Alcoa World Alumina

Emissions to Air from Residue Disposal Area

Assessment of Emissions from Diffuse Area Sources

GHD Report

Project Management and Technical Review by Greg Power and Associates

March 2005

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Executive Summary

GHD was commissioned by Alcoa World Alumina Pty Ltd (AWA) to undertake an assessment the contribution of diffuse area sources (as opposed to point sources) to the overall emissions of Volatile Organic Compounds (VOCs) and odour from the Wagerup Alumina Refinery. Greg Power and Associates managed the overall program interface and technical review. Independent review of the project was undertaken by Dr. Neil Salisbury (Environ Pty Ltd). Previous studies have established knowledge of the point source emissions, through an initial Emissions Inventory and a programme of ongoing measurements[1,2]. The intention of this study was to provide the information required for inclusion of the gaseous emissions from the Residue Drying Areas (RDAs) and various liquor storage areas associated with them, in the Refinery Emissions Inventory. This was in response to a finding of the Environmental Audit by AWN in 2003-3[3], and similar recommendation in the more recent Review by CSIRO[4]. Both recommended the use of an emission isolation flux chamber and method as described in USEPA document EPA/600/8-86/008[5].

The study was carried out in two Phases. Phase 1 was a preliminary survey of the main area sources in order to establish the overall order of magnitude contribution of these sources to air emissions, and to enable priorities for further investigation to be established. In Phase 2 more detailed study was made of the priority areas indicated from Phase 1. Two of the key issues investigated were the effect of diurnal variation on emissions, and the effect of the material of construction of the flux hood on the results obtained.

All sampling and analysis was carried out according to standard USEPA techniques, or where an exact method was not available USEPA methods were adapted and tested to ensure their applicability in the specific application required. For example, USEPA methods for sampling of ambient air were adapted to collect samples on the flux hood discharge, which required recovery tests to be conducted to ensure that the absorbent materials were not overloaded. Also, there is no USEPA standard for flux hood measurements, EPA/600/8-86/008 being a "User's Guide"[5]. This document was used as the basis of the methods used, along with other more recent information as appropriate.

The main results from the Phase 1 study, carried out in October 2004, were:

- The main compounds detected in measurable amounts over most of the diffuse emission sources were formaldehyde, acetaldehyde and acetone, with smaller amounts of other carbonyl compounds and aromatics detected in a number of sources;
- The most concentrated emission sources are the Super-thickener and Cooling Pond, both of which contain relatively hot liquor;
- The rate of emission from residue is low, with dry residue lower than wet residue;

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[1] "Wagerup Refinery Air Emissions Inventory", Alcoa World Alumina Australia, September 2002

[2] "Wagerup Refinery Bi-Monthly Monitoring Programme ", Alcoa World Alumina Australia, reports from 2002 onwards

[3] "Environmental Audit of Alcoa World Alumina Australia Wagerup Refinery", AWN Pty Ltd, May 2003, Finding 13.1.5.3, p 13.3

[4]" Wagerup Air Quality Review", CSIRO Atmospheric Research, May 2004, Recommendation 7, p 127

[5] "Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber – User's Guide", USEPA Document EPA/600/8-86/008, 1986

- The only Polycyclic Aromatic hydrocarbon (PAH) that could be detected was naphthalene, and then only from the Super-thickener;

The results of Phase 1 were reviewed with Alcoa and other consultants. From this review a number of issues were identified for investigation in Phase 2. They were:

- The flux hood used in Phase 1 has a stainless steel hood, whereas the 1986 USEPA report refers to a plexiglass hood. The possibility that this difference could influence the results should be investigated and any differences quantified;
- There is likely to be diurnal variation in the rate of emissions from residue surfaces. This should be investigated and quantified;
- The residue areas vary considerably in relation to the time since deposition, the degree of drying that has taken place, and the effects of ploughing to promote evaporation and sprinkling to control dust. Some additional investigation of these effects should be done to improve the overall estimates of emission rates;
- The sources with the highest specific emission rates are the Super-thickener and Cooling Pond. Additional samples should be taken to confirm the measured rates and provide some indication of variability;
- An attempt should be made to achieve lower detection limits for PAHs on the Super-thickener and Cooling Pond.

Phase 2 of the study was carried out in February 2005. The main results were:

- The stainless steel and Perspex flux hoods gave comparable results under most conditions. Under conditions of strong sunlight on residue surfaces, the Perspex hood was subject to solar heating that raised the temperature in the hood significantly above the ambient temperature. The stainless steel hood therefore better represented the undisturbed surface environment under those conditions;
- The diurnal variation in emissions from residue surfaces was quantified, and a correlation was found between ambient temperature and emission rates;
- The emissions from dry and wet residue surfaces were investigated. It was found that emission rate is a function of dryness, with emissions from very dry surfaces close to or below detection for most compounds;
- Extended sampling times to achieve lower detection limits gave additional information on trace emissions of PAHs from the hot liquor sources, but attempts to lower detection limits in this way for the more soluble compounds from the liquor sources appears to have resulted in loss of sample due to moisture effects.

This work has provided a set of indicative data on the emission rates of VOCs and odour form the main diffuse sources at the RDAs. This data is presented in a form suitable as input to a dispersion model for determining ground level concentrations in the surrounding region.

1. Introduction

GHD was commissioned by Alcoa World Alumina Pty Ltd (AWA) to undertake an assessment the contribution of diffuse area sources (as opposed to point sources) to the overall emissions of Volatile Organic Compounds (VOCs) and odour from the Wagerup Alumina Refinery. Greg Power and Associates managed the overall program interface and technical review. Independent review of the project was undertaken by Dr. Neil Salisbury (Environ Pty Ltd). Previous studies have established knowledge of the point source emissions, through an initial Emissions Inventory and a programme of ongoing measurements[6,7]. The intention of this study was to provide the information required for inclusion of the gaseous emissions from the Residue Drying Areas (RDAs) and various liquor storage areas associated with them, in the Refinery Emissions Inventory. This was in response to a finding of the Environmental Audit by AWN in 2003-3[8], and similar recommendation in the more recent Review by CSIRO[9]. Both recommended the use of an emission isolation flux chamber and method as described in USEPA document EPA/600/8-86/008[10].

The study was carried out in two Phases. Phase 1 was a preliminary survey of the main area sources in order to establish the overall order of magnitude contribution of these sources to air emissions, and to enable priorities for further investigation to be established. In Phase 2 more detailed study was made of the priority areas indicated from Phase 1. Two of the key issues investigated were the effect of diurnal variation on emissions, and the effect of the material of construction of the flux hood on the results obtained.

1.1 Objectives

Phase 1

Undertake preliminary assessment of emissions of a range of analytes from the residue area at Wagerup in order to provide a basis for decision making.

Identify issues and constraints, which can be addressed in second phase.

Determine sources that appear to be significant.

Phase 2

Validate method used in phase 1.

Assess spatial and temporal variability of “significant sources”.

Increase overall dataset in order to improve statistical validity.

[6] “Wagerup Refinery Air Emissions Inventory”, Alcoa World Alumina Australia, September 2002

[7] “Wagerup Refinery Bi-Monthly Monitoring Programme “, Alcoa World Alumina Australia, reports from 2002 onwards

[8] “Environmental Audit of Alcoa World Alumina Australia Wagerup Refinery”, AWN Pty Ltd, May 2003, Finding 13.1.5.3, p 13.3

[9]“ Wagerup Air Quality Review”, CSIRO Atmospheric Research, May 2004, Recommendation 7, p 127

[10] “Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber – User’s Guide”, USEPA Document EPA/600/8-86/008, 1986

2. Scope of Work

An initial Scope of Work was developed by GHD and Alcoa in September 2004. This scope was based on a requirement in the response to the 2003 Environmental Audit[3], and the need to provide input data for atmospheric dispersion modelling needed for the Health Risk Assessment (HRA) required for the Wagerup III project approval process. The initial Scope became the scope for Phase 1 of the project. Following review of the Phase 1 results, additional work was defined for Phase 2, which was carried out in February 2005.

2.1 Phase 1 Scope:

2.1.1 General

- Samples to be collected using the isolation flux hood method described in USEPA Document EPA/600/8-86/008[5], as recommended by independent consultants[3,4]
- Sample capture and preparation to be according to Australian or International standard methods as far as possible, with any deviations from strict standards to be justified and validated as appropriate
- Analysis of all samples to be undertaken using recognised international standard methods in certified laboratories under NATA accreditation
- Collect bag samples for analysis for odour by dynamic olfactometry on selected samples
- Alcoa safety policies and procedures to be strictly adhered to, and personal safety to be a priority at all times in the work

2.1.2 Sampling Plan

Samples to be collected from the following sites (Table 1):

Table 1. Phase 1. Sampling Program

Sample Site	Number of Sampling Runs	Standard Analysis Required	Comments
Cooling Pond (CP)	2	TO17, TO11A, AS 4323.3	One sample close to inlet, one from main water body. One volumetric air sample (not reported here).
Run-off Water Storage (ROWS)	2	TO17, TO11A, AS 4323.3	One sample close to inlet, one from main water body
Runoff Collection Pond (ROCP)	2	TO17, TO11A, AS 4323.3	One sample close to inlet, one from main water body
Residue Disposal Area 2 (RDA2)	2	TO17, TO11A, AS 4323.3	Samples to be taken on surface of liquor currently stored in this area

Sample Site	Number of Sampling Runs	Standard Analysis Required	Comments
Super-thickener (ST)	1	TO17, TO11A, AS 4323.3	
Oxalate Storage	2	TO17, TO11A, AS 4323.3	
Wet Residue[11]	1	TO17, TO11A, AS 4323.3	
Dry Residue	1	TO17, TO11A, AS 4323.3	
Wet Sand[6]	1	TO17, TO11A, AS 4323.3	
Lower Dam	2	TO17, TO11A, AS 4323.3	

2.1.3 Reporting

- All results to be reported as specific emission rates, in units of micrograms per square meter per minute ($\mu g/m^2/min$) or odour units per square meter per minute ($OU/m^2/min$);
- Results to be provided in a summary report, and all original data to be made available, including field notes, laboratory reports, calculations, and quality control;

2.2 Phase 2 Scope

2.2.1 General

- General conditions as for Phase 1;
- In order to validate the method, conduct comparative evaluation of the performance of the stainless steel flux hood and a Perspex-domed flux hood of identical dimensions, both complying with specifications given in EPA 600/8-86/008[5] in all other respects;
- Conduct an evaluation of the variation in emissions from dry and wet residue areas over two periods of 24 hours;
- Collect replicate samples from selected sources to enhance overall data set;
- Undertake sampling for PAHs on selected sources, targeting lower detection limits by collecting larger sample volumes;
- Collect bag samples for analysis for odour by dynamic olfactometry on selected samples.

[11] In this report “residue” refers to the fine fraction of the Bayer residue, and “sand” refers to the coarse fraction

2.2.2 Sampling Plan

Samples to be collected from the following sites (Table 2):

Table 2 Phase 2. Sampling Program

Sample Site	Number of Sampling Runs	Standard Analysis Required	Comments
RDA: Dry Residue just after tilling, and after a period of solar drying	32	TO17, TO11A, AS 4323.3	Stainless steel (Ss) and Perspex hoods co-located on dry residue RDA during two 24 hour cycles – the first set of samples from residue that had been recently tilled, and the second from the same area a week later after solar drying in hot conditions; TO-17 and TO-11A samples collected from both hoods every three hours; hoods removed from sampling site for at least an hour on each run to allow site to re-equilibrate to ambient conditions; 8 samples of odour collected from the stainless steel hood in addition to the other samples on second 24 hour run.
RDA: Wet Residue	16	TO17, TO11A, AS 4323.3	Ss and Perspex hoods co-located on wet residue RDA during two 24 hour cycles; TO-17 and TO-11A samples collected from both hoods every six hours; hoods removed from sampling site for at least an hour on each run to allow site to re-equilibrate to ambient conditions; 4 samples of odour collected from the stainless steel hood in addition to the other samples on second 24 hour run; compared locating sample tube inside vs. outside the Perspex hood.
Cooling Pond	3	TO17, TO11A	Samples taken close to inlet, close to outlet, and at an intermediate location
RDA2	3	TO17, TO11A	Samples taken around the perimeter of the liquor area
ROWS	4	TO17, TO11A	Two samples during daylight, one at night; one pair near inlet, the other pair away from inlet
Bitumen	2	TO17, TO11A	Freshly sprayed area and area sprayed several weeks earlier sampled.
Super-thickener	2	TO17, TO11A	Samples taken from open area away from still-well
Dry Residue, Cooling Pond, Super-thickener	3	PAH (Method Number (TO13)	Extended sample times and larger absorbent volumes were used to improve the sensitivity for PAH determination. Method largely conforms to TO-13, but is relying on Tenax to retain vapours that might not be retained by PUF plug alone.

Figure 1. Location of Sampling Points

3. Methods

Data was required to be provided in the form of specific emission rates (emission rate per unit area) of VOCs and odour, suitable for input to an air pollution model for determining dispersion in the surrounding environment. The requirement from Alcoa was to undertake this assessment according to standard methods where these exist. Any departure from standard methods was to be identified and where possible quantified as part of this study. It is noted that there is no accredited standard for the determination of emissions using an isolation flux hood. Rather, the USEPA document that is used is a "User's Guide"[5]. The hood obtained by GHD for the initial sampling runs complies to the specifications in the User's Guide in every respect except the material of construction of the dome. A hood with a stainless steel dome was chosen for this work, based on a) the knowledge that this design has become widely used in the USA and Europe, and b) the 1992 paper by B Eklund of Radian Corp, the commercial developers of the hood[12]. Eklund notes that there are advantages to using a stainless steel hood in corrosive environments, and also that artefacts due to solar heating are reduced. The matter of solar heating as a difficulty with Perspex hoods is also mentioned in the USEPA paper[5]. Nevertheless, following a review of the work by AWN[13], it was decided to conduct a field evaluation of the stainless steel hood in comparison to a Perspex hood in Phase 2.

