waste's environmental authority.

Given our client's interest in the area, our client would appreciate you advising whether your Department has any concerns with respect to the bypass events at Ace Waste and whether any action is being taken by the Department with respect to these events.

We thank you in anticipation of your assistance with this query.

Yours faithfully
SHAND TAYLOR LAWYERS

Section 78B(2) RTI Act

Christine O'Neill
Associate

T (07) 3307 4505
E coneill@shandtaylor.com.au

**PRIVILEGE IS NOT WAIVED BY MISTAKEN DELIVERY OF THIS CONFIDENTIAL COMMUNICATION
IF THERE IS A PROBLEM WITH THIS COMMUNICATION PLEASE CONTACT US**



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Department of
**Environment and
Heritage Protection**

Enquiries: Ashleigh Fowler
Phone: 07 3330 5670
Our ref: SOR/117766(Pt1) / CTS 10473/13
Your ref: CLO 121001

22 May 2013

Ms Christine O'Neill
Shand Taylor Lawyers
GPO BOX 2486
BRISBANE QLD 4001

Dear Ms O'Neill,

Thank you for your letter dated 23 April 2013 which raised concerns about bypass events at Ace Waste.

The Department of Environment and Heritage Protection is aware that a number of bypass events have occurred at the Ace Waste facility and is working with the company to ensure that these are addressed so that the conditions of Ace Waste's Environmental Authority are complied with.

Should you have any further enquiries, please contact Mr Ashleigh Fowler, Senior Environmental Officer of the department on telephone 3330 5670.

Yours sincerely,

Section 78B(2) RTI Act

Bryce Hertslet
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DATE OF REPORT: 18TH JUNE, 2013

Ashleigh Fowler
Senior Environmental Officer
Environmental Services and Regulation Division
Southern Region – Brisbane South
Department of Environment and Heritage Protection
GPO Box 2454
Brisbane QLD 4001

REPORT No. APR13058.3

**DEVELOPMENT APPROVAL SR0209 - WASTE
STREAM TRIALS AT ACE WASTE WILLAWONG**

**IMPACT ON THE ACE WASTE
INCINERATOR EMISSIONS FROM THE
ADDITION OF NON-BIOMEDICAL WASTE**

Prepared by:

sch4p4(6) Personal information

Dr. C.M. Clunies-Ross PhD(Chem.Eng.)
LABORATORY MANAGER

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1 Executive Summary

1.1 Activity

Ace Waste Pty Ltd has completed testing of stack gas emissions and residual ash leachate during a combustion program trial of non-biomedical regulated wastes in combination with biomedical waste at its Willawong site. This trial is authorised under Development Approval SR0209.

Regulated wastes coded F100, F110, N100 and T120 were processed during the trial. Non-biomedical wastes materials were introduced to the combustion unit to identify:

- any physical limitations of the equipment;
- any variation to the air emissions discharged during the combustion of the blends of wastes; and
- any changes in the residual ash residues relevant to their current disposal as solid wastes.

1.2 Operating Conditions

Normal operating conditions within the combustion unit were observed during the trial operations and emissions monitoring activities were completed over an extended period.

No natural gas use was required during the testing periods indicating sufficient energy in the feedstock to maintain autogenous combustion.

Trial mixtures were tested in July 2012 and January 2013 with sample collection and measurements extending over approximately 5 hours.

Slightly higher than normal secondary combustion chamber temperatures greater than 1190°C were observed during the trial activities.

1.3 Measured Results

No significant deviation from "normal" operating conditions were experienced during the trial testing periods.

Carbon monoxide measurements during the two trials indicated lower than test detection limits indicating good combustion activities.

Total organic compounds emissions were measured at better than ten times lower than the regulated site limit and were observed to be typically lower than concentrations recorded during the usual Clinical and Infectious (R100) wastes operations.

Acid gas emissions (HCl, HF, SO_x, NO_x) and particulate matter were recorded in the typical range previously recorded without the additional regulated wastes. A slight relative increase for individual heavy metals concentrations consistent with the ink and paint pigment sources was observed in the total particulate matter collected.

1.4 Residues

Ash residues from the primary combustion chamber when operating with the addition of non-biomedical wastes as compared to the normal R100 feedstock indicate a slight rise in heavy metal leachable concentrations but remaining well below the acceptance limits for the traditional landfill disposal from the combustion unit.

When compared with the landfill limit the worst case leachable metal was at least ten times less than the acceptance limit.

1.5 Conclusion

No significant increase in the emissions concentrations were recorded for combustion by-products. This indicates the existing emissions control equipment is operating effectively under the trial conditions.

Secondary chamber temperatures were recorded at higher values than previously reported and as expected lower carbon monoxide measurements indicate an improvement in combustion efficiency during the trial periods. The combustion process therefore was well controlled and within the design capabilities.

Residual ash leachable concentrations during the test period indicate no change in normal disposal activities is required.

The trial operations indicate for the change in process feedstock there is no increased risk of adverse environmental impact from the operation of inclusion of the non-biomedical wastes within the combustor feedstock.

Full compliance to the existing Development Approval is observed with the modified combustor feedstock.

The operation with the additional non-biomedical wastes is compliant with all relevant environmental requirements for the process and by-products. It can be argued that incineration in the Ace Waste facility is superior to the direct landfilling of these waste streams as it reduces the total volume to be landfilled, reduces the potential greenhouse gas generation and reduces leachate management requirements from direct landfilling activities.

2 Glossary of Terms

Ag	Silver
As	Arsenic
ASLP	Australian Standard Leachate Procedure
Be	Beryllium
Br	Bromide
Cd	Cadmium
Cl	Chloride
CN	Cyanide
CO	Carbon monoxide
Co	Cobalt
Cr	Chromium
Cu	Copper
F	Fluorine
F100	Waste from the manufacture, formulation or use of inks, dyes, pigments, paints, lacquers or varnish
F110	Waste from the manufacture, formulation or use of resins, latex, plasticisers, glues or other adhesives
g/m ³	Gram per cubic metre
g/min	Gram per minute
GJ	Gigajoule
HCl	Chlorine compounds as hydrogen chloride
HF	Fluorine compounds as hydrogen fluoride
Hg	Mercury
Hmets	Heavy Metals including antimony, arsenic, lead, chromium (total), cobalt, copper, manganese, nickel, vanadium
Mn	Manganese
N100	Packaging contaminated with <1% waste residues
Ni	Nickel
NO ₂	Nitrogen oxides as nitrogen dioxide
NO ₃	Nitrate
Pb	Lead
PCDD	Polychlorinated Dibenzo-p-Dioxins
PCDF	Polychlorinated Dibenzofurans
Sb	Antimony
Se	Selenium
Sn	Tin
SO _x	Sulphur oxides (SO ₂ & SO ₃ /H ₂ SO ₄)
SO ₄	Sulphate
T120	Waste from the manufacture, formulation or use of photographic chemicals or processing materials
Tl	Thallium
TVOC	Total volatile organic compounds expressed as methane
TSP	Total solid particulates
V	Vanadium
Zn	Zinc

3 Introduction

AirLabs Environmental Pty Ltd has been engaged by Ace Waste Pty Ltd to report the results of air emissions and residuals testing completed under the waste stream trial SR0209 of the Ace Development Approval.

The waste stream trial was initiated to investigate the performance of the existing biomedical waste combustion system during the inclusion of non-biomedical regulated wastes to the feedstock. The investigation work was completed to:

1. determine the operational suitability of non-biomedical waste for use in the current equipment;
2. confirm the emissions to the air environment during the operation of non-biomedical wastes are not detrimental to the beneficial use of the environment; and
3. confirm the residues from the operation during the treatment of non-biomedical wastes are not significantly changed.

Trials of the modified feedstock were completed in July 2012 and January 2013 with the emissions testing completed during both runs by AirLabs Environmental. This report details the testing and the conclusions from the trial program.

4 Background & Scope

Ace Waste operates a modern biomedical and pharmaceutical waste combustion facility to world's best practice at its Willawong site. The combustion unit is a stepped hearth primary chamber with secondary oxidation chamber designed to process 1,500 kg/hr of solid biomedical waste.

The unit is equipped with an air cooled heat exchanger, a water quench and wet gas scrubbing system to treat the combustion by-products prior to their release to the air environment. The goal of the operation is to perform beyond the regulatory emission standards, and to be sustainable with respect to energy use on a continuous operating basis.

Ace Waste has identified large volumes of high calorific value mixed waste materials that cannot be recovered or recycled; and are currently directed to landfill for disposal. These wastes are combustible and can be safely and efficiently destroyed via the incineration process at the Willawong facility.

Disposal by incineration rather than landfilling will ensure that virtually all waste is converted to carbon dioxide and water. This will greatly reduce the global warming potential of air emissions compared to landfilling, where around half the waste will be converted to methane. As a result, the proposal offers a net benefit in terms of greenhouse gas production.

Destruction of these wastes by incineration will remove the uncertainty associated risk to the environment currently existing through landfilling as well as offering energy benefits to the Ace Waste process.

Ace Waste has requested to undertake a demonstration program to determine whether emissions to the environment are adversely affected through the introduction of these non-biomedical materials. It is anticipated that the success of

these trials will facilitate the granting of an extension to their existing Development Approval to include these waste streams.

This report incorporates the results of the trials completed and documents the performance of the unit on the combined mixed waste streams including those wastes coded F100, F110, N100 and T120.

5 Summary of Process

The Development Approval issued to Ace Waste allows for the processing of up to 2% of regulated waste streams in combination with the biomedical waste feedstock for a period of 12 months. Based on a maximum allowable throughput of 1,500 kg/hr, this equates to 30 kg/hr of regulated waste streams.

A number of short period burns were completed to establish the practical processing of some of the non-biomedical waste materials in combination with the biomedical waste. Having established the practical activities that maintain a steady operation to enable representative emissions and residue testing, trial mixes were formulated for the emissions testing trials.

Materials handling and production activities associated with the preparation and disposal of the materials under the trials were monitored.

Sampling and analyses of air emissions and residues was completed in July 2012 and January 2013. The reports associated with the air emission sampling and testing and residuals reports are included in Appendix A.

Regulated wastes in combination with the clinical wastes were introduced to the primary combustion chamber for the periods required to sustain steady conditions prior to and during the sampling activities.

The combustion equipment comprises a stepped hearth primary chamber with solid waste fed by ram displacement to the upper level hearth. As progressively more waste is introduced the material on the top hearth is pushed to a lower hearth with controlled under fire air to maintain a reduced oxygen environment within the chamber. Solid wastes gradually heat to their combustion temperatures as the material moves from upper hearths to lower.

At the lowest hearth very little solid residue other than non-combustibles, metals and glass are present as all organic materials have transferred to the gas phase from the waste mix. A negative air pressure is maintained within the primary combustion chamber at all times extracting all gases to the secondary combustion chamber.

Gases within the primary chamber are maintained at a reduced oxygen level to limit heat release and are captured and directed to the secondary combustion chamber where the necessary air for complete combustion is added and the gas treatment is maintained at $>1000^{\circ}\text{C}$ for more than one second.

