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Results of Flare Emissions Testing

Cleanaway Landfills Ltd

Tullamarine Closed Landfill
Western Avenue, Tullamarine, Victoria

Report Date: 25 November 2016

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Tullamarine Closed Landfill

Western Avenue, Tullamarine, Victoria 3043

Kleinfelder Project Number: 20163079.001A

Prepared for:

Cleanaway Pty Ltd

Western Avenue
Tullamarine, VIC 3043

Prepared by:

Kleinfelder Australia Pty Ltd

Level 1, 95 Coventry Street
South Melbourne, VIC 3205
Phone: 03 9907 6000
Fax: 03 9907 6090

ABN: 23 146 082 500

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		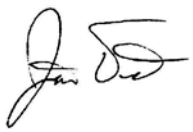
Michael Sussman/ Russ Erbes	David Corrigan	Jim Dill

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ABBREVIATIONS

AQM	Air Quality Management
AAQ	Ambient Air Quality
BPEM	Best Practice Environmental Management
CSM	Conceptual Site Model
DNPH	2,4-Dinitrophenylhydrazine
DRE	Destruction and Removal Efficiency
EPA Victoria	Environment Protection Authority Victoria
g/min	Grams per Minute
GC/MS	Gas Chromatograph-Mass Spectrometer
m/s	Metres per Second
ug/m^3	Micrograms per Cubic Metre
mg/kg	Milligram per kilogram
OC	Organochlorine
mg/m^3	Milligram per cubic metre
NATA	National Association of Testing Authorities
PAHs	Polycyclic Aromatic Hydrocarbons
PAN	Pollution Abatement Notice
PCBs	Polychlorinated biphenyls
PCDD & PCDFs	Dioxins and furans
ppm	Parts per Million
SEPP	State Environmental Protection Policy
STP	Standard Temperature and Pressure
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
v/v	Volume per Volume

EXECUTIVE SUMMARY

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by Cleanaway Pty Ltd (Cleanaway) to oversee the completion of emissions testing to determine potential emissions and the destruction efficiency of methane, other volatile organic compounds (VOCs), and reduced sulphur compounds from the candlestick flare operated at the closed Tullamarine landfill. The emission test results were used to assess the adequacy of the enclosed flare, to evaluate the emissions of methane and other pollutants, and to assess the potential off-site ambient air impacts from the flare operation.

The flare testing demonstrated that the potential emissions from the flare and the worst case potential ambient air quality impact of those emissions are all less than the EPA Victoria State Environmental Protection Policy standards and the other evaluation criteria. The testing shows that the flare exceeded the 98% necessary flare destruction efficiency for methane and VOC emissions. This result is due to the relatively high destruction efficiency of the flare that averages over 99.9 percent on a VOC mass-weighted average basis. Methane destruction is over 99.995 percent.

Modelling of the flare emissions provides conservative ambient air concentrations and used worst case weather conditions which are unlikely to occur. The modelled emissions were calculated for the maximum impact point, which was determined to be 235 metres from the flare. At this distance, the modelling showed no exceedance of the toxicity or odour design conditions for the analytes measured. Also, the nearest receptor point (residences to the east) are approximately three times the distance from the maximum impact point, meaning that concentrations encountered by actual receptors will be many times lower than the predicted emissions.

1. INTRODUCTION

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by Cleanaway Pty Ltd (Cleanaway) to oversee the completion of emissions testing on the enclosed flare located at the Tullamarine Closed Landfill, Western Avenue, Tullamarine, Victoria (the site).

1.1 PURPOSE

The purpose of the flare emission testing was to determine potential emissions and the destruction efficiency of methane, other volatile organic compounds (VOCs), and reduced sulphur compounds from the enclosed flare operated at the closed Tullamarine Landfill.

1.2 OBJECTIVES

The objectives for this assessment are to:

- Assess the adequacy of the current flare for controlling methane.
- Determine actual emissions from the flare.
- Assess the potential off-site ambient air impacts from the flare operation.

1.3 SCOPE OF WORK

Flare emissions testing was performed on the incoming landfill gas stream and the exhaust of the landfill gas flare on 12 July 2016 and again between 9 August 2016 and 11 August 2016 by Cleanaway's selected emission testing contractor, Ektimo. **Table 1.1** shows the scope of work of the testing and analyses conducted. Test runs were conducted during normal operating conditions.

Table 1.1: Summary of Sampling Works

Sample Location	Analyte Suite	Sampling Date
Flare Outlet	Dioxins and furans (PCDD & PCDFs)	12 July 2016
	Dioxin like polychlorinated biphenyls (PCBs),	12 July 2016
	Polycyclic aromatic hydrocarbons (PAHs)	12 July 2016
	Organochlorine (OC) pesticides.	12 July 2016
	Speciated volatile organic compounds	9 August 2016
	C1-C4 hydrocarbons	9 August 2016
	Reduced sulphur gases	9 August 2016
	Hydrogen halide and halogen	10 August 2016
	Ammonia	10 August 2016
	Sulfuric acid, sulphur dioxide, sulphur trioxide	10 August 2016
	Nitrogen oxides	10 August 2016
	Carbon dioxide	10 August 2016
	Carbon monoxide	10 August 2016
	Oxygen	10 August 2016
	Total organic compounds (as methane)	10 August 2016
	Total particulate matter	11 August 2016
	Metals (arsenic, chromium, and mercury)	11 August 2016
	Amines	11 August 2016
	Aldehydes	11 August 2016
Flare Inlet	Speciated volatile organic compounds	9 August 2016
	C1-C4 hydrocarbons	9 August 2016
	Reduced sulphur gases	9 August 2016

The testing result considerations were as follows:

- Comparisons of the inlet and exhaust emission rates to determine the destruction efficiency of the flare.
- Summary of the results and destruction efficiency calculations in a report.
- Evaluation of modelled potential emissions impact on ambient air.

2. SITE OVERVIEW

2.1 SITE BACKGROUND

- The Tullamarine Landfill began operations in 1972 and was licensed by the Environment Protection Authority Victoria (EPA Victoria) under license HS346 for disposal of a variety of wastes from industries. Up to 1987 the landfill also received liquid wastes such as oil and industrial sludge. The landfill ceased operations and was closed in 2008.

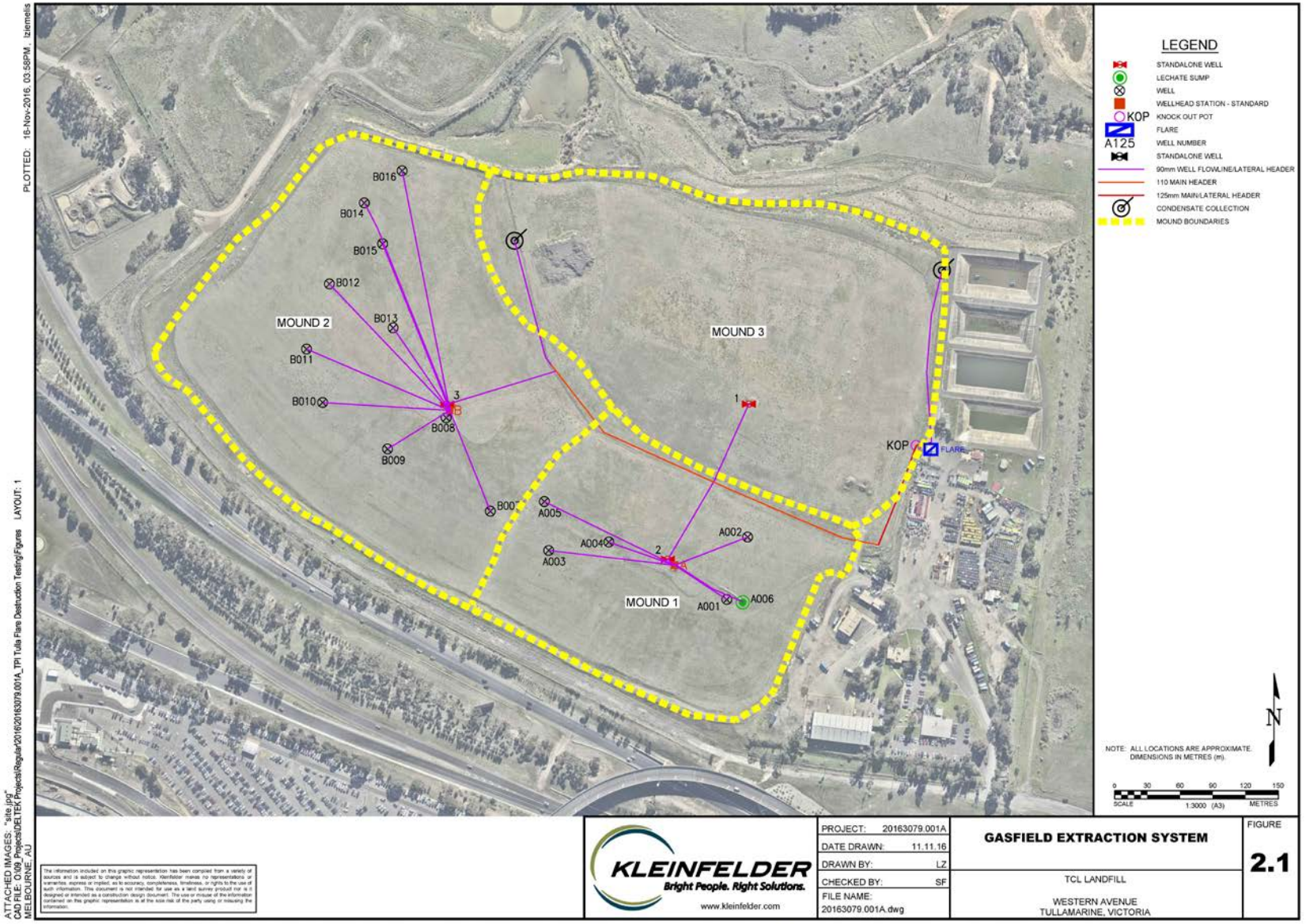
- A landfill gas system was first installed at the landfill on mound 3 in 2006. In January 2010 a solar spark landfill gas vent flare system was installed on the vent.

- In 2011 the remaining areas of the landfill (mounds 1 and 2) were capped, and a landfill gas collection system comprised of laterals beneath the caps was installed. The system was expanded to incorporate fifteen leachate wells in late 2011. At this time the solar spark flare was replaced with a temporary shrouded candlestick flare. In 2013 the gas collection system was upgraded and the current enclosed flare was installed. **Figure 2.1** shows the general layout of the site, laterals, and flare location.

- The Tullamarine Closed Landfill operated in its initial post-closure period under a Pollution Abatement Notice (PAN), N08168, dated 4 December 2009, which is still active. The PAN required that Cleanaway prepare a Landfill Gas Management Plan to ensure adequate management of landfill gases once the capping was completed in 2011.

- Cleanaway developed an approved ambient air and landfill gas management plan in September 2012.

Figure 2.1: Gasfield Extraction System



2.2 SURROUNDING LAND USE

A summary of surrounding land use is provided in **Table 2.1** below.

Table 2.1: Summary of Surrounding Land Use

Direction	Land Use
North	• Moonee Ponds Creek is located immediately adjacent to the north, beyond which is a former quarry area which has been filled and appears to be undeveloped land.
East	• Victoria Street road reserve is located immediately adjacent to the east, beyond which is vacant land (Cleanaway owned). • Beyond the vacant land, approximately 500 metres from Victoria Street is the residential suburb of Westmeadows.
South	• Western Avenue is located immediately adjacent to the south, beyond which is the Tullamarine Freeway (M2). Tullamarine Freeway becomes Terminal Drive and Melbourne Drive as it enters the airport to the west. • Beyond the Tullamarine Freeway are asphalt covered parking lots associated with the Melbourne Airport.
West	• Quarry Road (continuation of Western Avenue) is located immediately adjacent to the west, beyond which is the Tullamarine Freeway. Beyond the Freeway (starting at approximately 200 metres from the boundary) are restaurants and hotels associated with the Melbourne Airport.

2.3 LANDFILL GAS COLLECTION SYSTEM

An active LFG extraction system has been installed at the site and is currently operated and maintained by Run Energy Pty Ltd (Run Energy).

The LFG extraction network comprises horizontal gas collection blankets on all three mounds located under the membrane. In addition, LFG is extracted from a number of leachate sumps. The vertical and horizontal extraction wells are connected three header stations which feed extracted landfill gas into the landfill gas flare.

2.4 LANDFILL GAS CONTROL DEVICE

This section contains a brief description of the measured process, control equipment, and monitoring, including a sampling schematic.

The landfill gas is directed to an elevated enclosed flare to combust the landfill gas. The flare burns only landfill gas and is not supplied with supplemental feed gas during operation.

Figure 2.2 provides an airflow conceptual schematic for the flare.

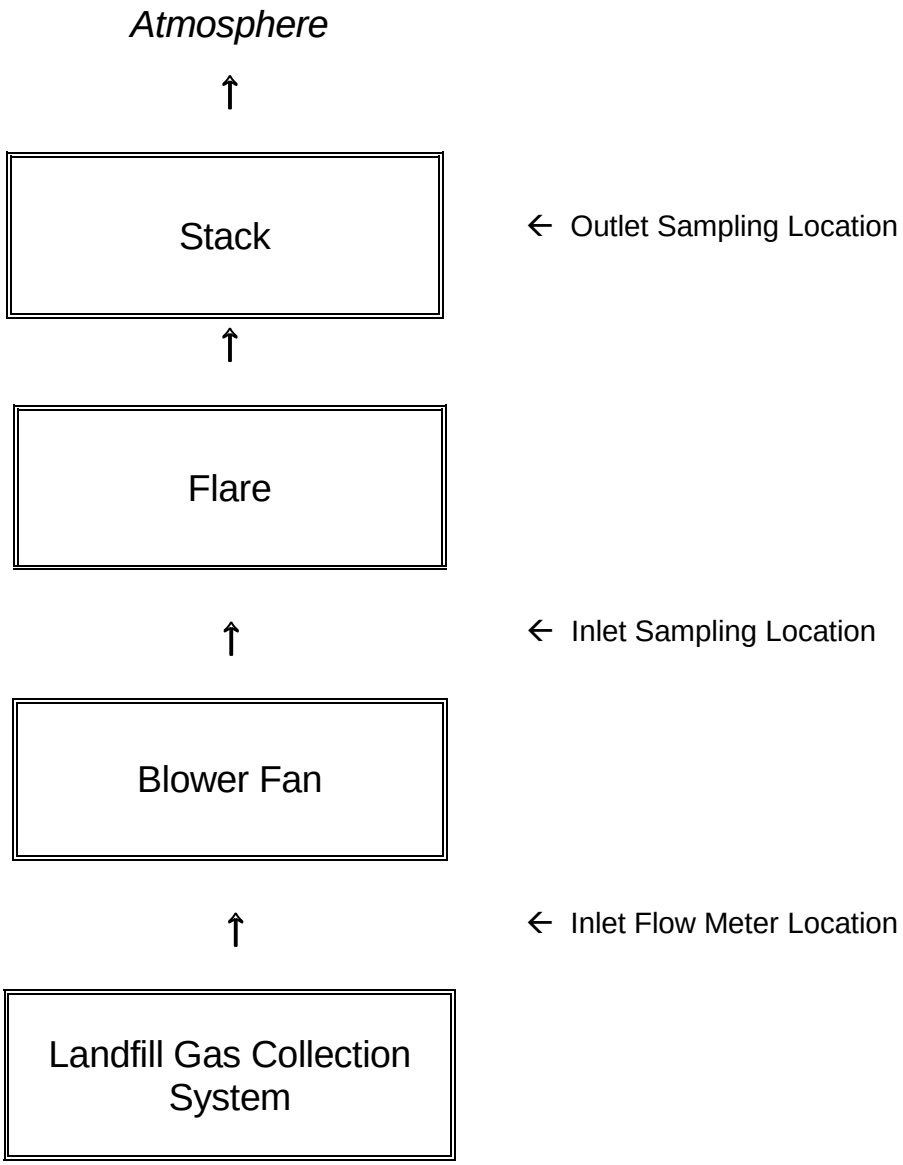


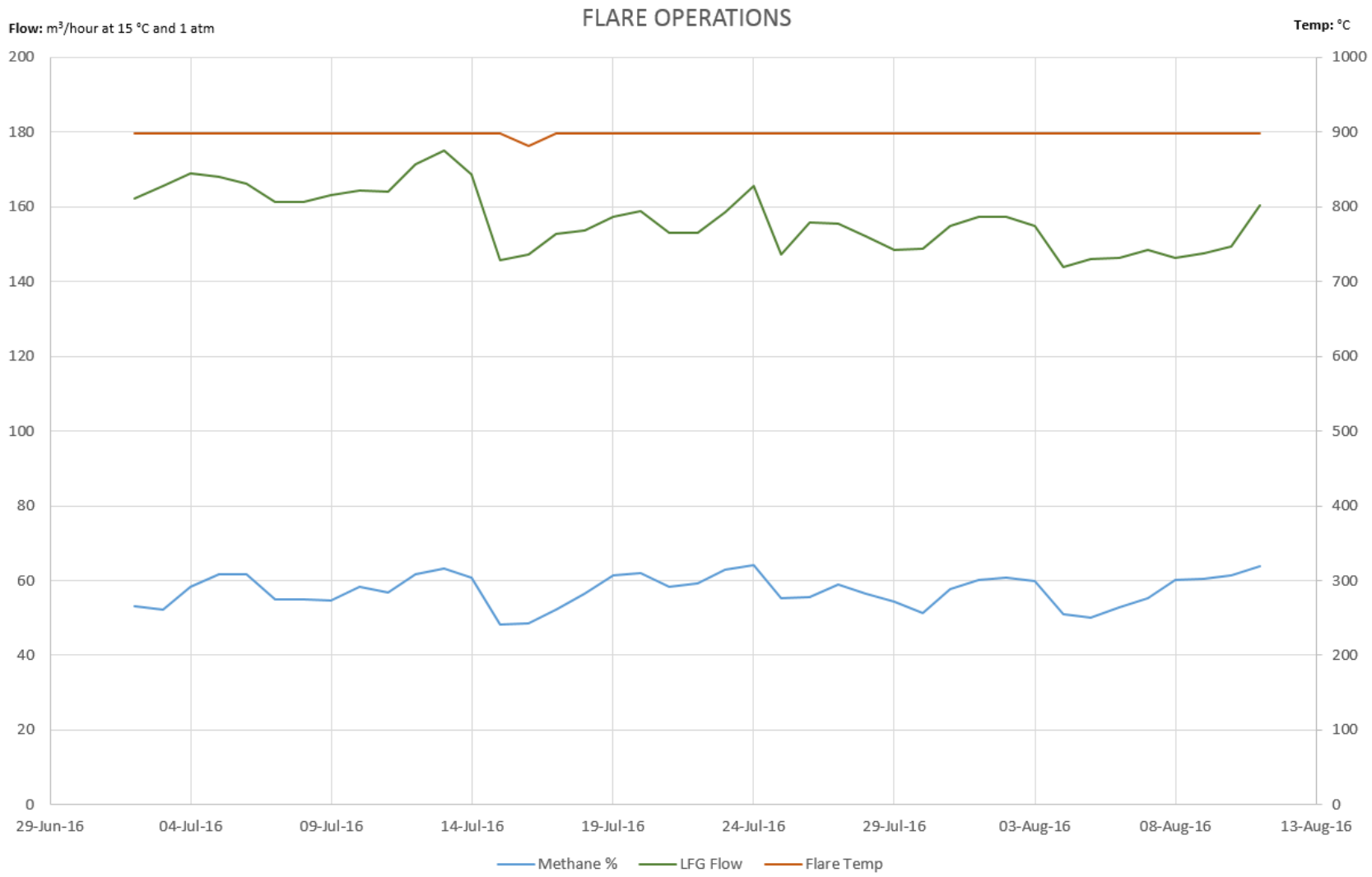
Figure 2.2: Conceptual Process Air Flow Schematic

The flare has several instruments connected to the unit to monitor flare performance. These include a landfill gas flow rate monitor, an inlet methane concentration analyzer, and a flare combustion chamber temperature monitor. These instruments continuously record data at 15-minute intervals. Prior to the flare testing, operations personnel evaluated the flare performance data for the months prior to and during the test to confirm that the flare was operating at typical conditions when the testing was being conducted. Ektimo measured the flare exhaust parameters and took samples of the inlet landfill gas to determine the inlet concentrations and mass flow rate of the compounds analysed. Ektimo used data from the flare gas flow rate monitor to calculate the mass flow rate of the analysed compounds. The flare operating parameters during the testing periods are shown in **Table 2.2**. The flare exhaust data are shown in Sections 3.1, 3.2, 3.4, 3.6, and 3.7 of the Flare Testing Report in Appendix A. **Figure 2.3** shows the flare operational data for the period before and after the flare testing dates.