GHD sourced a stainless steel emission isolation flux hood that complies with the published method in all respects except for the material of construction of the dome. The stainless steel hood has been used extensively in the United States and elsewhere, and was the preferred option for the Bayer liquor ponds because acrylic is identified as not being chemically resistant to alkalis. The comparison of the two types of hood carried out in this work also showed the stainless steel hood to have the advantage of minimising artefacts associated with enhanced solar heating on solid surfaces.

3.1 Flux Hood

The flux hood is dimensionally the same as the flux hood described in EPA report EPA/600/8-86/008 and is shown in Figure 2.

[12] "Practical Guidance for Flux Chamber Measurements of Fugitive Volatile Organic Emission Rates", B Eklund, Radian Corporation Austin, Texas, in J Air Waste Management Assoc, 42, 1583-1591, Dec 1992

[13] "Point Source and Area Source Emission Test Methods – Review", AWN Pty Ltd, consultants report to Alcoa, Dec 2004

Figure 2. Flux Hood Floating on ROWS pond.

The dimensions of the flux hood were exactly 16 inches (40.5 cm) diameter at the skirt giving an actual volume of 25.4 litres to the base of the skirt. Under the USEPA method the skirt can be inserted into the media (liquor, water, mud) to a maximum depth of 2.5 cm. At maximum insertion the volume in the skirt is 21.9 litres. The stainless steel dome was 17.4 cm high and is slightly flattened at the top to allow the 4 ports. This gives a volume inside the dome of 17 litres, providing an overall volume of 42.4 litres to the base of the skirt or 38.9 litres to the insertion depth. At 5 litres a minutes this allows 3 times the volume to be circulated in approximately 25 minutes. This dome shape departs slightly from the USEPA method in that it has a small flat area on the top. However, Eklund (1996) indicates that tests have been undertaken comparing a completely cylindrical hood with the USEPA dome hood and there was no statistical difference in the results. The Perspex dome used in the second program was a perfect dome as described in the USEPA method.

Ultrapure nitrogen was supplied to an inlet port via tygon tubing that was degassed for 48 hours by pulling ambient air through the tubing before it was used on site during the first study. In the second program all lines were swapped to be PTFE lines with stainless steel fittings in order to conform more accurately to the USEPA method. The nitrogen was then distributed via PTFE tube (in the stainless steel hood) and stainless steel tube (in the Perspex hood) run around the circumference, which had four holes,

located at equidistant points around the tube in accordance with the published USEPA method. Sample collection tubes (2 off) were run from the top of the dome to the centre of the dome.

During the second program, it became clear that the higher temperature associated with the Perspex hood was leading to increased moisture condensation in tubes and samples lines outside of the Perspex dome. This was a cause for concern due to the potential for sample loss. Therefore a decision was made to locate the sample tubes as internal "probes" inside the Perspex hood since this would make the tubes the same temperature as the inside of the dome and avoid excessive condensation. Two comparison replicate runs were undertaken to test the efficacy of this approach.

A fourth outlet was left open to allow the sweep air to exit. This port was also used to allow a thermocouple wire access to the interior of the flux hood. During the first program, the thermocouple logged continuously, both inside and outside of the flux hood to ascertain any temperature differential that might require correction. The nominal diameter of this port was 1.8 cm, noting that the thermocouple wire took up some of this space. In the second program temperatures in the hoods were collected at the start middle and end of each sample run.

Operation of the hood requires that ultra-pure nitrogen or air is passed through the hood at a rate of 5 litres per minutes throughout the sampling run. To confirm that this was happening a field rotameter (SKC, Nutech Scientific, Victoria Park, WA) was connected onto the hood inlet line. The field rotameter was calibrated on a daily basis using a bubble flow meter supplied by SKC. When the sampling position allowed, the flow was regularly reviewed and adjusted as required. Where a crane was used, any change in flow rate was noted and logged when the system was returned to shore. In practice the flow rate proved stable throughout the 90 –120 minutes of a sampling run.

The published method requires that no more than 40% (2 litres per minute) of the sweep gas can be drawn as sample at any time. Samples were collected sequentially, but because of the dual pump arrangement the total sampling rate of the two pumps was adjusted to ensure that the flow would not be greater than 2 litres a minute even if there was an overlap in the pumps triggering.

Each time the hood was removed from the water surface and replaced it was necessary to equilibrate the hood by passing at least three volumes of sweep air through the hood prior to sampling. GHD equilibrated the hood for 30 minutes prior to collecting the samples giving more time than required to ensure this requirement was exceeded on each run.

During the second program, when the two hoods were being compared the supply gas was split to the two hoods from a single cylinder.

3.2 Odour Sampling

Odour sampling was undertaken according to Australian Standard Method AS4323.3. A lung type barrel (Figure 3) was located in the cage and connected to the hood using 3/8” PTFE tubing. GHD prefers the use of this wide bore tubing because it lowers flow resistance between the hood and the barrel enabling better control of flow rate using a constant flow rate pump. Calibrations of this system were undertaken daily and provided confidence that the flow drawn from the hood was a constant 1.8 liters per minute and below the 40% of sweep air allowed as part of the USEPA published report.

Samples were collected into nalopthane bags supplied by The Odour Unit. The Odour Unit degasses the nalopthane bags prior to dispatch, however GHD also equilibrated them with the sample matrix by filling each bag from the hood and then evacuating this prior to collecting the sample for analysis. In some

cases this required that the system be returned to shore and that the hood therefore be re-equilibrated prior to collection of the samples. This usually meant that each sampling site required in excess of three hours to collect the required number of samples.

The sample pump used in this method was a battery powered Aircheck 2000 (SKC). The Aircheck 2000 is a time programmable, mass flow controlled, constant flow pump. This allowed the pump to be triggered at an appropriate time once the hood had equilibrated and then collect a suitable sample volume at the appropriate flow prior to shutting down. The pump retains data on each run within internal memory and, on return to the shore, the pump characteristics were reviewed to ensure that it had operated correctly.

Odour samples were assessed using dynamic olfactometry according to Australian Standard AS4323.3 by The Odour Unit, a Perth Based laboratory (Myaree, WA) that is NATA accredited for this method. Samples were presented to the laboratory within 24 hours in order to allow compliance with the maximum time limit of 30 hours under the standard.

Figure 3. Sampling hood connected to Automated Sampling system

3.3 VOCs and Carbonyls

VOCs were collected and analysed using the USEPA standard method TO-17, whilst Carbonyls were collected and analysed using USEPA TO-11A. TO-17 VOC tubes were packed and supplied by Geotech Laboratories (Welshpool, WA). TO-11A tubes were supplied by SKC (Nutech Scientific, Victoria Park WA).

Please note that the TO-17 and TO-11A methods are designed for ambient monitoring of these substances and therefore there is some risk of sample breakthrough if emission sources were elevated or high in humidity. In view of this a qualitative assessment of the potential source strength and moisture was made of each source prior to sampling and the sampling volume reduced if this was considered a problem.

Between one and three litres of sample was drawn though the TO-17 tubes in the first phase and this was increased on some sources to 6 litres in the second phase. Between 5 and 10 litres was drawn though the TO-11A tubes at a rate of 200ml per minute during the first phase and this was increased to up to 60 litres at a rate of 1 litre/min during the second phase. This gave detection limits for emission sources only two or three times higher than ambient guidelines where they exist (e.g. benzene, formaldehyde) and is therefore more than appropriate when receptors are located some distance away from the source.

Tenax/Carbosieve packing was used for the TO-17 tubes and DNPH coated silica gel was used for the carbonyls tubes.

Samples were collected using an Aircheck 2000 constant volume pump fitted with a constant pressure low flow adapter during the first phase. The packing on some of the tubes was found to be variable and this affected the flow rate through each tube. In view if this, the pump and tube combinations were individually calibrated immediately prior to sampling using a bubble flow meter. In order to reduce the risk of cross contamination the tubes were calibrated on 100 ml timed volumes and two calibration blanks were sent to the laboratory to ensure that there was no contamination from the calibration equipment.

During the second phase all samples were collected using mass flow controlled constant volume pumps in order to reduce potential error from the constant pressure adapters.

Each sample for odour required 2 runs (one to equilibrate the bag and one to collect the sample) and therefore it was possible to swap between tube types without incurring additional runs.

3.4 Quality Assurance

3.4.1 Sample Collection and Handling

Quality assurance is a process that begins prior to the collection of sampling, with the selection of appropriate methods and sampling sites.

In this study all air sampling methods were standard methods, although, as noted the TO-17 and TO-11A methods are ambient methods and therefore potential for sample loss was considered at all stages and where evidence appeared additional review and sampling was undertaken.

The flux hood is the subject of a report by the USEPA and follow up clarification by Radian (the designer of that hood). Both reports are quite difficult to obtain and therefore are available to an interested reader in PDF format from the GHD Perth Library.

The flux hood matches the design of the EPA report except in two considerations;

1. The flux hood used in this program had two proximal sample collection tubes with the hood allowing for collection of two sample streams. This change is considered an improvement over the original method in that it allows for absolute integrity of sample flow where multiple samples are to be drawn simultaneously from the hood.
2. The flux hood dome comprised stainless steel as opposed to Perspex as in the original report. In both cases the skirt of the hood was stainless steel. A stainless steel dome was selected because of the lower reactivity of this material to hot caustic solution. It is noted in the companion report (Eklund, 1992) that the importance or otherwise of net energy flux (solar insolation) is discussed and identified as being important for contaminated surface soils and quiescent liquids with an organic layer over the surface. Since this is not the situation for all sources except, perhaps, dry residue, there is no sample integrity reason to support the use of a plexiglass hood over a stainless steel hood. Indeed we note that plexiglass is not chemically inert and may contribute to sample loss at low concentrations of analyte. With this in mind, appropriate sample recovery tests were performed. Eklund (1992), does however note that plexiglass allows the assessment of condensation levels within the flux hood. Condensation from the sources at Alcoa was a persistent problem and this is discussed when reviewing the results. However, GHD were aware of this issue as being significant because condensation beads formed on the surfaces of the transparent PTFE odour line and we were therefore able to consider this issue without the need for plexiglass.

3.4.2 Laboratory Quality Assurance Procedures

This section is based on information and notes provided by Geotech Laboratories[14]. It is a summary and explanation of their NATA accredited procedures.

TO17 Quality Assurance

- Theory
  - The USEPA TO-17 sampling protocol collects VOCs from air samples by passing a known volume of air through suitable adsorbent medium, (Tenax) followed by thermal desorption. The desorbed components are then separated by gas chromatography and analysed by mass spectrometry. The method is considered capable of measuring VOC concentrations of 0.5 ppb to 25 ppb in ambient air. In using this method for the current application, care is taken to ensure effects due to overloading of the adsorbent by moisture or high VOC concentrations are avoided.
  - The sample tubes are analysed using a Thermal Desorber coupled to a GC-MS by methods based on Sections 8 to 13 of US EPA TO17. This method must achieve a detection limit of ≤ 0.5 ppb (V). All limits specified below are derived from US EPA TO15 and TO17. Target compounds are quantified based on instrument responses of a set of authentic external standards, relative to an internal standard. The standards are prepared by adding a known amount of authentic material into a solvent and then diluting these as necessary. The standards are then introduced onto the tubes by a system designed to simulate sampling. A range of quality control measures is in place to ensure that the results are as robust and accurate as is practicable.
- Multipoint Calibration

[14] Nigel West, Geotech Laboratories, private communication.

- A six point calibration curve is prepared for each target compound (this does not include the system blank i.e. zero). One calibration point may be deleted from each compound to ensure a correlation coefficient of > 0.96 for the range of compounds monitored.

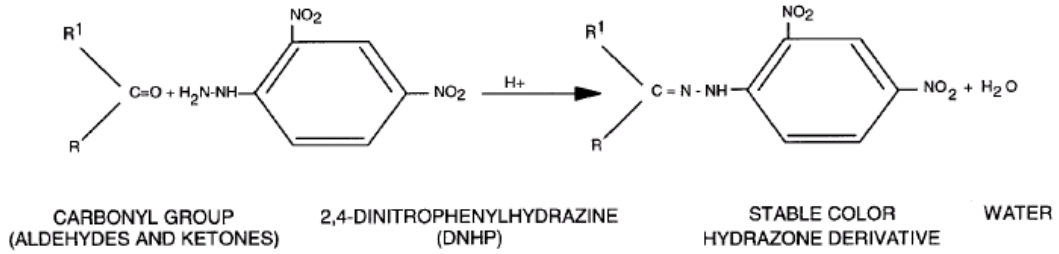
- Daily / Single Point Calibration
  - A single point calibrant (normally 100 ng) is used to check that the system is still operating within acceptable parameters i.e. all compounds are responding within 30% of the multi point calibration.
- Blank Analyses
  - The system is monitored to ensure that any possible laboratory contamination is kept to a minimum.
- Analytical Procedure
  - After the system has passed all QC and cleanliness checks, samples may be analysed. The system is monitored by analysing a Check standard (Chkstd) after every 9-10 samples. This ensures that what happens to the samples while they are waiting for analysis also occurs to the Chkstd. A laboratory blank is also analysed at the end of the sequence.
- Reproducibility
  - The reproducibility of each of the sources of error, syringes, balances, MS etc is measured every six months. The results of these tests are entered into an Excel spreadsheet that is sent out with the client data. See the error analysis worksheet for an example.
- Error Analysis
  - The calculations used to derive the uncertainty estimations are based on the CSIRO National Measurement Laboratory Course Notes TM089 (Author R. Cook and W. Giardini). The results of these tests are included in the Excel spreadsheet that is sent out with the client data.
- Audit Accuracy
  - The accuracy of the benzene standard is determined six monthly. This gives the laboratory an independent indication of whether the standards need to be replaced.