Where insufficient energy is available from the waste combustion to maintain the secondary chamber temperature at $>1000^{\circ}\text{C}$, natural gas is introduced for additional energy.

Gases and entrained particulates exiting the secondary chamber are subsequently cooled and treated prior to atmospheric discharge using air heat exchangers, adiabatic water quench, wet gas scrubbing equipment prior to gases discharging to the environment.

Discharge stack gas emissions monitoring was completed for combustion gases and other pollutants during the trial operations measuring emission rates of total air, CO, SO_x, NO_x, HCl, HF, heavy metals and PCDDs. Ash residue from the primary combustion chamber was also analysed for leachable heavy metals for comparison with the landfill acceptance criterion.

6 Trial Emissions Testing Activities

During the periods 18th-19th July 2012 and 17th-18th January 2013, the emission testing of the different formulations of non-biomedical solid wastes was conducted. The proportion of waste mix by waste code that was utilized during the stack emissions and residue testing is identified in Table 1.

Table 1: Waste feedstock make up during emissions testing.

Waste Description	July 2012		January 2013	
	Average Load Rate (kg/hour)	% of Av. Hourly Load	Average Load Rate (kg/hour)	% of Av. Hourly Load
Clinical and Infectious (R100)	1,100	87.30%	1,160	87.88%
Quarantine Wastes	100	7.90%	100	7.58%
Pharmaceutical Waste (R120/R140)	30	2.40%	30	2.27%
Ink/Paint Wastes (F100)**	20	1.60%	15	1.13%
Resins/Adhesives (F110)**	5	0.40%	5	0.38%
Waste Containers (N100)**	5	0.40%	5	0.38%
Photographic Chemicals (T120)**	--	--	5	0.38%
TOTAL	1,260	100%	1,320	100%

** Categories of non-biomedical regulated wastes included in the trials.

Tests conducted on the emissions to atmosphere included:

- Gas Velocity, Volume Flow Rate and Temperature;
- Water Vapour (Moisture Content);
- Oxygen, Carbon Monoxide and Carbon Dioxide;
- Total Solid Particulates, PM₁₀ & PM_{2.5} Particulate Matter;
- Nitrogen Oxides;
- Acid Gases (HCl & HF);
- Hydrogen Sulfide
- Sulfur Oxides (Sulfur Dioxide & Sulfur Trioxide);
- Total (Volatile) Organic Compounds;
- Heavy Metals; and
- Dioxins & Furans (PCDD/Fs).

In addition, Australian Standard Leachate Procedure testing was completed on ash residues generated during the trials.

The individual component make-up of the non-biomedical wastes included in each run is provided in Tables 2 & 3 below.

Table 2: Component additions to July 2012 Trial

EPA DOCKET #	DATE RECEIVED	GENERATOR	WASTE CODE	KGS RECEIVED
Q00327401	02/02/12	AMCOR	F100	1494.0
Q00398712	16/07/12	QANTAS HANGER 1 AND 3	F100	100.0
Q00398711	16/07/12	QANTAS HANGER 1 AND 3	F110	80.0
Q00398354	30/05/12	QANTAS HANGER 1 AND 3	N100	23.0
Q00398355	06/06/12	QANTAS HANGER 1 AND 3	N100	104.0
Q00398350	13/06/12	QANTAS HANGER 1 AND 3	N100	80.5
Q00398712	16/07/12	QANTAS HANGER 1 AND 3	F100	100.0

Table 3: Component additions to January 2013 Trial

EPA DOCKET #	DATE RECEIVED	GENERATOR	WASTE CODE	KGS RECEIVED
Q00398551	7/11/12	QANTAS HANGER 1 & 3	F100	185.5
Q00398575	12/12/12	QANTAS HANGER 1 & 3	F100	48.5
Q00398580	19/12/12	QANTAS HANGER 1 & 3	F100	29.5
Q00327428	20/09/12	AMCOR	F100	1047.5
Q00327434	18/10/12	AMCOR	F100	1888.0
Q00398735	17/10/12	QANTAS HANGER 1 & 3	F110	69.5
Q00398566	30/11/12	QANTAS HANGER 1 & 3	F110	30.0
Q00398574	12/12/12	QANTAS HANGER 1 & 3	F110	35.5
Q00398583	27/12/12	QANTAS HANGER 1 & 3	F110	15.0
Q00398730	10/10/12	QANTAS HANGER 1 & 3	N100	8.5
Q00398736	17/10/12	QANTAS HANGER 1 & 3	N100	10.0
Q00398562	28/11/12	QANTAS HANGER 1 & 3	N100	54.5
Q00398579	19/12/12	QANTAS HANGER 1 & 3	N100	11.5
Q00398584	27/12/12	QANTAS HANGER 1 & 3	N100	13.5
Q00327414	02/07/12	RUNAWAY BAY DENTAL CARE	T120	11.0
Q00398707	03/07/12	GANDANT PTY LTD	T120	7.5
Q00398713	26/07/12	CONDAMINE VETERINARY CLINIC	T120	25.0
Q00398715	03/08/12	DRS O'HARE & ELLIOT	T120	34.0
Q00398729	5/10/12	RBH DENTAL HOSPITAL	T120	65.5
Q00398735	04/12/12	RBH DENTAL HOSPITAL	T120	90.5

7 Test Measurements

7.1 Operating Parameters

Average combustion chamber temperatures and exhaust gas flows recorded during the test periods are presented in Table 4.

Stack emission test results are included in Table 5 and ASLP leachate results for heavy metals and anions are summarized in Table 6 & 7 respectively.

Table 4: Average combustion chamber temperatures and gas flow measurements.

	Baseline	Trial 1		Trial 2	
Test Conditions	31/01/2012	18/07/2012	19/07/2012	17/01/2013	18/01/2013
Average stack gas temperature (°C)	110	108	107	125	142
Average velocity at point of discharge (m/s)	11.9	12.2	11.9	11.7	12.4
Actual gas flow rate (Am ³ /min)	1710	1730	1710	1,680	1,790
Average moisture content (% v/v)	9.6	8.48	9	9.1	8.7
Average CO ₂ concentration, dry (% v/v)	1.82	1.75	2.52	2.24	2.35
NAG consumption (GJ/hr)	0	0		0	
Primary Chamber #1 Temp (°C)	1119	1156		1057	
Primary Chamber #2 Temp (°C)	1126	1140		1064	
Secondary Chamber Temp (°C)	1123	1198		1231	

Table 5: Average exhaust stack emissions characteristics for each trial period.

Test Date	CO (g/min)	CO (mg/m ³)	TSP (g/min)	TSP (mg/m ³)	PM ₁₀ (g/min)	PM ₁₀ (mg/m ³)	PM _{2.5} (g/min)	PM _{2.5} (mg/m ³)	HCl (g/min)	HCl (mg/m ³)	HF (g/min)	HF (mg/m ³)	NO ₂ (g/min)	NO ₂ (mg/m ³)	SO _x (g/min)	SO _x (mg/m ³)	TVOC (g/min)	TVOC (mg/m ³)	PCDD (μg/min)	PCDD (ng/m ³)
31/01/12	<1	<1	8.0	8.0	6.5	6.5	3.7	3.7	1.3	1.2	0.087	0.08	35	29	0.17	0.15	0.85	0.77	N/A	N/A
18-19/07/12	<1	<1	9.0	8.1	8.0	7.2	5.4	4.9	0.7	0.6	<0.1	<0.1	43	38	0.82	0.73	2.6	2.3	0.02	0.069
17-18/01/13	<1	<1	10.2	9.4	8.0	7.4	4.5	4.2	0.2	0.2	<0.2	<0.2	43	41	1.7	1.6	<0.09	<0.09	0.046	0.16
DA Limit	30.6	50	10.2	N/A	N/A	N/A	N/A	N/A	10.2	50	5.1	25	71	350	20.4	100	6.1	30	N/A	1
Measurement Uncertainty	±5%				±15%				±15%				±5%				±20%			

7.2 Residuals ASLP Results Summary

A composite sample of bottom ash was produced from each test run and tested to identify the residual heavy metal content for comparison against the local regulated waste landfill acceptance criteria.

Table 6: Soluble (ASLP) heavy metal concentrations recorded in primary chamber bottom ash

Test Date	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Cr tot (mg/L)	Co (mg/L)	Cu (mg/L)	Pb (mg/L)	Mo (mg/L)	Ni (mg/L)	Se (mg/L)	Ag (mg/L)	Tl (mg/L)	Sn (mg/L)	V (mg/L)	Zn (mg/L)	Hg (mg/L)
16/05/11*	0.06	<1	1.8	0.04	0.014	0.067	0.7	0.007	0.018	1.3	0.024	<0.001	<0.001	<0.001	0.013	15	<0.0005
18-19/07/12	0.17	<1	0.5	0.18	0.024	0.053	0.61	0.004	0.11	0.95	0.062	<0.001	<0.001	<0.001	0.01	4.5	<0.0005
17-18/01/13	0.08	0.015	0.03	0.04	0.2	0.12	6.5	0.880	0.019	3.7	0.015	0.003	<0.001	0.13	0.039	28	<0.0005
Leachate Limit	5	5	100	0.5	5	5	200	5	5	5	1	10	1	3	5	500	0.1

*Closest leachate test with respect to stack testing conducted on 31/01/12.

7.3 Residuals ASLP Anion Results Summary

A composite sample of bottom ash was produced from each test run and tested to identify the residual heavy metal content for comparison against the local regulated waste landfill acceptance criteria.

Table 7: Soluble (ASLP) concentration of anions recorded in primary chamber bottom ash.

Test Date	Br (mg/L)	CN (mg/L)	F (mg/L)	Cl (mg/L)	SO ₄ (mg/L)	NO ₃ (mg/L)
16/05/11*	--	0.07	460	--	--	--
18-19/07/12	0.002	<0.005	1.7	--	--	--
17-18/01/13	--	--	--	600	150	0.04
Leachate Limit	50	8	150	6000	50000	5000

*Closest leachate test with respect to stack testing conducted on 31/01/12.

8 Observations & Discussion

No physical handling or other operational issues were observed to be associated with the addition of the non-medical wastes to the feedstock to the primary chamber of the combustion system during the testing period.

The addition of the trial materials did not impact on the operability of the combustion system or the emissions control system. Normal operations were observed during the trials.

8.1 Biomedical Waste

The composition of biomedical waste materials is highly variable in terms of energy and moisture content. To help achieve a homogeneous waste stream, the materials are blended based on historical operating information.

It is seen from the combustion information, natural gas usage and the residual ash results that the efficient destruction performance of the system was not impacted by the addition of the non-biomedical wastes.

8.2 Stack Emissions Results

A full suite of emissions testing was undertaken during the two trial runs with the addition of non-biomedical waste. The emissions results reported for all exhaust stack parameters are within the limits as set by the regulator in the Ace Waste Development Approval.