Table 2.2: Flare Operating Parameters During Testing

Parameter	12 July 2016	9 August 2016	10 August 2016	11 August 2016
Landfill Gas Inlet Flow Rate (m^3/hour at 15 °C and 1 atm)	171	148	149	160
Inlet Methane Concentration (percent)	61.83 %	60.54 %	61.41 %	63.76 %
Combustion Chamber Temperature, °C	898	898	898	898

Figure 2.3: Flare Operational Data



3. METHODOLOGY

3.1 FLARE EMISSION TESTING METHODOLOGY

Flare emission testing was completed by Cleanaway's selected emission test contractor, Ektimo. The methodologies chosen were those recommended by EPA Victoria as specified in *A Guide to Sampling and Analysis Air Emissions and Air Quality, dated December 2002*.

The following is a detailed description of the methodologies used.

Flare Velocity, Temperature and Flows

Sampling locations were determined to meet AS4323.2 criteria. Flare flow rate parameters were measured and/or performed each day following Ektimo (EML Air) Method 100. Initial data were obtained prior to each isokinetic test to establish sampling rates and settings for the runs. Velocity was measured and flow was calculated. An S-type pitot with differential digital manometer and type K thermocouple with pyrometer measured at the sample plane where ports were provided. Differential pressure and temperature readings were taken from two traverses, 90° apart, six points per traverse (i.e., 12 points in total). The other variables for determination of velocity are static and total pressure and molecular weight. Static pressure was determined using the same manometer. Ambient pressure was sourced from local meteorology station Melbourne Airport. Total flare pressure was calculated. Molecular weight was determined by measurement of O_2 and CO_2 (United States Environmental Protection Agency, US EPA 3A – direct reading instrumental methods) and measurement of moisture (US EPA 4 – fixed rate grab sampling into a series impingers).

Results were reported as metres per second (m/s) and °C. These measurements enabled the calculation of flow and mass emission rates. Results were reported as m^3/min at discharge conditions, wet standard temperature and pressure (STP), dry STP and grams per minute (g/min). Pre- and post- requirements meet the EPA Victoria requirements.

Flare inlet flow (m^3/hr), pressure, and temperature data from the installed Cleanaway Rosemount flow metre was provided by Run Energy every 15-minutes. Moisture was calculated assuming saturated gas at the temperatures provided.

Nitrogen Oxides, Carbon Dioxide, Carbon Monoxide, and Oxygen

These parameters were determined using direct read instrument. Sampling duration was 60 minutes. Sixty readings were taken over a 60-minute period when the operation was determined as stable. Results were reported as parts per million (ppm) volume/volume (v/v) and/or % v/v dry basis; minimum, maximum, and average. This is compliant with AS4323.1 and EPA Victoria Pub. 440. The average results are not corrected to account for spikes.

Speciated VOCs and Reduced Sulphur Gases

Whole gas samples were collected in Summa Canisters for laboratory analysis via TO-15 sampling and gas chromatograph–mass spectrometer (GC-MS) analysis. Two 30-minute samples were taken over a 60-minute period when the sample process was determined as stable. The 6-liter Summa Canister with flow regulators were filled at ~ 200 cc/min. Inlet and outlet samples were collected simultaneously and flare destruction efficiency was calculated for each species of VOC and reduced sulphur compound that was observed above the reporting limit in the inlet.

Analysis was performed by NMI who are accredited by National Association of Testing Authorities (NATA) for this analysis. Results were reported as ppm v/v dry basis or milligrams per cubic metre (mg/m^3) dry STP and g/min.

Methane, (C_1-C_4 Organic Compounds)

Sampling for methane and other low molecular weight volatile organics was completed by tedlar bag and sorbent tube sampling and GC-MS analysis. Two 30-minute samples were taken over a 60-minute period when the sample process was determined as stable. Inlet and outlet samples were collected simultaneously to enable flare destruction efficiency to be calculated for methane.

Analysis was performed by Ektimo who are accredited by NATA for this analysis. Results were reported as ppm v/v dry basis or mg/m^3 dry STP and g/min.

Amines

Sampling for speciated amines was completed by silica gel sorbent tubes. Two 15-minute samples were taken over a 30-minute period when the sample process was determined as stable.

Analysis was performed by NMI who are accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

Aldehydes

Sampling for speciated aldehydes was completed by silica gel sorbent tubes impregnated with 2,4-Dinitrophenylhydrazine (DNPH). Two 15-minute samples were taken over a 30-minute period when the sample process was determined as stable.

Analysis was performed by Ektimo who are accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

Ammonia

Sampling for ammonia was completed by midget impingers containing 0.1 N H_2SO_4. Two 30-minute samples were taken over a 60-minute period when the sample process was determined as stable.

Analysis was performed by Envirolab who are accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

Hydrogen Halide and Halogens

Sampling was performed according to US EPA Method 26A. Gaseous and particulate pollutants were withdrawn isokinetically and collected in a multi-component sampling train. Two 120-minute samples were taken over a 120-minute period when the sample process was determined as stable.

Analysis was performed by Ektimo who is accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

Particulate Matter and Multiple Metals

Sampling for filterable particulate matter and metals was performed according to Methods AS 4323.2 and Ektimo (EML Air) 280. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in a multi-component sampling train. Two 120-minute samples were taken over a 120-minute period when the sample process was determined as stable.

Particulate analysis was performed by Ektimo who are accredited by NATA for this analysis. Metals Analysis was performed by Envirolab who are accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

Dioxin/Furans and PCBs

Sampling for dioxin (polychlorinated dibenzo-p-dioxins), furans (dibenzofurans) and the 12 "dioxin-like" PCBs was performed according to US EPA Method 23A. Gaseous and particulate pollutants were withdrawn isokinetically from the source and collected in a multi-component train. Two 120-minute samples were taken over a 120-minute period when the sample process was determined as stable.

Analysis was performed by NMI who are accredited by NATA for this analysis. Results were reported as ng/m^3 dry STP and ng/min.

Polycyclic Aromatic Hydrocarbons

Sampling for PAHs was completed by US EPA Method SW-846 0010. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in a multi-component sampling train. Two 120-minute samples were taken over a 120-minute period when the sample process was stable.

Analysis was performed by NMI who is accredited by NATA for this analysis. Results were reported as ng/m^3 dry STP and ng/min.

Organochlorine Pesticides

Sampling for Organochlorine Pesticides was completed by US EPA Method SW-846 0010. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in a multi-component sampling train. Two 120-minute samples were taken over a 120-minute period when the sample process was determined as stable.

Analysis was performed by NMI who is accredited by NATA for this analysis. Results were reported as ng/m^3 dry STP and ng/min.

Sulphur Trioxide or Sulphuric Acid and Sulphur Dioxide

Sampling for Sulphur Trioxide or Sulfuric Acid and Sulphur Dioxide was completed by US EPA Method 8. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in a multi-component sampling train. Two 90-minute samples were taken over a 90-minute period when the sample process was determined as stable.

Analysis was performed by Ektimo who are accredited by NATA for this analysis. Results were reported as mg/m^3 dry STP and g/min.

3.2 CALCULATION METHODOLOGY

This section describes the calculation and data analysis methods implemented during this project.

An objective of the testing was to determine the destruction efficiency of the flare. Ektimo used the data collected during the testing (outlet gas flow rate, outlet concentration, inlet gas flow rate, and inlet concentration) to calculate the destruction efficiency. The difference between the inlet and outlet mass flow is used to calculate the destruction efficiency (see Equation 1).

$$\frac{\text{Inlet (Flow x Concentration)} - \text{Outlet (Flow x Concentration)}}{\text{Inlet (Flow x Concentration)}} \times 100\% = \%\ \text{Destruction} \qquad \text{Eqn 1}$$

The outlet gas flow rate, outlet concentration, and inlet concentration were directly measured by Ektimo using standard field and laboratory methodology. The inlet landfill gas flow rate was directly measured by Cleanaway using the flow meter installed on the inlet landfill gas flow line. The inlet and outlet data were taken simultaneously.

At the inlet, the landfill gas stream flow rate was measured using the facility calibrated on-site flow meter. It is a closed system between the monitoring point and the flare combustion chamber. The flow meter records as wet standard cubic metres per hour. Temperature measurements and the moisture equations were used to correct the data to dry standard conditions. At the inlet location, Ektimo measured temperature, calculated the moisture content of the gas stream assuming it is saturated air and assumed the gas stream molecular weight at the inlet was equal to methane.

3.3 AMBIENT AIR IMPACT ASSESSMENT

To evaluate the potential ambient air quality impact of emissions from the flare, the regulatory SCREEN3 dispersion model was used. This model was chosen because the facility consists of a single source and simple terrain. SCREEN3 uses hypothetical worst case meteorological conditions to estimate worst case ambient air quality impacts. Modelling allows the flare emissions to be evaluated under worst case atmospheric conditions (which are unlikely to occur) and allows the impacts from the flare to be isolated from other sources that may exist. As such the modelling is preferable to ambient monitoring as the results provide an upper boundary of the potential impacts on any day rather than a snap shot in time of conditions on the day of ambient monitoring. The model result should be considered as a high estimate of the actual ambient air concentrations that would be seen at a receptor under any weather conditions. The actual ambient air concentrations from the flare would be expected to be below the values indicated by the model.

SCREEN3 is a single source Gaussian plume model that calculates the maximum worst case ground-level concentration of compounds emitted from flare sources. SCREEN3 is a screening model that has long been used by the US EPA.

For purposes of running the SCREEN3 model, the area near the facility was considered to be rural. The majority of the land use within the facility 1.6 kilometre (1-mile) radius is largely open space with low level structures. The terrain surrounding the facility where receptors are located is relatively flat and is not greater than the flare base elevation. While the on-site landfill mounds do rise above the flare base elevation, the top of the flare still extends above the elevation of the mounds. Therefore, the effects of the on-site terrain were determined to be minimal to the dispersion from the flare emissions. Therefore, the flat terrain option in the model was selected when off-site impact concentrations were evaluated.

The regulatory building downwash option was not used, since no building structures are located near the flare. Generally, small tanks, storage sheds, and engines are not large enough to cause downwash effect and should not be considered as causing flare tip downwash in the analysis.

Full meteorology was selected such that the modelled selected a worst-case scenario of meteorological conditions. This includes all stability classes and wind speeds, 10-metre anemometer height, and regulatory mixing height.

The automated distance option was selected to model from the source to the point of maximum impact and beyond. The modelling input and output file for this modelling assessment is presented in Appendix B.

SCREEN3 calculates a 1-hour average concentration. To convert the 1-hour results to a 3-minute average needed to compare the model results to the assessment criteria, the following formula was used as prescribed by EPA Victoria:

$$c(t) = c(t_0)\ (t_0/t)^{0.2} \qquad \text{Eqn 2}$$

where: *(t) is the averaging time (minutes) of interest (3 minutes in this case)*
(t_0) is the averaging time consistent with the model (60 minutes in this case)

3.4 EVALUATION CRITERIA

Kleinfelder used the current EPA Victoria State Environmental Protection Policy (Air Quality Management), referred to herein as SEPP (AQM), Schedule A design criteria to evaluate the potential ambient air quality impact of emissions from the flare. The most recent SEPP (AQM) was published 21 December 2001. Schedule A lists design criteria in terms of ambient air concentrations of various compounds that, per the SEPP (AQM) are to be used in the assessment of the design of new or expanded sources of emissions such as industrial premises. Ambient air quality impact modelling is required in order to assess the design criteria, and Schedule C of the SEPP (AQM) details modelling procedures. The ambient air quality modelling used herein is consistent with Schedule C.

Table 3.1 shows the Schedule A design criteria for those compounds emitted from the flare in concentrations greater than the reporting threshold. SEPP (AQM) categorizes substances of interest into 4 categories:

- Class 1 indicators: common or widely distributed air pollutants which are established as environmental indicators in the State environment protection policy (Ambient Air Quality) and may threaten the beneficial uses of both local and regional air environments.
- Class 2 indicators: hazardous substances that may threaten the beneficial uses of the air environment by virtue of their toxicity, bio-accumulation or odorous characteristics.
- Class 3 indicators: extremely hazardous substances that are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent, and which may threaten the beneficial uses of the air environment.
- Unclassified indicators: indicators of the beneficial uses of local amenity and aesthetic enjoyment, namely odour and total suspended particles (nuisance dust).

Table 3.1: Schedule A Design Criteria for Compounds Emitted Above Laboratory Reporting Limit from the Tullamarine Flare

Substance	Averaging Time	Design Criteria (mg/m^3)	Design Criteria Odour (mg/m^3)
Class 1 Indicators			
Carbon monoxide	1-hour	29	
Nitrogen dioxide	1-hour	0.19	
Sulphur dioxide	1-hour	0.45	
Particles as PM_{10}	1-hour	0.080	
Class 2 Indicators			
Acetone	3-minute	40	
Ammonia	3-minute	0.6	
Chlorine	3-minute	0.1	
Formaldehyde	3-minute	0.04	
Hydrogen chloride	3-minute	0.25	
Mercury			
-Organic	3-minute	0.00033	
-Inorganic	3-minute	0.0033	
Particles as $PM_{2.5}$	1-hour	0.050	
Sulphuric acid	3-minute	0.033	
Class 2 Indicators (Odour-based)			
Carbon disulphide	3-minute	1.01	0.13
Ethanol	3-minute	62.7	3.8
Hydrogen sulfide	3-minute	0.47	0.00014
Methyl ethyl ketone	3-minute	16	5.9
Class 3 Indicators			
Acrolein	3-minute	0.00077	
Arsenic and compounds	3-minute	0.00017	
Benzene	3-minute	0.053	
Chromium VI Compounds	3-minute	0.00017	
PAH (as BaP)	3-minute	0.00073	
Total PCDD + PCDFs	3-minute	3.7×10^{-9} as I-TEQ	

Kleinfelder also considered the Schedule 2 Environmental Quality Objectives and Goals from the EPA Victoria State Environmental Protection Policy (Ambient Air Quality), herein referred to as SEPP (AAQ), as most recently amended on 28 July 2016. However, the SEPP (AQM) Schedule A concentrations are more stringent than the SEPP (AAQ) Schedule 2 concentrations. Thus, the Schedule A design criteria in Table 3.1 were used.

SEPP (AQM) also presents a set of emission limits for stationary sources in Victoria. These limits are promulgated in terms of the concentration of a substance in the flare (not the ambient air as promulgated in Schedule A). The Schedule D emission limits relevant to the Tullamarine flare are shown in **Table 3.2.**

Table 3.2: SEPP (AQM) Schedule D Emission Criteria for Compounds Relevant to the Tullamarine Flare

Substance	Emission Limit (mg/m^3)
Combustion particles	250
Total particulate matter	500
Sulphuric acid mist and sulphur trioxide	200
Hydrogen sulphide	7.5
Oxides of nitrogen	1000
Fluorine compounds	50
Chlorine and chlorine compounds	200
Total of antimony, arsenic, cadmium, lead, and mercury	10
Arsenic and its compounds	10

Kleinfelder considered an additional source of evaluation criteria which is the emission limits promulgated in the United Kingdom by the Environment Agency Wales in publication LFTGN05 v2 for landfill flares commissioned after 21 December 2003. The limits are shown in **Table** 3.3**.** These limits are promulgated in terms of concentration of the substance in the flare.

Table 3.3: UK Emission Limits

Substance	Emission Limit
Oxides of nitrogen	150 mg/m^3
Carbon monoxide	50 mg/m^3
Total VOCs	10 mg/m^3

In addition to the above numerical limits, Kleinfelder also evaluated the destruction efficiency of the flare by comparing the exhaust emission rate to the inlet emission rate as discussed in Section 3.2 herein. The minimum flare destruction efficiency for methane and VOCs is specified in EPA Victoria Publication 788.3 *Best Practice Environmental Management – Siting, Design, Operation and Rehabilitation of Landfills* (Landfill BPEM). Table 6.4 of the Landfill BPEM outlines the action levels associated with landfill gas in varying forms. The action levels are considered to be an environmental performance objective for the site (i.e., mandatory reporting levels to the EPA Victoria), however it is noted the levels are not considered to be risk based. A summary of the action levels as outlined in Table 6.4 of the Landfill BPEM are provided in **Table 3.4** below.

Table 3.4: Summary of Landfill Gas Trigger Levels

Monitoring Location	Parameter Monitored	Action Level & Units
Landfill surface final cap areas and penetrations through the cover[1].	CH_4 in air[1]	100 ppm
Within 50 mm of penetrations through the final cap.	CH_4 in air[2]	100 ppm
Landfill surface intermediate cover areas[3].	CH_4[1]	200 ppm
Within 50 mm of penetrations through the intermediate cover.	CH_4[2]	1,000 ppm
Subsurface geology at the landfill boundary.	CH_4 & CO_2	1% v/v CH_4 or 1.5% v/v CO_2 above background[5]
Subsurface services on and adjacent to the landfill site.	CH_4	10,000 ppm
Buildings/structures on and adjacent to the landfill site.	CH_4	0.5% v/v CH_4 or 5,000 ppm
Landfill gas flares.	Methane and Volatile Organic Compounds	98% destruction efficiency

Notes:
1. Point of measurement is 50 mm above the landfill surface.
2. Point of measurement is 50 mm from the point of discharge.
3. Intermediate cover areas are those that do not have an engineered landfill cap and are not scheduled to receive waste during the next three months.
4. The above action levels are drawn from the EPA BPEM (EPA, 2015).
5. Kleinfelder note that background levels have not been developed for the site and therefore the applied background level is 1.0% v/v for methane and 1.5% v/v for carbon dioxide.

4. RESULTS AND ANALYSIS

4.1 EMISSION RESULTS

The report of testing results for the Tullamarine flare during the July and August 2016 testing period are included in **Appendix A**. The results are summarized in **Section 2** of the Report and details are provided in **Section 3** of the Report.

Table 4.1 presents a synopsis of the sampling results for the flare. Substances reported in this table are primarily limited to species identified in emission test where the concentration of the substance in the exhaust was greater than the reporting limit. An exception was made for the following species of interest, which are reported at the reporting limit concentration: organochlorine pesticides, hydrogen sulfide, methane, ammonia, total particulate matter, arsenic, and mercury. Detailed sampling results, example calculations, and analytical details for the test program can be found in **Appendix A**.

In keeping with generally accepted international methods for reporting and evaluating the impacts of families of polycyclic aromatic hydrocarbon (PAH), dioxins/furans (PCDD and PCDF), and polychlorinated biphenyls (PCB) the measured concentrations are normalized against a toxicity standard and reported as the sum of the pollutants in terms of toxicity equivalent (BaP TEQ for PAHs, I-TEQ for dioxins/furans, and WHO_{05}-TEQ for PCBs). In adding up these emissions there is the question of how to include the substances that were not found in the sample (i.e., not measured above the method reporting limit or non-detectable). For the purposes of this summary table the Upper Bound concentration is reported, in which the concentration of each non-detect species is set equal to the reporting limit so as to show a calculated highest possible value. Also, the PCDD and PCDF laboratory blank data exhibited concentrations above the detection limit which may further result in artificially elevated reported sample values. This reported value is likely significantly higher than the true total but provides a worst case concentration for the reader.