TO-11A Quality Assurance

The USEPA TO-11A method is applicable for monitoring ambient air with low carbonyl content requires a calibrated pumping system to sample ambient air for a known time. The airflow can be between 100 mL/minute and 2000 mL/minute, depending on the concentration of organics present. The air is passed through a cartridge containing an adsorbent such as silica coated with 2,4-dinitrophenylhydrazine (DNPH) and a strong acid catalyst. The hydrazones resulting from reaction with airborne carbonyls and ketones are later analysed using high performance liquid chromatography. Before contacting the DNPH adsorbent, the ambient air is passed through granular potassium iodide to remove ozone, necessary to prevent loss of the DNPH product prior to analysis. Using TO-11A, low molecular weight carbonyl compounds including benzaldehyde are commonly measured to less than 0.5 ppb by volume. In using this method for the current application, care is taken to ensure effects due to overlading of the adsorbent by moisture or high VOC concentrations are avoided.

- Theory
  - Carbonyls reach equilibrium with 2,4 dinitrophenylhydrazine in acidic medium in the reaction described below. These derivatised carbonyls are extracted from their sample matrix (tube or

solution) and then analysed by HPLC. Quantitation is carried out by comparison with authentic standards. This procedure is based on a combination of USEPA Method 8315A, USEPA Method 0011, USEPA TO-5 and USEPA TO-11A.



- Preparation of Standards
  - Target compounds are quantified based on instrument responses of a set of authentic external standards. External standards are replaced as needed. The standards are then analysed and the data processed and reported
- Purity of Reagents and Derivatives:
  - After preparation of a fresh aldehyde or ketone DNPH derivative the compound needs to be diluted and analysed by HPLC to ensure that it is > 96 % pure. If not a different source of aldehyde or ketone needs to be obtained, or the raw material needs to be checked by another technique eg thermal desorption gas chromatography mass spectrometry. Once the purity of the standard has been established suitable adjustments need to be made to the calibration of that compound when the data is processed, this is done automatically in the Excel files used to calculate the abundance of the material.
- Multipoint Calibration
  - The entire suite of carbonyl standards is analysed in duplicate at least every six months, sooner if the daily calibration fails.
- Independent Standard:
  - Can be purchased from Novachem Phone. This standard is used to check the accuracy of the standards that are prepared in-house and should be run after the multipoint calibration. If this standard is kept sealed in the fridge it should last at least 18 months.
- Precision
  - A mid range standard is analysed with every batch of samples.
- Validation of Compounds Detected
  - Any new compounds that are added to the target suite need to be validated. This validation need only be carried out if the compound is not covered in USEPA TO-5 and TO-11A. Recoveries need to be > 80% for the compound to be acceptable. Validation comprises adding the new compound, at known concentrations, to either or both of the derivatising media at 0.2 ppm.
- Method Detection Limit: (MDL)
  - A very low range standard is analysed every six months.

- Column Performance
  - The efficiency of the column is determined from the 0.1 ppm standard data.
- Daily Calibration
  - The HPLC is calibrated with a mid or low range standard with every batch of samples analysed. A single point calibrant is used to check that the system is still operating within acceptable parameters i.e. all compounds are responding within 10% of the multi point calibration. This analysis may be repeated until the system passes or in cases where the calibration will never pass a multi point calibration should be carried out with fresh standards.
- Blank Analyses
  - The system is monitored by analysing laboratory and system blanks to ensure that any possible laboratory contamination is kept to a minimum.
- Sample Analysis Procedure:
  - After the system has passed all QC and cleanliness checks, samples may be extracted and then analysed. The system is monitored by re-analysing the single point calibrant after every 10 samples (20 analyses). The laboratory blank is also analysed at the end of the sequence.
- Reproducibility
  - The reproducibility of each of the sources of error, syringes, balances, MS etc is measured every six months. The results of these tests are entered into an Excel spreadsheet that is sent out with the client data.
- Error Analysis
  - The calculations used to derive the uncertainty estimations are based on the CSIRO National Measurement Laboratory Course Notes TM089 (Author R. Cook and W. Giardini). The results of these tests are included in the Excel spreadsheet that is sent out with the client data.

3.5 Quality Control

Two trip/calibration blanks for TO-17 and TO-11A were collected during the initial monitoring round at Wagerup. Calibration blanks were used because of the need to calibrate each tube individually prior to collection of a sample. This exposed each tube to a small amount of ambient air, which needed to be accounted for. In the event, the trip/calibration blanks all returned values below the quantifiable detection limit.

In the first phase, replicate samples were collected at the Superthickener for odour, TO-17 and TO-11A methods. In the event it appears that multiple sampling of some well-mixed area sources has also given good indication of repeatability. Additional replicates were also collected at the superthickener to confirm the emissions found at higher volumes.

The second phase replicates were again collected to TO-17 and TO-11a at the superthickener.

System blanks were collected according to the method described by Radian (USEPA, 1986). In this case the hood was placed on a Teflon sheet and equilibrated using the ultrapure nitrogen. Once equilibrated, samples were collected for each analyte according to the standard field methods and volumes. Initially system blanks returned values higher than some of the field samples and this appeared to be due to offgassing of the PTFE (Teflon). With this in mind, that PTFE was exposed to ambient air and further system blanks were undertaken. In order to be sure that a valid blank was

collected the system was also operated whilst being placed on a nalopthane odour bag which had been cut open This indicated a consistent system odour blank of 56 odour units, the presence of minimal amounts of acetone and benzaldehyde on the TO-17 tube. There were also small but consistent levels of formaldehyde, acetaldehyde and acetone on the system blanks. These values have been subtracted from the final emission estimates and have been included in the consolidated data spreadsheet.

3.6 Safety

Safety consideration are extremely important in a program where personnel are operating next to areas of caustic liquor or caustic residue and on some occasions next to hot caustic liquors. This issue was increased due to a need to work at night. The following identifies some of the key safety issues and how they were addressed. Where this imposed a limitation on the ability to take samples this is also highlighted.

1. Superthickener – the Superthickener can only be accessed via a moving set of stairs leading to a rotating gantry. In order to place the sampling hood onto the gantry it was necessary to stop the rotating gantry and crane lift the equipment onto the gantry. This is a non-trivial logistical exercise limiting the amount of time available for sampling in this location, because larger cylinders cannot be transported in this manner and because the logistical requirements take considerable effort to achieve.
2. Dry Residue – sampling on dry residue requires the location of the equipment on a trailer. In order to allow an operator to remain in proximity to the equipment during sampling it is important to have a vehicular refuge that the operator can retreat to between forays (Note that on both occasions winds at night exceeded 50 km/hour leading to some localised dust lift off and daytime temperatures exceeded 40 degrees C). This had the effect of limiting the choice of sites. It was necessary to turn off sprinklers during this monitoring.
3. Wet Residue – Access to wet residue is very constrained when access is required at night. This meant that sampling points had to be immediately adjacent to RDA berms. In one case (RDA – 6) gas supply lines were extended to approximately 5m, which is within the limits of the published method.
4. RDA-2 and ROWS pond – sampling and access of most of these sites was achieved by crane. This limits the ability to cross-check zero gas supplies, however these appeared to be stable on these runs.
5. Cooling Pond – good access to the surface was possible at the Northern end and had to be undertaken with care on the Southern end. Samples were collected from the margins of the pond in these locations and two personnel were stationed at this location throughout the sampling.

4. Results

Emission measurements were corrected for any contamination in the sample collection system, by system blank correction according to the USEPA procedure. The results presented in this report have not been temperature corrected.

The detailed results, including the original laboratory data, are given in the appendices. Appendix A presents the results for each location as specific emission rates (emissions per square metre of area) in $\mu g/m^2/min$. Note that this allows comparison of results to a standard condition. The original Laboratory results for each sample are shown in Appendix B, expressed as sample tube loadings in nanograms.

The following sections summarise and discuss the main aspects of the results.

4.1 Quality Control Results

Internal quality control relates to the overall consistency of the data. It includes blank correction and field replicate data. It also includes a reality check that highest emissions are found from the sites with the highest liquor concentrations and temperatures, for example, and investigates any results considered anomalous on the basis of knowledge of the processes and sources, and comparisons between results.

Apart from odour and acetone, all substances were below the detection limit for at least one of the samples collected. This indicates that any background levels being contributed by the sample collection system (flux hood, tubing, pumps) in the field were not significant, and that any contribution of the system is accounted for by system blanks taken under laboratory conditions as required by the USEPA method.

4.1.1 Field Replicates

Duplicate samples were taken at the Super-thickener samples to provide field replicate data. The Super-thickener was chosen for this because it is the source expected to have the highest specific emission rate with low variability due to the uniformity of the source (well mixed liquid of large volume). Due to constraints associated with location and access, it was not possible to take replicates concurrently so each type of sample (odour, TO-11A, TO-17) was collected sequentially (that is two odour samples followed by two carbonyl samples and then two VOC samples).

Replicates were taken at the super-thickener site for all sample types (Table 3). These results indicate good agreement in most cases (RSD<25%), but there are examples of unexplained variability that indicate the need for duplicate samples where possible. All determinations of carbonyl and VOC emission rates were based on multiple measurements.

Table 3. Residual Standard Deviation of Replicates (from emission rates)

Analyte	Sample 1	Sample2	Sample 3	Sample 4	Mean	StDev	RSD(%)[1]
Odour ($OU/m^2/s$)	4.9	6.1			5.5	0.8	15%
Acetone ($\mu g/m^2/min$)	678	485	555	546	566	81	15%
Acetaldehyde ($\mu g/m^2/min$)	198	181	138	155	168	27	16%
Benzene ($\mu g/m^2/min$)	1.2	1.7			1.5	0.4	27%
Toluene ($\mu g/m^2/min$)	3.8	3.7			3.7	0.07	1.9%

[1] Relative Standard Deviation (RSD) = Standard Deviation/Mean x 100

4.1.2 Blank Results

Trip Blanks

Both trip blanks of the TO-17 and TO-11A tubes were sent for analysis to the laboratory and indicated no detectable levels of analytes.

System Blanks

System blanks were collected according to the USEPA method, which specifies the use of PTFE as the material that the flux hood should be placed on to represent an uncontaminated surface. However it was found that the new PTFE (Teflon) used was not completely inert and required out-gassing before use. Once this was done it returned results consistent with an uncontaminated surface, and which could be used as a system blank.

A total of five TO-17 system blanks; seven TO-11A system blanks and two odour blanks were collected.

The applicable system blanks were subtracted from all results.

4.1.3 Laboratory QC

Results of Laboratory QC checks and associated comments are included with relevant analytical documentation in Appendix B.

4.1.4 Sampling Volumes: Sensitivity vs. Sample Recovery

In Phase 2 an attempt was made to improve sensitivity by increasing sample volumes. This was successful on the residue sources, and enabled determination of emission values for Propanal. MEK, Benzaldehyde, 2-Pentanone and n-Pentanal, which were below detection limits at the lower volumes. However it also raised questions in relation to sample recovery in the case of the hot, wet sources (super-thickener and Cooling Pond) despite the sample volumes and flow rates used in all cases being within the safe sampling volumes identified in methods TO11A and TO17. There was suggestion of sample breakthrough for these sources at the higher sample volumes, which could explain lower

reported emission rates of some compounds in comparison to those recorded in Phase 1, which warrants further investigation.

4.2 Flux Hood Comparison

4.2.1 Hood Temperature

A series of measurements were carried out to establish the influence of the material of construction of the hood on the emission rates measured. This work was done in conjunction with the determination of diurnal variation in emissions from dry and wet residue. Measurements were made of the temperatures inside the hoods, and these were compared with the ambient temperature as measured at the Bancell Road weather station just south of the refinery. The results of these determinations on dry residue are summarised in Figure 4. On both days the Perspex hood showed higher internal temperatures than the stainless steel hood, but this effect was much greater on the first day. Ambient measurements of the mud were taken in the field at the sampling location. These agreed well with the readings at the Bancell Rd monitoring station on the first day, but not on the second day. During the day on the second run, the field residue temperature and the two hood temperatures agreed quite well, but the Bancell Rd temperature was significantly lower. All temperatures agreed well during the night.

The corresponding results for wet residue are shown in Figure 5. In this case the hood temperatures for the two hoods agree very well, indicating that for the wet surface the temperature inside the hood is determined principally by the temperature of the bulk material and is little influenced by solar flux through the hood itself. The agreement between field residue temperature and hood temperature suggests that the surface temperature of the bulk substrate follows the ambient temperature quite closely. The differences between field residue temperature and Bancell Rd temperature were significant, particularly during the day as noted for the dry residue runs.