Comparison of these results with those available from the most recent exhaust stack emissions monitoring on clinical and related wastes indicate no significant variation in any tested parameter.

Hydrochloric acid (HCl) gas emissions are slightly lower in both trials than the base clinical waste reported results which may indicate the lower chloride level within the additional non-clinical waste. A similar trend is seen with the hydrofluoric acid (HF) results, but all are of a low rate/concentration and not significant.

No significant increase in the emission concentrations were recorded for combustion by-products. This indicates the existing emissions control equipment was operating effectively under the trial conditions.

8.3 Primary Chamber Residue

All tested parameters are within the acceptance criteria stipulated by the Veolia Environmental Services Ti Tree landfill.

The variable nature of the biomedical waste make-up and the inability to safely sample and evaluate the clinical waste feedstock renders a direct comparison of the relative leachable heavy metals concentrations of trial mix with clinical feedstocks relatively inaccurate. The results do indicate for most metals the leachable concentrations are similar, but paint and ink pigment additive compounds (Sb, Cr, Cd, Pb) can be assumed to be related with some of the higher levels observed. These levels are magnitude less than the individual acceptance criteria limits.

8.4 Natural Gas Usage

No change in the natural gas usage occurred during the trials. Previous stack emission reports indicate zero natural gas addition is required and this was confirmed with the mixed waste feedstock operations.

8.5 Non biomedical waste destruction

The wastes identified for addition to the combustion system are typically destined for landfill disposal either directly or following treatment by a third party.

When ultimately landfilled, either directly or following stabilization or immobilization of the organic based wastes, the generation of greenhouse gas via either anaerobic or aerobic degradation will have a greater impact than direct combustion.

Methane generation is twenty two times greater than the combustion by-product carbon dioxide and is liberated from the landfill prior to landfill cell closure, capping and gas extraction.

Leachate generation of the non-biomedical wastes will also influence the quality of landfill leachate generated for the life of the landfill prior to a final impermeable cap installation. There is likely to be a period of decades where the infiltration of stormwater will leach both organic and inorganic components from these waste streams.

For this reason, the direct combustion of the organics with the subsequent reduction in volume of the waste stream is a preferable solution for these waste materials.

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9 Conclusion

Ace Waste, over the period of the Development Approval trial program, has demonstrated the capabilities of the existing biomedical waste combustion system to successfully destroy the non-biomedical wastes being trialled. The incineration of these wastes did not require the addition of supplementary natural gas for combustion purposes.

Combustion chamber and exhaust stack emissions monitoring during the trial period has confirmed compliance with the operating site licence while destroying the non-biomedical wastes.

The conclusion based on the above results is that the addition of the trialled non-biomedical wastes to supplement the volumes of biomedical waste at up to 30 kg/hr or 2% substitution based on the maximum loading rate of 1,500 kg/hr will not adversely impact the beneficial use of the environment. This treatment process offers an alternate disposal outlet to landfill for non-recyclable, high calorific value wastes.

It is likely that, with the increased variation in feedstock, there will be a slightly raised ASLP leachable concentration from the residuals. However, this will still remain acceptable to landfill, which is the normal disposal route for residuals.

The materials supplementing the biomedical waste are in all probability destined for landfill. The reduction in volume to landfill as a result of incineration, coupled with a reduction in global warming potential of the emissions presents a more environmentally sustainable option than landfill. It may be concluded that the net benefits exceed the slightly raised risk posed by marginally elevated ASLP leachable concentrations from the residuals.

The inclusion of the trialled non-biomedical wastes in the allowable wastes for the facility will enhance the ability of Ace Waste to offer a more sustainable solution to regulated waste disposal in Queensland.

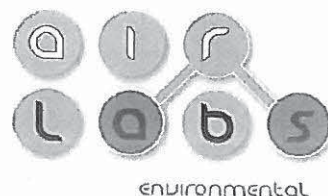
APPENDIX A

Airlabs Environmental Test Report No. JAN12015
31st January 2012

RTI DLRELEASE - EHP

DATE OF REPORT: 7TH MARCH, 2012

Mr Kevin Maddick
Operations Supervisor
Ace Waste Pty Ltd
PO Box 400
Acacia Ridge QLD 4110



TEST REPORT NO. JAN12015

**MONITORING OF AIR EMISSIONS
FROM THE ACE WASTE INCINERATOR
STACK IN WILLAWONG, QLD**

DATE OF SAMPLING: 31ST JANUARY, 2012

ACCREDITATION:



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NATA Accredited Laboratory Number: 15463
Accredited for compliance with ISO/IEC 17025:2005
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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Ace Waste Pty Ltd to monitor stack emissions leaving the Biomedical Waste Incinerator situated at Willawong for the following parameters:

- Temperature, Gas Velocity and Volume Flow Rate
- Concentration of Water Vapour (Moisture Content)
- Concentration of Oxygen and Carbon Dioxide
- Concentration and Mass Emission Rate of:
 - Carbon Monoxide
 - Total Solid Particulates
 - PM₁₀
 - PM_{2.5}
 - Hydrogen Halogens and Halides (expressed as HCl)
 - Nitrogen Oxides (expressed as NO₂)
 - Hydrogen Sulfide
 - Fluorides (expressed as HF)
 - Total Volatile Organic Compounds (TOC)
 - Sulfur Dioxide and Sulfur Trioxide
 - Heavy metals (antimony, arsenic, cadmium, lead, mercury, vanadium and their compounds)
 - Polycyclic Aromatic Hydrocarbons (PAHs)

All of the above samples were collected on 31st January, 2012.

QUALITY STATEMENT

AirLabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to and continuous improvement of all our processes and test work. Our goal is to meet or exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to insure that all data generated is scientifically valid.

TEST METHODS

Gas Velocity, Volume Flow Rate and Temperature

Gas velocity and volumetric flow rate were determined in accordance with USEPA Method 2 'Determination of stack gas velocity and volumetric flow rate (type s pitot tube)'. In accordance with this method pressure differential and temperature profiles were obtained across the sampling plane at transverse points specified by AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions'. Gas velocity and volume flow rates were then calculated in accordance with USEPA Method 2.

The estimated measurement uncertainty for temperature measurement is $\pm 1\%$. The estimated measurement uncertainty for gas velocity and volume flow rate is $\pm 10\%$.

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Water Vapour (Moisture Content)

Stack gas moisture content was determined in accordance with USEPA Method 4 'Determination of Moisture Content in Stack Gases'. A measured volume of stack gas was aspirated through a series of chilled impingers each containing 100 mls of water and then drawn through a silica gel tube. The total change in volume of water in the impingers and the weight change of the silica gel tube were used to calculate the percentage moisture in the stack.

The estimated measurement uncertainty is $\pm 5\%$.

Oxygen and Carbon Dioxide

Oxygen (O₂) and carbon dioxide (CO₂) concentrations were monitored in accordance with USEPA Method 3A 'Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and portions were conveyed to a Paramagnetic O₂ analyser and a Non Dispersive Infrared (NDIR) CO₂ analyser.

Each analyser was zeroed using dry nitrogen and calibrated in accordance with the method using ambient air for O₂ as well as NATA certified span gases for O₂ and CO₂. The estimated measurement uncertainty is $\pm 2\%$.

Carbon Monoxide

Carbon monoxide (CO) was monitored in accordance with USEPA Method 10 'Determination of Carbon Monoxide Emissions from Stationary Sources'. The sample gas was withdrawn continuously from the gas stream and conveyed to a Non Dispersive Infrared (NDIR) CO analyser. The instrument was calibrated using NATA certified CO span gas and zeroed with dry nitrogen. The estimated measurement uncertainty is $\pm 5\%$.

Total Solid Particulates

Monitoring for solid particles was conducted in accordance with Australian Standard 4323.2 - 1995 'Stationary Source Emissions, Method 2: Determination of Total Particulate Matter - Isokinetic Manual Sampling - Gravimetric Method'.

Stack gas was withdrawn isokinetically through a nozzle, which had a sharp and tapered leading edge. Particulate matter was collected on a pre-weighed glass fibre filter located in a holder downstream of the nozzle. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The weight change of the filter was determined using an Ohaus electronic balance and this figure used to calculate the concentration of particulate matter.

The estimated measurement uncertainty is $\pm 15\%$.

PM₁₀ and PM_{2.5} Particulate Matter

Monitoring for PM₁₀ and PM_{2.5} particulate matter was conducted in accordance with USEPA Method CTM 040 'Method for the Determination of PM₁₀ and PM_{2.5} Emissions (Constant Sampling Rate Procedures)'. This method is used to determine particulate matter emissions equal to or less than a nominal aerodynamic diameter of 10 μ m (PM₁₀) and 2.5 μ m (PM_{2.5}) in stationary source emissions

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In accordance with this method, a sample of stack gas was extracted at a predetermined constant flow rate through a cascade impactor. This in-stack sizing device separated particles with nominal aerodynamic diameters of PM₁₀ and PM_{2.5}. To minimize variations in the isokinetic sampling conditions, testing was conducted within well-defined limits. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The particulate mass for each size fraction was determined using gravimetric analysis.

The estimated measurement uncertainty is $\pm 15\%$.

Nitrogen Oxides

Nitric oxide (NO) and nitrogen dioxide (NO₂) concentrations were monitored in accordance with USEPA Method 7E 'Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and a portion was conveyed to a NO/NO₂/NO_x Chemiluminescent analyser. Total nitrogen oxides (NO_x) are expressed as NO₂. The estimated measurement uncertainty is $\pm 5\%$.

Acid Gases

Sampling for acid gases was conducted in accordance with USEPA Method 26 - 'Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Non-Isokinetic Method'.

Each sample was drawn through a heated probe and filters into a dilute sulphuric acid and dilute sodium hydroxide solutions, which collected the gaseous hydrogen halides and halogens, respectively. Sodium thiosulphate was added in excess to the alkaline solution to ensure complete reaction. The filter was not recovered for analysis. The halide ions in the separate solutions were measured by ion chromatography. Acid gases are expressed as hydrogen chloride (HCl). The estimated measurement uncertainty is $\pm 20\%$.

Hydrogen Sulfide

Monitoring for hydrogen sulfide (H₂S) was conducted in accordance with USEPA Method 15 'Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources'. Stack gas was withdrawn from the emission source and diluted with clean dry air using a mass flow controlled Dynamic Diluter device. An aliquot of the diluted sample was then analysed for H₂S using a Gas Chromatograph with a Flame Photometric Detector (GC-FPD). The estimated measurement uncertainty is $\pm 5\%$.

Total (Volatile) Organic Compounds

Sampling and analysis were performed in accordance with USEPA Method 18 'Measurement of Gaseous Organic Compound Emissions by Gas Chromatography - Adsorption tube procedure'.

A measured volume of stack gas was drawn through an activated carbon tube, trapping organic compounds present in the gas. Samples were extracted with carbon disulphide and analysed using gas chromatography/mass spectrometry. The summation of individual VOCs is reported.

The estimated measurement uncertainty is $\pm 20\%$.