Dispersion modelling is needed to evaluate the emissions shown in **Table 4.1** compared to the Schedule A ambient concentrations, and this comparison is discussed in the next section of this report. However, the concentrations shown in **Table 4.1** can be directly compared to the emission limit evaluation criteria set out in SEPP (AQM) as shown in **Table 3.2** and the United Kingdom - Environment Agency Wales standards in **Table 3.3.**

Table 4.1: Synopsis of Flare Testing Results

Substance	Flare Exhaust Concentration (mg/m^3)	Flare Exhaust Emission Rate (g/min)	Comments
Class 1 Indicators:			
Carbon monoxide	2.5	0.083	
Nitrogen dioxide	52	1.7	
Sulphur dioxide	6.5	0.22	
Particles as PM_{10}	≤ 5.5	≤ 0.15	Assume all particulate is PM_{10}
Class 2 Indicators			
Acetone	0.014	0.00052	
Ammonia	< 0.08	< 0.003	
Chlorine	0.036	0.0011	
Formaldehyde	0.0045	0.0013	
Hydrogen chloride	2.5	0.075	All chloride assumed HCl
Mercury			
-Organic	<0.0003	<0.000008	Assume all mercury is organic
-Inorganic	-	-	Assume all mercury is organic
Particles as $PM_{2.5}$	≤ 5.5	≤ 0.15	Assume all particulate is $PM_{2.5}$
Sulphuric acid	8.8	0.29	Reported as sulphur trioxide and/or sulphuric acid (as SO_3)
Class 2 Indicators (Odour-based)			
Carbon disulphide	0.0028	0.00011	
Ethanol	0.03	0.0011	
Hydrogen sulfide	< 0.01	< 0.0005	
Methyl ethyl ketone	0.0039	0.00014	
Class 3 Indicators			
Acrolein	0.0085	0.00032	
Arsenic and compounds	< 0.003	< 0.00009	
Benzene	0.0028	0.00011	
Chromium VI Compounds	0.17	0.0047	Assumed all reported chromium is chromium VI
Total PAHs (Upper Bound)	0.03	1.7	BaP TEQ
Total PCDD+PCDFs (Upper Bound)	0.0000066	0.00037	I-TEQ
Additional Compounds of Interest			
Total PCBs (Upper Bound)	0.0000012	0.000064	WHO_{05}-TEQ
Organochlorine pesticides (each)	< 0.00006	< 0.000003	
Heptane	0.0013	0.000049	
Hydrogen fluoride (soluble)	0.27	0.0081	
Methane	< 1	< 0.05	
Propionaldehyde	0.18	0.0053	
Total Organic Carbon (as methane)	<2	< 0.05	

Table 4.2: Flare Testing Results Compared to SEPP (AQM) Schedule D Criteria

Substance	Schedule D Emission Limit in Terms of mg/m^3	Tullamarine Flare Exhaust Concentration (mg/m^3) (from Table 4.1)	Flare Exhaust Exceeds Evaluation Criteria?
Combustion particles	250	≤ 5.5	No
Total particulate matter	500	≤ 5.5	No
Sulphuric acid mist and sulphur	200	8.8	No
Hydrogen sulphide	7.5	< 0.01	No
Oxides of nitrogen	1000	52	No
Fluorine compounds	50	0.27	No
Chlorine and chlorine compounds	200	2.536 (Cl_2 + HCl)	No
Total of antimony, arsenic, cadmium, lead, and mercury	10	<0.0033	No
Arsenic and its compounds	10	< 0.003	No

Table 4.3: Flare Testing Results Compared to UK Emission Limits

Substance	Emission Limit in Terms of mg/m^3	Tullamarine Flare Exhaust Concentration (mg/m^3) (from Table 4.1)	Flare Exhaust Exceeds Evaluation Criteria?
Oxides of nitrogen	150	52	No
Carbon monoxide	50	2.5	No
Total volatile organic compounds (VOC)	10	< 2	No

4.2 AMBIENT AIR IMPACTS

Potential ambient air quality impacts from emissions from the flare were evaluated using the SCREEN3 dispersion model and the emission rates shown in **Table 4.1**. Those compounds that were emitted in concentrations greater than the reporting limit and for which there were promulgated Schedule A concentrations were evaluated.

The SCREEN3 model was initially run with a unit emission rate of 1 gram per minute. The maximum ambient concentration calculated by the SCREEN3 model (which is a 1-hour average) was then multiplied by the actual emission rate from the flare to estimate a maximum ambient 1-hour average concentration of the compound. The input and output SCREEN3 report is shown in **Appendix B**.

For an emission rate of 1 gram per minute, the maximum ambient 1-hour concentration calculated by SCREEN3 was 0.5179 ug/m^3 at a distance of 235 metres from the flare.

Accordingly, the 1-hour concentration for compounds emitted from the flare is calculated as follows, using carbon monoxide as an example:

> 0.083 g/min carbon monoxide x 0.5179 ug/m^3 modelled 1-hour concentration / 1 g/min unit emission rate = 0.043 ug/m^3 maximum ambient 1-hour carbon monoxide concentration.

To calculate 3-minute average concentrations, the 1-hour concentrations were adjusted using Equation 2 in Section 3.3 of this report. An example is shown for benzene:

> 0.00011 g/min benzene x 0.5179 ug/m^3 modelled 1-hour concentration / 1 g/min unit emission rate = 0.000057 ug/m^3 maximum ambient 1-hour benzene concentration.
>
> 0.000057 ug/m^3 maximum ambient 1-hour benzene concentration x (60 minutes / 3 minutes)$^{0.2}$ = 0.000057 ug/m^3 x 1.82 = 0.00010 ug/m^3 3-minute benzene concentration.

The results of the assessment are shown in **Table 4.4.** Note that the Schedule A design criteria are expressed in terms of mg/m^3 as shown in **Table 4.1.** However, the modelled concentrations are expressed in terms of micrograms per cubic metre (ug/m^3). Accordingly, the Schedule A criteria have been converted to ug/m^3 to allow for the comparison to modelled concentrations.

Table 4.4: Potential Ambient Air Concentrations Resulting from the Tullamarine Flare Compared to Schedule A Criteria for Compounds Emitted Above Laboratory Reporting Limit

Substance	Flare Emission Rate (g/min)	Design Criteria Averaging Time	Design Criteria Toxicity and Odour (ug/m^3)	Modelled Ambient Concentration (ug/m^3)	Modelled Concentration Exceeds Toxicity or Odour Design Criteria?
Class 1 Indicators:					
Carbon monoxide	0.083	1-hour	29000	0.043	No
Nitrogen dioxide	1.7	1-hour	190	0.88	No
Sulphur dioxide	0.22	1-hour	450	0.11	No
Particles as PM_{10}	≤ 0.15	1-hour	80	< 0.078	No
Class 2 Indicators					
Acetone	0.00052	3-minute	40000	0.00049	No
Ammonia	< 0.003	3-minute	600	< 0.0028	No
Chlorine	0.0011	3-minute	100	0.0010	No
Formaldehyde	0.0013	3-minute	40	0.0012	No
Hydrogen chloride	0.075	3-minute	250	0.071	No
Mercury					
-Organic	<0.000008	3-minute	0.33	< 0.0000075	No
-Inorganic	-	3-minute	3.3	-	-
Particles as $PM_{2.5}$	≤ 0.15	1-hour	50	< 0.078	No
Sulphuric acid	0.29	3-minute	3.3	0.27	No

Substance	Flare Emission Rate (g/min)	Design Criteria Averaging Time	Design Criteria Toxicity and Odour (ug/m^3)	Modelled Ambient Concentration (ug/m^3)	Modelled Concentration Exceeds Toxicity or Odour Design Criteria?
Class 2 Indicators (Odour-based)					
Carbon disulphide	0.00011	3-minute	1010 and	0.00010	No
Ethanol	0.0011	3-minute	62700	0.00104	No
Hydrogen sulfide	< 0.0005	3-minute	470 and	< 0.00047	No
Methyl ethyl ketone	0.00014	3-minute	16000	0.00013	No
Class 3 Indicators					
Acrolein	0.00032	3-minute	0.77	0.00030	No
Arsenic and compounds	< 0.00009	3-minute	0.17	< 0.000085	No
Benzene	0.00011	3-minute	53	0.00010	No
Chromium VI compounds	0.0047	3-minute	0.17	0.0044	No
PAH (as BaP)	1.7	3-minute	0.73	0.0000016	No
Total PCDD + PCDF*	0.00037	3-minute	3.7×10^{-9}	3.5×10^{-10}	No

Notes:

* PCDD and PCDF are total dioxin and furans expressed in terms of I-TEQ.

The modelled concentrations in **Table 4.5** were calculated for the maximum impact point, which was 235 metres from the flare. However, as shown in **Table 4.6** , the closest receptors and/or sensitive land uses to the site are at a greater distance than 235 metres.

Table 4.5: Receptors Closest to the Site

Receptor	Type	Approximate Location	Comment
Melbourne Airport	Industrial receptor	1,300 metres west of flare location	Airport and associated facilities; closest receptor to the west; parking area to the south of flare
Residential	Sensitive receptor	700 m east of flare location	Closest receptor to the east

4.3 DESTRUCTION EFFICIENCY OF THE FLARE

In addition to assessing potential emissions from the flare with respect to the various evaluation criteria, the destruction efficiency of the flare for all of the compounds that have a Schedule A criteria and that were detected at levels greater than the reporting limit was calculated using Equation 1 in **Section 3.2** of this report. The results of the destruction efficiency calculations are shown in **Table 4.6**. The results are compared to the necessary flare destruction efficiency for methane and VOCs as set out in the Landfill BPEM.

Table 4.6: Destruction Efficiency for the Tullamarine Flare

Analyte	Flare Outlet Emission Rate (g/min)	Flare Inlet Feed Rate (g/min)	Destruction Efficiency
Hydrogen sulfide	<0.0005	0.013	>96.15%
Acrolein	0.00032	<0.00013	NC
Acetone	0.00052	0.0037	85.95%
Ethanol	0.0011	0.0011	0%*
Carbon disulphide	0.00011	0.00081	86.42%
2-Butanone (MEK)	0.00014	0.0022	93.64%
Benzene	0.00011	0.23	99.95%
Heptane	0.000049	0.095	99.95%
Methane	<0.05	1100	99.995%
Average VOC (mass weighted)	-	-	99.9%

Notes:

NC = efficiency not calculated as the outlet concertation reported is higher than the inlet concertation reported. As shown above, screening at this outlet concentration was found to not be above the AQM thresholds.

***** *Ethanol was reported to have the same concentration at the outlet as the inlet. Ethanol is not expected to survive the flare and therefore this appears to be a result of laboratory operations and is not considered to be accurate data.*

5. CONCLUSIONS

Modelling of the flare emissions provides conservative ambient air concentrations using worst case conditions, which are unlikely to occur. The modelled concentrations were calculated for the maximum impact point, which was determined to be 235 metres from the flare. At this distance, the modelling showed no exceedance of the toxicity or odour design conditions for the analytes measured. Also, the nearest receptor point (residences to the east) are approximate three times the distance from the maximum impact point, meaning that concentrations encountered by actual receptors will be many times below the predicted emissions.

The flare testing demonstrated that the potential emissions from the flare and the potential ambient air quality impact of those emissions are all less than the SEPP (AQM), SEPP (AAQ), and the other evaluation criteria. The testing shows that the flare exceeded the 98% necessary flare destruction efficiency for methane and VOCs as established in the Landfill BPEM. This result is due to the relatively high destruction efficiency of the flare that averages over 99.9 percent on a VOC mass-weighted average basis. Methane destruction is over 99.995 percent.

APPENDIX A: FLARE TESTING REPORT

Ektimo

Address (Head Office)
427 Canterbury Road
SURREY HILLS VIC 3127

Postal Address
Unit 13, 9 Ambitious Link
BIBRA LAKE WA 6163

Office Locations
VIC NSW WA QLD

Freecall: 1300 364 005
www.ektimo.com.au
ABN: 86 600 381 413

Report Number R002960r

Emission Testing - Flare Stack
Cleanaway Landfills Ltd, Tullamarine
July-August 2016

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Attention:	Kieren McDermott
Address:	Western Avenue TULLAMARINE VIC 3043
Testing Laboratory:	Ektimo (EML) ABN 98 006 878 342

Report Status

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R002960r	Client (DCo)	17/11/16	2 (result summary)	Reference to 2015 results removed

Report Authorisation

Zac Xavier
Ektimo Signatory

NATA Accredited Laboratory
No. 2732

Greg Sceneay
Client Manager

Accredited for compliance with ISO/IEC 17025. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports

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1 EXECUTIVE SUMMARY

Ektimo was engaged by Transpacific Cleanaway Landfills Ltd (Tullamarine) to perform full scope emissions testing on the Enclosed Flare exhaust and to determine the Destruction and Removal Efficiency (DRE) of methane, other volatile organic compounds (VOCs) and reduced sulfur compounds. Flare DRE was calculated for each species of VOC and reduced sulfur compound that are observed above detection limit at the inlet.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Enclosed Flare Outlet	12 July 2016	Dioxins and furans (PCDD & PCDF), "dioxin like" polychlorinated biphenyls (PCBs) polycyclic aromatic hydrocarbons (PAHs), organochlorine (OC) pesticides
	9 August 2016	NMI TO-15 speciated volatile organic compounds and reduced sulfur gases, C_1-C_4 hydrocarbons (includes calculation of DRE[1] for SVOCs, reduced sulfur gases, C_1-C_4 hydrocarbons)
	10 August 2016	Halides, halogens, ammonia, sulfuric acid, sulfur dioxide, sulfur trioxide, nitrogen oxides, carbon dioxide, carbon monoxide, oxygen and total organic compounds
	11 August 2016	Total particulate matter, metals (arsenic, chromium, mercury), amines and aldehydes
Flare Inlet	9 August 2016	NMI TO-15 speciated volatile organic compounds and reduced sulfur gases, C_1-C_4 hydrocarbons (includes calculation of DRE[1] for SVOCs, reduced sulfur gases, C_1-C_4 hydrocarbons)

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated

1. Plant flow data was used to calculate inlet mass rate and DRE.

The methodologies chosen by Ektimo are those recommended by the Victorian Environment Protection Authority (as specified in A Guide to Sampling and Analysis of Air Emissions and Air Quality, December 2002).

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 RESULTS SUMMARY

The following table summarises testing performed for the Enclosed Flare exhaust in 2016. All concentrations are reported on a dry basis at STP, (0°C, 101.325 kPa).

Flare Stack Test 1 and 2 average	2016 Report R002960	
	Average	
	Concentration	Mass Rate
	ng/m^3	ng/min
Dioxins & Furans (Lower Bound)	0.005	0.28
PAHs (Upper Bound)	30	1700
	mg/m^3	g/min
OC Pesticides (Individual)	<0.00006	<0.000003
Nitrogen oxides (as NO_2)	52	1.7
Carbon monoxide	2.5	0.083
Carbon dioxide	6.4%	
Oxygen	11.4%	
Total particulate matter	≤5.5	≤0.15
Hydrogen fluoride (Soluble)	0.27	0.0081
Chloride (as HCl)	2.5	0.075
Chlorine	0.036	0.0011
Ammonia	<0.08	<0.003
Formaldehyde	0.0045	0.0013
Acetaldehyde	<3	<0.09
Acrolein	<0.03	<0.0009
Propionaldehyde	0.18	0.0053
n-Butraldehyde	<0.03	<0.0009
Valeraldehyde	<0.03	<0.0009
Hexanal	<0.03	<0.0009
Amines (n-Butylamine)	<0.8	<0.02
Arsenic	<0.003	<0.00009
Chromium	0.17	0.0047
Mercury	<0.0003	<0.000008
Sulfur trioxide and/or sulfuric acid (as SO_3)	8.8	0.29
Sulfur dioxide	6.5	0.22
Methane	<1	<0.05
Hydrogen sulfide (Summa Canister)	<0.01	<0.0005

The following table summarises testing performed (volatile hydrocarbons only) for the Enclosed Flare exhaust performed in 2016. All concentrations are reported on a dry basis at STP, (0°C, 101.325 kPa).

Flare Stack Average Outlet TO-15 VOCs (Summa Canister)	2016 Report R002960	
	Average	
	Concentration mg/m³	Mass Rate g/min
Propene	<0.0004	<0.00001
Dichlorodifluoromethane	<0.001	<0.00004
Chloromethane	<0.001	<0.00004
1,2-Dichlorotetrafluoroethane	<0.002	<0.00006
Vinyl chloride	<0.0006	<0.00002
1,3-Butadiene	<0.0005	<0.00002
Bromomethane	<0.01	<0.0004
Chloroethane	<0.0006	<0.00002
Acrolein	0.0085	0.00032
Acetone	0.014	0.00052
Ethanol	0.03	0.0011
2-Propanol	≤0.0035	≤0.00013
Trichlorofluoromethane	<0.001	<0.00005
1,1-Dichloroethene	<0.0009	<0.00003
Dichloromethane	<0.002	<0.00007
1,1,2-Trichloro-1,2,2 trifluoroethane	<0.002	<0.00006
Carbon disulfide	0.0028	0.00011
trans-1,2-Dichloroethene	<0.0009	<0.00003
1,1-Dichloroethane	<0.0009	<0.00003
Methyl-tert-butylether (MTBE)	<0.0008	<0.00003
Vinyl acetate	<0.0008	<0.00003
2-Butanone (MEK)	0.0039	0.00014
cis-1,2-Dichloroethene	<0.0009	<0.00003
Hexane	≤0.00085	≤0.000032
Chloroform	<0.001	<0.00004
Ethyl Acetate	<0.0008	<0.00003
Tetrahydrofuran	≤0.00071	≤0.000027
1,2-Dichloroethane	<0.0009	<0.00003
1,1,1-Trichloroethane	<0.001	<0.00004
Benzene	0.0028	0.00011
Carbon tetrachloride	<0.001	<0.00005
Cyclohexane	≤0.0011	≤0.000041
1,2-Dichloropropane	<0.001	<0.00004
Bromodichloromethane	<0.001	<0.00005
Trichloroethene	<0.001	<0.00004
1,4-Dioxane	<0.0008	<0.00003
Heptane	0.0013	0.000049
Methyl methacrylate	<0.0009	<0.00003
cis-1,3-Dichloropropene	<0.001	<0.00004
4-Methyl-2-pentanone (MIBK)	<0.0009	<0.00003
trans-1,3-Dichloropropene	<0.001	<0.00004
1,1,2-Trichloroethane	<0.001	<0.00004
Toluene	≤0.0029	≤0.00011
2-Hexanone (MBK)	<0.0009	<0.00003
Dibromochloromethane	<0.002	<0.00007
1,2-Dibromoethane	<0.002	<0.00006
Tetrachloroethylene	<0.001	<0.00006
Chlorobenzene	<0.001	<0.00004
Ethylbenzene	<0.0009	<0.00004
Bromoform	<0.002	<0.00008
m & p-Xylenes	<0.002	<0.00009
Styrene	<0.002	<0.00008
1,1,2,2-Tetrachloroethane	<0.001	<0.00006
o-Xylene	<0.0009	<0.00004
4-Ethyltoluene	<0.001	<0.00004
1,3,5-Trimethylbenzene	<0.001	<0.00004
1,2,4-Trimethylbenzene	<0.001	<0.00004
Benzyl Chloride	<0.001	<0.00004
1,3-Dichlorobenzene	<0.001	<0.00005
1,4-Dichlorobenzene	<0.001	<0.00005
1,2-Dichlorobenzene	<0.001	<0.00005
1,2,4-Trichlorobenzene	<0.002	<0.00008
Hexachlorobutadiene	<0.002	<0.00009
Naphthalene	<0.001	<0.00005

3 RESULTS

3.1 Flare Outlet (12/7/16)

Date	12-07-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 61.5% / Flow 174 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	9.3	
Gas molecular weight, g/g mole	28.5 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.32 (dry)
	Test 1	Test 2
Gas Flow Parameters		
Measurement time (hhmm)	1001	1001
Temperature, °C	991	991
Velocity at sampling plane, m/s	9.6	9.6
Velocity at exit plane, m/s	9.6	9.6
Volumetric flow rate, discharge, m³/min	290	290
Volumetric flow rate (wet STP), m³/min	62	62
Volumetric flow rate (dry STP), m³/min	56	56
Mass flow rate (wet basis), kg/hour	4700	4700
	Test 1	Test 2
Isokinetic Sampling Parameters		
Sampling time, min	120	120
Isokinetic rate, %	109	104
Velocity difference, %	<1	<1