Figure 4: Effect of Ambient Temperature and Hood Material on Hood Temperature for Dry Residue

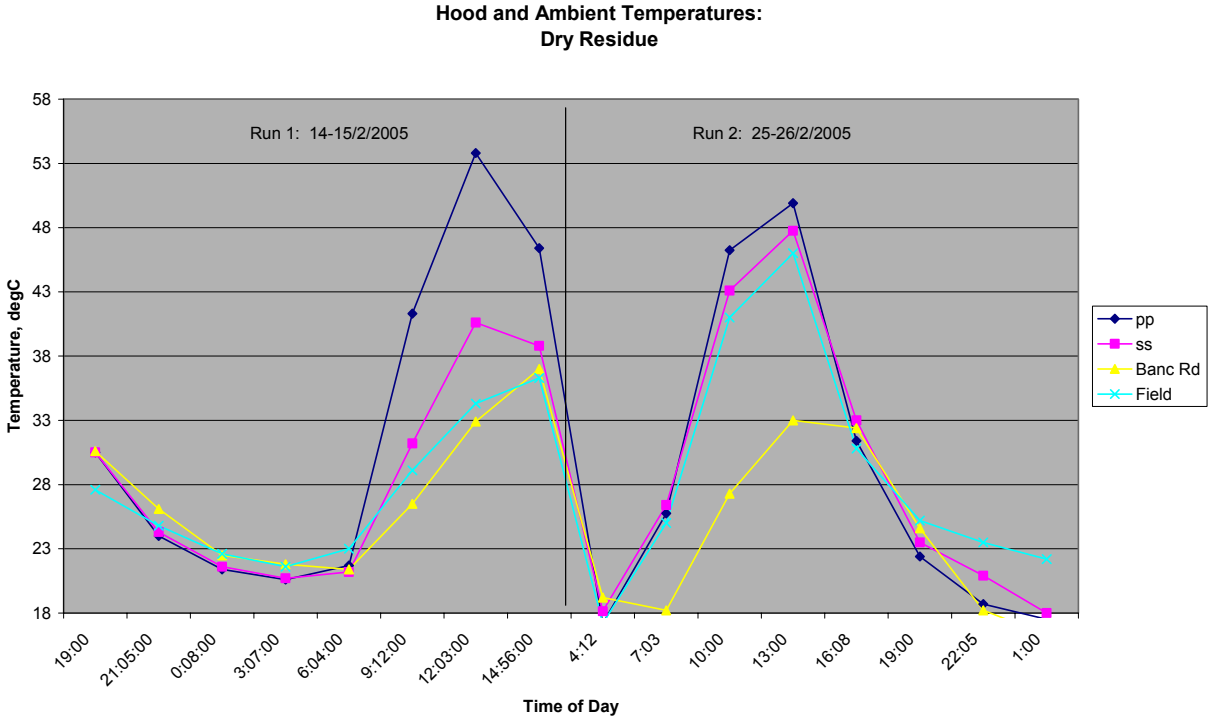
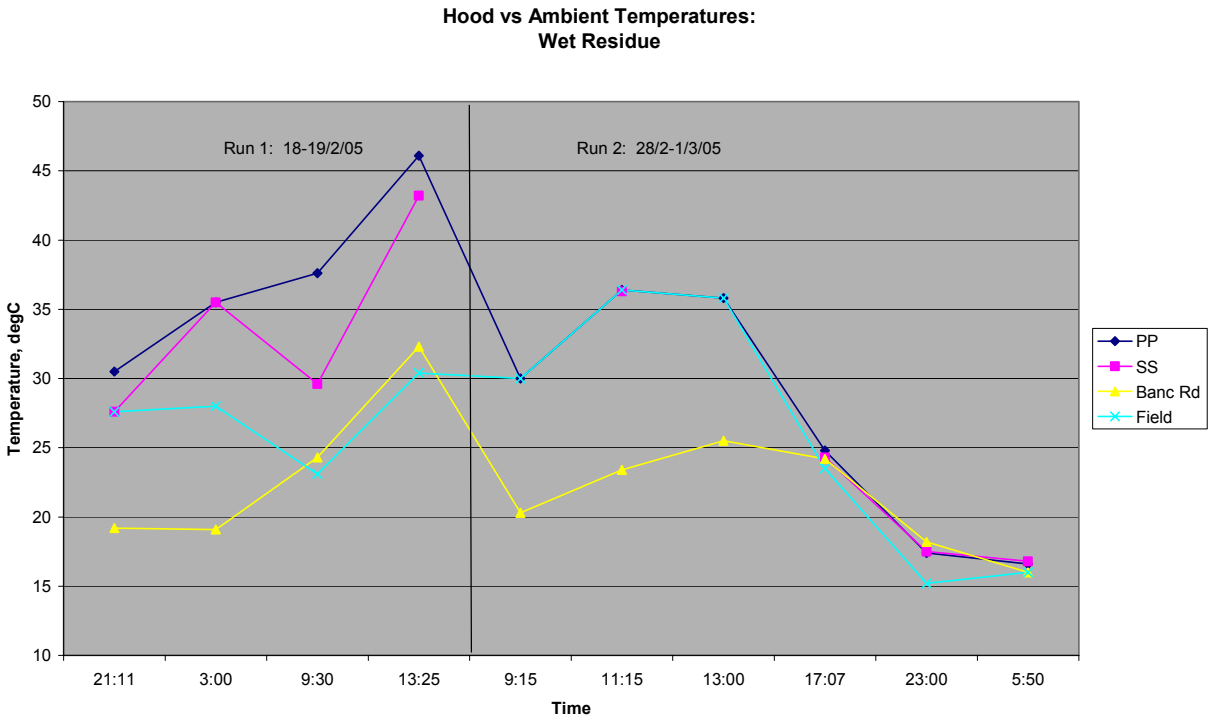


Figure 5: Effect of Ambient Temperature and Hood Material on Hood Temperature for Wet Residue

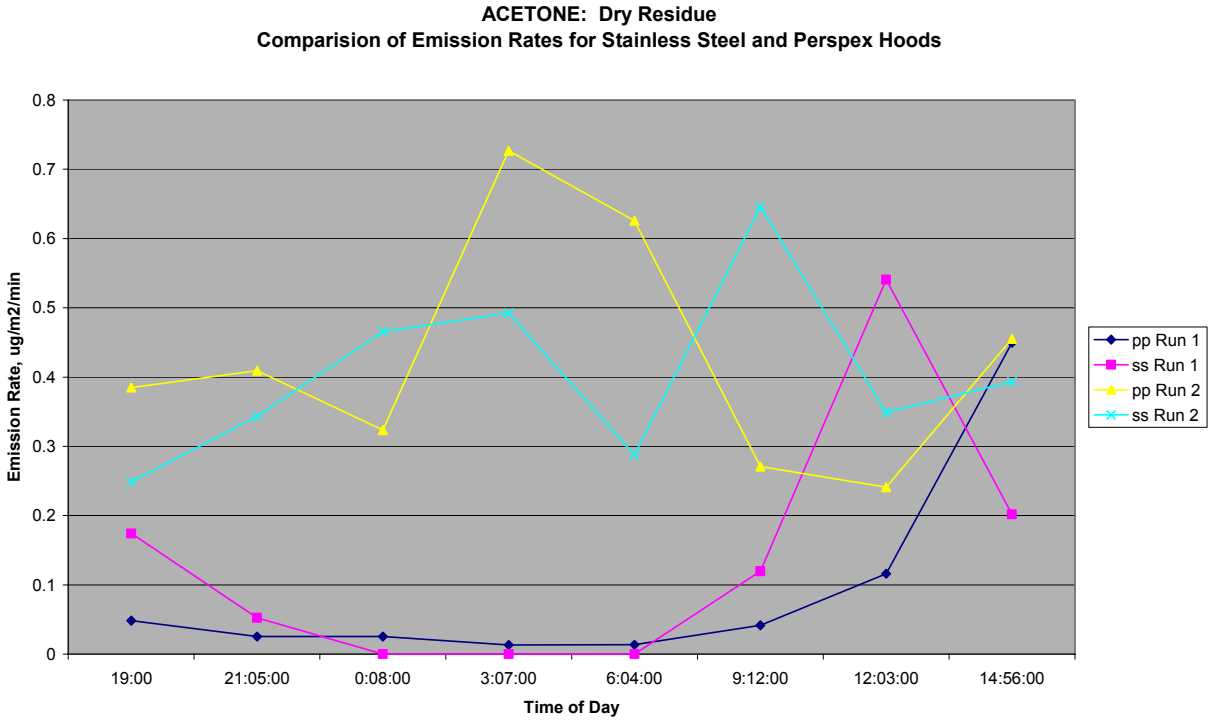


4.2.2 Statistical Comparison of Emissions Results Between Hoods

The emission rates measured using the Stainless Steel (ss) and Perspex (pp) hoods were compared on dry and wet residue, under a range of conditions over 24 hour periods. The example of acetone is given in Figure 6. It can be seen that the variability between samples in each sequence is greater than the difference between hoods. In the case of Run 1 the effect of diurnal variation can be seen in both sets of results, whereas for Run 2 the data agree within the variability of the determination.

The greater amount of data available for wet and dry residue allowed a more detailed test of the overall emissions and therefore paired t-tests were undertaken on each dry and one wet residue run. These test indicated that the differences between the two datasets were not statistically significant at the 95% confidence level.

Figure 6: Comparison of Acetone Emission Rates for Acetone Measured by SS and PP Hoods



4.2.3 Effect of Temperature on Emission Rates

An attempt was made to correlate regional ambient temperature with the measured rates of emissions from residue in order to enable evaluation of diurnal variations and facilitate emissions rate modelling over longer periods. Figure 7 to Figure 9 show the results of this for two sets of determinations on each of dry and wet residue. Essentially, for dry residue that has been recently ploughed there is some correlation for acetaldehyde but not for formaldehyde or acetone (Figure 7), and for residue that has undergone additional drying there is no dependence for any of the compounds emitted (Figure 8). Figure 9 indicates no relationship between regional temperature and emissions for any of the compounds emitted from wet residue, as all the lines of best fit have correlation coefficients of 0.3 or less.