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Fluorides

Sampling for gaseous and particulate fluorides was conducted in accordance with US EPA Method 13B - Determination of Total Fluoride Emissions from Stationary Sources. Stack gas was withdrawn isokinetically through a nozzle having a sharp and tapered leading edge.

Particulate matter was collected on a low fluoride ($< 0.01 \text{ mg F/cm}^2$) $0.2 \mu\text{m}$ organic membrane filter located in a holder in a heated box. This was followed by an impinger train situated in an ice bath. The first two impingers each contained 100 ml of deionised distilled water. The third impinger was empty to collect any carry-over liquid, and the fourth impinger contained 250 g of silica gel to dry the gas stream prior to metering.

The filter retained particulate fluorides and gaseous fluorides were absorbed in the deionised distilled water. The two fractions were analysed separately utilising ion chromatography. Fluorides are expressed as hydrofluoric acid (HF). The estimated measurement uncertainty is $\pm 20\%$.

Sulfur Dioxide and Sulfur Trioxide

Testing for sulfuric acid mist/sulfur trioxide and sulfur dioxide was performed in accordance with USEPA Method 8 'Determination of Sulfuric Acid Mist & Sulfur Dioxide Emissions from Stationary Sources'. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources.

A measured volume of stack gas was withdrawn isokinetically from the stack through a series of four Greenburg Smith impingers connected in series. The first and second impingers were separated by a glass fibre filter. The first impinger contained an aqueous solution of 80% isopropanol. This was used to remove sulfuric acid mist and sulfur trioxide from the gas stream. The second and third impingers each contained an aqueous solution of 3% hydrogen peroxide for the collection of sulfur dioxide, with the final impinger was empty to collect any carry-over solution.

After sampling, the concentration of sulfuric acid mist / sulfur trioxide was determined from an aliquot of the isopropanol solution (containing the filter) using the barium-thorin titration method. The concentration of sulfur dioxide was determined from an aliquot of the hydrogen peroxide solution using the barium-thorin titration method. The estimated measurement uncertainty is $\pm 20\%$.

Heavy Metals

Monitoring for antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), vanadium (V) and their compounds was performed in accordance with USEPA Method 29 'Determination of Metal Emissions from Stationary Sources'. A stack sample was withdrawn isokinetically from the source. Particulate matter was collected in the probe and on a heated filter, and gaseous emissions in an aqueous acidic solution of hydrogen peroxide and an aqueous acidic solution of potassium permanganate.

The probe, filter, and aqueous acidic solution of hydrogen peroxide was analysed for all metals (including Hg). The aqueous acidic solution of potassium permanganate was analysed only for Hg. The recovered samples were digested, and the appropriate fractions analysed for Hg by cold vapour atomic absorption spectroscopy (CVAAS) and for other metals by inductively coupled argon plasma emission spectroscopy - mass spectrometry (ICAP-MS). The estimated measurement uncertainty is $\pm 20\%$.

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Polycyclic Aromatic Hydrocarbons (PAHs)

Monitoring for Polycyclic Aromatic Hydrocarbons (PAHs) was conducted in accordance with the USEPA Method 23A – 'Determination of Polycyclic Aromatic Hydrocarbon (PAH) Emissions from Stationary Sources'.

Sampling was undertaken using a USEPA Modified Method 5 sampling train. The XAD-2 resin was spiked prior to sampling with isotopically labelled PAH surrogate standards. In the laboratory, PAH recovery standards were added to the sample components. The filter, resin and impinger solutions were extracted with organic solvents and the extract purified by chemical treatment and solid phase chromatographic techniques.

Measurement of PAHs was performed using gas chromatography/mass spectrometry (GC/MS). The total of USEPA Priority Pollutant PAHs is given. The PAH total toxic equivalent (BaP-TEQ_{PAH}) was calculated using benzo(a)pyrene potency equivalency factors (BaP-PEFs) as specified in 'Benzo(a)pyrene as a Toxic Air Contaminant', CARB/OEHHA Executive Summary, July 1994. The estimated measurement uncertainty is $\pm 20\%$.

OPERATING CONDITIONS

The following plant operating conditions were noted during the testing program:

Fuel Consumption The average consumption of fuel (natural gas) was 0.0 GJ/hr.

Chamber Temperatures Primary 2 Temperature = 1,119°C average
Primary 3 Temperature = 1,126°C average
Secondary Temperature = 1,123°C average

Table 1: Waste Composition

Waste Description	Load Rate (kg/hour)	% of Hourly Load Rate
General & Infectious Waste	1,150	93.9 %
Regulated Waste	75	6.1 %
TOTAL	1,225	100.00%

Report to Ace Waste Pty Ltd - Willawong

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DEFINITIONS

'PAHs'	Polycyclic Aromatic Hydrocarbons.
'VOCs'	Volatile organic compounds.
'WHO'	World Health Organisation.
'CARB'	California Air Resources Board.
'OEHHA'	Office of Environmental Health Hazard Assessment (US).
'BaP-PEF'	Benzo(a)pyrene Potency Equivalent Factor.
'BaP-TEQ _{PAH} '	Benzo(a)pyrene Toxic Equivalents.
'STP'	Standard temperature and pressure (0°C and 101.3 kPa).
'K'	Absolute temperature in Kelvin (°C + 273).
'Am ³ '	Actual gas volume in cubic metres at stack conditions.
'm ³ '	Gas volume in dry cubic metres at STP.
'<'	Less than. The value stated is the limit of detection.
'g'	Grams.
'mg'	Milligrams (10 ⁻³ grams).
'µg'	Micrograms (10 ⁻⁶ grams).
'g/m ³ '	Grams of substance per dry cubic meter of gas at STP.
'mg/m ³ '	Milligrams of substance per dry cubic meter of gas at STP.
'g/min'	Grams of substance emitted per minute.
'N/A'	Not applicable.

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RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 31st January, 2012
Sampling Period 08:31 – 18:06
Testing Officers L. Brown & L. Taylor

Test Conditions

Stack dimensions at sampling plane (m) 1.81
Stack dimensions at point of discharge (m) 1.75
Average stack gas temperature (K) 883 (110°C)
Average velocity at sampling plane (m/s) 11.1
Average velocity at point of discharge (m/s) 11.9
Actual gas flow rate (Am³/min) 1,710
Average moisture content (% v/v) 9.61
Dry gas flow rate at STP (m³/min) 1,100
Average carbon dioxide concentration, dry (% v/v) 1.82
Average oxygen concentration, dry (% v/v) 18.6
Dry gas flow rate at STP and 7% O₂ (m³/min) 165

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RESULTS Continued

Table 2: Test Results for the Incinerator Stack

Parameter	Concentration (g/m ³) ^a	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Total Solid Particulates Actual at STP: At 7% O ₂ :	0.0080 0.048	N/A 0.05	8.0	10.2
PM ₁₀ Actual at STP: At 7% O ₂ :	0.0065 0.039	N/A	6.5	N/A
PM _{2.5} ^b Actual at STP: At 7% O ₂ :	0.0037 0.022	N/A	3.7	N/A
Acid Gases as HCl	0.0012	0.05	1.3	10.2
Carbon Monoxide	< 0.001	0.15	< 1	30.6
Oxides of Nitrogen (as NO ₂) Actual at STP: At 7% O ₂ :	0.029 0.21	N/A 0.35	35	71.4
Fluorides as HF	0.000079	0.025	0.087	5.1
Total Organic Compounds	0.00017	0.03	0.85	6.1
Heavy Metals ^c	0.00029	0.01	0.32	2.0
Hydrogen Sulfide	< 0.0003	0.005	< 0.3	1.0
Sulfur Dioxide & Trioxide	0.00015	0.1	0.17	20.4
Polycyclic Aromatic Hydrocarbons (PAHs) Total PAHs ^d WHO BaP-TEQ for PAHs ^e	0.0 µg/m ³ 0.017 µg/m ³	N/A	0.0 mg/min 0.019 mg/min	N/A

^a Unless otherwise stated.

^b PM_{2.5} is a subset of PM₁₀.

^c Total of Sb, V, As, Cd, Pb, Hg and their compounds.

^d Individual PAHs are given in Table 4.

^e Including half limit of detection values.

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RESULTS Continued

Table 3: Concentration of Individual Metals and their Compounds

Metal/Metal Compound	Concentration (g/m ³)	Release Limit (g/m ³)	Emission Rate (g/min)	Release Limit (g/min)
<i>Antimony (Sb)</i>	0.000011	N/A	0.012	N/A
<i>Arsenic (As)</i>	0.00000068	N/A	0.00075	N/A
Beryllium (Be)	<0.00000004	N/A	<0.00004	N/A
<i>Cadmium (Cd)</i>	0.000027	0.001	0.030	0.2
Chromium III (Cr)	0.000000077	N/A	0.000085	N/A
Chromium VI (Cr)	0.00000077	N/A	0.00085	N/A
Copper (Cu)	0.000085	N/A	0.093	N/A
<i>Lead (Pb)</i>	0.00015	0.003	0.17	0.6
<i>Mercury (Hg)</i>	0.000012	0.002	0.013	0.4
Magnesium Oxide (MgO)	0.0000026	N/A	0.0029	N/A
Nickel (Ni)	0.00000085	N/A	0.00093	N/A
<i>Vanadium (V)</i>	0.000000085	N/A	0.000093	N/A
Total of As, Cd, Hg, Pb, Sb, V and their compounds	0.00029	0.01	0.32	2.0

RESULTS Continued

Table 4: Individual USEPA Priority Pollutant PAHs

Individual USEPA Priority Pollutant PAHs	Concentration of PAHs ($\mu\text{g}/\text{m}^3$)	BaP-PEF value	BaP-TEQ _{PAH} Contribution ($\mu\text{g}/\text{m}^3$)	Emission Rate of PAHs (mg/min)
Naphthalene	<0.8	0.0	0	<0.9
2-Methylnaphthalene	<0.2	0.0	0	<0.3
Acenaphthylene	<0.02	0.0	0	<0.02
Acenaphthene	<0.02	0.0	0	<0.02
Fluorene	<0.05	0.0	0	<0.05
Phenanthrene	<0.2	0.0	0	<0.2
Anthracene	<0.05	0.0	0	<0.05
Fluoranthene	<0.09	0.0	0	<0.1
Pyrene	<0.09	0.0	0	<0.1
Benz(a)anthracene	<0.02	0.1	0.00091	<0.02
Chrysene	<0.02	0.01	0.00009	<0.02
Benzo(b)fluoranthene	<0.02	0.1	0.00091	<0.02
Benzo(k)fluoranthene	<0.02	0.1	0.00091	<0.02
Benzo(e)pyrene	<0.02	0.0	0.0	<0.02
Benzo(a)pyrene	<0.02	1.0	0.0091	<0.02
Perylene	<0.02	0.0	0	<0.02
Indeno(1 23-cd)pyrene	<0.02	0.1	0.00091	<0.02
Dibenz(ah)anthracene	<0.02	0.4	0.0037	<0.02
Benzo(ghi)perylene	<0.02	0.0	0	<0.02

Table 5: Total USEPA Priority Pollutant PAHs

Total USEPA Priority Pollutant PAHs	Concentration ($\mu\text{g}/\text{m}^3$)	Emission Rate (mg/min)
Excluding LOD values	0.0	0.0

Table 6: Total PAH Toxic Equivalents (BaP-TEQ_{PAH})

Total PAH Toxic Equivalents (BaP-TEQ _{PAH}) ^f	Concentration ($\mu\text{g}/\text{m}^3$)	Emission Rate (mg/min)
Excluding LOD values	0.0	0.0
Including half LOD values	0.017	0.019

^f Calculated using benzo(a)pyrene potency equivalency factors (BaP-PEF values).