OC Pesticides	Average		Test 1		Test 2	
Sampling time			1037-1239		1037-1239	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
HCB	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Heptachlor	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Heptachlor expoxide	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Aldrin	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
gamma-BHC (Lindane)	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
alpha-BHC	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
beta-BHC	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
delta-BHC	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
trans-Chlordane	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
cis-Chlordane	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Oxychlordane	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Dieldrin	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
pp-DDE	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
pp-DDD	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
pp-DDT	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Endrin	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Endrin Aldehyde	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Endrin Ketone	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
alpha-Endosulfan	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
beta-Endosulfan	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Endosulfan Sulfate	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003
Methoxychlor	<0.00006	<0.000003	<0.00006	<0.000003	<0.00006	<0.000003

Date	12-07-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 61.5% / Flow 174 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Dioxins & Furans	Average		Test 1		Test 2	
Sampling time			1037-1239		1037-1239	
	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min
2,3,7,8-TCDF	0.00055	0.031	0.0008	0.045	0.0003	0.017
2,3,7,8-TCDD	<0.001	<0.07	<0.001	<0.06	<0.001	<0.07
1,2,3,7,8-PeCDF	0.00025	0.014	0.0004	0.022	0.000091	0.0051
2,3,4,7,8-PeCDF	0.0025	0.14	0.0043	0.24	0.00061	0.034
1,2,3,7,8-PeCDD	≤0.001	≤0.056	0.0014	0.079	<0.0006	<0.03
1,2,3,4,7,8-HxCDF	0.00032	0.018	0.00049	0.028	0.00014	0.0078
1,2,3,6,7,8-HxCDF	0.00034	0.019	0.00057	0.032	0.000097	0.0054
2,3,4,6,7,8-HxCDF	≤0.00016	≤0.0091	0.00028	0.016	<0.00004	<0.002
1,2,3,7,8,9-HxCDF	≤0.000047	≤0.0026	0.000063	0.0035	<0.00003	<0.002
1,2,3,4,7,8-HxCDD	≤0.000068	≤0.0038	0.000075	0.0042	<0.00006	<0.003
1,2,3,6,7,8-HxCDD	≤0.000079	≤0.0044	0.000098	0.0055	<0.00006	<0.003
1,2,3,7,8,9-HxCDD	≤0.000068	≤0.0038	0.000075	0.0042	<0.00006	<0.003
1,2,3,4,6,7,8-HpCDF	0.000036	0.002	0.000054	0.003	0.000019	0.0011
1,2,3,4,7,8,9-HpCDF	<0.00001	<0.0008	<0.00001	<0.0006	<0.00002	<0.001
1,2,3,4,6,7,8-HpCDD	0.000031	0.0017	0.000034	0.0019	0.000027	0.0015
OCDF	<0.0000009	<0.00005	<0.0000006	<0.00003	<0.000001	<0.00007
OCDD	0.000016	0.00087	0.00002	0.0011	0.000011	0.00061
Total TCDF isomers	0.079	4.4	0.13	7.1	0.031	1.7
Total TCDD isomers	0.0085	0.47	0.011	0.61	0.0061	0.34
Total PeCDF isomers	0.049	2.7	0.086	4.8	0.011	0.61
Total PeCDD isomers	0.012	0.68	0.02	1.1	0.0048	0.27
Total HxCDF isomers	0.023	1.3	0.039	2.2	0.0067	0.37
Total HxCDD isomers	0.008	0.44	0.013	0.71	0.0033	0.18
Total HpCDF isomers	0.0041	0.23	0.0063	0.35	0.0019	0.11
Total HpCDD isomers	0.0068	0.38	0.0075	0.42	0.0061	0.34
Total PCDD + PCDF's	0.21	11	0.33	18	0.081	4.6
I-TEQ						
Lower Bound	0.005	0.28	0.0087	0.49	0.0013	0.072
Middle Bound	0.0058	0.32	0.0093	0.52	0.0023	0.13
Upper Bound	0.0066	0.37	0.0099	0.55	0.0034	0.19

Date	12-07-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 61.5% / Flow 174 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

PCB's	Average		Test 1		Test 2	
Sampling time			1037-1239		1037-1239	
	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min
PCB 77	0.000014	0.00079	0.000013	0.00071	0.000016	0.00088
PCB 81	0.000002	0.00011	0.0000019	0.00011	0.0000022	0.00012
PCB 126	0.0011	0.059	0.00098	0.055	0.0012	0.064
PCB 169	<0.00003	<0.001	<0.00002	<0.001	<0.00004	<0.002
PCB 105	0.00001	0.00056	0.0000084	0.00047	0.000012	0.00065
PCB 114	0.0000011	0.000062	0.000001	0.000058	0.0000012	0.000067
PCB 118	0.000027	0.0015	0.000023	0.0013	0.000031	0.0017
PCB 123	0.00000039	0.000022	0.00000031	0.000017	0.00000047	0.000026
PCB 156	0.0000018	0.0001	0.0000014	0.000079	0.0000022	0.00012
PCB 157	0.00000044	0.000025	0.00000036	0.00002	0.00000053	0.000029
PCB 167	0.0000019	0.00011	0.0000017	0.000095	0.0000022	0.00012
PCB 189	<0.00000007	<0.000004	<0.00000005	<0.000003	<0.00000009	<0.000005
Total PCB's	1.6	89	1.4	76	1.8	100
Lower Bound	0.0011	0.063	0.001	0.057	0.0012	0.068
Middle Bound	0.0011	0.064	0.001	0.058	0.0012	0.069
Upper Bound	0.0012	0.064	0.001	0.058	0.0013	0.07

PAH's	Average		Test 1		Test 2	
Sampling time			1037-1239		1037-1239	
	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min	Concentration ng/m³	Mass Rate ng/min
Naphthalene	1200	67000	1400	77000	1000	58000
2-Methylnaphthalene	260	15000	280	16000	240	14000
Acenaphthylene	23	1300	25	1400	21	1200
Acenaphthene	15	810	12	670	17	950
Fluorene	71	4000	63	3500	79	4400
Phenanthrene	580	33000	690	39000	480	27000
Anthracene	17	940	17	930	17	950
Fluoranthene	200	11000	180	10000	220	13000
Pyrene	89	5000	75	4200	100	5800
Benz(a)anthracene	22	1200	12	670	32	1800
Chrysene	40	2200	36	2000	43	2400
Benzo(b)fluoranthene	≤25	≤1400	<10	<600	39	2200
Benzo(k)fluoranthene	26	1400	17	930	35	1900
Benzo(e)pyrene	≤12	≤680	<10	<600	13	710
Benzo(a)pyrene	≤13	≤710	<10	<600	14	780
Perylene	<10	<700	<10	<600	<10	<700
Indeno(1,2,3-cd)pyrene	19	1100	16	900	22	1300
Dibenz(ah)anthracene	20	1100	25	1400	16	880
Benzo(ghi)perylene	20	1100	17	930	22	1300
Total 16 PAH's	2400	130000	2600	140000	2200	120000
Total 19 PAH's	2600	150000	2800	160000	2400	140000
BaP-TEQ						
Lower Bound	24	1300	15	820	34	1900
Middle Bound	27	1500	21	1200	34	1900
Upper Bound	30	1700	27	1500	34	1900

3.2 Flare Outlet (9/8/16) – Summa Canister

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 63% / Flow 161 m^3/hr at 15°C and 1 atm. Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satisfactory	

Comments
Mass rate DRE determined from measured (1) inlet and (2) outlet concentrations and measured (3) outlet flow and (4) inlet flow recorded from plant instrumentation. (1) (2) and (3) performed by Ektimo.

Stack Parameters		
Moisture content, %v/v	9	
Gas molecular weight, g/g mole	28.5 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.32 (dry)

Gas Flow Parameters	
Measurement time (hhmm)	1115
Temperature, °C	986
Velocity at sampling plane, m/s	6.3
Velocity at exit plane, m/s	6.3
Volumetric flow rate, discharge, m³/min	190
Volumetric flow rate (wet STP), m³/min	41
Volumetric flow rate (dry STP), m³/min	38
Mass flow rate (wet basis), kg/hour	3100
Velocity difference, %	<1

Reduced Sulfur Gases (Summa Canister)	Average		Test 1		Test 2	
Sampling time			1149-1219		1220-1253	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Hydrogen sulfide	<0.01	<0.0005	<0.01	<0.0005	<0.01	<0.0005
Carbonyl sulfide	<0.01	<0.0004	<0.01	<0.0004	<0.01	<0.0004
Methyl mercaptan	<0.009	<0.0003	<0.009	<0.0003	<0.009	<0.0003
Ethyl mercaptan	<0.01	<0.0004	<0.01	<0.0004	<0.01	<0.0004
Dimethyl sulfide	<0.01	<0.0004	<0.01	<0.0004	<0.01	<0.0004
Isopropyl mercaptan	<0.01	<0.0005	<0.01	<0.0005	<0.01	<0.0005
Propyl mercaptan	<0.01	<0.0005	<0.01	<0.0005	<0.01	<0.0005
Ethyl methyl sulfide	<0.01	<0.0005	<0.01	<0.0005	<0.01	<0.0005
s-Butyl mercaptan	<0.02	<0.0006	<0.02	<0.0006	<0.02	<0.0006
Diethyl sulfide	<0.02	<0.0006	<0.02	<0.0006	<0.02	<0.0006
n-Butyl mercaptan	<0.02	<0.0006	<0.02	<0.0006	<0.02	<0.0006

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 63% / Flow 161 m^3/hr at 15°C and 1 atm. Vacuum -5 kPa				

TO-15 VOCs (Summa Canister)	Average		Test 1		Test 2	
Sampling time			1149-1219		1220-1253	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Propene	<0.0004	<0.00001	<0.0004	<0.00001	<0.0004	<0.00001
Dichlorodifluoromethane	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Chloromethane	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,2-Dichlorotetrafluoroethane	<0.002	<0.00006	<0.002	<0.00006	<0.002	<0.00006
Vinyl chloride	<0.0006	<0.00002	<0.0006	<0.00002	<0.0006	<0.00002
1,3-Butadiene	<0.0005	<0.00002	<0.0005	<0.00002	<0.0005	<0.00002
Bromomethane	<0.01	<0.0004	<0.01	<0.0005	<0.008	<0.0003
Chloroethane	<0.0006	<0.00002	<0.0006	<0.00002	<0.0006	<0.00002
Acrolein	0.0085	0.00032	0.0055	0.00021	0.012	0.00043
Acetone	0.014	0.00052	0.016	0.00061	0.011	0.00042
Ethanol	0.03	0.0011	0.029	0.0011	0.031	0.0012
2-Propanol	≤0.0035	≤0.00013	0.0043	0.00016	<0.003	<0.0001
Trichlorofluoromethane	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
1,1-Dichloroethene	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
Dichloromethane	<0.002	<0.00007	<0.002	<0.00007	<0.002	<0.00007
1,1,2-Trichloro-1,2,2 trifluoroethane	<0.002	<0.00006	<0.002	<0.00006	<0.002	<0.00006
Carbon disulfide	0.0028	0.00011	0.0025	0.000096	0.0031	0.00012
trans-1,2-Dichloroethene	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
1,1-Dichloroethane	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
Methyl-tert-butylether (MTBE)	<0.0008	<0.00003	<0.0008	<0.00003	<0.0008	<0.00003
Vinyl acetate	<0.0008	<0.00003	<0.0008	<0.00003	<0.0008	<0.00003
2-Butanone (MEK)	0.0039	0.00014	0.0045	0.00017	0.0032	0.00012
cis-1,2-Dichloroethene	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
Hexane	≤0.00085	≤0.000032	0.00092	0.000035	<0.0008	<0.00003
Chloroform	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Ethyl Acetate	<0.0008	<0.00003	<0.0008	<0.00003	<0.0008	<0.00003
Tetrahydrofuran	≤0.00071	≤0.000027	0.00077	0.000029	<0.0006	<0.00002
1,2-Dichloroethane	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
1,1,1-Trichloroethane	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Benzene	0.0028	0.00011	0.0022	0.000082	0.0035	0.00013
Carbon tetrachloride	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
Cyclohexane	≤0.0011	≤0.000041	0.0014	0.000054	<0.0008	<0.00003
1,2-Dichloropropane	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Bromodichloromethane	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
Trichloroethene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,4-Dioxane	<0.0008	<0.00003	<0.0008	<0.00003	<0.0008	<0.00003
Heptane	0.0013	0.000049	0.0014	0.000054	0.0012	0.000045
Methyl methacrylate	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
cis-1,3-Dichloropropene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
4-Methyl-2-pentanone (MIBK)	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
trans-1,3-Dichloropropene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,1,2-Trichloroethane	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Toluene	≤0.0029	≤0.00011	0.0041	0.00015	<0.002	<0.00006
2-Hexanone (MBK)	<0.0009	<0.00003	<0.0009	<0.00003	<0.0009	<0.00003
Dibromochloromethane	<0.002	<0.00007	<0.002	<0.00007	<0.002	<0.00007
1,2-Dibromoethane	<0.002	<0.00006	<0.002	<0.00006	<0.002	<0.00006
Tetrachloroethylene	<0.001	<0.00006	<0.001	<0.00006	<0.001	<0.00006
Chlorobenzene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Ethylbenzene	<0.0009	<0.00004	<0.0009	<0.00004	<0.0009	<0.00004
Bromoform	<0.002	<0.00008	<0.002	<0.00008	<0.002	<0.00008
m & p-Xylenes	<0.002	<0.00009	<0.002	<0.00009	<0.002	<0.00009
Styrene	<0.002	<0.00008	<0.002	<0.00009	<0.002	<0.00007
1,1,2,2-Tetrachloroethane	<0.001	<0.00006	<0.001	<0.00006	<0.001	<0.00006
o-Xylene	<0.0009	<0.00004	<0.0009	<0.00004	<0.0009	<0.00004
4-Ethyltoluene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,3,5-Trimethylbenzene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,2,4-Trimethylbenzene	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
Benzyl Chloride	<0.001	<0.00004	<0.001	<0.00004	<0.001	<0.00004
1,3-Dichlorobenzene	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
1,4-Dichlorobenzene	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
1,2-Dichlorobenzene	<0.001	<0.00005	<0.001	<0.00005	<0.001	<0.00005
1,2,4-Trichlorobenzene	<0.002	<0.00008	<0.002	<0.00009	<0.002	<0.00006
Hexachlorobutadiene	<0.002	<0.00009	<0.002	<0.00009	<0.002	<0.00009
Naphthalene	<0.001	<0.00005	<0.001	<0.00004	<0.002	<0.00006

3.3 Flare Inlet (9/8/16) – Summa Canister

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Inlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with Inlet Gas Condition: CH_4 63% / Flow 161 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Comments
Mass rate DRE determined from measured (1) inlet and (2) outlet concentrations and measured (3) outlet flow and (4) inlet flow recorded from plant instrumentation. (1) (2) and (3) performed by Ektimo.

Reduced Sulfur Gases (Summa Canister) Sampling time	Average		Test 1 1152-1222		Test 2 1224-1256		**Destruction Efficiency %**
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	
Hydrogen sulfide	5.3	0.013	4.4	0.011	6.1	0.016	> **96.15** %
Carbonyl sulfide	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
Methyl mercaptan	<0.9	< 0.0023	<0.9	< 0.0023	<0.9	< 0.0023	-
Ethyl mercaptan	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
Dimethyl sulfide	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
Isopropyl mercaptan	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
Propyl mercaptan	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
Ethyl methyl sulfide	<1	< 0.0025	<1	< 0.0025	<1	< 0.0025	-
s-Butyl mercaptan	<2	< 0.0051	<2	< 0.0051	<2	< 0.0051	-
Diethyl sulfide	<2	< 0.0051	<2	< 0.0051	<2	< 0.0051	-
n-Butyl mercaptan	<2	< 0.0051	<2	< 0.0051	<2	< 0.0051	-

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Inlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with Inlet Gas Condition: CH_4 63% / Flow 161 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

TO-15 VOCs (Summa Canister) Sampling time	Average		Test 1 1152-1222		Test 2 1224-1256		**Destruction Efficiency %**
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	
Propene	<0.04	<0.0001	<0.04	<0.0001	<0.04	<0.0001	-
Dichlorodifluoromethane	0.7	0.0018	0.76	0.0019	0.65	0.0017	> **97.78** %
Chloromethane	<0.1	<0.00038	<0.2	<0.00051	<0.1	<0.00025	-
1,2-Dichlorotetrafluoroethane	0.38	0.00095	0.35	0.00089	0.4	0.001	> **93.68** %
Vinyl chloride	11	0.029	11	0.028	12	0.031	> **99.93** %
1,3-Butadiene	<0.05	<0.00013	<0.05	<0.00013	<0.05	<0.00013	-
Bromomethane	<0.8	<0.002	<0.8	<0.002	<0.8	<0.002	-
Chloroethane	1.4	0.0036	1.3	0.0033	1.5	0.0038	> **99.44** %
Acrolein	<0.05	<0.00013	<0.05	<0.00013	<0.05	<0.00013	-
Acetone	1.4	0.0037	1.5	0.0038	1.4	0.0036	**85.95** %
Ethanol	0.44	0.0011	0.43	0.0011	0.45	0.0011	-
2-Propanol	0.71	0.0018	0.7	0.0018	0.72	0.0018	≥ **92.78** %
Trichlorofluoromethane	0.3	0.00076	0.26	0.00066	0.34	0.00086	> **93.42** %
1,1-Dichloroethene	0.091	0.00023	0.087	0.00022	0.095	0.00024	> **86.96** %
Dichloromethane	0.8	0.002	0.76	0.0019	0.83	0.0021	> **96.5** %
1,1,2-Trichloro-1,2,2 trifluoroethane	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
Carbon disulfide	0.32	0.00081	0.3	0.00076	0.34	0.00086	**86.42** %
trans-1,2-Dichloroethene	0.19	0.00048	0.18	0.00046	0.2	0.00051	> **93.75** %
1,1-Dichloroethane	2.8	0.0071	2.6	0.0066	3	0.0076	> **99.58** %
Methyl-tert-butylether (MTBE)	1.8	0.0045	1.6	0.0041	1.9	0.0048	> **99.33** %
Vinyl acetate	<0.08	<0.0002	<0.08	<0.0002	<0.08	<0.0002	-
2-Butanone (MEK)	0.85	0.0022	0.77	0.002	0.93	0.0024	**93.64** %
cis-1,2-Dichloroethene	8.9	0.023	8.1	0.021	9.7	0.025	> **99.87** %
Hexane	40	0.1	36	0.092	43	0.11	≥ **99.97** %
Chloroform	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
Ethyl Acetate	<0.08	<0.0002	<0.08	<0.0002	<0.08	<0.0002	-
Tetrahydrofuran	0.9	0.0023	0.8	0.002	1	0.0025	≥ **98.83** %
1,2-Dichloroethane	<0.09	<0.00023	<0.09	<0.00023	<0.09	<0.00023	-
1,1,1-Trichloroethane	0.14	0.00034	0.13	0.00033	0.14	0.00036	> **88.24** %
Benzene	91	0.23	81	0.21	100	0.25	**99.95** %
Carbon tetrachloride	0.93	0.0023	0.82	0.0021	1	0.0025	> **97.83** %
Cyclohexane	23	0.06	21	0.053	26	0.066	≥ **99.93** %
1,2-Dichloropropane	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
Bromodichloromethane	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
Trichloroethene	1.4	0.0034	1.2	0.0031	1.5	0.0038	> **98.82** %
1,4-Dioxane	<0.08	<0.0002	<0.08	<0.0002	<0.08	<0.0002	-
Heptane	37	0.095	33	0.084	42	0.11	**99.95** %
Methyl methacrylate	<0.09	<0.00023	<0.09	<0.00023	<0.09	<0.00023	-
cis-1,3-Dichloropropene	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
4-Methyl-2-pentanone (MIBK)	1.7	0.0045	1.5	0.0038	2	0.0051	> **99.33** %
trans-1,3-Dichloropropene	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
1,1,2-Trichloroethane	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
Toluene	95	0.24	82	0.21	110	0.28	≥ **99.95** %
2-Hexanone (MBK)	<0.09	<0.00023	<0.09	<0.00023	<0.09	<0.00023	-
Dibromochloromethane	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
1,2-Dibromoethane	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
Tetrachloroethylene	2	0.0052	1.7	0.0043	2.4	0.0061	> **98.85** %
Chlorobenzene	1.6	0.0042	1.4	0.0036	1.9	0.0048	> **99.05** %
Ethylbenzene	97	0.24	79	0.2	110	0.28	> **99.98** %
Bromoform	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
m & p-Xylenes	93	0.24	75	0.19	110	0.28	> **99.96** %
Styrene	2.8	0.0071	2.3	0.0059	3.3	0.0084	> **98.87** %
1,1,2,2-Tetrachloroethane	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
o-Xylene	21	0.055	17	0.043	26	0.066	> **99.93** %
4-Ethyltoluene	2.4	0.0062	1.8	0.0046	3.1	0.0079	> **99.35** %
1,3,5-Trimethylbenzene	3.7	0.0093	2.9	0.0074	4.4	0.011	> **99.57** %
1,2,4-Trimethylbenzene	8.6	0.022	6.5	0.017	11	0.028	> **99.82** %
Benzyl Chloride	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
1,3-Dichlorobenzene	<0.1	<0.00025	<0.1	<0.00025	<0.1	<0.00025	-
1,4-Dichlorobenzene	≤0.69	≤0.0017	<0.5	<0.0013	0.85	0.0022	> **97.06** %
1,2-Dichlorobenzene	<0.3	<0.00064	<0.2	<0.00051	<0.3	<0.00076	-
1,2,4-Trichlorobenzene	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
Hexachlorobutadiene	<0.2	<0.00051	<0.2	<0.00051	<0.2	<0.00051	-
Naphthalene	2.5	0.0065	2.5	0.0064	2.6	0.0066	> **99.23** %