Figure 7: Emission Rates vs. Regional Temperature for Dry Residue: Run 1

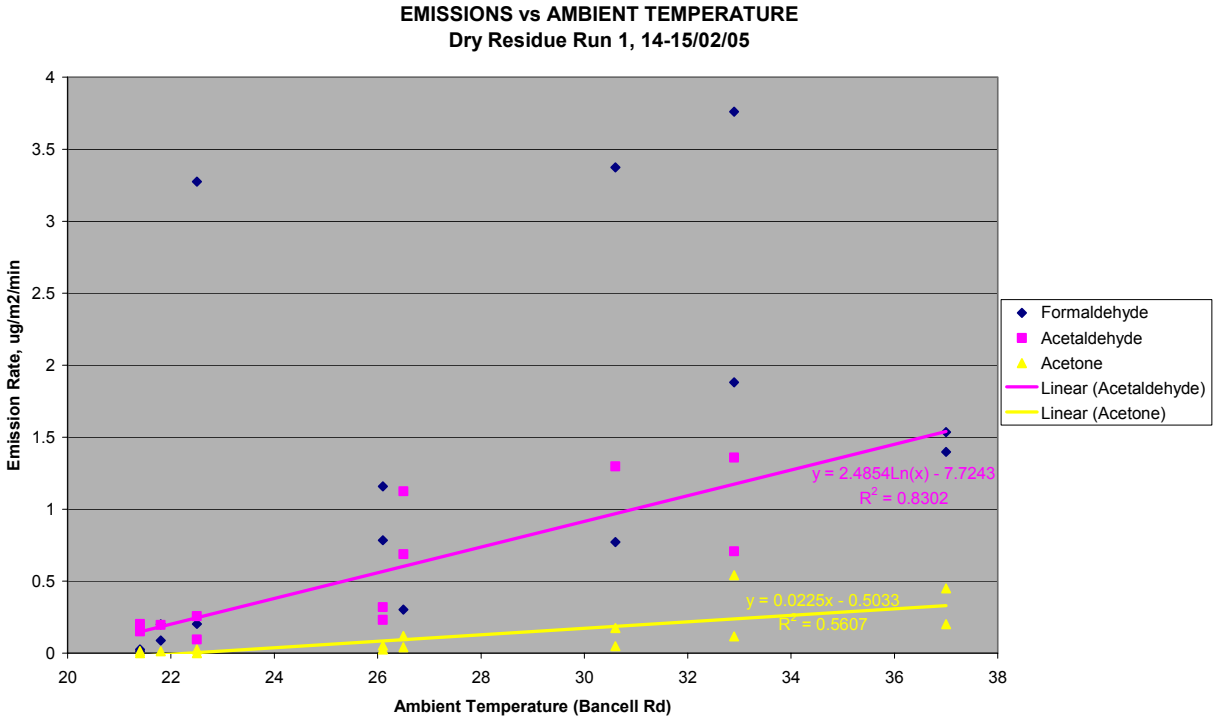


Figure 8: Emission Rates vs. Regional Temperature for Dry residue: Run 2

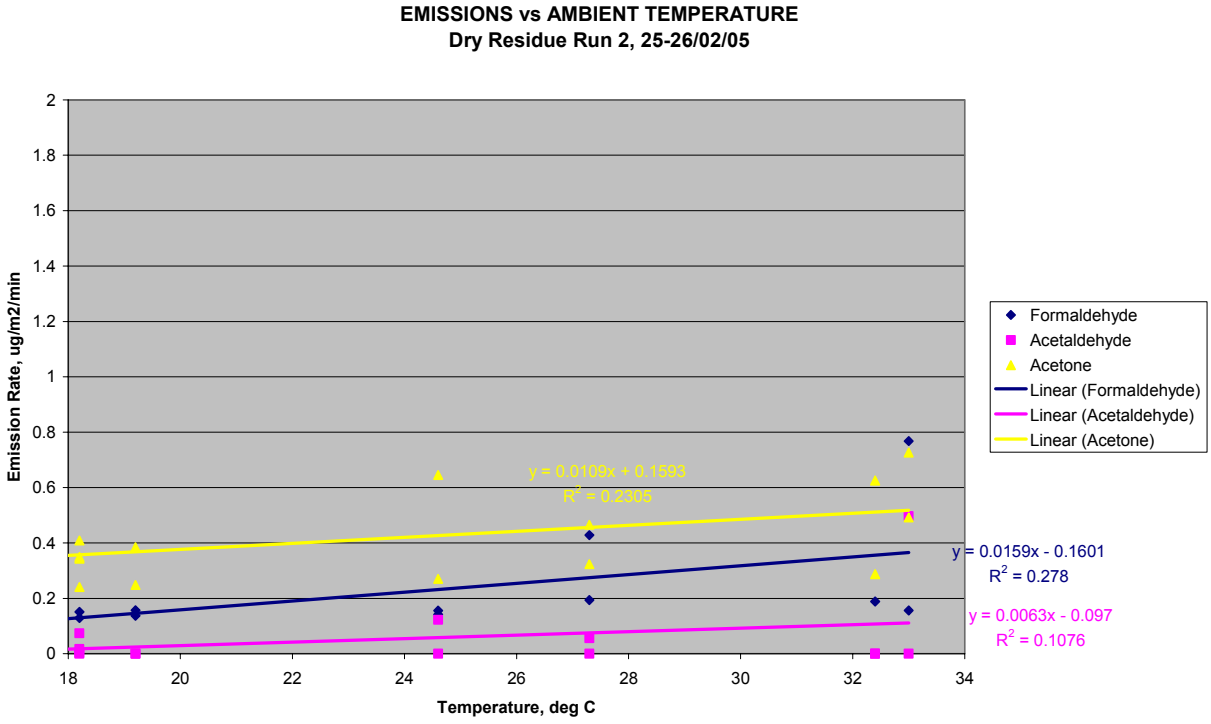
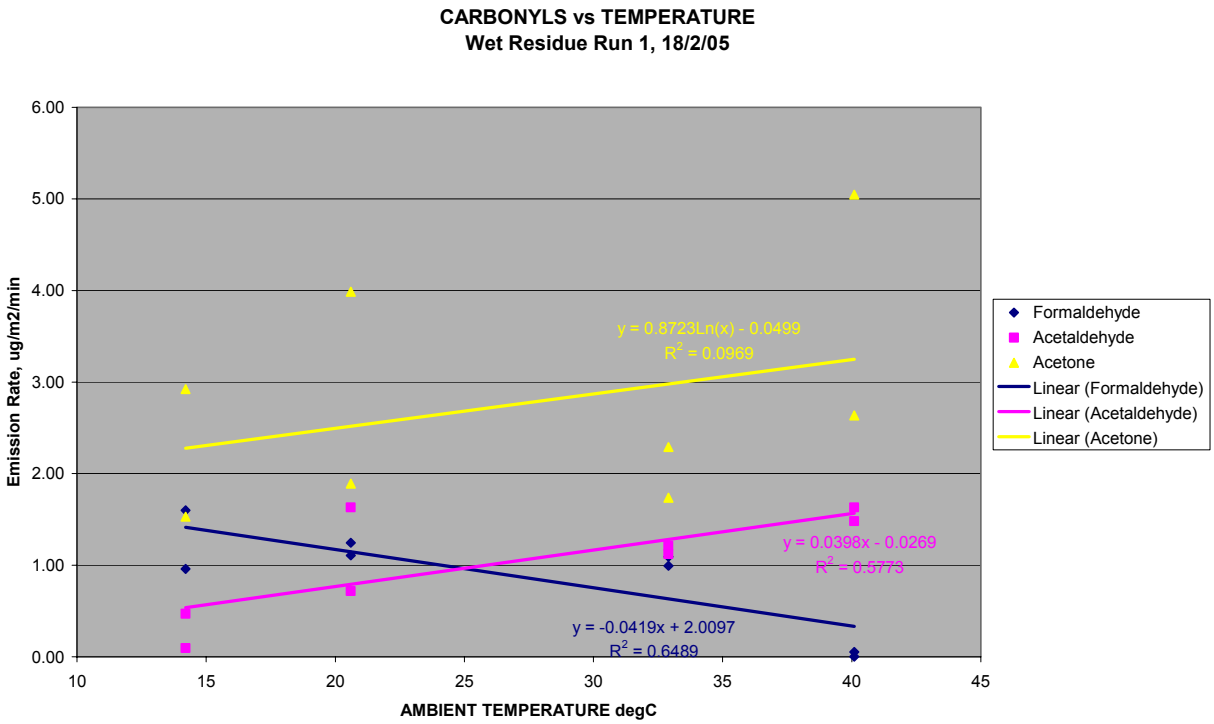
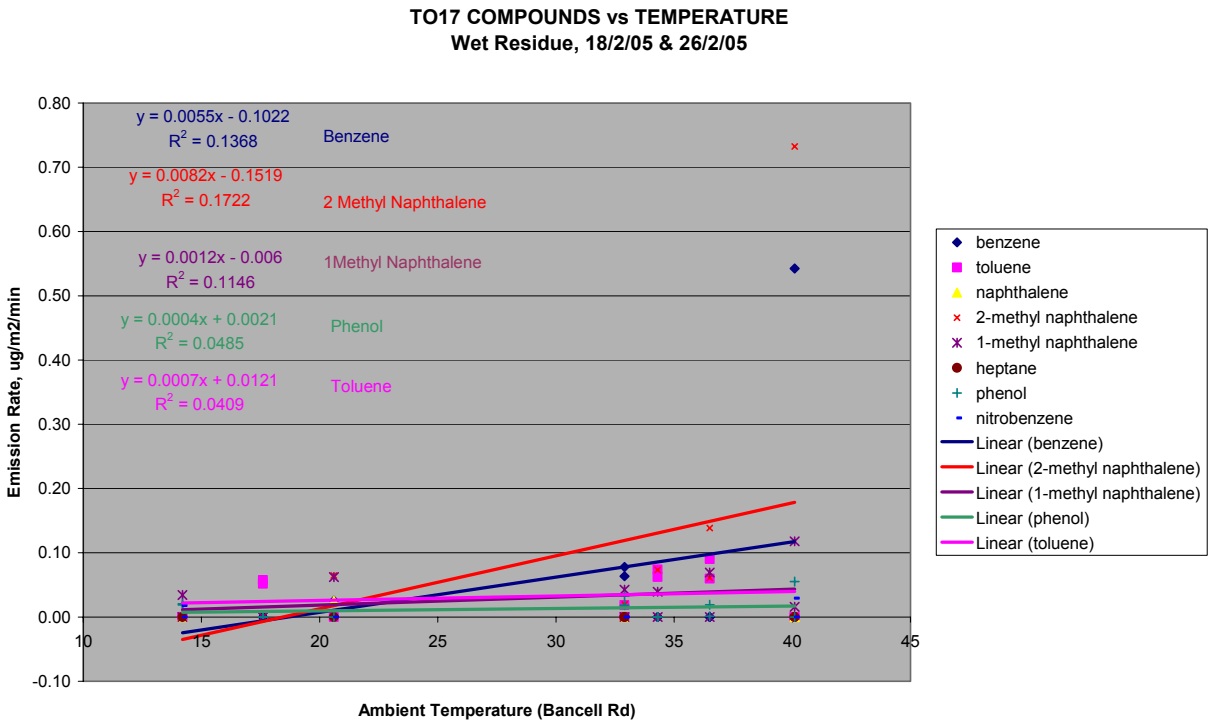


Figure 9: Emission Rates vs. Regional Temperature for Wet Residue



The emission rates for the TO17 compounds were all very low from residue surfaces. As expected they were higher from wet residue than dry residue. Figure 10 summarises the results for wet residue. There is no significant relationship between emissions of these compounds and regional temperature, as all of the correlation coefficients are less than 0.15.

Figure 10: Emission Rates vs. Regional Temperature for TO17 Compounds



4.3 Emission Rates from Liquor Sources

4.3.1 Super-thickener

The super-thickener is a large open vessel containing dilute Bayer liquor at a Total Alkali (TA) concentration of about 20g/L at a temperature of about 55^{o}C. Samples can be taken by suspending the flux hood from the gantry that provides access to the central rake drive. The specific emission rates are highest from the super-thickener of all the residue area sources, because of its high temperature and concentration. Its contribution to overall mass emissions is relatively small however, because of its low surface area in comparison to the residue drying areas.

4.3.2 RDA-2

The open liquor storage area at RDA2 was also sampled. It has similar concentration to the super-thickener, but is cooler. Its specific emission rates are correspondingly less. The specific emission rates for the carbonyl compounds from the super-thickener and RDA2 liquor are summarised in Figure 11.

4.3.3 Cooling Pond

The specific emission rates of carbonyls from the Cooling Pond are shown in Figure 12, and for the TO17 compounds in Figure 13,