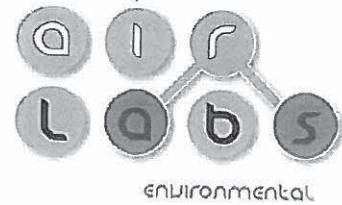
APPENDIX B

Airlabs Environmental Test Report No. JUL12107
18th – 19th July 2012

RTI DLRELEASE / EHP

DATE OF REPORT: 14TH SEPTEMBER, 2012

Mr Kevin Maddick
Operations Supervisor
Ace Waste Pty Ltd
PO Box 400
Acacia Ridge QLD 4110



TEST REPORT No. JUL12107

**MONITORING OF AIR EMISSIONS
FROM THE ACE WASTE INCINERATOR
STACK IN WILLAWONG, QLD**

DATE OF SAMPLING: 18TH – 19TH JULY 2012

ACCREDITATION:



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NATA Accredited Laboratory Number: 15463
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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Ace Waste Pty Ltd to monitor stack emissions leaving the Biomedical Waste Incinerator situated at Willawong for the following parameters:

- Temperature, Gas Velocity and Volume Flow Rate
- Concentration of Water Vapour (Moisture Content)
- Concentration of Oxygen and Carbon Dioxide
- Concentration and Mass Emission Rate of:
 - Carbon Monoxide
 - Total Solid Particulates
 - PM₁₀
 - PM_{2.5}
 - Hydrogen Halogens and Halides (expressed as HCl)
 - Nitrogen Oxides (expressed as NO₂)
 - Hydrogen Sulfide
 - Fluorides (expressed as HF)
 - Total Volatile Organic Compounds (TOC)
 - Sulfur Dioxide and Sulfur Trioxide
 - Heavy metals (antimony, arsenic, cadmium, lead, mercury, vanadium and their compounds)
 - Dioxins and Furans

All of the above samples were collected on the 18th - 19th July 2012.

QUALITY STATEMENT

AirLabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to and continuous improvement of all our processes and test work. Our goal is to meet or exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to insure that all data generated is scientifically valid.

TEST METHODS

Gas Velocity, Volume Flow Rate and Temperature

Gas velocity and volumetric flow rate were determined in accordance with USEPA Method 2 'Determination of stack gas velocity and volumetric flow rate (type s pitot tube)'. In accordance with this method pressure differential and temperature profiles were obtained across the sampling plane at transverse points specified by AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions'. Gas velocity and volume flow rates were then calculated in accordance with USEPA Method 2.

The estimated measurement uncertainty for temperature measurement is $\pm 1\%$. The estimated measurement uncertainty for gas velocity and volume flow rate is $\pm 10\%$.

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Water Vapour (Moisture Content)

Stack gas moisture content was determined in accordance with USEPA Method 4 'Determination of Moisture Content in Stack Gases'. A measured volume of stack gas was aspirated through a series of chilled impingers each containing 100 mls of water and then drawn through a silica gel tube. The total change in volume of water in the impingers and the weight change of the silica gel tube were used to calculate the percentage moisture in the stack.

The estimated measurement uncertainty is $\pm 5\%$.

Oxygen and Carbon Dioxide

Oxygen (O₂) and carbon dioxide (CO₂) concentrations were monitored in accordance with USEPA Method 3A 'Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and portions were conveyed to a Paramagnetic O₂ analyser and a Non Dispersive Infrared (NDIR) CO₂ analyser.

Each analyser was zeroed using dry nitrogen and calibrated in accordance with the method using ambient air for O₂ as well as NATA certified span gases for O₂ and CO₂. The estimated measurement uncertainty is $\pm 2\%$.

Carbon Monoxide

Carbon monoxide (CO) was monitored in accordance with USEPA Method 10 'Determination of Carbon Monoxide Emissions from Stationary Sources'. The sample gas was withdrawn continuously from the gas stream and conveyed to a Non Dispersive Infrared (NDIR) CO analyser. The instrument was calibrated using NATA certified CO span gas and zeroed with dry nitrogen. The estimated measurement uncertainty is $\pm 5\%$.

Total Solid Particulates

Monitoring for solid particles was conducted in accordance with Australian Standard 4323.2 - 1995 'Stationary Source Emissions, Method 2: Determination of Total Particulate Matter - Isokinetic Manual Sampling - Gravimetric Method'.

Stack gas was withdrawn isokinetically through a nozzle, which had a sharp and tapered leading edge. Particulate matter was collected on a pre-weighed glass fibre filter located in a holder downstream of the nozzle. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The weight change of the filter was determined using an Ohaus electronic balance and this figure used to calculate the concentration of particulate matter.

The estimated measurement uncertainty is $\pm 15\%$.

PM₁₀ and PM_{2.5} Particulate Matter

Monitoring for PM₁₀ and PM_{2.5} particulate matter was conducted in accordance with USEPA Method CTM 040 'Method for the Determination of PM₁₀ and PM_{2.5} Emissions (Constant Sampling Rate Procedures)'. This method is used to determine particulate matter emissions equal to or less than a nominal aerodynamic diameter of 10µm (PM₁₀) and 2.5µm (PM_{2.5}) in stationary source emissions

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In accordance with this method, a sample of stack gas was extracted at a predetermined constant flow rate through a cascade impactor. This in-stack sizing device separated particles with nominal aerodynamic diameters of PM₁₀ and PM_{2.5}. To minimize variations in the isokinetic sampling conditions, testing was conducted within well-defined limits. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The particulate mass for each size fraction was determined using gravimetric analysis.

The estimated measurement uncertainty is $\pm 15\%$.

Nitrogen Oxides

Nitric oxide (NO) and nitrogen dioxide (NO₂) concentrations were monitored in accordance with USEPA Method 7E 'Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and a portion was conveyed to a NO/NO₂/NO_x Chemiluminescent analyser. Total nitrogen oxides (NO_x) are expressed as NO₂. The estimated measurement uncertainty is $\pm 5\%$.

Acid Gases

Sampling for acid gases was conducted in accordance with USEPA Method 26 - 'Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Non-Isokinetic Method'.

Each sample was drawn through a heated probe and filters into a dilute sulphuric acid and dilute sodium hydroxide solutions, which collected the gaseous hydrogen halides and halogens, respectively. Sodium thiosulphate was added in excess to the alkaline solution to ensure complete reaction. The filter was not recovered for analysis. The halide ions in the separate solutions were measured by ion chromatography. Acid gases are expressed as hydrogen chloride (HCl). The estimated measurement uncertainty is $\pm 20\%$.

Hydrogen Sulfide

Monitoring for hydrogen sulfide (H₂S) was conducted in accordance with USEPA Method 15 'Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources'. Stack gas was withdrawn from the emission source and diluted with clean dry air using a mass flow controlled Dynamic Diluter device. An aliquot of the diluted sample was then analysed for H₂S using a Gas Chromatograph with a Flame Photometric Detector (GC-FPD). The estimated measurement uncertainty is $\pm 5\%$.

Total (Volatile) Organic Compounds

Sampling and analysis were performed in accordance with USEPA Method 18 'Measurement of Gaseous Organic Compound Emissions by Gas Chromatography - Adsorption tube procedure'.

A measured volume of stack gas was drawn through an activated carbon tube, trapping organic compounds present in the gas. Samples were extracted with carbon disulphide and analysed using gas chromatography/mass spectrometry. The summation of individual VOCs is reported.

The estimated measurement uncertainty is $\pm 20\%$.

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Fluorides

Sampling for gaseous and particulate fluorides was conducted in accordance with US EPA Method 13B - Determination of Total Fluoride Emissions from Stationary Sources. Stack gas was withdrawn isokinetically through a nozzle having a sharp and tapered leading edge.

Particulate matter was collected on a low fluoride ($< 0.01 \text{ mg F/cm}^2$) $0.2 \text{ }\mu\text{m}$ organic membrane filter located in a holder in a heated box. This was followed by an impinger train situated in an ice bath. The first two impingers each contained 100 ml of deionised distilled water. The third impinger was empty to collect any carry-over liquid, and the fourth impinger contained 250 g of silica gel to dry the gas stream prior to metering.

The filter retained particulate fluorides and gaseous fluorides were absorbed in the deionised distilled water. The two fractions were analysed separately utilising ion chromatography. Fluorides are expressed as hydrofluoric acid (HF). The estimated measurement uncertainty is $\pm 20\%$.

Sulfur Dioxide and Sulfur Trioxide

Testing for sulfuric acid mist/sulfur trioxide and sulfur dioxide was performed in accordance with USEPA Method 8 'Determination of Sulfuric Acid Mist & Sulfur Dioxide Emissions from Stationary Sources'. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources.

A measured volume of stack gas was withdrawn isokinetically from the stack through a series of four Greenburg Smith impingers connected in series. The first and second impingers were separated by a glass fibre filter. The first impinger contained an aqueous solution of 80% isopropanol. This was used to remove sulfuric acid mist and sulfur trioxide from the gas stream. The second and third impingers each contained an aqueous solution of 3% hydrogen peroxide for the collection of sulfur dioxide, with the final impinger was empty to collect any carry-over solution.

After sampling, the concentration of sulfuric acid mist / sulfur trioxide was determined from an aliquot of the isopropanol solution (containing the filter) using the barium-thorin titration method. The concentration of sulfur dioxide was determined from an aliquot of the hydrogen peroxide solution using the barium-thorin titration method. The estimated measurement uncertainty is $\pm 20\%$.

Heavy Metals

Monitoring for antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), vanadium (V) and their compounds was performed in accordance with USEPA Method 29 'Determination of Metal Emissions from Stationary Sources'. A stack sample was withdrawn isokinetically from the source. Particulate matter was collected in the probe and on a heated filter, and gaseous emissions in an aqueous acidic solution of hydrogen peroxide and an aqueous acidic solution of potassium permanganate.

The probe, filter, and aqueous acidic solution of hydrogen peroxide was analysed for all metals (including Hg). The aqueous acidic solution of potassium permanganate was analysed only for Hg. The recovered samples were digested, and the appropriate fractions analysed for Hg by cold vapour atomic absorption spectroscopy (CVAAS) and for other metals by inductively coupled argon plasma emission spectroscopy - mass spectrometry (ICAP-MS). The estimated measurement uncertainty is $\pm 20\%$.