3.4 Flare Outlet (9/8/16)

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 63% / Fow 161 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	9	
Gas molecular weight, g/g mole	28.5 (wet)	29.5 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.32 (dry)
Gas Flow Parameters		
Measurement time (hhmm)	1115	
Temperature, °C	986	
Velocity at sampling plane, m/s	6.3	
Velocity at exit plane, m/s	6.3	
Volumetric flow rate, discharge, m³/min	190	
Volumetric flow rate (wet STP), m³/min	41	
Volumetric flow rate (dry STP), m³/min	38	
Mass flow rate (wet basis), kg/hour	3100	
Velocity difference, %	<1	

Total Speciated VOCs	Average		Test 1		Test 2	
Sampling time			1254-1320		1323-1338	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Gas Bags	<3	<0.1	<3	<0.1	<3	<0.1

VOC's C_1-C_4	Average		Test 1		Test 2	
Sampling time			1126-1136		1136-1146	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Methane	<1	<0.05	<1	<0.05	<1	<0.05
Ethane	<1	<0.05	<1	<0.05	<1	<0.05
Ethylene	<1	<0.05	<1	<0.05	<1	<0.05
Acetylene	<1	<0.04	<1	<0.04	<1	<0.04
Propane	<2	<0.07	<2	<0.07	<2	<0.07
Propylene	<2	<0.07	<2	<0.07	<2	<0.07
Cyclopropane	<2	<0.07	<2	<0.07	<2	<0.07
Isobutane	<3	<0.1	<3	<0.1	<3	<0.1
n-Butane	<3	<0.1	<3	<0.1	<3	<0.1
Propadiene	<2	<0.07	<2	<0.07	<2	<0.07
1-Butene	<3	<0.09	<3	<0.09	<3	<0.09
Propyne	<2	<0.07	<2	<0.07	<2	<0.07
trans-2-Butene	<3	<0.09	<3	<0.09	<3	<0.09
1,3-Butadiene	<2	<0.09	<2	<0.09	<2	<0.09
cis-2-Butene	<3	<0.09	<3	<0.09	<3	<0.09

3.5 Flare Inlet (9/8/16)

Date	9-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Inlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 63% / Flow 161 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Comments
Concentrations only
Mass rate DRE determined from measured (1) inlet and (2) outlet concentrations and measured (3) outlet flow and (4) inlet flow recorded from plant instrumentation. (1) (2) and (3) performed by Ektimo.

Total Speciated VOCs	Average	Test 1	Test 2
Sampling time		1259-1315	1319-1334
	Concentration mg/m³	Concentration mg/m³	Concentration mg/m³
Gas Bags	420000	420000	420000

VOC's C_1-C_4	Average			Test 1			Test 2			Destruction Efficiency %		
Sampling time				1125-1135			1135-1145					
	Concentration mg/m³		Mass Rate g/min	Concentration mg/m³		Mass Rate g/min	Concentration mg/m³		Mass Rate g/min			
Methane	420000		1100	420000		1100	420000		1100	>	**99.995**	%
Ethane	230		0.59	230		0.59	230		0.59	>	**91.463**	%
Ethylene	27		0.067	28		0.071	25		0.064	>	**29.94**	%
Acetylene	<1	<	0.0025	<1	<	0.0025	<1	<	0.0025		-	
Propane	28		0.071	28		0.071	28		0.071		-	
Propylene	<2	<	0.0051	<2	<	0.0051	<2	<	0.0051		-	
Cyclopropane	20		0.051	20		0.051	20		0.051		-	
Isobutane	<3	<	0.0076	<3	<	0.0076	<3	<	0.0076		-	
n-Butane	9.6		0.025	9.9		0.025	9.4		0.024		-	
Propadiene	16		0.042	17		0.043	16		0.041		-	
1-Butene	<3	<	0.0076	<3	<	0.0076	<3	<	0.0076		-	
Propyne	<2	<	0.0051	<2	<	0.0051	<2	<	0.0051		-	
trans-2-Butene	<3	<	0.0076	<3	<	0.0076	<3	<	0.0076		-	
1,3-Butadiene	24		0.062	25		0.064	24		0.061		-	
cis-2-Butene	<3	<	0.0076	<3	<	0.0076	<3	<	0.0076		-	

3.6 Flare Outlet (10/8/16)

Date	10-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 59.5% / Flow 154 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	8.6	
Gas molecular weight, g/g mole	28.6 (wet)	29.6 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.32 (dry)
	Test 1	Test 2
Gas Flow Parameters		
Measurement time (hhmm)	0945	0945
Temperature, °C	1030	1030
Velocity at sampling plane, m/s	5.2	5.2
Velocity at exit plane, m/s	5.2	5.2
Volumetric flow rate, discharge, m³/min	160	160
Volumetric flow rate (wet STP), m³/min	33	33
Volumetric flow rate (dry STP), m³/min	30	30
Mass flow rate (wet basis), kg/hour	2500	2500
	Test 1	Test 2
Isokinetic Sampling Parameters		
Sampling time, min	120	120
Isokinetic rate, %	102	103
Velocity difference, %	3	3

Isokinetic Results	Average		Test 1		Test 2	
Sampling time			1005-1207		1005-1207	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Chloride (as HCl)	2.5	0.075	2.3	0.07	2.6	0.079
Chlorine	0.036	0.0011	0.037	0.0011	0.035	0.0011
Hydrogen fluoride (soluble)	0.27	0.0081	0.24	0.0073	0.29	0.0088

Ammonia	Average		Test 1		Test 2	
Sampling time			1026-1100		1107-1147	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Ammonia	<0.08	<0.003	<0.09	<0.003	<0.08	<0.002

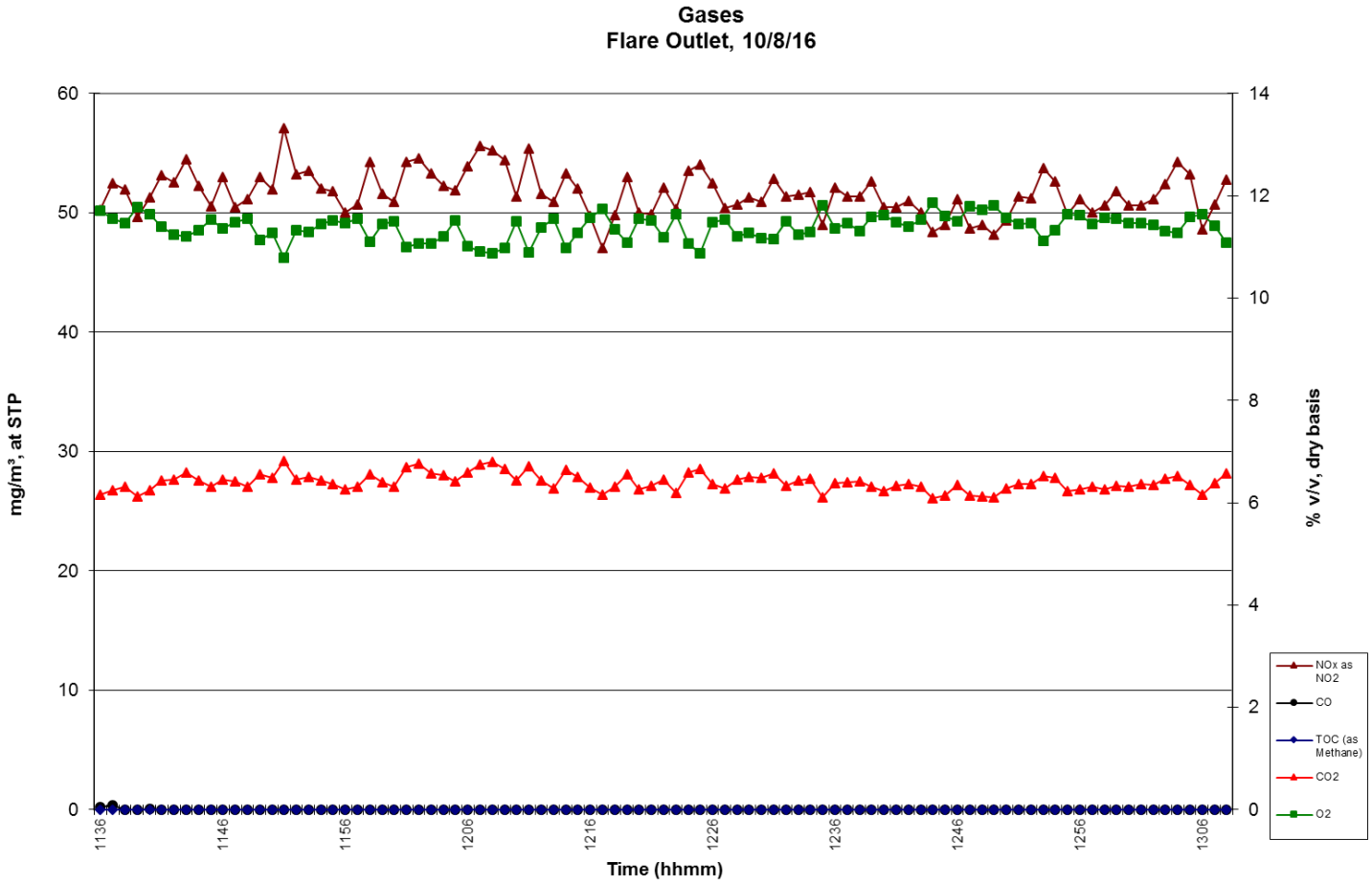
Date	10-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 59.5% / Flow 154 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satisfactory	

Stack Parameters		
Moisture content, %v/v	8.6	
Gas molecular weight, g/g mole	28.6 (wet)	29.6 (dry)
Gas density at STP, kg/m³	1.28 (wet)	1.32 (dry)
	Test 1	Test 2
Gas Flow Parameters		
Measurement time (hhmm)	1145	1145
Temperature, °C	1027	1027
Velocity at sampling plane, m/s	5.8	5.8
Velocity at exit plane, m/s	5.8	5.7
Volumetric flow rate, discharge, m³/min	170	170
Volumetric flow rate (wet STP), m³/min	36	36
Volumetric flow rate (dry STP), m³/min	33	33
Mass flow rate (wet basis), kg/hour	2800	2800
	Test 1	Test 2
Isokinetic Sampling Parameters		
Sampling time, min	96	96
Isokinetic rate, %	100	100
Velocity difference, %	15	15

Isokinetic Results	Average		Test 1		Test 2	
Sampling time			1231-1410		1231-1410	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Sulfur dioxide	6.5	0.22	6.6	0.22	6.5	0.21
Sulfur trioxide and/or Sulfuric acid (as SO3)	8.8	0.29	7.2	0.24	10	0.34

Gases	Average		Minimum		Maximum	
Sampling time	1136-1308		1136-1308		1136-1308	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Nitrogen oxides (as NO_2)	52	1.7	47	1.6	57	1.9
Carbon monoxide	2.5	0.083	2.5	0.083	2.5	0.083
TOC (as Methane)	<2	<0.05	<2	<0.05	<2	<0.05
	Concentration %		Concentration %		Concentration %	
Carbon dioxide	6.4		6.1		6.8	
Oxygen	11.4		10.8		11.9	


Gases
Flare Outlet, 10/8/16
mg/m³, at STP
% v/v, dry basis
Time (hhmm)
60
50
40
30
20
10
0
14
12
10
8
6
4
2
0
1136
1146
1156
1206
1216
1226
1236
1246
1256
1306
NOx as NO2
CO
TOC (as Methane)
CO2
O2

3.7 Flare Outlet (11/8/16)

Date	11-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 52% / Flow 147 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Sampling Plane Details		
Sampling plane dimensions	800 mm	
Sampling plane area	0.503 m²	
Exit plane dimensions	800	
Exit plane area	0.503 m²	
Sampling port size, number & depth	4" Flange (x2), 300 mm	
Access & height of ports	Fixed ladder	8 m
Duct orientation & shape	Vertical	Circular
Downstream disturbance	Exit	2 D
Upstream disturbance	Connection	6 D
No. traverses & points sampled	2	12
Compliance of sample plane to AS4323.1	Satsifactory	

Stack Parameters		
Moisture content, %v/v	8.6	
Gas molecular weight, g/g mole	28.4 (wet)	29.4 (dry)
Gas density at STP, kg/m³	1.27 (wet)	1.31 (dry)
	Test 1	Test 2
Gas Flow Parameters		
Measurement time (hhmm)	1005	1005
Temperature, °C	1034	1034
Velocity at sampling plane, m/s	4.6	5.2
Velocity at exit plane, m/s	4.6	5.2
Volumetric flow rate, discharge, m³/min	140	160
Volumetric flow rate (wet STP), m³/min	29	33
Volumetric flow rate (dry STP), m³/min	27	30
Mass flow rate (wet basis), kg/hour	2200	2500
	Test 1	Test 2
Isokinetic Sampling Parameters		
Sampling time, min	120	120
Isokinetic rate, %	101	100
Velocity difference, %	19	-5

Date	11-08-2016	**Client**	Cleanaway Landfills		
Report	R002960	**Stack ID**	Flare Outlet		
Licence No.	-	**Location**	Tullamarine	**State**	VIC
Ektimo Staff	Justin Snell, Greg Sceneay				
Process Conditions	Normal operation with inlet gas conditions: CH_4 52% / Flow 147 m^3/hr at 15°C and 1 atm Vacuum -5 kPa				

Isokinetic Results	Average		Test 1		Test 2	
Sampling time			1029-1232		1029-1232	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Total particulate matter	≤5.5	≤0.15	8.4	0.23	<3	<0.08
Arsenic	<0.003	<0.00009	<0.003	<0.00009	<0.003	<0.00008
Chromium	0.17	0.0047	0.31	0.0084	0.032	0.00097
Mercury	<0.0003	<0.000008	<0.0003	<0.000008	<0.0002	<0.000007

Aldehydes	Average		Test 1		Test 2	
Sampling time			1026-1103		1108-1140	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Acetaldehyde	<3	<0.09	<3	<0.08	<3	<0.1
Acrolein	<0.03	<0.0009	<0.03	<0.0008	<0.03	<0.001
n-Butyraldehyde	<0.03	<0.0009	<0.03	<0.0008	<0.03	<0.001
Formaldehyde	0.045	0.0013	0.038	0.0011	0.052	0.0015
Hexanal	<0.03	<0.0009	<0.03	<0.0008	<0.03	<0.001
Propionaldehyde	0.18	0.0053	0.16	0.0046	0.21	0.006
Valeraldehyde	<0.03	<0.0009	<0.03	<0.0008	<0.03	<0.001

Amines	Average		Test 1		Test 2	
Sampling time			1146-1215		1219-1253	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
n-Butylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Cyclohexylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Dibutylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Diethylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Dimethylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Dipropylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
n-Heptylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
n-Hexylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Methylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
Monoisopropylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02
n-Propylamine	<0.8	<0.02	<0.9	<0.02	<0.7	<0.02

4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Cleanaway Landfills Ltd (Tullamarine)'s records for complete process conditions.

5 TEST METHODS

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Method Detection Limit	Uncertainty*	NATA Accredited	
					Sampling	Analysis
Sample plane criteria	AS 4323.1	NA	-	-	✓	NA
Moisture	USEPA Alt-008	USEPA Alt-008	1.0%	19%	✓	✓
Moisture	USEPA 4	USEPA 4	0.4%	8%	✓	✓
Temperature	Ektimo (EML Air) 100	NA	0°C	2%	✓	NA
Flow rate	Ektimo (EML Air) 100	NA	Location specific	8%	✓	NA
Velocity	Ektimo (EML Air) 100	NA	2 m/s	7%	✓	NA
Total particulate matter	AS 4323.2	AS 4323.2	1 mg/m³	5%	✓	✓
Total (gaseous and particulate) metals	Ektimo (EML Air) 280	Envirolab inhouse	Analyte specific	15%	✓	✓[1]
Ammonia and ammonium compounds	Ektimo (EML Air) 260	Envirolab inhouse	0.4 mg/m³	18%	✓	✓[1]
Polychlorinated biphenyls (PCB's)	USEPA SW-846 0023A	NMI AUTL_02	0.003 - 0.02 ng/m³	16%	✓	✓[2]
Dioxins and furans (PCDD's and PCDF's)	USEPA 0023A	NMI AUTL_02	0.0005 - 0.003 ng/m³	16%	✓	✓[2]
Polycyclic aromatic hydrocarbons (PAH's)	USEPA SW-846 0010	NGCMS 11.27	10 - 60 ng/m³	21%	✓	✓[3]
Organochlorine (OC) pesticides	USEPA 0010	NMI NR_19	0.05 µg/m³	not specified	×	✓[4]
Sulfur trioxide and/or sulfuric acid mists and sulfur dioxide	USEPA 8	Ektimo (EML Air) 235	0.02 mg/m³	16%	✓	✓
Hydrogen halide and halogen emissions	USEPA 26A	Ektimo (EML Air) 235	0.02 mg/m³	14%	✓	✓
Carbon monoxide	Ektimo (EML Air) 200	Ektimo (EML Air) 200	3 mg/m³	12%	✓	✓
Carbon dioxide	Ektimo (EML Air) 200	Ektimo (EML Air) 200	0.1%	13%	✓	✓
C_1-C_4 Hydrocarbons	Ektimo (EML Air) 340	Ektimo (EML Air) 340	1 - 2 ppm v/v	19%	✓	✓
Speciated volatile organic compounds[(NMI)]	Method TO-15	NMI VOC_01	0.5 - 1 ppb v/v	not specified	×	✓[5]
Aldehydes	Ektimo (EML Air) 330	Ektimo (EML Air) 330	0.007 mg/m³	16%	✓	✓
Amines	Ektimo (EML Air) 370	SGS inhouse	Analyte specific	not specified	✓	✓[6]
Reduced sulfur gases[(NMI)]	Method TO-15	NMI VOC_04	2 - 5 ppb v/v	not specified	×	×[7]
Nitrogen oxides	USEPA 7E	USEPA 7E	4 mg/m³	12%	✓	✓
Oxygen	USEPA 3A	USEPA 3A	0.1%	13%	✓	✓
Total organic compounds as methane	USEPA 25A	USEPA 25A	1 mg/m³	not specified	✓	✓

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

1. Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 24 August 2016 in report number 152045
2. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 25 October 2016 in report number # DAU16_167A
3. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 18 August 2016 in report number # ORG16_051
4. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 19 August 2016 in report number RN1126420
5. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 25 August 2016 in report number VOC16_104
6. Analysis performed by SGS Australia, NATA accreditation number 2562. Results were reported to Ektimo on 16 September 2016 in report number M161743
7. Analysis performed by Australian Government National Measurement Institute, NATA accreditation number 198. Results were reported to Ektimo on 25 August 2016 in report number VOC16_107

6 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

7 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D_{50}	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DER	WA Department of Environment & Regulation
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry

8 APPENDIX 1. NMI RESULTS

Dioxins & Furans (PCDD & PCDF) and polychlorinated biphenyls (PCBs) Report. # DAU16_167

Sample Identification	*NMI Lab Ref*	*Sample Location*	*Date of Test*
DAU300616A	N16/020291X	Flare Stack Test 1	12 July 2016
DAU300616B	N16/020292X	Flare Stack Test 2	12 July 2016

Polycyclic Aromatic Hydrocarbons (PAHs) Report. # ORG16_051

Sample Identification	*NMI Lab Ref*	*Sample Location*	*Date of Test*
DAU300616A	N16/020291	Flare Stack Test 1	12 July 2016
DAU300616B	N16/020292	Flare Stack Test 2	12 July 2016

Organochlorine (OC) Pesticides Report. RN1126420

Sample Identification	*NMI Lab Ref*	*Sample Location*	*Date of Test*
DAU300616A	N16/020291	*Flare Stack Test 1*	*12 July 2016*
DAU300616B	N16/020292	*Flare Stack Test 2*	*12 July 2016*

Sulfur Gases Report. VOC16_107

Sample Identification	*NMI Lab Ref*	*Sample Location*	*Date of Test*
V11776	NV16/00285/1	*Flare Inlet Test 1*	*9 August 2016*
V11777	NV16/00286/1	*Flare Inlet Test 2*	*9 August 2016*
V11778	NV16/00287/1	*Flare Stack Test 1*	*9 August 2016*
V11779	NV16/00288/1	*Flare Stack Test 2*	*9 August 2016*

T015 VOCs Report. VOC16_104

Sample Identification	*NMI Lab Ref*	*Sample Location*	*Date of Test*
V11776	NV16/00285	*Flare Inlet Test 1*	*9 August 2016*
V11777	NV16/00286	*Flare Inlet Test 2*	*9 August 2016*
V11778	NV16/00287	*Flare Stack Test 1*	*9 August 2016*
V11779	NV16/00288	*Flare Stack Test 2*	*9 August 2016*

Australian Government
National Measurement Institute

CERTIFICATE OF ANALYSIS # DAU16_167A

Client	Ektimo Pty. Ltd. Unit 2, 160 New Street Ringwood VIC 3134	**Job No.**	EKTI01/160721
		Sampled by	Client
		Date Sampled	not specified
Contact	Zac Xavier	**Date Received**	21-Jul-16

The results relate only to the sample(s) tested.