Figure 11: Emission Rates of Carbonyls from Super-thickener and RDA2 Liquor

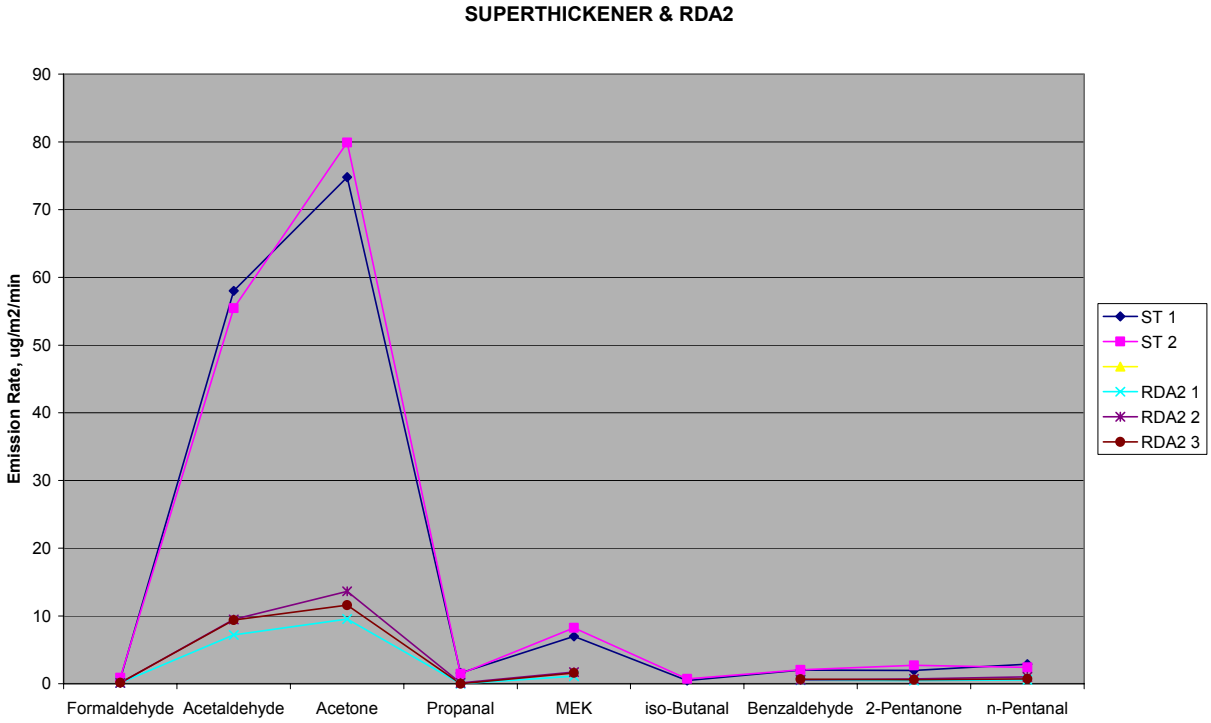


Figure 12: Carbonyl Emission Rates from the Cooling Pond

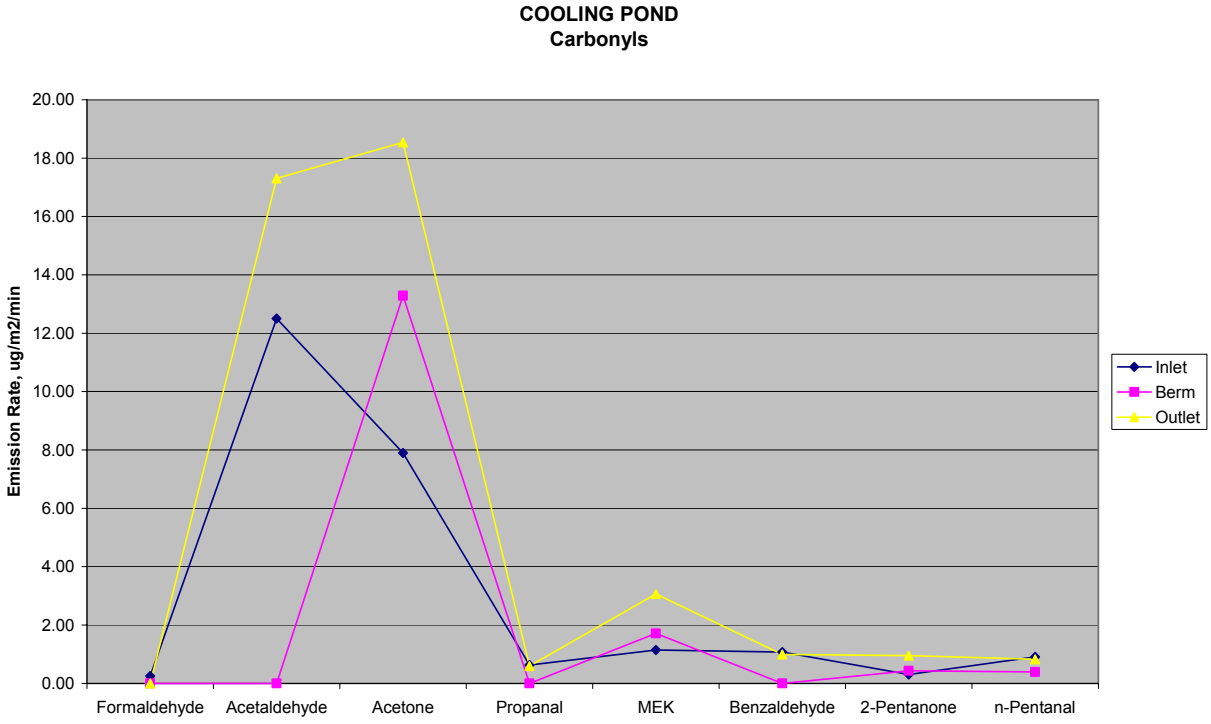
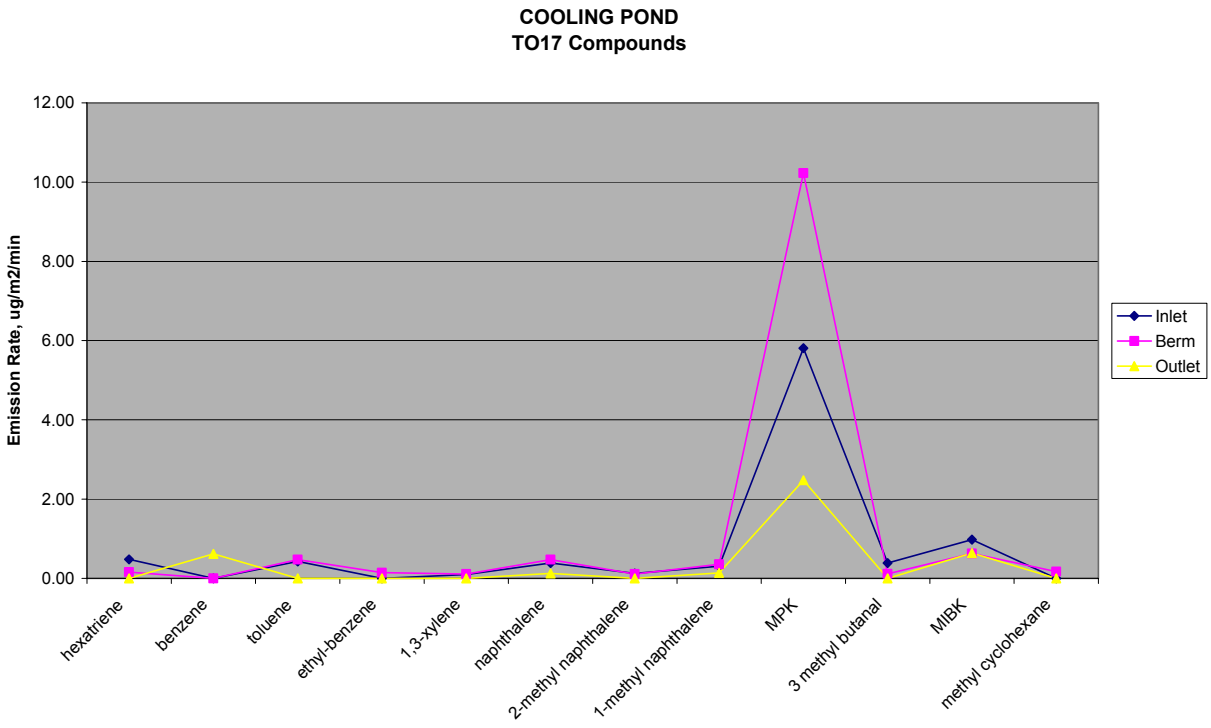


Figure 13: TO17 Emission Rates from the Cooling Pond



4.3.4 Run-off Water Storage (ROWS) Pond

A set of four samples was taken on the ROWS Pond. The only compounds detected were the main carbonyls, and then at low and variable levels, as shown in Figure 14.

4.4 Polycyclic Aromatic Hydrocarbons (PAHs)

A special set of samples was taken to investigate trace amounts of PAHs in the emissions from the main liquor sources and dry residue. This was done using a medium volume Tenax absorbent tube and sampling for extended periods, followed by the normal TO17 analysis. In addition a method based on USEPA TO-13 was employed to collect the less volatile PAHs. This method varied slightly from the standard approach in that Tenax was used as the adsorbent. This will have made no difference to the result. The results are shown in Figure 15. Naphthalene was the main PAH detected, at a specific emission rate of 23 ng/m^2/min from the Super-thickener. Acenaphthylene, acenaphthene, fluorene, phenanthrene and chrysene were detected in trace amounts (<2 ng/m^2/min).

Figure 14: ROWS Pond

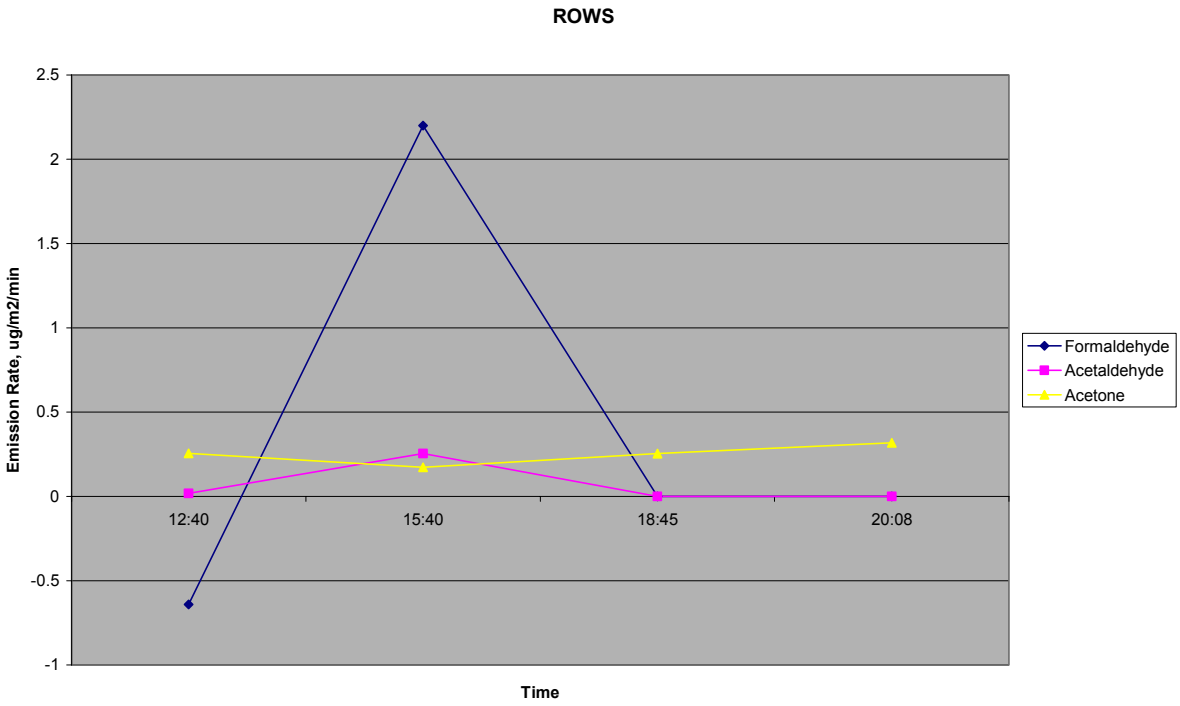
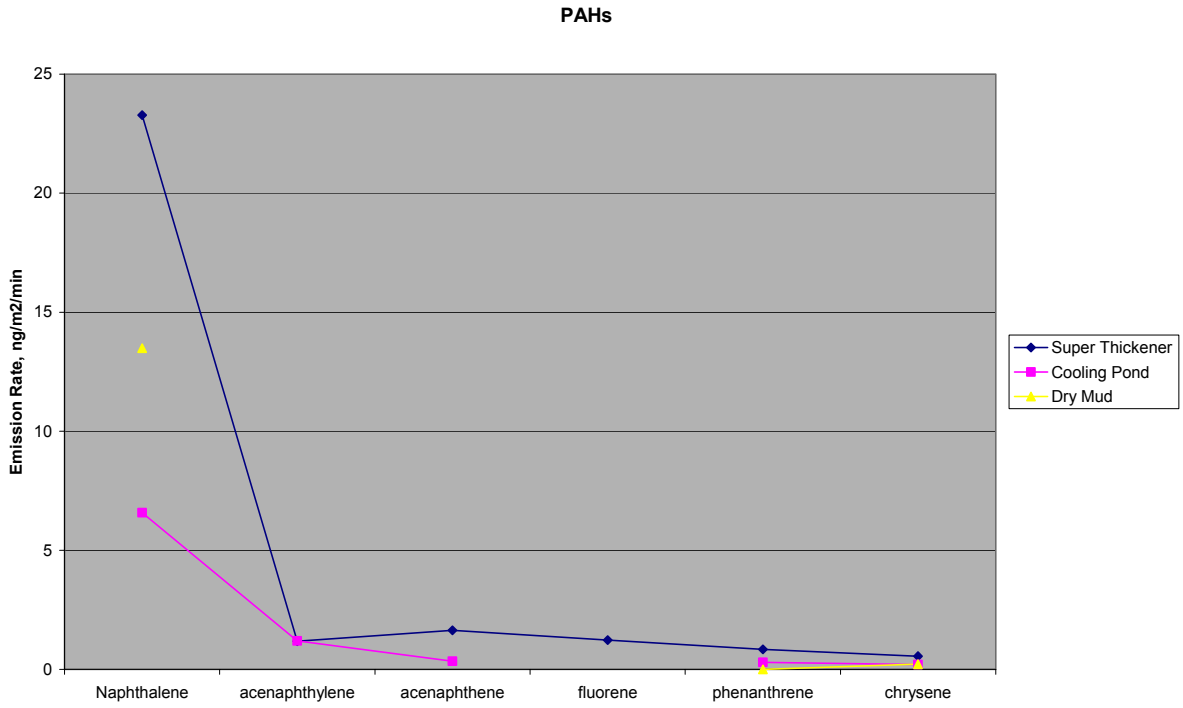


Figure 15: PAH Emissions



4.5 Bitumen

Bitumen is sprayed on banks and roads at the residue area for dust control. The area involved is small overall, but there is from time to time an odour generated after spraying. Samples were taken to investigate the VOC emissions from fresh and aged bitumen. The results, shown in Appendix B, show the expected components in the emissions, mainly toluene, xylenes and naphthalenes for freshly sprayed bitumen, which quickly disappear as the material cures.

4.6 Odour

Table 4 indicates specific odour emission rates found during the first program, whilst Table 5 indicates specific odour emission rates from the dry residue and wet residue respectively. It can be seen that odour emissions from dry residue were of a similar magnitude between the two programs. However, wet residue emissions were found to be higher during the second program. There is also a clear diurnal variation in odour emissions from the wet residue in Phase 2. Please note that these emission values were not temperature corrected.

Table 4. Odour Emissions during First Phase

Location	Specific Emission Rate (OU/m^2/s)
Cooling Pond 1	0.78
Cooling Pond 2	1.76
Rows Pond 1	0.13
Rows Pond 2	0.07
RDA 2-1	1.11
RDA 2-2	2.18
Lower Dam 1	0.93
Lower Dam 2	1.07
Oxalate	0.17
Oxalate	0.12
Superthickener 1	5.82
Superthickener 2	7.16
Dry Residue	0.06
Wet Residue	1.00
Wet Sand	1.00
ROCP2-2	0.15
ROCP2-1	0.28

Table 5. Odour Emissions during Second Phase

Location	Time Collected	Specific Emission Rate ($OU/m^2/s$)
RDA-6 (Wet Residue)	12:30hrs	16.96
	18:10hrs	11.36
	24:03hrs	5.6
	09:15hrs	8.08
RDA-5 (Dry Residue)	04:00hrs	1.2
	05:45hrs	0.88
	08:26hrs	0.6
	10:00hrs	0.24
	11:30hrs	0.08
	14:20hrs	0.8
	17:30hrs	nd
	23:17hrs	1

5. Discussion

The information presented in this report is the result of a significant campaign of emissions monitoring undertaken by GHD at Alcoa's Wagerup Residue Disposal Area. The emissions data is suitable for use in emission modelling.

Generally, emission strengths were found to follow expected patterns, with the sources known to contain higher liquor concentrations of contaminants and with higher temperatures showing the higher specific emission rates (mass emission rate per unit area, µg/min/m^2). Accordingly, the super-thickener and cooling ponds were found to have the highest specific emission rates. In addition, these emission sources are relatively uniform (well mixed liquor bodies), and for these reasons are more easily quantified.

The residue disposal areas consist of residue in various stages of drying. These sources exhibit relatively low specific emission rates. Nevertheless, they have a large surface area, which increases the significance of their contribution to overall emission rates. The specific emission rates were found to be a function of factors, which vary according to the history, state of dryness, and environment of the residue. These factors are important in determining emission rates, which by analogy with soils are controlled by the following main residue-related factors:

- Air-filled porosity
- Bulk soil temperature
- Surface temperature

The other main determinants of specific emission rates are the concentration and vapour pressure of the contaminants, and the wind speed[10].