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Dioxins and Furans

Sampling for Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) was performed in accordance with NSW EPA TM-18, directly incorporating USEPA Method 23 - "Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans from Stationary Sources", using a USEPA Modified Method 5 sampling train.

The XAD-2 resin was spiked prior to sampling with isotopically labelled PCDD/PCDF surrogate standards. In the laboratory, PCDD and PCDF recovery standards were added to the sample components. The filter, resin and impinger solutions were extracted with organic solvents and the extract purified by chemical treatment and solid phase chromatographic techniques.

Measurement of PCDDs and PCDFs was performed by NMI using high resolution gas chromatography with high resolution electron impact mass spectrometry in accordance with USEPA Method 1613A.

The total toxic equivalent (TEQ) for each PCDD/F congener was calculated using NATO international toxic equivalency factors (TEFs). All results as presented in the tables are expressed to 2 significant figures for PCDDs, PCDFs. The estimated accuracy for the determination of PCDDs and PCDFs in stationary source emissions is $\pm 25\%$.

OPERATING CONDITIONS

The following plant operating conditions were noted during the testing program:

Fuel Consumption The average consumption of fuel (natural gas) was 0.0 GJ/hr.

Chamber Temperatures Primary 2 Temperature = 1,156°C average
Primary 3 Temperature = 1,140°C average
Secondary Temperature = 1,198°C average

Table 1: Waste Composition

Waste Description	Load Rate (kg/hour)	% of Hourly Load Rate
Clinical and Infectious	1,100	87.3%
Quarantine Wastes	100	7.9%
Pharmaceutical Waste	30	2.4%
Ink/Paint Wastes	20	1.6%
Resins/Adhesives	5	0.4%
Waste Containers	5	0.4%
TOTAL	1,260	100%

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DEFINITIONS

'PCDDs' Polychlorinated Dibenzo-p-Dioxins.
'PCDFs' Polychlorinated Dibenzofurans.
'PAHs' Polycyclic Aromatic Hydrocarbons.
'VOCs' Volatile organic compounds.
'NATO' North Atlantic Treaty Organisation.
'WHO' World Health Organisation.
'CARB' California Air Resources Board.
'OEHHA' Office of Environmental Health Hazard Assessment (US).
'BaP-PEF' Benzo(a)pyrene Potency Equivalent Factor.
'BaP-TEQ_{PAH}' Benzo(a)pyrene Toxic Equivalents.
'NATO₈₉ I-TEF' International Toxic Equivalency Factor (NATO 1989 basis).
'NATO₈₉ I-TEQ' International Toxic Equivalent based on the 2,3,7,8-TCDD congener (NATO 1989 basis).
'WHO₀₅ TEF' International Toxic Equivalency Factor (WHO 2005 basis).
'WHO₀₅ TEQ' International Toxic Equivalent based on the 2,3,7,8-TCDD congener (WHO 2005 basis).
'STP' Standard temperature and pressure (0°C and 101.3 kPa).
'K' Absolute temperature in Kelvin (°C + 273).
'Am³' Actual gas volume in cubic metres at stack conditions.
'm³' Gas volume in dry cubic metres at STP.
'<' Less than. The value stated is the limit of detection.
'g' Grams.
'mg' Milligrams (10⁻³ grams).
'µg' Micrograms (10⁻⁶ grams).
'ng' Nanograms (10⁻⁹ grams).
'g/m³' Grams of substance per dry cubic meter of gas at STP.
'g/min' Grams of substance emitted per minute.
'N/A' Not applicable.
'TCDF' Tetrachlorodibenzofuran.
'TCDD' Tetrachlorodibenzo-p-dioxin.
'PeCDF' Pentachlorodibenzofuran.
'PeCDD' Pentachlorodibenzo-p-dioxin.
'HxCDF' Hexachlorodibenzofuran.
'HxCDD' Hexachlorodibenzo-p-dioxin.
'HpCDF' Heptachlorodibenzofuran.
'HpCDD' Heptachlorodibenzo-p-dioxin.
'OCDF' Octachlorodibenzofuran.
'OCDD' Octachlorodibenzo-p-dioxin.

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RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 18th July 2012
Sampling Period 10:16 – 15:34
Testing Officers T. Dare & A. Williams

Table 2: Test Conditions for the Incinerator Stack- 18th July 2012

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	381 (108°C)
Average velocity at sampling plane (m/s)	11.2
Average velocity at point of discharge (m/s)	12.0
Actual gas flow rate (Am ³ /min)	1,730
Average moisture content (% v/v)	8.48
Dry gas flow rate at STP (m ³ /min)	1,130
Average carbon dioxide concentration, dry (% v/v)	1.75
Average oxygen concentration, dry (% v/v)	18.6
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	187

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Release

RESULTS CONTINUED

Table 3: Test Results for the Incinerator Stack – 18th July 2012

Parameter	Concentration (g/m ³) ^a	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Acid Gases as HCl	0.00063	0.05	0.71	10.2
Carbon Monoxide	<0.001	0.15	<1	30.6
Oxides of Nitrogen (as NO ₂) <i>Actual at STP: At 7% O₂:</i>	0.038 0.23	N/A 0.35	43	71.4
Fluorides as HF	<0.00009	0.025	<0.1	5.1
Total Organic Compounds	0.0023	0.03	2.6	6.1
Heavy Metals ^b	0.00029	0.01	0.33	2.0
Hydrogen Sulfide	<0.0003	0.005	<0.3	1.0
Sulfur Dioxide & Trioxide	0.00073	0.1	0.82	20.4

^a Unless otherwise stated.

^b Total of Sb, V, As, Cd, Pb, Hg and their compounds.

RESULTS CONTINUED

Table 4: Concentration of Individual Metals and their Compounds

Metal/Metal Compound	Concentration (g/m ³)	Release Limit (g/m ³)	Emission Rate (g/min)	Release Limit (g/min)
Antimony (Sb)	0.0000099	N/A	0.011	N/A
Arsenic (As)	0.0000012	N/A	0.0014	N/A
Beryllium (Be)	<0.0000002	N/A	<0.0002	N/A
Cadmium (Cd)	0.000080	0.001	0.090	0.2
Chromium III (Cr)	0.0000017	N/A	0.0019	N/A
Chromium VI (Cr)	0.0000018	N/A	0.0020	N/A
Copper (Cu)	0.00014	N/A	0.16	N/A
Lead (Pb)	0.00019	0.003	0.21	0.6
Mercury (Hg)	0.0000059	0.002	0.0067	0.4
Magnesium Oxide (MgO)	0.000017	N/A	0.019	N/A
Nickel (Ni)	0.0000022	N/A	0.0025	N/A
Vanadium (V)	<0.00000006	N/A	<0.00007	N/A
Total of As, Cd, Hg, Pb, Sb, V and their compounds	0.00029	0.01	0.33	2.0

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RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 19th July, 2012
Sampling Period 09:45 – 16:03
Testing Officers T. Dare & A. Williams

Table 5: Test Conditions for the Incinerator Stack – 19th July 2012

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	380 (107°C)
Average velocity at sampling plane (m/s)	11.1
Average velocity at point of discharge (m/s)	11.9
Actual gas flow rate (Am ³ /min)	1,710
Average moisture content (% v/v)	9.00
Dry gas flow rate at STP (m ³ /min)	1,120
Average carbon dioxide concentration, dry (% v/v)	2.52
Average oxygen concentration, dry (% v/v)	18.4
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	201
Dry gas flow rate at STP and 11% O ₂ (m ³ /min)	283

RESULTS CONTINUED

Table 6: Test Results for the Incinerator Stack – 19th July 2012

Parameter	Concentration (g/m ³) ^c	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Total Solid Particulates <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0081 0.045	N/A 0.05	9.0	10.2
PM ₁₀ <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0072 0.040	N/A	8.0	N/A
PM _{2.5} ^d <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0049 0.027	N/A	5.4	N/A
PCDD/Fs (I-TEQ) ^e	0.069 ng/m ³	1.0 ng/m ³	0.020 µg/min	N/A

^c Unless otherwise stated.

^d PM_{2.5} is a subset of PM₁₀.

^e Including half LOD values. The PCDD/F concentration is referenced to 11% O₂.

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RESULTS CONTINUED

Table 7: PCDD/F Congener Profile

PCDD/F Congeners	Concentration (ng/m ³)	WHO ₀₅ TEF	WHO ₀₅ TEQ contribution (ng/m ³)	NATO ₈₉ I-TEF	NATO ₈₉ I-TEQ contribution (ng/m ³)
2378 TCDF	0.046	0.1	0.0046	0.1	0.0046
2378 TCDD	<0.0031	1	0.0015	1	0.0015
12378 PeCDF	0.024	0.03	0.00071	0.05	0.0012
23478 PeCDF	0.034	0.3	0.010	0.5	0.017
12378 PeCDD	0.0034	1	0.0034	0.5	0.0017
123478 HxCDF	0.062	0.1	0.0062	0.1	0.0062
123678 HxCDF	0.068	0.1	0.0068	0.1	0.0068
234678 HxCDF	0.080	0.1	0.0080	0.1	0.0080
123789 HxCDF	0.0077	0.1	0.00077	0.1	0.00077
123478 HxCDD	0.010	0.1	0.0010	0.1	0.0010
123678 HxCDD	0.028	0.1	0.0028	0.1	0.0028
123789 HxCDD	0.022	0.1	0.0022	0.1	0.0022
1234678 HpCDF	0.71	0.01	0.0071	0.01	0.0071
1234789 HpCDF	0.13	0.01	0.0013	0.01	0.0013
1234678 HpCDD	0.34	0.01	0.0034	0.01	0.0034
OCDF	1.8	0.0003	0.00054	0.001	0.0018
OCDD	1.3	0.0003	0.00039	0.001	0.0013

PCDD/F Homologue Groups	Concentration (ng/m ³)
Total TCDF isomers	0.37
Total TCDD isomers	0.020
Total PeCDF isomers	0.37
Total PeCDD isomers	0.056
Total HxCDF isomers	0.59
Total HxCDD isomers	0.34
Total HpCDF isomers	1.3
Total HpCDD isomers	0.68

PCDD/F Summary Results	Concentration (ng/m ³)	Rate of Emission (µg/min)
Sum of PCDD/F congeners (Total of all tetra to octa congeners)		
Excluding LOD values	6.8	1.9
WHO ₀₅ TEQ (Total of WHO ₀₅ TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.059	0.017
Including half LOD values	0.061	0.017
NATO ₈₉ I-TEQ (Total of NATO ₈₉ I-TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.067	0.019
Including half LOD values	0.069	0.020

APPENDIX C

Airlabs Environmental Test Report No. JAN13005.1
17th – 18th January 2013

RTI DL RELEASE - EHP



DATE OF REPORT: 19TH MARCH, 2013

Mr Kevin Maddick
Operations Supervisor
Ace Waste Pty Ltd
PO Box 400
Acacia Ridge QLD 4110

TEST REPORT No. JAN13005

**MONITORING OF AIR EMISSIONS
FROM THE ACE WASTE INCINERATOR
STACK IN WILLAWONG, QLD**

DATE OF SAMPLING: 17TH - 18TH JANUARY, 2013

ACCREDITATION:



This laboratory is accredited by the National Association of Testing Authorities (NATA)
NATA Accredited Laboratory Number: 15463
Accredited for compliance with ISO/IEC 17025:2005
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Report to Ace Waste Pty Ltd - Willawong

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INTRODUCTION

Airlabs Environmental Pty Ltd was commissioned by Ace Waste Pty Ltd to monitor stack emissions leaving the Biomedical Waste Incinerator situated at Willawong for the following parameters:

- Temperature, Gas Velocity and Volume Flow Rate
- Concentration of Water Vapour (Moisture Content)
- Concentration of Oxygen and Carbon Dioxide
- Concentration and Mass Emission Rate of:
 - Carbon Monoxide
 - Total Solid Particulates
 - PM₁₀
 - PM_{2.5}
 - Hydrogen Halogens and Halides (expressed as HCl)
 - Nitrogen Oxides (expressed as NO₂)
 - Hydrogen Sulfide
 - Fluorides (expressed as HF)
 - Total Volatile Organic Compounds (TOC)
 - Sulfur Dioxide and Sulfur Trioxide
 - Heavy metals (antimony, arsenic, cadmium, lead, mercury, vanadium and their compounds)
 - Dioxins and Furans

All of the above samples were collected on the 17th - 18th January 2013.