Replacement of Report DAU16_167 dated 9 August 2016 . Please destroy or return the original report.

Method	AUTL_02	**Date Reported**	25-Oct-16

Details

The method is for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs), plus "dioxin-like" PCBs in emission samples by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS). This method provides data on all toxic 2,3,7,8-PCDD (seven) and PCDF (ten) isomers as well as the "dioxin-like" PCBs (twelve). PCDD and PCDF totals for each homologue group (tetra to octa) are also reported. The dioxin toxicity equivalent (I-TEQ) in each sample is calculated using International toxic equivalency factors (I-TEFs). The PCB toxicity equivalent (WHO_{05}-TEQ_P) in each sample is calculated using World Health Organization toxic equivalency factors (WHO_{05}-TEFs). All results are corrected for labelled surrogate recoveries.

After sampling the filter(s) & resin are spiked with a range of isotopically labelled surrogate standards and exhaustively extracted. Clean up is effected by partitioning with sulphuric acid then distilled water. Further purification is performed using column chromatography on acid and base modified silica gels, basic alumina and carbon dispersed on celite.

Immediately prior to injection, internal standards are added to each extract, and an aliquot of the extract is injected into the GC. The analytes are separated by the GC and detected by a high-resolution (>10,000) mass spectrometer.

Authorisation

Nino Piro
Senior Chemist
Dioxin Analysis Unit

Dr Alan Yates
Senior Analyst
Dioxin Analysis Unit

Accreditation

NATA Accredited Laboratory Number : 198

Accredited for compliance with ISO/IEC 17025.

Sample Details : Job No. EKTI01/160721

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/020291X	DAU300616A	Emission	Resin, Filter & Rinses
N16/020292X	DAU300616B	Emission	Resin, Filter & Rinses
Blank DF H2065	Solvent lab blank	Emission	Same batch as samples
Blank DF H2060	Solvent lab blank	Emission	Previous batch

Project Details

Project Name	*Cleanaway Tullamarine*
Project Number	*R002960 / Purchase Order W001600*

Key

Analytes

TCDD	Tetrachlorodibenzo-p-dioxin	TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin	HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin	HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin	OCDF	Octachlorodibenzofuran
PCB 77	3,3',4,4'-Tetrachlorobiphenyl	PCB 126	3,3',4,4',5-Pentachlorobiphenyl
PCB 81	3,4,4',5-Tetrachlorobiphenyl	PCB 156	2,3,3',4,4',5-Hexachlorobiphenyl
PCB 105	2,3,3',4,4'-Pentachlorobiphenyl	PCB 157	2,3,3',4,4',5'-Hexachlorobiphenyl
PCB 114	2,3,4,4',5-Pentachlorobiphenyl	PCB 167	2,3',4,4',5,5'-Hexachlorobiphenyl
PCB 118	2,3',4,4',5-Pentachlorobiphenyl	PCB 169	3,3',4,4',5,5'-Hexachlorobiphenyl
PCB 123	2',3,4,4',5-Pentachlorobiphenyl	PCB 189	2,3,3',4,4',5,5'-Heptachlorobiphenyl

Units & Abbreviations

pg	picograms
<	level less than limit of detection (LOD)
I-TEF‡	International toxic equivalency factor
I-TEQ‡	International toxic equivalents - dioxins & furans
WHO_{05}-TEF†	World Health Organization toxic equivalency factor
WHO_{05}-TEQ_P†	World Health Organization toxic equivalents - dioxin like PCBs

† as defined by Van den Berg et al., *Toxicol. Sci.* ***93*** *(2), pp. 223–241* (2006)

‡ as defined in USEPA publication **EPA/625/3-89/016** (1989)

TEQs are calculated by multiplying the quantified level for each individual congener by corresponding TEF and summing result.

$$\text{I–TEQ}_{\text{DF}} = \sum_{i=1}^{7}\left[\text{PCDD}_i \times \text{TEF}_i\right] + \sum_{j=1}^{10}\left[\text{PCDF}_j \times \text{TEF}_j\right]$$

$$\text{WHO}_{05}\text{–TEQ}_{\text{P}} = \sum_{k=1}^{12}\left[\text{PCB}_k \times \text{TEF}_k\right]$$

i = PCDD congener index (1 - 7)
j = PCDF congener index (1 - 10)
k = PCB congener index (1 - 12)

Lower Bound TEQ	defines all congener values reported below the LOD as equal to zero.
Middle Bound TEQ	defines all congener values reported below the LOD as equal to half the LOD.
Upper Bound TEQ	defines all congener values reported below the LOD as equal to the LOD.

Surrogate Recovery	percentage recovery for $^{13}C_{12}$ labelled surrogate standard
⚐	Laboratory surrogate recovery outside normal acceptance criteria: **40-130%** for Tetra/Penta/Hexa PCCD/F congeners - **25-130%** for Hepta/Octa PCDD/F congeners **40-120%** for PCB congeners
⚑	Dioxin/Furan field surrogate recovery outside normal acceptance criteria (**70-130%**) PCB field surrogate recovery outside normal acceptance criteria (**60-140%**)

Results : Job No. EKTI01/160721

Laboratory Reg. No.	N16/020291X	**Date Extracted**	29-Jul-16
Client Sample Ref.	DAU300616A	**DB5 Analysis**	05-Aug-16
Matrix	Emission	**DB-Dioxin Analysis**	03-Aug-16
Description	Resin, Filter & Rinses	**PCB Analysis**	05-Aug-16

PCDD/F Congeners	Level pg	I-TEF	I-TEQ middle bound contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	14	0.1	1.4	47	
2,3,7,8-TCDD	<2	1	1	50	
1,2,3,7,8-PeCDF	14	0.05	0.71	53	
2,3,4,7,8-PeCDF	15	0.5	7.5	115	
1,2,3,7,8-PeCDD	4.9	0.5	2.4	68	
1,2,3,4,7,8-HxCDF	8.6	0.1	0.86	98	
1,2,3,6,7,8-HxCDF	10	0.1	1.0	76	
2,3,4,6,7,8-HxCDF	4.9	0.1	0.49		
1,2,3,7,8,9-HxCDF	1.1	0.1	0.11		
1,2,3,4,7,8-HxCDD	1.3	0.1	0.13	107	
1,2,3,6,7,8-HxCDD	1.7	0.1	0.17	82	
1,2,3,7,8,9-HxCDD	1.3	0.1	0.13		
1,2,3,4,6,7,8-HpCDF	9.4	0.01	0.094	57	
1,2,3,4,7,8,9-HpCDF	<2	0.01	0.01	89	
1,2,3,4,6,7,8-HpCDD	5.9	0.01	0.059	62	
OCDF	<1	0.001	0.0005		
OCDD	35	0.001	0.035	54	

PCB Congeners	Level pg	WHO_{05}-TEF	WHO_{05}-TEQ_P middle bound contribution	Labelled Surrogate recovery	
Non-Ortho PCBs					
PCB 77	220	0.0001	0.022	51	
PCB 81	11	0.0003	0.0033	46	
PCB 126	17	0.1	1.7	63	
PCB 169	<1	0.03	0.015	66	
Mono-Ortho PCBs					
PCB 105	490	0.00003	0.015	33	[1]
PCB 114	60	0.00003	0.0018	29	[1]
PCB 118	1340	0.00003	0.040	28	[1]
PCB 123	18	0.00003	0.00055	26	[1]
PCB 156	82	0.00003	0.0025	53	
PCB 157	21	0.00003	0.00062	62	
PCB 167	99	0.00003	0.0030	52	
PCB 189	<3	0.00003	0.000045	56	

PCDD/F Homologue Groups	Level pg
Total TCDF isomers	220
Total TCDD isomers	19
Total PeCDF isomers	150
Total PeCDD isomers	34
Total HxCDF isomers	68
Total HxCDD isomers	22
Total HpCDF isomers	11
Total HpCDD isomers	13

Summary Results			
Sum of PCDD and PCDF congeners			
	Excluding LOD values	570	pg
I-TEQ			
	Lower Bound [excluding LOD values]	**15**	pg
	Middle Bound [including half LOD values]	**16**	pg
	Upper Bound [including LOD values]	**17**	pg
WHO_{05}-TEQ_P			
	Lower Bound [excluding LOD values]	**1.8**	pg
	Middle Bound [including half LOD values]	**1.8**	pg
	Upper Bound [including LOD values]	**1.8**	pg

Results : Job No. EKTI01/160721

Laboratory Reg. No. N16/020292X **Date Extracted** 29-Jul-16

Client Sample Ref. DAU300616B **DB5 Analysis** 05-Aug-16
Matrix Emission **DB-Dioxin Analysis** 03-Aug-16
Description Resin, Filter & Rinses **PCB Analysis** 05-Aug-16

PCDD/F Congeners	Level pg	I-TEF	I-TEQ middle bound contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	5.0	0.1	0.50	55	
2,3,7,8-TCDD	<2	1	1	61	
1,2,3,7,8-PeCDF	3.0	0.05	0.15	57	
2,3,4,7,8-PeCDF	2.0	0.5	0.98	117	
1,2,3,7,8-PeCDD	<2	0.5	0.5	73	
1,2,3,4,7,8-HxCDF	2.3	0.1	0.23	102	
1,2,3,6,7,8-HxCDF	1.6	0.1	0.16	82	
2,3,4,6,7,8-HxCDF	<0.7	0.1	0.035		
1,2,3,7,8,9-HxCDF	<0.5	0.1	0.025		
1,2,3,4,7,8-HxCDD	<1	0.1	0.05	113	
1,2,3,6,7,8-HxCDD	<1	0.1	0.05	83	
1,2,3,7,8,9-HxCDD	<1	0.1	0.05		
1,2,3,4,6,7,8-HpCDF	3.1	0.01	0.031	53	
1,2,3,4,7,8,9-HpCDF	<3	0.01	0.015	95	
1,2,3,4,6,7,8-HpCDD	4.5	0.01	0.045	58	
OCDF	<2	0.001	0.001		
OCDD	18	0.001	0.018	47	

PCB Congeners	Level pg	WHO_{05}-TEF	WHO_{05}-TEQ_P middle bound contribution	Labelled Surrogate recovery	
Non-Ortho PCBs					
PCB 77	260	0.0001	0.026	59	
PCB 81	12	0.0003	0.0037	56	
PCB 126	19	0.1	1.9	67	
PCB 169	<2	0.03	0.03	66	
Mono-Ortho PCBs					
PCB 105	640	0.00003	0.019	51	
PCB 114	66	0.00003	0.0020	44	
PCB 118	1720	0.00003	0.052	44	
PCB 123	26	0.00003	0.00077	42	
PCB 156	120	0.00003	0.0037	60	
PCB 157	29	0.00003	0.00088	71	
PCB 167	120	0.00003	0.0037	68	
PCB 189	<5	0.00003	0.000075	60	

PCDD/F Homologue Groups	Level pg
Total TCDF isomers	51
Total TCDD isomers	10
Total PeCDF isomers	18
Total PeCDD isomers	7.9
Total HxCDF isomers	11
Total HxCDD isomers	5.4
Total HpCDF isomers	3.1
Total HpCDD isomers	10

Summary Results			
Sum of PCDD and PCDF congeners			
	Excluding LOD values	130	pg
I-TEQ			
	Lower Bound [excluding LOD values]	**2.1**	pg
	Middle Bound [including half LOD values]	**3.8**	pg
	Upper Bound [including LOD values]	**5.6**	pg
WHO_{05}-TEQ_P			
	Lower Bound [excluding LOD values]	**2.0**	pg
	Middle Bound [including half LOD values]	**2.0**	pg
	Upper Bound [including LOD values]	**2.1**	pg

Results : Job No. EKTI01/160721

Laboratory Reg. No. Blank DF H2065 **Date Extracted** 29-Jul-16

Client Sample Ref. Solvent lab blank **DB5 Analysis** 05-Aug-16
Matrix Emission
Description Same batch as samples **PCB Analysis** 05-Aug-16

PCDD/F Congeners	Level pg	I-TEF	I-TEQ middle bound contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<3	0.1	0.15	37	⚐
2,3,7,8-TCDD	<1	1	0.5	42	
1,2,3,7,8-PeCDF	<1	0.05	0.025	49	
2,3,4,7,8-PeCDF	<1	0.5	0.25	124	
1,2,3,7,8-PeCDD	<0.8	0.5	0.2	69	
1,2,3,4,7,8-HxCDF	<0.6	0.1	0.03	98	
1,2,3,6,7,8-HxCDF	<0.6	0.1	0.03	72	
2,3,4,6,7,8-HxCDF	<0.6	0.1	0.03		
1,2,3,7,8,9-HxCDF	<0.7	0.1	0.035		
1,2,3,4,7,8-HxCDD	<0.7	0.1	0.035	114	
1,2,3,6,7,8-HxCDD	<0.7	0.1	0.035	75	
1,2,3,7,8,9-HxCDD	<0.7	0.1	0.035		
1,2,3,4,6,7,8-HpCDF	0.33	0.01	0.0033	54	
1,2,3,4,7,8,9-HpCDF	<0.4	0.01	0.002	99	
1,2,3,4,6,7,8-HpCDD	1.1	0.01	0.011	62	
OCDF	<0.7	0.001	0.00035		
OCDD	4.0	0.001	0.004	62	

PCB Congeners	Level pg	WHO_{05}-TEF	WHO_{05}-TEQ_P middle bound contribution	Labelled Surrogate recovery	
Non-Ortho PCBs					
PCB 77	3.0	0.0001	0.0003	38	⚐
PCB 81	<2	0.0003	0.0003	33	⚐
PCB 126	<2	0.1	0.1	54	
PCB 169	<0.8	0.03	0.012	64	
Mono-Ortho PCBs					
PCB 105	85	0.00003	0.0025	2	⚐
PCB 114	<100	0.00003	0.0015	1	⚐
PCB 118	270	0.00003	0.008	1	⚐
PCB 123	<100	0.00003	0.0015	1	⚐
PCB 156	19	0.00003	0.00056	9	⚐
PCB 157	<10	0.00003	0.00015	13	⚐
PCB 167	18	0.00003	0.00053	7	⚐
PCB 189	5.1	0.00003	0.00015	30	⚐

PCDD/F Homologue Groups	Level pg
Total TCDF isomers	<30
Total TCDD isomers	<7
Total PeCDF isomers	<5
Total PeCDD isomers	<5
Total HxCDF isomers	<2
Total HxCDD isomers	<2
Total HpCDF isomers	<0.5
Total HpCDD isomers	<2

Summary Results			
Sum of PCDD and PCDF congeners			
	Excluding LOD values	5.4	pg
I-TEQ			
	Lower Bound [excluding LOD values]	**0.018**	pg
	Middle Bound [including half LOD values]	**1.4**	pg
	Upper Bound [including LOD values]	**2.7**	pg
WHO_{05}-TEQ_P			
	Lower Bound [excluding LOD values]	**0.012**	pg
	Middle Bound [including half LOD values]	**0.13**	pg
	Upper Bound [including LOD values]	**0.24**	pg

Results : Job No. EKTI01/160721

Laboratory Reg. No.	Blank DF H2060	**Date Extracted**	29-Jul-16
Client Sample Ref.	Solvent lab blank	**DB5 Analysis**	25-Jul-16
Matrix	Emission		
Description	Previous batch	**PCB Analysis**	25-Jul-16

PCDD/F Congeners	Level pg	I-TEF	I-TEQ middle bound contribution	Labelled Surrogate recovery	
2,3,7,8-TCDF	<0.9	0.1	0.045	55	
2,3,7,8-TCDD	<1	1	0.5	68	
1,2,3,7,8-PeCDF	<0.9	0.05	0.023	62	
2,3,4,7,8-PeCDF	<1	0.5	0.25	83	
1,2,3,7,8-PeCDD	<0.6	0.5	0.15	86	
1,2,3,4,7,8-HxCDF	<0.5	0.1	0.025	66	
1,2,3,6,7,8-HxCDF	<0.5	0.1	0.025	78	
2,3,4,6,7,8-HxCDF	<0.5	0.1	0.025		
1,2,3,7,8,9-HxCDF	<0.5	0.1	0.025		
1,2,3,4,7,8-HxCDD	<0.6	0.1	0.03	71	
1,2,3,6,7,8-HxCDD	<0.6	0.1	0.03	87	
1,2,3,7,8,9-HxCDD	<0.6	0.1	0.03		
1,2,3,4,6,7,8-HpCDF	<0.5	0.01	0.0025	48	
1,2,3,4,7,8,9-HpCDF	<0.7	0.01	0.0035	70	
1,2,3,4,6,7,8-HpCDD	<0.7	0.01	0.0035	60	
OCDF	<1	0.001	0.0005		
OCDD	1.8	0.001	0.0018	61	

PCB Congeners	Level pg	WHO_{05}-TEF	WHO_{05}-TEQ_P middle bound contribution	Labelled Surrogate recovery	
Non-Ortho PCBs					
PCB 77	3.0	0.0001	0.0003	57	
PCB 81	<1	0.0003	0.00015	53	
PCB 126	<1	0.1	0.05	63	
PCB 169	<1	0.03	0.015	58	
Mono-Ortho PCBs					
PCB 105	32	0.00003	0.00096	62	
PCB 114	<4	0.00003	0.00006	60	
PCB 118	110	0.00003	0.0034	59	
PCB 123	<3	0.00003	0.000045	59	
PCB 156	12	0.00003	0.00036	50	
PCB 157	<7	0.00003	0.00011	51	
PCB 167	<6	0.00003	0.00009	56	
PCB 189	<3	0.00003	0.000045	58	

PCDD/F Homologue Groups	Level pg
Total TCDF isomers	<7
Total TCDD isomers	0.27
Total PeCDF isomers	<7
Total PeCDD isomers	<4
Total HxCDF isomers	<3
Total HxCDD isomers	<2
Total HpCDF isomers	<1
Total HpCDD isomers	<0.7

Summary Results			
Sum of PCDD and PCDF congeners			
	Excluding LOD values	2.1	pg
I-TEQ			
	Lower Bound [excluding LOD values]	**0.0018**	pg
	Middle Bound [including half LOD values]	**1.2**	pg
	Upper Bound [including LOD values]	**2.3**	pg
WHO_{05}-TEQ_P			
	Lower Bound [excluding LOD values]	**0.005**	pg
	Middle Bound [including half LOD values]	**0.071**	pg
	Upper Bound [including LOD values]	**0.14**	pg

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

Greg Sceneay
Ektimo
2/160 New Street
Ringwood
VIC 3134

Dear Greg,

RE: Blank subtract of emission testing samples

For the results NMI reported in certificate DAU16_167A, the levels of dioxins, furans and dioxin-like PCBs measured in the laboratory blank were **not** subtracted from the levels detected in the emission samples submitted. NMI does not routinely blank subtract for this type of measurement.