To address the soil-related factors, in Phase 2 of the study samples were taken on residue at key stages of drying. Two sets of samples were taken on freshly deposited wet residue. Samples were also taken on residue that had been drying for several weeks, but had been recently tilled. That same area was sampled again after a week of solar drying under hot, dry conditions. In order to investigate the influence of surface temperature, a study of the diurnal variation in emissions was undertaken on the two dry residues and on wet residue. It was found that, for the recently tilled dry residue, emission rates tended to be greater in the heat of the day than at night. It was also found that there was a relationship between the temperature in the hood, the measured field ambient temperature at the site, and the regional ambient temperature. The relationship between specific emission rates and regional ambient temperature was investigated. It was found that there was a weak relationship for acetaldehyde, but not for the other species. For residue, which had been dried for a further week the emission rates were all much lower, and there was no longer a relationship with ambient temperature. For wet residue and for the liquor sources there was no significant relationship between emission rates and ambient temperature.

The performance of the stainless steel (ss) and Perspex (pp) flux hoods was investigated. It was found that there was no statistically significant difference in the emission rates determined by the two hoods. This is consistent with the findings of Eklund[10]. It was noted that the pp hood has an internal hood temperature that is higher on sunny days than the ss hood due to the greenhouse effect created by the transparent dome. This can give rise to artificial enhancement of the emissions from the surface under

study in some circumstances. It also can increase the moisture content of air in the hood when sampling wet sources, as was the case for several of the situations in this study. This has the potential to reduce retention of analytes on the tubes due to condensation. On the other hand, if condensation is an issue it is more easily observed with a transparent hood. During this program the Perspex hood did not appear to be affected by the caustic environment. Overall, the performance of the hoods was generally the same, with some practical advantages to the ss hood.

The sampling of wet sources, particularly when hot as for the super-thickener, is problematic for trace analysis of VOCs. The USEPA methods used are designed for application to ambient air. In applying them to flux hood emissions it is necessary to be aware of the limitations of acceptable sample loadings, and that these may change in the presence of high moisture. Attempts were made in this work to improve the sensitivity of detection of VOCs by increasing sampling time, but this was only partially successful. While all sampling times used were well within the limits allowed by the USEPA methods, recoveries were reduced and this is presumably due to the effects of moisture on the adsorbent media. Losses in recovery of this kind are to some extent compensated for by the use of deuterated standard additions by the laboratory. However, it is clearly preferable to avoid excessive condensation during sampling.

6. Conclusions

The main conclusions from this work are:

- The USEPA flux hood method can be successfully applied to the determination of specific emission rates from solid and slurry residue, and open liquor sources at a Bayer alumina refinery, using a special cage and lowering method designed for this purpose where necessary to achieve access;
- The use of a stainless steel hood did not have any negative effect on the results obtained in comparison to a Perspex hood; the stainless steel hood had some advantages in eliminating artefacts introduced by greenhouse heating and possibly reducing moisture effects under some circumstances; for the purposes of this program, the Perspex hood was sufficiently chemically inert for use in contact with Bayer residue and dilute liquors;
- Emission rates were found to be a function of surface properties in the manners expected; moisture, concentration in substrate, and temperature are the main determinants of emission rates;
- The highest emission rates were from the more concentrated, hot liquor sources. The lowest emission rates were from dry residue and low concentration, cool liquid sources;
- The main sources of emissions from the residue areas at Wagerup have been characterised to enable dispersion modelling for determination of concentrations at regional receptors;
- A number of questions arising from this work warrant further investigation, including the effect of moisture on recoveries, the long and short term variability of emission rates from all sources, and the spatial and seasonal variability in emissions from the wet and dry residue areas.

7. Recommendations

Based on the information provided in this report, the following recommendations are made:

- The results from the emission rate determinations can be used as input to dispersion modelling; where possible average results over a large number of samples should be used, and Phase 2 results should be used where possible;
- A more detailed sampling programme to improve the knowledge of the temporal and spatial source variability, particularly for the dry and wet residue areas, should be considered;
- Further investigation of the effects of moisture on sample recovery from hot wet sources on sensitivity of detection and accuracy of analysis would be of benefit in increasing the applicability of these standard ambient methods to emission source determinations by flux hood.

Appendix A

Emission Rates

Appendix A – List of Tables

Table A1. Phase 2 Bitumen TO17 VOC Emission Rate (No samples collected during Phase 1)

VOCs by WIENV 31	Client ID	Fresh Bitumen	Fresh Bitumen	Old Bitumen
TO17	Date	16/02/2005	16/02/2005	16/02/2005
	Time	11:50	18:36	21:05
	Hood	Perspex	Stainless Steel	Perspex
	Tube No	B15517	A01467	A72151
	Geotech ID	05-053 13	05-053 15	05-053 19
		$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$
Toluene		0.43	0.04	0.07
Ethyl-benzene		nd	0.01	nd
1,3-xylene		0.11	0.05	nd
1,2-xylene		nd	0.01	nd
Naphthalene		0.46	0.04	nd
1H-indole		nd	0.01	nd
2-methyl naphthalene		0.06	0.06	0.09
1-methyl naphthalene		0.14	0.14	0.04
MPK		0.04	nd	nd

nd = not detected

Table A2. Phase 2 Bitumen TO11 Carbonyls Emission Rate (No samples collected during Phase 1)

Carbonyls by WIENV 34	Client ID	Fresh Bitumen	Fresh Bitumen	Old Bitumen
TO11	Date	16/02/2005	16/02/2005	16/02/2005
	Time	11:50	18:36	21:05
	Hood	Perspex	Stainless Steel	Perspex
	Tube No	1274305376	1274305375	1274305379
	Geotech ID	HP021821.D	HP021845.D	HP021825.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.52	3.11	0.52
Acetaldehyde		nd	1.30	0.23
Acetone		0.05	0.17	0.03

nd = not detected

Table A3. Phase 1 Dry Residue TO17 VOC and TO11 Carbonyl Emission Rate

	Client ID	Dry Residue 28/10
VOCs by WIENV 31	Tube No	A14300
TO17	Geotech ID	10280416.D
		µg/m^2/min
Acetone		1.50
Benzene		0.81
Toluene		2.12
Benzaldehyde		0.49
Aceto-phenone		1.18
MEK		1.68
MPK		0.29
Carbonyls by WIENV 34		**Dry Residue 28/10**
TO11		µg/m^2/min
Formaldehyde		nd
Acetaldehyde		8.02
Acetone		28.83

Table A4. Phase 2 Dry Residue Run 1 TO17 VOC Emission Rate

VOCs by WIENV 31	Date	14/02/2005	14/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005
TO17	Time	18:36	18:36	0:08	0:08	3:07	3:07	6:04	6:04	9:12	9:12	12:03	12:03	14:56	14:56
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	A11293	A11144	C06289	A15036	A72258	C06252	B16433	A72158	A12416	C06646	B15881	A11389	A09645	A14439
	Geotech ID	02180514.D	02180509.D	02180518.D	02180511.D	02180521.D	02180520.D	02180527.D	02180516.D	02180522.D	02180524.D	02180510.D	02180504.D	02180512.D	02180526.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Benzene		nd	0.88	nd	nd	nd	nd	nd	nd	0.05	nd	nd	0.03	nd	nd
Toluene		nd	0.04	nd	nd	nd	nd	0.06	nd	nd	nd	nd	nd	nd	nd
1,3-xylene		nd	0.05	nd	nd	nd	nd	0.05	nd	nd	nd	nd	nd	nd	nd
MEK		nd	0.30	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.11	nd
MPK		nd	0.13	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptane		nd	0.13	nd	nd	nd	nd	0.07	nd	nd	nd	nd	nd	nd	nd
Phenol		nd	nd	nd	nd	nd	nd	0.04	0.05	nd	nd	nd	nd	nd	nd

nd = not detected

Table A5. Phase 2 Dry Residue Run 1 TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Date	14/02/2005	14/02/2005	14/02/2005	14/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005	15/02/2005
TO11	Time	19:19	18:36	21:05	21:05	0:08	0:08	3:07	3:07	6:04	6:04	9:12	9:12	12:03	12:03	14:56	14:56
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	1274305376	1274305375	1274305379	1274305370	1274305372	1274305378	1274305377	1274305374	1274305373	1274305371	1274304759	1274304756	1274304758	1274304750	1274304757	1274304753
	Geotech ID	HP021821.D	HP021845.D	HP021825.D	HP021847.D	HP021843.D	HP021823.D	HP021819.D	HP021809.D	HP021841.D	HP021817.D	HP021833.D	HP021835.D	HP021811.D	HP021813.D	HP021839.D	HP021831.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.77	3.37	0.78	1.16	3.27	0.20	0.20	0.09	0.03	0.01	nd	0.30	1.88	3.76	1.53	1.40
Acetaldehyde		nd	1.30	0.23	0.32	0.26	0.09	0.20	nd	0.20	0.15	0.69	1.12	0.71	1.36	0.15	nd
Acetone		0.05	0.17	0.03	0.05	0.03	nd	0.01	nd	0.01	nd	0.04	0.12	0.12	0.54	0.45	0.20
MEK		nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.23	nd

nd = not detected

Table A6. Phase 2 Dry Residue Run 2 TO17 VOC Emission Rate

VOCs by WIENV 31	Date	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005
TO17	Time	4.12	4.12	7.03	7.03	10.00	10.00	13.00	13.00
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	A72166	B16459	A10482	A14506	C06514	B16449	A13823	A01467
	Geotech ID	03010513.D	03010527.D	03010512.D	03010525.D	03020529.D	03010518.D	03010516.D	03010524.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Benzene		nd	nd	nd	nd	0.06	nd	nd	nd
Toluene		nd	nd	0.77	3.37	0.78	1.16	3.27	0.20
…contd	Date	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	26/02/2005	26/02/2005
	Time	16.08	16.08	19.00	19.00	22.05	22.05	1.00	1.00
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	A10058	B15517	A16087	A15036	A11352	A09645	A70150	A14502
	Geotech ID	03010519.D	03010526.D	03010511.D	03020528.D	03010514.D	03010523.D	03010515.D	03010521.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Benzene		nd	nd	nd	nd	nd	nd	nd	nd
Toluene		0.04	0.04	0.05	0.04	0.13	nd	0.06	0.06

nd = not detected

Table A7. Phase 2 Dry Residue Run 2 TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Date	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005
TO11	Time	4.12	4.12	7.03	7.03	10.00	10.00	13.00	13.00
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	1274305529	1274305524	1274305521	1274305520	1274305522	1274305528	1274305525	1274305523
	Geotech ID	HP030122.D	HP030136.D	HP030116.D	HP030134.D	HP030112.D	HP030110.D	HP030138.D	HP030124.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.14	0.16	nd	0.15	0.19	0.43	0.16	0.77
Acetaldehyde		nd	nd	nd	0.07	nd	0.06	0.50	nd
Acetone		0.38	0.25	0.41	0.34	0.32	0.47	0.73	0.49
MEK		nd	nd	nd	nd	0.15	nd	nd	nd
iso-Butanal		nd	nd	nd	nd	nd	nd	nd	nd
…contd	Date	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	25/02/2005	26/02/2005	26/02/2005
	Time	16.08	16.08	19.00	19.00	22.05	22.05	1.00	1.00
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	1274305526	1274305527	1274305544	1274305545	1274305549	1274305548	1274305547	1274305543
	Geotech ID	HP030144.D	HP030140.D	HP030120.D	HP030142.D	HP030114.D	HP030118.D	HP030130.D	HP030132.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.19	nd	0.14	0.16	nd	0.13	0.14	nd
Acetaldehyde		nd	nd	nd	0.12	nd	0.02	0.07	nd
Acetone		0.63	0.29	0.27	0.65	0.24	0.35	0.46	0.39
MEK		0.17	nd	nd	nd	nd	nd	nd	nd
iso-Butanal		3.25	nd	nd	nd	nd	nd	nd	nd

Table A8. Phase 1 Wet Residue TO17 VOC and TO11 Carbonyl Emission Rate

VOCs by WIENV 31	Client ID	Dry Residue 28/10
TO17	Tube No	A14300
	Geotech ID	10280416.D
		µg/m^2/min
Acetone		117.29
Benzene		0.31
Toluene		nd
Benzaldehyde		0.65
Aceto-phenone		1.54
MEK		9.07
MPK		0.56
Heptane		0.70
Carbonyls by WIENV 34	**Client ID**	**Dry Residue 28/10**
TO11	Tube No	979701729
	Geotech ID	HP110315.D
		µg/m^2/min
Formaldehyde		nd
Acetaldehyde		0.02
Acetone		7.34

Table A9. Phase 2 Wet Residue Run 1 TO17 VOC Emission Rate

VOCs by WIENV 31	Date	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005
TO17	Time	3:00	3:00	9:30	9:30	13:25	13:25	21:11
	Type	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex
	Tube No	A63757	A14314	A10347	A70303	A13110	A10353	A10069
	Geotech ID	02240506.D	02240507.D	02240512.D	02240508.D	02240510.D	02240511.D	02240504.D
	ug/m2/min	$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$	$\mu g/m^2/min$
Acetone		104.25	24.06	nd	6.80	nd	nd	71.56
Benzene		nd	nd	0.08	0.06	0.54	nd	0.03
Toluene		nd	nd	0.02	nd	nd	nd	nd
Naphthalene		nd	nd	nd	nd	nd	nd	0.02
2-methyl naphthalene		nd	nd	0.02	nd	0.73	nd	0.06
1-methyl naphthalene		0.03	nd	0.04	nd	0.12	0.02	0.06
MEK		13.21	7.79	0.64	0.88	nd	2.14	5.80
MPK		0.65	0.62	1.42	nd	0.64	0.32	1.43
3 methyl butanal		0.33	0.07	0.05	0.04	nd	0.04	0.04
Heptane		1.53	nd	nd	nd	nd	nd	nd
Phenol		0.02	0.02	0.03	0.02	0.06	nd	nd
Nitrobenzene		0.02	nd	nd	nd	0.03	nd	nd
Iodomethane		nd	nd	nd	nd	nd	nd	nd