QUALITY STATEMENT

Airlabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO 17025 (NATA) accreditation. This requires strict adherence to and continuous improvement of all our processes and test work. Our goal is to meet or exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to insure that all data generated is scientifically valid.

TEST METHODS

Gas Velocity, Volume Flow Rate and Temperature

Gas velocity and volumetric flow rate were determined in accordance with USEPA Method 2 'Determination of stack gas velocity and volumetric flow rate (type s pitot tube)'. In accordance with this method pressure differential and temperature profiles were obtained across the sampling plane at transverse points specified by AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions'. Gas velocity and volume flow rates were then calculated in accordance with USEPA Method 2.

The estimated measurement uncertainty for temperature measurement is $\pm 1\%$. The estimated measurement uncertainty for gas velocity and volume flow rate is $\pm 10\%$.

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Water Vapour (Moisture Content)

Stack gas moisture content was determined in accordance with USEPA Method 4 'Determination of Moisture Content in Stack Gases'. A measured volume of stack gas was aspirated through a series of chilled impingers each containing 100 mls of water and then drawn through a silica gel tube. The total change in volume of water in the impingers and the weight change of the silica gel tube were used to calculate the percentage moisture in the stack.

The estimated measurement uncertainty is $\pm 5\%$.

Oxygen and Carbon Dioxide

Oxygen (O₂) and carbon dioxide (CO₂) concentrations were monitored in accordance with USEPA Method 3A 'Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and portions were conveyed to a Paramagnetic O₂ analyser and a Non Dispersive Infrared (NDIR) CO₂ analyser.

Each analyser was zeroed using dry nitrogen and calibrated in accordance with the method using ambient air for O₂ as well as NATA certified span gases for O₂ and CO₂. The estimated measurement uncertainty is $\pm 2\%$.

Carbon Monoxide

Carbon monoxide (CO) was monitored in accordance with USEPA Method 10 'Determination of Carbon Monoxide Emissions from Stationary Sources'. The sample gas was withdrawn continuously from the gas stream and conveyed to a Non Dispersive Infrared (NDIR) CO analyser. The instrument was calibrated using NATA certified CO span gas and zeroed with dry nitrogen. The estimated measurement uncertainty is $\pm 5\%$.

Total Solid Particulates

Monitoring for solid particles was conducted in accordance with Australian Standard 4323.2 - 1995 'Stationary Source Emissions, Method 2: Determination of Total Particulate Matter - Isokinetic Manual Sampling - Gravimetric Method'.

Stack gas was withdrawn isokinetically through a nozzle, which had a sharp and tapered leading edge. Particulate matter was collected on a pre-weighed glass fibre filter located in a holder downstream of the nozzle. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The weight change of the filter was determined using an Ohaus electronic balance and this figure used to calculate the concentration of particulate matter.

The estimated measurement uncertainty is $\pm 15\%$.

PM₁₀ and PM_{2.5} Particulate Matter

Monitoring for PM₁₀ and PM_{2.5} particulate matter was conducted in accordance with USEPA Method CTM 040 'Method for the Determination of PM₁₀ and PM_{2.5} Emissions (Constant Sampling Rate Procedures)'. This method is used to determine particulate matter emissions equal to or less than a nominal aerodynamic diameter of 10µm (PM₁₀) and 2.5µm (PM_{2.5}) in stationary source emissions

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In accordance with this method, a sample of stack gas was extracted at a predetermined constant flow rate through a cascade impactor. This in-stack sizing device separated particles with nominal aerodynamic diameters of PM₁₀ and PM_{2.5}. To minimize variations in the isokinetic sampling conditions, testing was conducted within well-defined limits. Gases were then conditioned (for removal of moisture) and finally metered for flow rate and sample volume. The particulate mass for each size fraction was determined using gravimetric analysis.

The estimated measurement uncertainty is $\pm 15\%$.

Nitrogen Oxides

Nitric oxide (NO) and nitrogen dioxide (NO₂) concentrations were monitored in accordance with USEPA Method 7E 'Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyser Procedure)'. The sample gas was withdrawn continuously from the gas stream and a portion was conveyed to a NO/NO₂/NO_x Chemiluminescent analyser. Total nitrogen oxides (NO_x) are expressed as NO₂. The estimated measurement uncertainty is $\pm 5\%$.

Acid Gases

Sampling for acid gases was conducted in accordance with USEPA Method 26 - 'Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Non-Isokinetic Method'.

Each sample was drawn through a heated probe and filters into a dilute sulphuric acid and dilute sodium hydroxide solutions, which collected the gaseous hydrogen halides and halogens, respectively. Sodium thiosulphate was added in excess to the alkaline solution to ensure complete reaction. The filter was not recovered for analysis. The halide ions in the separate solutions were measured by ion chromatography. Acid gases are expressed as hydrogen chloride (HCl). The estimated measurement uncertainty is $\pm 20\%$.

Hydrogen Sulfide

Monitoring for hydrogen sulfide (H₂S) was conducted in accordance with USEPA Method 15 'Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources'. Stack gas was withdrawn from the emission source and diluted with clean dry air using a mass flow controlled Dynamic Diluter device. An aliquot of the diluted sample was then analysed for H₂S using a Gas Chromatograph with a Flame Photometric Detector (GC-FPD). The estimated measurement uncertainty is $\pm 5\%$.

Total (Volatile) Organic Compounds

Sampling and analysis were performed in accordance with USEPA Method 18 'Measurement of Gaseous Organic Compound Emissions by Gas Chromatography - Adsorption tube procedure'.

A measured volume of stack gas was drawn through an activated carbon tube, trapping organic compounds present in the gas. Samples were extracted with carbon disulphide and analysed using gas chromatography/mass spectrometry. The summation of individual VOCs is reported.

The estimated measurement uncertainty is $\pm 20\%$.

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Fluorides

Sampling for gaseous and particulate fluorides was conducted in accordance with US EPA Method 13B - Determination of Total Fluoride Emissions from Stationary Sources. Stack gas was withdrawn isokinetically through a nozzle having a sharp and tapered leading edge.

Particulate matter was collected on a low fluoride ($< 0.01 \text{ mg F/cm}^2$) $0.2 \mu\text{m}$ organic membrane filter located in a holder in a heated box. This was followed by an impinger train situated in an ice bath. The first two impingers each contained 100 ml of deionised distilled water. The third impinger was empty to collect any carry-over liquid, and the fourth impinger contained 250 g of silica gel to dry the gas stream prior to metering.

The filter retained particulate fluorides and gaseous fluorides were absorbed in the deionised distilled water. The two fractions were analysed separately utilising ion chromatography. Fluorides are expressed as hydrofluoric acid (HF). The estimated measurement uncertainty is $\pm 20\%$.

Sulfur Dioxide and Sulfur Trioxide

Testing for sulfuric acid mist/sulfur trioxide and sulfur dioxide was performed in accordance with USEPA Method 8 'Determination of Sulfuric Acid Mist & Sulfur Dioxide Emissions from Stationary Sources'. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources.

A measured volume of stack gas was withdrawn isokinetically from the stack through a series of four Greenburg Smith impingers connected in series. The first and second impingers were separated by a glass fibre filter. The first impinger contained an aqueous solution of 80% isopropanol. This was used to remove sulfuric acid mist and sulfur trioxide from the gas stream. The second and third impingers each contained an aqueous solution of 3% hydrogen peroxide for the collection of sulfur dioxide, with the final impinger was empty to collect any carry-over solution.

After sampling, the concentration of sulfuric acid mist / sulfur trioxide was determined from an aliquot of the isopropanol solution (containing the filter) using the barium-thorin titration method. The concentration of sulfur dioxide was determined from an aliquot of the hydrogen peroxide solution using the barium-thorin titration method. The estimated measurement uncertainty is $\pm 20\%$.

Heavy Metals

Monitoring for antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), vanadium (V) and their compounds was performed in accordance with USEPA Method 29 'Determination of Metal Emissions from Stationary Sources'. A stack sample was withdrawn isokinetically from the source. Particulate matter was collected in the probe and on a heated filter, and gaseous emissions in an aqueous acidic solution of hydrogen peroxide and an aqueous acidic solution of potassium permanganate.

The probe, filter, and aqueous acidic solution of hydrogen peroxide was analysed for all metals (including Hg). The aqueous acidic solution of potassium permanganate was analysed only for Hg. The recovered samples were digested, and the appropriate fractions analysed for Hg by cold vapour atomic absorption spectroscopy (CVAAS) and for other metals by inductively coupled argon plasma emission spectroscopy - mass spectrometry (ICAP-MS). The estimated measurement uncertainty is $\pm 20\%$.

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Dioxins and Furans

Sampling for Polychlorinated Dibenzo-*p*-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) was performed in accordance with NSW EPA TM-18, directly incorporating USEPA Method 23 - "Determination of Polychlorinated Dibenzo-*p*-Dioxins and Polychlorinated Dibenzofurans from Stationary Sources", using a USEPA Modified Method 5 sampling train.

The XAD-2 resin was spiked prior to sampling with isotopically labelled PCDD/PCDF surrogate standards. In the laboratory, PCDD and PCDF recovery standards were added to the sample components. The filter, resin and impinger solutions were extracted with organic solvents and the extract purified by chemical treatment and solid phase chromatographic techniques.

Measurement of PCDDs and PCDFs was performed by NMI using high resolution gas chromatography with high resolution electron impact mass spectrometry in accordance with USEPA Method 1613A.