Our approach when conducting ultra-trace analysis like these is to only report chemicals found in samples when they are more than three times the level in the blank, otherwise they are reported as 'less than limit of detection'. Due to the ubiquitous nature of dioxins, furans, and dioxin-like PCBs, they are always present to some extent within the environment and any laboratory. We have rigorous cleaning procedures to reduce the levels present in the laboratory but cannot remove the background levels completely, and they will vary over time, so a dynamic approach is necessary.

Please feel free to contact me to discuss this matter further.

Yours sincerely

Gavin Stevenson

November 2016
02 9449 0140
dioxins@measurement.gov.au

Australian Government
National Measurement Institute

ANALYSIS REPORT # ORG16_051

Client	Ektimo Pty. Ltd. Unit 2, 160 New Street Ringwood VIC 3134	**Job No.**	EKTI01/160721
		Sampled by	Client
		Date Sampled	not specified
Contact	Zac Xavier	**Date Received**	21-Jul-16

The results relate only to the sample(s) tested.

Method NGCMS 11.27

Details The samples are spiked with a range of isotopically labelled PAHs then extracted with organic solvent. The extracts were purified by chemical treatment and column chromatography. Analysis was performed using high resolution gas chromatography with low resolution mass spectrometry. Results have been corrected for recoveries of the internal standard.

Instrument: Agilent 5975 GCMS run in SIM mode. Column is a DB5-ms (30m×0.25mm×0.25µm). Method based on CARB429, July 1997 Revision.

Authorisation

Danny Slee
Senior Chemist- Environment
August 18, 2016

Accreditation

NATA Accreditation Number : 198

Accredited for compliance with ISO/IEC 17025.

This report shall not be reproduced, except in full.

Sample Details : Job No. EKTI01/160721

Laboratory Reg. No.	Client Sample Ref.	Matrix	Description
N16/020291	DAU300616A	Emission	Cartridge+Filter+Solvent Rinse
N16/020292	DAU300616B	Emission	Cartridge+Filter+Solvent Rinse

Project Details

Project Name	*Cleanaway Tullamarine*
Project Number	*R002960 / Purchase Order W001600*

Key

Analytes	**Labelled internal std.**	**Analytes**	**Labelled internal std.**
Naphthalene	d8-Naphthalene	Chrysene	d12-Chrysene
2-Methylnaphthalene		Benzo(b)fluoranthene	d12-Benzo(b)fluoranthene
Acenaphthylene	d8-Acenaphthylene	Benzo(k)fluoranthene	d12-Benzo(k)fluoranthene
Acenaphthene	d10-Acenaphthene	Benzo(e)pyrene	
Fluorene	d10-Fluorene	Benzo(a)pyrene	d12-Benzo(a)pyrene
Phenanthrene	d10-Phenanthrene	Perylene	
Anthracene		Indeno(1,2,3-cd)pyrene	d12-Indeno(1,2,3-c,d)pyrene
Fluoranthene	d10-Fluoranthene	Dibenz(ah)anthracene	d14-Dibenz(ah)anthracene
Pyrene		Benzo(ghi)perylene	d12-Benzo(ghi)perylene
Benz(a)anthracene	d12-Benz(a)anthracene		

Abbreviations & Definitions

ng	nanograms per sample train
<	level less than limit of reporting (LOR)
BaP-PEF†	Benzo(a)pyrene Potency Equivalent Factor
BaP-TEQ$_{PAH}$	Benzo(a)pyrene Toxic Equivalents

† as defined in "Benzo(a)pyrene as a Toxic Air Contaminant", CARB/OEHHA Executive Summary, July 1994

TEQs are calculated by multiplying the quantified level for each toxic PAH by corresponding PEF and summing the result:

$$BaP-TEQ_{PAH} = \sum_{i=1}^{n} [PAH_i \times BaP-PEF_i]$$ i = toxic PAH analyte index (1 to n=7)

CARB	California Air Resources Board
OEHHA	Office of Environmental Health Hazard Assessment (US)

Surrogate Standard	Known amount of deuterated standard added to the XAD resin prior to sampling. Surrogates are 'field spikes'. The surrogate recovery indicates how effectively the sample train retains PAHs collected on the resin. It is also a guide to matrix effects caused by time of storage and transportation.
Internal Standard	Known amount of deuterated PAHs added to field samples, blanks and QC samples prior to laboratory analysis. The internal standard is used to measure the concentration of native PAHs and surrogates. The internal standard recovery will determine the performance of the laboratory method. Usual recoveries are 50 to 150%. Lower recoveries can be accepted as long as the signal/noise ratio of the internal standard is >10.

Results : Job No. EKTI01/160721

Laboratory Reg. No.	N16/020291	**Date Reported**	18-Aug-2016
Client Sample Ref.	DAU300616A	**Date Extracted**	29-Jul-2016
Matrix	Emission		
Description	Cartridge+Filter+Solvent Rinse		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	2400	1000	-	-	78	
2-Methylnaphthalene	490	72	-	-		
Acenaphthylene	43	20	-	-	92	
Acenaphthene	21	20	-	-	117	
Fluorene	110	20	-	-	107	
Phenanthrene	1200	45	-	-	80	
Anthracene	29	20	-	-		
Fluoranthene	320	20	-	-	116	
Pyrene	130	20	-	-		
Benz(a)anthracene	21	20	0.1	2.1	89	
Chrysene	63	20	0.01	0.6	99	
Benzo(b)fluoranthene	<20	20	0.1	1.0	132	
Benzo(k)fluoranthene	29	20	0.1	2.9	135	
Benzo(e)pyrene	<20	20	-	-		
Benzo(a)pyrene	<20	20	1.0	10	122	
Perylene	<20	20	-	-		
Indeno(1,2,3-cd)pyrene	28	20	0.1	2.8	126	
Dibenz(ah)anthracene	43	20	0.4	17	130	
Benzo(ghi)perylene	29	20	-	-	119	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Summary Results		
BaP -TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**25**	ng
Middle Bound [including half LOD values]	**36**	ng
Upper Bound [including LOD values]	**47**	ng

Results : Job No. EKTI01/160721

Laboratory Reg. No.	N16/020292	**Date Reported**	18-Aug-2016
Client Sample Ref.	DAU300616B	**Date Extracted**	29-Jul-2016
Matrix	Emission		
Description	Cartridge+Filter+Solvent Rinse		

PAH	Conc. ng	Reporting Level (LOR, ng)	BaP-PEF Value	BaP-TEQ Contribution	Labelled Internal recovery (%)	Flags
Naphthalene	1700	1000	-	-	111	
2-Methylnaphthalene	400	72	-	-		
Acenaphthylene	34	20	-	-	74	
Acenaphthene	28	20	-	-	96	
Fluorene	130	20	-	-	96	
Phenanthrene	790	45	-	-	112	
Anthracene	28	20	-	-		
Fluoranthene	370	20	-	-	110	
Pyrene	170	20	-	-		
Benz(a)anthracene	53	20	0.1	5.3	107	
Chrysene	71	20	0.01	0.7	112	
Benzo(b)fluoranthene	65	20	0.1	6.5	126	
Benzo(k)fluoranthene	57	20	0.1	5.7	116	
Benzo(e)pyrene	21	20	-	-		
Benzo(a)pyrene	23	20	1.0	23	127	
Perylene	<20	20	-	-		
Indeno(1,2,3-cd)pyrene	37	20	0.1	3.7	123	
Dibenz(ah)anthracene	26	20	0.4	10	126	
Benzo(ghi)perylene	37	20	-	-	118	

Flags
" * " : indicates the recovery is outside range but signal to noise is >10.
Acceptable recovery range set at 50 to 150%.

Summary Results		
BaP -TEQ$_{PAH}$		
Lower Bound [excluding LOD values]	**55**	ng
Middle Bound [including half LOD values]	**55**	ng
Upper Bound [including LOD values]	**55**	ng

REPORT OF ANALYSIS

Report No. RN1126420

Client	: EKTIMO PTY LTD	**Job No.**	: EKTI01/160721
	UNIT 3, 4 MONASH GATE	**Quote No.**	: QT-01937
	JANDAKOT WA 6164	**Order No.**	: W001600
		Date Sampled	:
		Date Received	: 21-JUL-2016
Attention	: MAGDA MROZEK	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: RICHARD COGHLAN	**Phone**	: (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N16/020291	DAU300616A	FILTER RESIN RINSE ACETONE TOLUENE JOB NO: R002960 CLIENT: CLEANAWAY TULLAMARINE
N16/020292	DAU300616B	FILTER RESIN RINSE ACETONE TOLUENE JOB NO: R002960 CLIENT: CLEANAWAY TULLAMARINE

Lab Reg No.		N16/020291	N16/020292			
Sample Reference	**Units**	**DAU300616A**	**DAU300616B**			**Method**
Polycyclic Aromatic Hydrocarbons						
PAHs		See comment	See comment			NGCMS11_27
Organochlorine (OC) Pesticides						
HCB	ug	<0.1	<0.1			NR_19
Heptachlor	ug	<0.1	<0.1			NR_19
Heptachlor epoxide	ug	<0.1	<0.1			NR_19
Aldrin	ug	<0.1	<0.1			NR_19
gamma-BHC (Lindane)	ug	<0.1	<0.1			NR_19
alpha-BHC	ug	<0.1	<0.1			NR_19
beta-BHC	ug	<0.1	<0.1			NR_19
delta-BHC	ug	<0.1	<0.1			NR_19
trans-Chlordane	ug	<0.1	<0.1			NR_19
cis-Chlordane	ug	<0.1	<0.1			NR_19
Oxychlordane	ug	<0.1	<0.1			NR_19
Dieldrin	ug	<0.1	<0.1			NR_19
pp-DDE	ug	<0.1	<0.1			NR_19
pp-DDD	ug	<0.1	<0.1			NR_19
pp-DDT	ug	<0.1	<0.1			NR_19
Endrin	ug	<0.1	<0.1			NR_19
Endrin Aldehyde	ug	<0.1	<0.1			NR_19
Endrin Ketone	ug	<0.1	<0.1			NR_19
alpha-Endosulfan	ug	<0.1	<0.1			NR_19
beta-Endosulfan	ug	<0.1	<0.1			NR_19
Endosulfan Sulfate	ug	<0.1	<0.1			NR_19
Methoxychlor	ug	<0.1	<0.1			NR_19

REPORT OF ANALYSIS

N16/020291
to
N16/020292,
See attached report for PAH results(REPORT#ORG16_051).

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

19-AUG-2016

NATA
ACCREDITED FOR
TECHNICAL
COMPETENCE

This Report supersedes reports: *RN1126398*

Australian Government

National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_107

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0147

Laboratory Reg. No. :	NV16/00285/1	**Method:**	VOC_04
Client Sample Ref. :	V11776	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN017
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-3
		Dilution :	180

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Hydrogen Sulfide	900	2900	1000	4040	7783-06-04
Carbonyl Sulfide	400	<400	900	<900	463-58-1
Methyl Mercaptan	400	<400	700	<700	74-93-1
Ethyl Mercaptan	400	<400	900	<900	75-08-1
Dimethyl Sulfide	400	<400	900	<900	75-18-3
Isopropyl mercaptan	400	<400	1000	<1000	75-33-2
n-Propyl mercaptan	400	<400	1000	<1000	107-03-9
Ethylmethyl sulfide	400	<400	1000	<1000	624-89-5
s-Butyl mercaptan	400	<400	1000	<1000	513-53-1
Diethyl sulfide	400	<400	1000	<1000	352-93-2
n-Butyl mercaptan	400	<400	1000	<1000	109-79-5
Internal Standard: BCM (%Rec.)	1	86			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	91			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	92			3114-55-4

Notes:
LOR = Limit of Reporting

Danny Slee
Organics Manager, North Ryde

25-Aug-16

Samples analysed as received
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

Australian Government

National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_107

Client	: EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
	UNIT 2, 160 NEW STREET	**Quote No. :**	
	RINGWOOD VIC 3134	**Order No. :**	
		Date Sampled :	
		Date Received :	18-Aug-2016
		Sampled by :	CLIENT
Attention	: GREG SCENEAY		
Project Name	: R002960		
Your Client Services Manager	: DANNY SLEE	**Phone :**	(02) 9449 0147

Laboratory Reg. No. :	NV16/00286/1	**Method:**	VOC_04
Client Sample Ref. :	V11777	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN004
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-2
		Dilution :	180.0

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Hydrogen Sulfide	900	4030	1000	5610	7783-06-04
Carbonyl Sulfide	400	<400	900	<900	463-58-1
Methyl Mercaptan	400	<400	700	<700	74-93-1
Ethyl Mercaptan	400	<400	900	<900	75-08-1
Dimethyl Sulfide	400	<400	900	<900	75-18-3
Isopropyl mercaptan	400	<400	1000	<1000	75-33-2
n-Propyl mercaptan	400	<400	1000	<1000	107-03-9
Ethylmethyl sulfide	400	<400	1000	<1000	624-89-5
s-Butyl mercaptan	400	<400	1000	<1000	513-53-1
Diethyl sulfide	400	<400	1000	<1000	352-93-2
n-Butyl mercaptan	400	<400	1000	<1000	109-79-5
Internal Standard: BCM (%Rec.)	1	87			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	91			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	91			3114-55-4

Notes:
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Danny Slee
Organics Manager, North Ryde

25-Aug-16

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National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_107

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0147

Laboratory Reg. No. :	NV16/00287/1	**Method:**	VOC_04
Client Sample Ref. :	V11778	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN007
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-0.2
		Dilution :	1.8

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Hydrogen Sulfide	9	<9	10	<10	7783-06-04
Carbonyl Sulfide	4	<4	9	<9	463-58-1
Methyl Mercaptan	4	<4	7	<7	74-93-1
Ethyl Mercaptan	4	<4	9	<9	75-08-1
Dimethyl Sulfide	4	<4	9	<9	75-18-3
Isopropyl mercaptan	4	<4	10	<10	75-33-2
n-Propyl mercaptan	4	<4	10	<10	107-03-9
Ethylmethyl sulfide	4	<4	10	<10	624-89-5
s-Butyl mercaptan	4	<4	10	<10	513-53-1
Diethyl sulfide	4	<4	10	<10	352-93-2
n-Butyl mercaptan	4	<4	10	<10	109-79-5
Internal Standard: BCM (%Rec.)	1	91			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	96			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	97			3114-55-4

Notes:
LOR = Limit of Reporting

Danny Slee
Organics Manager, North Ryde

25-Aug-16

Samples analysed as received
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Australian Government

National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_107

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0147

Laboratory Reg. No. :	NV16/00288/1	**Method:**	VOC_04
Client Sample Ref. :	V11779	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	EKIT CAN009
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-3
		Dilution :	1.8

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Hydrogen Sulfide	9	<9	10	<10	7783-06-04
Carbonyl Sulfide	4	<4	9	<9	463-58-1
Methyl Mercaptan	4	<4	7	<7	74-93-1
Ethyl Mercaptan	4	<4	9	<9	75-08-1
Dimethyl Sulfide	4	<4	9	<9	75-18-3
Isopropyl mercaptan	4	<4	10	<10	75-33-2
n-Propyl mercaptan	4	<4	10	<10	107-03-9
Ethylmethyl sulfide	4	<4	10	<10	624-89-5
s-Butyl mercaptan	4	<4	10	<10	513-53-1
Diethyl sulfide	4	<4	10	<10	352-93-2
n-Butyl mercaptan	4	<4	10	<10	109-79-5
Internal Standard: BCM (%Rec.)	1	88			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	95			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	96			3114-55-4

Notes:
LOR = Limit of Reporting

Danny Slee
Organics Manager, North Ryde

25-Aug-16

Samples analysed as received
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Results relate only to the sample(s) tested.

Australian Government

National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_104

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0111

Laboratory Reg. No. :	NV16/00285	**Method:**	VOC_01
Client Sample Ref. :	V11776	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN017
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-3
		Dilution :	180

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Propene	20	<20	30	<30	115-07-1
Dichlorodifluoromethane	20	140	90	690	75-71-8
Chloromethane	50	<70	90	<100	74-87-3
1,2-Dichlorotetrafluoroethane	20	46	100	320	76-14-2
Vinyl chloride	20	3890	50	9940	75-01-4
1,3-Butadiene	20	<20	40	<40	106-99-0
Bromomethane	70	<200	300	<600	74-83-9
Chloroethane	20	450	50	1200	75-00-3
Acrolein	20	<20	40	<40	107-02-8
Acetone	50	560	100	1320	67-64-1
Ethanol	50	210	80	390	64-17-5
2-Propanol	20	260	40	650	67-63-0
Trichlorofluoromethane	20	42	100	240	75-69-4
1,1-Dichloroethene	20	20	70	81	75-35-4
Dichloromethane	50	200	200	680	75-09-2
1,1,2-Trichloro-1,2,2 trifluoroethane	20	<20	100	<100	76-13-1
Carbon disulfide	20	89	60	280	75-15-0
trans-1,2-Dichloroethene	20	41	70	160	156-60-5
1,1-Dichloroethane	20	590	70	2390	75-34-3
Methyl-tert-butylether (MTBE)	20	400	60	1440	1634-04-4
Vinyl acetate	20	<20	60	<60	108-05-4
2-Butanone (MEK)	20	240	50	700	78-93-3
cis-1,2-Dichloroethene	20	1880	70	7450	156-59-2
Hexane	20	9420	60	33200	110-54-3
Chloroform	20	<20	90	<90	67-66-3
Ethyl Acetate	20	<20	60	<60	141-78-6
Tetrahydrofuran	20	250	50	730	109-99-9
1,2-Dichloroethane	20	<20	70	<70	107-06-2
1,1,1-Trichloroethane	20	22	100	120	71-55-6
Benzene	50	23300	100	74500	71-43-2

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Carbon tetrachloride	20	120	100	750	56-23-5
Cyclohexane	20	5500	60	18900	110-82-7
1,2-Dichloropropane	20	<20	80	<80	78-87-5
Bromodichloromethane	20	<20	100	<100	75-27-4
Trichloroethene	20	210	100	1120	79-01-6
1,4-Dioxane	20	<20	60	<60	123-91-1
Heptane	20	7310	70	29900	142-82-5
Methyl methacrylate	20	<20	70	<70	80-62-6
cis-1,3-Dichloropropene	20	<20	80	<80	10061-01-5
4-Methyl-2-pentanone (MIBK)	20	340	70	1380	108-10-1
trans-1,3-Dichloropropene	20	<20	80	<80	10061-02-6
1,1,2-Trichloroethane	20	<20	100	<100	79-00-5
Toluene	20	19900	70	75000	108-88-3
2-Hexanone (MBK)	20	<20	70	<70	591-78-6
Dibromochloromethane	20	<20	200	<200	124-48-1
1,2-Dibromoethane	20	<20	100	<100	106-93-4
Tetrachloroethylene	20	230	100	1550	127-18-4
Chlorobenzene	20	270	80	1230	108-90-7
Ethylbenzene	20	16700	80	72400	100-41-4
Bromoform	20	<20	200	<200	75-25-2
m & p-Xylenes	50	15900	200	69200	108-38-3 / 106-42-3
Styrene	20	490	80	2100	100-42-5
1,1,2,2-Tetrachloroethane	20	<20	100	<100	79-34-5
o-Xylene	20	3630	80	15800	95-47-6
4-Ethyltoluene	20	330	90	1630	622-96-8
1,3,5-Trimethylbenzene	20	550	90	2690	108-67-8
1,2,4-Trimethylbenzene	20	1210	90	5970	95-63-6
Benzyl Chloride	20	<20	90	<90	100-44-7
1,3-Dichlorobenzene	20	<20	100	<100	541-73-1
1,4-Dichlorobenzene	20	<80	100	<500	106-46-7
1,2-Dichlorobenzene	20	<30	100	<200	95-50-1
1,2,4-Trichlorobenzene	20	<30	100	<200	120-82-1
Hexachlorobutadiene	20	<20	200	<200	87-68-3
Naphthalene	20	440	90	2300	91-20-3
Internal Standard: BCM (%Rec.)	1	81			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	86			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	89			3114-55-4

Notes:

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Danny Slee
Organics Manager, North Ryde

Accreditation No. 198

25-Aug-16

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National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_104

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0111

Laboratory Reg. No. :	NV16/00286	**Method:**	VOC_01
Client Sample Ref. :	V11777	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN004
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-2
		Dilution :	180

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Propene	20	<20	30	<30	115-07-1
Dichlorodifluoromethane	20	120	90	600	75-71-8
Chloromethane	50	<60	90	<100	74-87-3
1,2-Dichlorotetrafluoroethane	20	53	100	370	76-14-2
Vinyl chloride	20	4300	50	11000	75-01-4
1,3-Butadiene	20	<20	40	<40	106-99-0
Bromomethane	70	<200	300	<600	74-83-9
Chloroethane	20	520	50	1370	75-00-3
Acrolein	20	<20	40	<40	107-02-8
Acetone	50	530	100	1250	67-64-1
Ethanol	50	220	80	410	64-17-5
2-Propanol	20	270	40	660	67-63-0
Trichlorofluoromethane	20	55	100	310	75-69-4
1,1-Dichloroethene	20	22	70	86	75-35-4
Dichloromethane	50	220	200	770	75-09-2
1,1,2-Trichloro-1,2,2 trifluoroethane	20	<20	100	<100	76-13-1
Carbon disulfide	20	100	60	330	75-15-0
trans-1,2-Dichloroethene	20	47	70	180	156-60-5
1,1-Dichloroethane	20	690	70	2780	75-34-3
Methyl-tert-butylether (MTBE)	20	490	60	1760	1634-04-4
Vinyl acetate	20	<20	60	<60	108-05-4
2-Butanone (MEK)	20	290	50	850	78-93-3
cis-1,2-Dichloroethene	20	2240	70	8870	156-59-2
Hexane	20	11300	60	39800	110-54-3
Chloroform	20	<20	90	<90	67-66-3
Ethyl Acetate	20	<20	60	<60	141-78-6
Tetrahydrofuran	20	310	50	920	109-99-9
1,2-Dichloroethane	20	<20	70	<70	107-06-2
1,1,1-Trichloroethane	20	24	100	130	71-55-6
Benzene	50	29000	100	92700	71-43-2

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Carbon tetrachloride	20	150	100	920	56-23-5
Cyclohexane	20	6810	60	23400	110-82-7
1,2-Dichloropropane	20	<20	80	<80	78-87-5
Bromodichloromethane	20	<20	100	<100	75-27-4
Trichloroethene	20	260	100	1390	79-01-6
1,4-Dioxane	20	<20	60	<60	123-91-1
Heptane	20	9340	70	38300	142-82-5
Methyl methacrylate	20	<20	70	<70	80-62-6
cis-1,3-Dichloropropene	20	<20	80	<80	10061-01-5
4-Methyl-2-pentanone (MIBK)	20	440	70	1820	108-10-1
trans-1,3-Dichloropropene	20	<20	80	<80	10061-02-6
1,1,2-Trichloroethane	20	<20	100	<100	79-00-5
Toluene	20	26400	70	99300	108-88-3
2-Hexanone (MBK)	20	<20	70	<70	591-78-6
Dibromochloromethane	20	<20	200	<200	124-48-1
1,2-Dibromoethane	20	<20	100	<100	106-93-4
Tetrachloroethylene	20	320	100	2140	127-18-4
Chlorobenzene	20	370	80	1720	108-90-7
Ethylbenzene	20	24200	80	105000	100-41-4
Bromoform	20	<20	200	<200	75-25-2
m & p-Xylenes	50	23300	200	101000	108-38-3 / 106-42-3
Styrene	20	720	80	3050	100-42-5
1,1,2,2-Tetrachloroethane	20	<20	100	<100	79-34-5
o-Xylene	20	5420	80	23500	95-47-6
4-Ethyltoluene	20	580	90	2850	622-96-8
1,3,5-Trimethylbenzene	20	820	90	4040	108-67-8
1,2,4-Trimethylbenzene	20	2000	90	9830	95-63-6
Benzyl Chloride	20	<20	90	<90	100-44-7
1,3-Dichlorobenzene	20	<20	100	<100	541-73-1
1,4-Dichlorobenzene	20	130	100	770	106-46-7
1,2-Dichlorobenzene	20	<50	100	<300	95-50-1
1,2,4-Trichlorobenzene	20	<20	100	<200	120-82-1
Hexachlorobutadiene	20	<20	200	<200	87-68-3
Naphthalene	20	450	90	2360	91-20-3
Internal Standard: BCM (%Rec.)	1	82			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	87			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	89			3114-55-4

Notes:

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Danny Slee
Organics Manager, North Ryde

Accreditation No. 198

25-Aug-16

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National Measurement Institute

REPORT OF ANALYSIS

Report No. VOC16_104

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0111

Laboratory Reg. No. :	NV16/00287	**Method:**	VOC_01
Client Sample Ref. :	V11778	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN007
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-0.2
		Dilution :	1.8

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Propene	0.2	<0.2	0.3	<0.3	115-07-1
Dichlorodifluoromethane	0.2	<0.2	0.9	<0.9	75-71-8
Chloromethane	0.5	<0.5	0.9	<1	74-87-3
1,2-Dichlorotetrafluoroethane	0.2	<0.2	1	<1	76-14-2
Vinyl chloride	0.2	<0.2	0.5	<0.5	75-01-4
1,3-Butadiene	0.2	<0.2	0.4	<0.4	106-99-0
Bromomethane	0.7	<3	3	<10	74-83-9
Chloroethane	0.2	<0.2	0.5	<0.5	75-00-3
Acrolein	0.2	2.2	0.4	5.1	107-02-8
Acetone	0.5	6.3	1	15	67-64-1
Ethanol	0.5	14	0.8	27	64-17-5
2-Propanol	0.2	1.6	0.4	3.9	67-63-0
Trichlorofluoromethane	0.2	<0.2	1	<1	75-69-4
1,1-Dichloroethene	0.2	<0.2	0.7	<0.7	75-35-4
Dichloromethane	0.5	<0.5	2	<2	75-09-2
1,1,2-Trichloro-1,2,2 trifluoroethane	0.2	<0.2	1	<1	76-13-1
Carbon disulfide	0.2	0.75	0.6	2.3	75-15-0
trans-1,2-Dichloroethene	0.2	<0.2	0.7	<0.7	156-60-5
1,1-Dichloroethane	0.2	<0.2	0.7	<0.7	75-34-3
Methyl-tert-butylether (MTBE)	0.2	<0.2	0.6	<0.6	1634-04-4
Vinyl acetate	0.2	<0.2	0.6	<0.6	108-05-4
2-Butanone (MEK)	0.2	1.4	0.5	4.2	78-93-3
cis-1,2-Dichloroethene	0.2	<0.2	0.7	<0.7	156-59-2
Hexane	0.2	0.24	0.6	0.85	110-54-3
Chloroform	0.2	<0.2	0.9	<0.9	67-66-3
Ethyl Acetate	0.2	<0.2	0.6	<0.6	141-78-6
Tetrahydrofuran	0.2	0.24	0.5	0.71	109-99-9
1,2-Dichloroethane	0.2	<0.2	0.7	<0.7	107-06-2
1,1,1-Trichloroethane	0.2	<0.2	1	<1	71-55-6
Benzene	0.5	0.63	1	2.0	71-43-2

Carbon tetrachloride	0.2	<0.2	1	<1	56-23-5
Cyclohexane	0.2	0.38	0.6	1.3	110-82-7
1,2-Dichloropropane	0.2	<0.2	0.8	<0.8	78-87-5
Bromodichloromethane	0.2	<0.2	1	<1	75-27-4
Trichloroethene	0.2	<0.2	1	<1	79-01-6
1,4-Dioxane	0.2	<0.2	0.6	<0.6	123-91-1
Heptane	0.2	0.32	0.7	1.3	142-82-5
Methyl methacrylate	0.2	<0.2	0.7	<0.7	80-62-6
cis-1,3-Dichloropropene	0.2	<0.2	0.8	<0.8	10061-01-5
4-Methyl-2-pentanone (MIBK)	0.2	<0.2	0.7	<0.7	108-10-1
trans-1,3-Dichloropropene	0.2	<0.2	0.8	<0.8	10061-02-6
1,1,2-Trichloroethane	0.2	<0.2	1	<1	79-00-5
Toluene	0.2	1.0	0.7	3.9	108-88-3
2-Hexanone (MBK)	0.2	<0.2	0.7	<0.7	591-78-6
Dibromochloromethane	0.2	<0.2	2	<2	124-48-1
1,2-Dibromoethane	0.2	<0.2	1	<1	106-93-4
Tetrachloroethylene	0.2	<0.2	1	<1	127-18-4
Chlorobenzene	0.2	<0.2	0.8	<0.8	108-90-7
Ethylbenzene	0.2	<0.2	0.8	<0.8	100-41-4
Bromoform	0.2	<0.2	2	<2	75-25-2
m & p-Xylenes	0.5	<0.5	2	<2	108-38-3 / 106-42-3
Styrene	0.2	<0.5	0.8	<2	100-42-5
1,1,2,2-Tetrachloroethane	0.2	<0.2	1	<1	79-34-5
o-Xylene	0.2	<0.2	0.8	<0.8	95-47-6
4-Ethyltoluene	0.2	<0.2	0.9	<0.9	622-96-8
1,3,5-Trimethylbenzene	0.2	<0.2	0.9	<0.9	108-67-8
1,2,4-Trimethylbenzene	0.2	<0.2	0.9	<0.9	95-63-6
Benzyl Chloride	0.2	<0.2	0.9	<0.9	100-44-7
1,3-Dichlorobenzene	0.2	<0.2	1	<1	541-73-1
1,4-Dichlorobenzene	0.2	<0.2	1	<1	106-46-7
1,2-Dichlorobenzene	0.2	<0.2	1	<1	95-50-1
1,2,4-Trichlorobenzene	0.2	<0.3	1	<2	120-82-1
Hexachlorobutadiene	0.2	<0.2	2	<2	87-68-3
Naphthalene	0.2	<0.2	0.9	<1	91-20-3
Internal Standard: BCM (%Rec.)	1	86			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	92			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	94			3114-55-4

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REPORT OF ANALYSIS

Report No. VOC16_104

Client	:	EKTIMO PTY. LTD.	**Job No. :**	EKTI01/160818
		UNIT 2, 160 NEW STREET	**Quote No. :**	
		RINGWOOD VIC 3134	**Order No. :**	
			Date Sampled :	
			Date Received :	18-Aug-2016
			Sampled by :	CLIENT
Attention	:	GREG SCENEAY		
Project Name	:	R002960		
Your Client Services Manager	:	DANNY SLEE	**Phone :**	(02) 9449 0111

Laboratory Reg. No. :	NV16/00288	**Method:**	VOC_01
Client Sample Ref. :	V11779	**Date Analysed :**	19-Aug-2016
Matrix :	Air Canisters	**Canister No. :**	CAN009
Description :	CANISTER JOB: R002960	**Receipt Vac/Press ("Hg):**	-3
		Dilution :	1.8

Compound	LOR ppbv	Level ppbv	LOR ug/m3	Level ug/m3	CAS Number
Propene	0.2	<0.2	0.3	<0.3	115-07-1
Dichlorodifluoromethane	0.2	<0.2	0.9	<0.9	75-71-8
Chloromethane	0.5	<0.5	0.9	<1	74-87-3
1,2-Dichlorotetrafluoroethane	0.2	<0.2	1	<1	76-14-2
Vinyl chloride	0.2	<0.2	0.5	<0.5	75-01-4
1,3-Butadiene	0.2	<0.2	0.4	<0.4	106-99-0
Bromomethane	0.7	<2	3	<10	74-83-9
Chloroethane	0.2	<0.2	0.5	<0.5	75-00-3
Acrolein	0.2	4.6	0.4	10	107-02-8
Acetone	0.5	4.3	1	10	67-64-1
Ethanol	0.5	15	0.8	29	64-17-5
2-Propanol	0.2	<1	0.4	<3	67-63-0
Trichlorofluoromethane	0.2	<0.2	1	<1	75-69-4
1,1-Dichloroethene	0.2	<0.2	0.7	<0.7	75-35-4
Dichloromethane	0.5	<0.5	2	<2	75-09-2
1,1,2-Trichloro-1,2,2 trifluoroethane	0.2	<0.2	1	<1	76-13-1
Carbon disulfide	0.2	0.91	0.6	2.8	75-15-0
trans-1,2-Dichloroethene	0.2	<0.2	0.7	<0.7	156-60-5
1,1-Dichloroethane	0.2	<0.2	0.7	<0.7	75-34-3
Methyl-tert-butylether (MTBE)	0.2	<0.2	0.6	<0.6	1634-04-4
Vinyl acetate	0.2	<0.2	0.6	<0.6	108-05-4
2-Butanone (MEK)	0.2	1.0	0.5	2.9	78-93-3
cis-1,2-Dichloroethene	0.2	<0.2	0.7	<0.7	156-59-2
Hexane	0.2	<0.2	0.6	<0.6	110-54-3
Chloroform	0.2	<0.2	0.9	<0.9	67-66-3
Ethyl Acetate	0.2	<0.2	0.6	<0.6	141-78-6
Tetrahydrofuran	0.2	<0.2	0.5	<0.5	109-99-9
1,2-Dichloroethane	0.2	<0.2	0.7	<0.7	107-06-2
1,1,1-Trichloroethane	0.2	<0.2	1	<1	71-55-6
Benzene	0.5	1.0	1	3.3	71-43-2

Report No. VOC16_104

Carbon tetrachloride	0.2	<0.2	1	<1	56-23-5
Cyclohexane	0.2	<0.2	0.6	<0.6	110-82-7
1,2-Dichloropropane	0.2	<0.2	0.8	<0.8	78-87-5
Bromodichloromethane	0.2	<0.2	1	<1	75-27-4
Trichloroethene	0.2	<0.2	1	<1	79-01-6
1,4-Dioxane	0.2	<0.2	0.6	<0.6	123-91-1
Heptane	0.2	0.27	0.7	1.1	142-82-5
Methyl methacrylate	0.2	<0.2	0.7	<0.7	80-62-6
cis-1,3-Dichloropropene	0.2	<0.2	0.8	<0.8	10061-01-5
4-Methyl-2-pentanone (MIBK)	0.2	<0.2	0.7	<0.7	108-10-1
trans-1,3-Dichloropropene	0.2	<0.2	0.8	<0.8	10061-02-6
1,1,2-Trichloroethane	0.2	<0.2	1	<1	79-00-5
Toluene	0.2	<0.4	0.7	<1	108-88-3
2-Hexanone (MBK)	0.2	<0.2	0.7	<0.7	591-78-6
Dibromochloromethane	0.2	<0.2	2	<2	124-48-1
1,2-Dibromoethane	0.2	<0.2	1	<1	106-93-4
Tetrachloroethylene	0.2	<0.2	1	<1	127-18-4
Chlorobenzene	0.2	<0.2	0.8	<0.8	108-90-7
Ethylbenzene	0.2	<0.2	0.8	<0.8	100-41-4
Bromoform	0.2	<0.2	2	<2	75-25-2
m & p-Xylenes	0.5	<0.5	2	<2	108-38-3 / 106-42-3
Styrene	0.2	<0.4	0.8	<2	100-42-5
1,1,2,2-Tetrachloroethane	0.2	<0.2	1	<1	79-34-5
o-Xylene	0.2	<0.2	0.8	<0.8	95-47-6
4-Ethyltoluene	0.2	<0.2	0.9	<0.9	622-96-8
1,3,5-Trimethylbenzene	0.2	<0.2	0.9	<0.9	108-67-8
1,2,4-Trimethylbenzene	0.2	<0.2	0.9	<0.9	95-63-6
Benzyl Chloride	0.2	<0.2	0.9	<0.9	100-44-7
1,3-Dichlorobenzene	0.2	<0.2	1	<1	541-73-1
1,4-Dichlorobenzene	0.2	<0.2	1	<1	106-46-7
1,2-Dichlorobenzene	0.2	<0.2	1	<1	95-50-1
1,2,4-Trichlorobenzene	0.2	<0.2	1	<2	120-82-1
Hexachlorobutadiene	0.2	<0.2	2	<2	87-68-3
Naphthalene	0.2	<0.3	0.9	<1	91-20-3
Internal Standard: BCM (%Rec.)	1	83			74-97-5
Internal Standard: 1,4-DFB (%Rec.)	1	91			540-36-3
Internal Standard: MCB-d5 (%Rec.)	1	94			3114-55-4

Notes:

LOR = Limit of Reporting

Danny Slee
Organics Manager, North Ryde

Accreditation No. 198

25-Aug-16

Samples analysed as received
This report shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025.
Results relate only to the sample(s) tested.

APPENDIX B: SCREEN3 INPUT AND OUTPUT REPORT

11/15/16

07:57:29

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

C:\Lakes\Screen View\Tullamarine Flare.scr

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	0.167000E-01
STACK HEIGHT (M)	=	9.3000
STK INSIDE DIAM (M)	=	0.8000
STK EXIT VELOCITY (M/S)	=	9.6000
STK GAS EXIT TEMP (K)	=	1264.1500
AMBIENT AIR TEMP (K)	=	293.0000
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL
BUILDING HEIGHT (M)	=	0.0000
MIN HORIZ BLDG DIM (M)	=	0.0000
MAX HORIZ BLDG DIM (M)	=	0.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 11.571 M**4/S**3; MOM. FLUX = 3.418 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 4. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.0	1.0	320.0	139.84	1.15	1.09	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

1.	0.000	0	0.0	0.0	0.0	0.00	0.00	0.00	

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 8. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
65.	1.923	4	20.0	20.0	6400.0	6.64	5.56	3.31	NO
100.	2.562	4	20.0	20.0	6400.0	6.64	8.28	4.78	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 65. M:

96.	2.569	4	20.0	20.0	6400.0	6.64	8.05	4.66	NO

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 8. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
130.	2.278	4	20.0	20.0	6400.0	6.64	10.54	5.99	NO
200.	1.493	4	15.0	15.0	4800.0	9.14	15.74	8.82	NO
300.	0.9828	4	10.0	10.0	3200.0	14.13	22.93	12.69	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 130. M:

130.	2.278	4	20.0	20.0	6400.0	6.64	10.54	5.99	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
600.	0.3551	4	8.0	8.0	2560.0	25.62	42.99	21.75	NO
700.	0.3176	4	8.0	8.0	2560.0	25.62	49.42	24.51	NO

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 4. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
65.	0.9177E-01	4	20.0	20.0	6400.0	10.51	5.56	3.31	NO
400.	0.5912	4	10.0	10.0	3200.0	18.00	29.70	15.74	NO

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 8. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
130.	2.278	4	20.0	20.0	6400.0	6.64	10.54	5.99	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
* SUMMARY OF TERRAIN HEIGHTS ENTERED FOR *
* SIMPLE ELEVATED TERRAIN PROCEDURE *
****

TERRAIN HT (M)	DISTANCE RANGE (M) MINIMUM	MAXIMUM

4.	1.	65.
8.	65.	130.
8.	130.	390.
0.	600.	--
0.	700.	--
4.	65.	--
4.	400.	--
8.	130.	--

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	2.569	96.	8.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****