The total toxic equivalent (TEQ) for each PCDD/F congener was calculated using NATO international toxic equivalency factors (TEFs). All results as presented in the tables are expressed to 2 significant figures for PCDDs, PCDFs. The estimated accuracy for the determination of PCDDs and PCDFs in stationary source emissions is $\pm 25\%$.

OPERATING CONDITIONS

The following plant operating conditions were noted during the testing program:

Fuel Consumption The average consumption of fuel (natural gas) was 0.0 GJ/hr.

Chamber Temperatures Primary 2 Temperature = 1,057°C average
Primary 3 Temperature = 1,064°C average
Secondary Temperature = 1,231°C average

Table 1: Waste Composition

Waste Type	Kg's Loaded Per Hour (Average)	% of Average Hourly Load
Clinical and Infectious (R100)	1,160 Kg	87.88%
Quarantine Wastes	100 Kg	7.58%
Pharmaceutical Waste (R120/R140)	30 Kg	2.27%
Ink/Paint Wastes (F100) **	15 Kg	1.13%
Resins/Adhesives (F110) **	5 Kg	0.38%
Waste Containers (N100) **	5 Kg	0.38%
Photographic Chemicals (T120)**	5 Kg	0.38%
TOTALS	1,320 Kg	100.00%

Those wastes marked ** are waste incinerated under the Waste Stream Trial reference: SR0209; BST369v1.

DEFINITIONS

'PCDDs'	Polychlorinated Dibenzo-p-Dioxins.
'PCDFs'	Polychlorinated Dibenzofurans.
'PAHs'	Polycyclic Aromatic Hydrocarbons.
'VOCs'	Volatile organic compounds.
'NATO'	North Atlantic Treaty Organisation.
'WHO'	World Health Organisation.
'CARB'	California Air Resources Board.
'OEHHA'	Office of Environmental Health Hazard Assessment (US).
'BaP-PEF'	Benzo(a)pyrene Potency Equivalent Factor.
'BaP-TEQ _{PAH} '	Benzo(a)pyrene Toxic Equivalents.
'NATO ₈₉ I-TEF'	International Toxic Equivalency Factor (NATO 1989 basis).
'NATO ₈₉ I-TEQ'	International Toxic Equivalent based on the 2,3,7,8-TCDD congener (NATO 1989 basis).
'WHO ₀₅ TEF'	International Toxic Equivalency Factor (WHO 2005 basis).
'WHO ₀₅ TEQ'	International Toxic Equivalent based on the 2,3,7,8-TCDD congener (WHO 2005 basis).
'STP'	Standard temperature and pressure (0°C and 101.3 kPa).
'K'	Absolute temperature in Kelvin (°C + 273).
'Am ³ '	Actual gas volume in cubic metres at stack conditions.
'm ³ '	Gas volume in dry cubic metres at STP.
'<'	Less than. The value stated is the limit of detection.
'g'	Grams.
'mg'	Milligrams (10 ⁻³ grams).
'µg'	Micrograms (10 ⁻⁶ grams).
'ng'	Nanograms (10 ⁻⁹ grams).
'g/m ³ '	Grams of substance per dry cubic meter of gas at STP.
'g/min'	Grams of substance emitted per minute.
'N/A'	Not applicable.
'TCDF'	Tetrachlorodibenzofuran.
'TCDD'	Tetrachlorodibenzo-p-dioxin.
'PeCDF'	Pentachlorodibenzofuran.
'PeCDD'	Pentachlorodibenzo-p-dioxin.
'HxCDF'	Hexachlorodibenzofuran.
'HxCDD'	Hexachlorodibenzo-p-dioxin.
'HpCDF'	Heptachlorodibenzofuran.
'HpCDD'	Heptachlorodibenzo-p-dioxin.
'OCDF'	Octachlorodibenzofuran.
'OCDD'	Octachlorodibenzo-p-dioxin.

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RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 17th January, 2013
Sampling Period 10:00 – 14:20
Testing Officers L. Taylor & L. Brown

Table 2: Test Conditions for the Incinerator Stack- 17th January 2013

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	398 (125°C)
Average velocity at sampling plane (m/s)	10.9
Average velocity at point of discharge (m/s)	11.7
Actual gas flow rate (Am ³ /min)	1,680
Average moisture content (% v/v)	9.10
Dry gas flow rate at STP (m ³ /min)	1,050
Average carbon dioxide concentration, dry (% v/v)	2.24
Average oxygen concentration, dry (% v/v)	18.2
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	204
Dry gas flow rate at STP and 11% O ₂ (m ³ /min)	286

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RESULTS CONTINUED

Table 3: Test Results for the Incinerator Stack- 17th January 2013

Parameter	Concentration (g/m ³) ^a	Release Limit (g/m ³) ^a	Emission Rate (g/min) ^a	Release Limit (g/min) ^a
Acid Gases as HCl	0.00020	0.05	0.21	10.2
Carbon Monoxide	<0.001	0.15	<1	30.6
Oxides of Nitrogen (as NO ₂) Actual at STP: At 7% O ₂ :	0.041 0.21	N/A 0.35	43	71.4
Total Organic Compounds	<0.00009	0.03	<0.09	6.1
Heavy Metals ^b	0.00059	0.01	0.62	2.0
Cadmium	0.000058	0.001	0.060	0.2
Mercury	0.0000020	0.002	0.0021	0.4
Hydrogen Sulfide	<0.0003	0.005	<0.3	1.0
PCDD/Fs (I-TEQ) ^c	0.16 ng/m ³	1.0 ng/m ³	0.046 µg/min	N/A

^a Unless otherwise stated.

^b Total of Sb, V, As, Cd, Pb, Hg and their compounds.

^c Including half LOD values. The PCDD/F concentration is referenced to 11% O₂.

RESULTS CONTINUED

Table 4: Concentration of Individual Metals and their Compounds- 17th January 2013

Metal/Metal Compound	Concentration (g/m ³)	Release Limit (g/m ³)	Emission Rate (g/min)	Release Limit (g/min)
Antimony (Sb)	0.000026	N/A	0.027	N/A
Arsenic (As)	0.0000011	N/A	0.0011	N/A
Beryllium (Be)	<0.0000002	N/A	<0.0002	N/A
Cadmium (Cd)	0.000058	0.001	0.060	0.2
Chromium III (Cr)	0.0000046	N/A	0.0048	N/A
Chromium VI (Cr)	0.0000057	N/A	0.0059	N/A
Copper (Cu)	0.00018	N/A	0.19	N/A
Lead (Pb)	0.00029	0.003	0.30	0.6
Mercury (Hg)	0.0000020	0.002	0.0021	0.4
Magnesium Oxide (MgO)	0.000020	N/A	0.021	N/A
Nickel (Ni)	0.0000025	N/A	0.0026	N/A
Vanadium (V)	<0.0000001	N/A	<0.0002	N/A
Total of As, Cd, Hg, Pb, Sb, V and their compounds	0.00039	0.01	0.62	2.0

RESULTS CONTINUED

Table 5: PCDD/F Congener Profile- 17th January 2013

PCDD/F Congeners	Concentration (ng/m ³)	WHO ₀₅ TEF	WHO ₀₅ TEQ contribution (ng/m ³)	NATO ₈₉ I-TEF	NATO ₈₉ I-TEQ contribution (ng/m ³)
2378 TCDF	0.021	0.1	0.0021	0.1	0.0021
2378 TCDD	<0.005	1	0.0026	1	0.0026
12378 PeCDF	0.087	0.03	0.0026	0.05	0.0043
23478 PeCDF	0.094	0.3	0.028	0.5	0.047
12378 PeCDD	0.012	1	0.012	0.5	0.0058
123478 HxCDF	0.24	0.1	0.024	0.1	0.024
123678 HxCDF	0.24	0.1	0.024	0.1	0.024
234678 HxCDF	0.23	0.1	0.023	0.1	0.023
123789 HxCDF	0.014	0.1	0.0014	0.1	0.0014
123478 HxCDD	0.015	0.1	0.0015	0.1	0.0015
123678 HxCDD	0.016	0.1	0.0016	0.1	0.0016
123789 HxCDD	0.014	0.1	0.0014	0.1	0.0014
1234678 HpCDF	1.7	0.01	0.017	0.01	0.017
1234789 HpCDF	0.23	0.01	0.0023	0.01	0.0023
1234678 HpCDD	0.14	0.01	0.0014	0.01	0.0014
OCDF	1.4	0.0003	0.00041	0.001	0.0014
OCDD	0.64	0.0003	0.00019	0.001	0.00064

PCDD/F Homologue Groups	Concentration (ng/m ³)
Total TCDF isomers	1.1
Total TCDD isomers	0.11
Total PeCDF isomers	1.5
Total PeCDD isomers	0.16
Total HxCDF isomers	3.4
Total HxCDD isomers	0.38
Total HpCDF isomers	2.9
Total HpCDD isomers	0.29

PCDD/F Summary Results	Concentration (ng/m ³)	Rate of Emission (µg/min)
Sum of PCDD/F congeners (Total of all tetra to octa congeners)		
Excluding LOD values	12	3.4
WHO ₀₅ TEQ (Total of WHO ₀₅ TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.14	0.040
Including half LOD values	0.14	0.040
NATO ₈₉ I-TEQ (Total of NATO ₈₉ I-TEQ contribution for 17 toxic congeners)		
Excluding LOD values	0.16	0.046
Including half LOD values	0.16	0.046

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RESULTS

Company Ace Waste Pty Ltd
Site 491 Gooderham Road, Willawong
Source Tested Biomedical Waste Incinerator Stack
Date of Test 18th January, 2013
Sampling Period 09:50 – 15:40
Testing Officers T. Dare & L. Taylor

Table 6: Test Conditions for the Incinerator Stack- 18th January 2013

Test Conditions	
Stack dimensions at sampling plane (m)	1.81
Stack dimensions at point of discharge (m)	1.75
Average stack gas temperature (K)	415 (142°C)
Average velocity at sampling plane (m/s)	11.6
Average velocity at point of discharge (m/s)	12.4
Actual gas flow rate (Am ³ /min)	1,790
Average moisture content (% v/v)	8.70
Dry gas flow rate at STP (m ³ /min)	1,080
Average carbon dioxide concentration, dry (% v/v)	2.35
Average oxygen concentration, dry (% v/v)	18.1
Dry gas flow rate at STP and 7% O ₂ (m ³ /min)	218

RESULTS CONTINUED

Table 7: Test Results for the Incinerator Stack- 18th January 2013

Parameter	Concentration (g/m ³)	Release Limit (g/m ³)	Emission Rate (g/min)	Release Limit (g/min)
Total Solid Particulates <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0094 0.047	N/A 0.05	10.2	10.2
PM ₁₀ <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0074 0.037	N/A	8.0	N/A
PM _{2.5} ^d <i>Actual at STP:</i> <i>At 7% O₂:</i>	0.0042 0.021	N/A	4.5 0.2	N/A
Fluorides as HF	<0.0002	0.025	<0.2	5.1
Sulfur Dioxide & Trioxide	0.0016	0.1	1.7	20.4

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^d PM_{2.5} is a subset of PM₁₀.