Table A10. Phase 2 Wet Residue Run 1 TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Date	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005	18/02/2005
TO11	Time	3:00	3:00	9:30	9:30	13:25	13:25	21:11	21:11
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	1274304990	1274304995	1274304755	1274304751	1274304997	1274304998	1274304754	1274304752
	Geotech ID	HP022519.D	HP022513.D	HP022517.D	HP022524.D	HP022526.D	HP022520.D	HP022511.D	HP022515.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		1.60	0.96	0.99	1.09	0.05	nd	1.11	1.25
Acetaldehyde		0.47	0.09	1.21	1.12	1.48	1.63	1.63	0.72
Acetone		2.92	1.53	1.74	2.29	2.64	5.05	3.99	1.89
Propanal		nd	1.75	nd	0.16	nd	nd	nd	nd
MEK		0.32	0.21	nd	0.25	0.41	0.55	0.31	0.17
iso-Butanal		nd	nd	0.15	nd	nd	nd	nd	nd
Benzaldehyde		nd	nd	nd	0.31	0.26	nd	0.23	nd

nd = not detected

Table A11. Phase 2 Wet Residue Run 2 TO17 VOC Emission Rate

VOCs by WIENV 31	Date	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005
TO17	Time	11.15	11.15	17.07	17.07	23.00	23.00
	Hood	Perspex	Stainless Steel	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	C06289	C06252	A00360	A11408	C06646	A09661
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Toluene		0.09	0.06	0.07	0.06	0.06	0.05
Styrene		nd	nd	2.00	nd	nd	nd
Benzaldehyde		0.44	0.17	nd	nd	0.08	nd
Aceto-phenone		0.12	0.29	0.32	0.33	0.66	0.13
Naphthalene		nd	0.02	0.02	nd	nd	0.01
2-methyl naphthalene		0.14	0.06	0.07	nd	nd	nd
1-methyl naphthalene		0.07	nd	0.04	nd	nd	nd
MPK		0.83	0.65	0.70	0.27	0.11	0.08
MIBK		0.18	nd	nd	nd	nd	nd
Phenol		nd	0.02	nd	nd	nd	nd

nd = not detected

Table A12. Phase 2 Wet Residue Run 2 TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Date	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005	28/02/2005
TO11	Time	9.15	9.15	11.15	11.15	13.00	13.00	17.07	17.07	23.00	23.00
	Hood	Inside	Outside	Perspex	Stainless Steel	Inside	Outside	Perspex	Stainless Steel	Perspex	Stainless Steel
	Tube No	1274304608	1274304603	1274304605	1274304692	1274304691	1274304690	1274305259	1274305250	1274304699	1274304698
	Geotech ID	HP030204.D	HP030202.D	HP030203.D	HP030207.D	HP030206.D	HP030205.D	HP030219.D	HP030215.D	HP030214.D	HP030213.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.08	0.09	0.13	0.16	0.14	0.11	0.10	0.13	nd	nd
Acetaldehyde		0.73	0.35	1.75	0.53	1.18	0.56	1.12	0.88	0.25	nd
Acetone		2.38	1.34	2.78	3.06	2.08	1.38	4.21	3.44	1.64	1.06
MEK		0.27	0.15	0.32	0.62	0.23	0.20	0.42	0.39	0.22	0.21
iso-Butanal		nd	nd	nd	nd	0.33	nd	nd	nd	nd	nd
n-Pentanal		nd	nd	1.46	nd	nd	nd	0.20	nd	nd	nd

nd = not detected

Table A13. Phase 1 Cooling Pond TO17 VOC Emission Rate

VOCs by WIENV 31	Client ID	Cooling Pond 1	Cooling Pond 1	Cooling Pond 2
TO17	Tube No	A14306	A70218	A11389
	Geotech ID	10280407.D	10280409.D	10280421.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Acetone		nd	nd	49.97
Benzene		2.91	7.92	nd
Toluene		0.56	1.10	0.19
1,3-xylene		nd	0.13	nd
Benzaldehyde		0.83	2.56	0.20
Naphthalene		0.13	0.24	nd
2-methyl naphthalene		0.12	0.18	0.19
1-methyl naphthalene		nd	0.16	0.12
MEK		nd	nd	7.32
MPK		0.75	1.97	0.74
MIBK		nd	0.22	nd
Phenol		0.29	nd	nd
Dibutylamine		1.00	2.26	2.39
2 Ethyl Hexanol		3.39	11.17	0.60

Table A14. Phase 1 Cooling Pond TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Client ID	Cooling Pond 1	Cooling Pond 1	Cooling Pond 2
TO11	Tube No	922803918		922803916
	Geotech ID	HP102842.D		HP102834.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		nd		nd
Acetaldehyde		10.27		37.79
Acetone		31.02		53.36

Table A15. Phase 2 Cooling Pond TO17 VOC Emission Rate

VOCs by WIENV 31	Client ID	Cooling Pond Inlet	Cooling Pond Berm	Cooling Pond Outlet
TO17	Date	24/02/2005	24/02/2005	24/02/2005
	Time	13.33	15.05	16.30
	Tube No	B16456	A11071	A15016
	Geotech ID	02250507.D	02250506.D	02250509.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Hexatriene		0.48	0.16	nd
Benzene		nd	nd	0.62
Toluene		0.43	0.47	nd
Ethyl-benzene		nd	0.15	nd
1,3-xylene		0.10	0.11	nd
Naphthalene		0.39	0.47	0.12
2-methyl naphthalene		0.12	0.11	nd
1-methyl naphthalene		0.31	0.35	0.14
MPK		5.81	10.23	2.48
3 methyl butanal		0.39	0.11	nd
MIBK		0.98	0.63	0.64
Methyl cyclohexane		nd	nd	0.17

Table A16. Phase 2 Cooling Pond TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Client ID	Cooling Pond Inlet	Cooling Pond Berm	Cooling Pond Outlet
TO11	Date	24/02/2005	24/02/2005	24/02/2005
	Time	13.33	15.05	16.30
	Tube No	B	A	C
	Geotech ID	HP022530.D	HP022529.D	HP022532.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.25	nd	nd
Acetaldehyde		12.50	nd	17.31
Acetone		7.89	13.28	18.54
Propanal		0.63	nd	0.59
MEK		1.15	1.71	3.07
Benzaldehyde		1.08	nd	0.99
2-Pentanone		0.31	0.44	0.95
n-Pentanal		0.91	0.39	0.82

nd = not detected

Table A17. Phase 1 Run-off Water Storage (ROWS) TO17 VOC and TO11 Carbonyl Emission Rate

VOCs by WIENV 31	Client ID	Rows Pond 1	Rows Pond 2
TO17	Tube No	A12078	A73725
	Geotech ID	10280408.D	10280420.D
		µg/m^2/min	µg/m^2/min
Acetone		nd	1.61
Benzene		nd	2.66
Toluene		nd	1.05
Heptane		nd	11.77
Semi-quantitive Results			
Dibutylamine		12.16	nd
2 Ethyl Hexanol		0.40	nd
Carbonyls by WIENV 34	**Client ID**	**Rows Pond 1**	**Rows Pond 2**
TO11	Tube No	9.23E+08	9.23E+08
	Geotech ID	HP102813.D	HP102811.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd
Acetaldehyde		1.21	nd
Acetone		0.63	nd

Table A18. Phase 2 Run-off Water Storage (ROWS) TO17 VOC Emission Rate

VOCs by WIENV 31	Client ID	ROWS1	ROWS2	ROWS3A	ROWS3B
TO17	Date	24/02/2005	24/02/2005	1/03/2005	1/03/2005
	Time	12.40	15.40	18.45	20.08
	Tube No	A11369	A10755	A11293	A72158
	Geotech ID	03010517.D	02250508.D		
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Toluene		0.14	nd	0.04	0.02
Aceto-phenone		nd	nd	nd	0.04
Naphthalene		nd	nd	0.01	0.02
Phenol		nd	nd	nd	nd

nd = not detected

Table A19. Phase 2 Run-off Water Storage (ROWS) TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Client ID	ROWS1	ROWS2	ROWS3A	ROWS3B
TO11	Date	24/02/2005	24/02/2005	1/03/2005	1/03/2005
	Time	12.40	15.40	18.45	20.08
	Tube No	1274304994	1274305255	1274305253	1274305254
	Geotech ID	HP030126.D	HP022534.D	HP030217.D	HP030218.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		nd	2.20	nd	nd
Acetaldehyde		0.02	0.25	nd	nd
Acetone		0.26	0.17	0.25	0.32

nd = not detected

Table A20. Phase 1 Superthickener TO17 VOC and TO11 Carbonyl Emission Rate

VOCs by WIENV 31	Client ID	Superthickener	Superthickener		
TO17	Tube No	A13714	A10353		
	Geotech ID	10280411.D	10280423.D		
		µg/m^2/min	µg/m^2/min		
Acetone		nd	2623.38		
Benzene		1.38	2.04		
Toluene		4.43	4.31		
1,3-xylene		1.31	0.33		
Benzaldehyde		7.00	7.39		
Naphthalene		1.01	nd		
2-methyl naphthalene		2.67	2.63		
1-methyl naphthalene		1.88	1.79		
Biphenyl		0.35	0.35		
MEK		nd	407.88		
MPK		16.35	29.26		
heptane		0.37	0.38		
MIBK		2.73	nd		
Carbonyls by WIENV 34	Client ID	Superthickener	Superthickener	Superthickener 3	Superthickener 2
	Tube No	979701719.00	979701735.00	# 0979701615	979701634.00
	Geotech ID	HP110306.D	HP102830.D		
		µg/m^2/min	µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd	23.35	11.37
Acetaldehyde		231.15	211.21	156.90	176.76
Acetone		793.54	567.53	637.26	621.74

Table A21. Phase 2 Superthickener TO17 VOC Emission Rate

VOCs by WIENV 31	Client ID	Superthickener	Superthickener
TO17	Date	1/03/2005	1/03/2005
	Tube No	A72188	A12413
		µg/m^2/min	µg/m^2/min
Benzene		0.99	1.24
Toluene		4.72	4.29
1,3-xylene		0.28	0.86
1,2-xylene		nd	0.28
Benzaldehyde		nd	0.43
Aceto-phenone		7.07	7.29
Naphthalene		0.12	0.15
2-methyl naphthalene		0.16	0.34
1-methyl naphthalene		0.13	0.26
MPK		16.72	23.58
MIBK		3.00	3.43
DMDS		1.78	1.59

Table A22. Phase 2 Superthickener TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Client ID	Superthickener	Superthickener
TO11	Date	1/03/2005	1/03/2005
	Tube No	1274304694	1274304693
	Geotech ID	HP030209.D	HP030208.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		0.69	0.87
Acetaldehyde		58.02	55.45
Acetone		74.79	79.92
Propanal		1.60	1.48
MEK		6.99	8.27
iso-Butanal		0.49	0.73
Benzaldehyde		2.01	2.05
2-Pentanone		1.97	2.70
n-Pentanal		2.90	2.41

Table A23. Phase 1 Residue Disposal Area 2 (RDA2) TO17 VOC and TO11 Carbonyl Emission Rate

VOCs by WIENV 31	**Client ID**	**RDA2-1**	**RDA2-2**
TO17	Tube No	A13823	A00360
	Geotech ID	10280405.D	10280417.D
		µg/m^2/min	µg/m^2/min
Acetone		nd	16.17
1,3-xylene		0.49	nd
Carbonyls by WIENV 34	**Client ID**	**RDA2-1**	**RDA2-2**
TO11	Tube No	922803911.00	922803917.00
	Geotech ID	HP102824.D	HP102815.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd
Acetaldehyde		8.27	3.05
Acetone		41.39	16.66

nd = not detected

Table A24. Phase 2 Residue Disposal Area 2 (RDA2) TO17 VOC Emission Rate

VOCs by WIENV 31	Date	1/03/2005	1/03/2005	1/03/2005
TO17	Time	11.00	13.30	16.00
	Tube No	A72151	A62959	A72163
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Benzene		nd	nd	0.14
Toluene		nd	0.05	0.43
Benzaldehyde		nd	0.12	nd
Aceto-phenone		nd	0.04	0.86
Naphthalene		nd	0.01	0.09
2-methyl naphthalene		nd	nd	0.16
1-methyl naphthalene		nd	nd	0.12
MPK		0.76	nd	9.32
MIBK		nd	nd	0.86
DMDS		nd	nd	0.13
Dimethylacetamide		nd	0.06	nd

nd = not detected

Table A25. Phase 2 Residue Disposal Area 2 (RDA2) TO11 Carbonyl Emission Rate

Carbonyls by WIENV 34	Date	1/03/2005	1/03/2005	1/03/2005
TO11	Time	11.00	13.30	16.00
	Tube No	1274305251	1274304695	1274304252
	Geotech ID	HP030216.D	HP030210.D	HP030201.D
		µg/m^2/min	µg/m^2/min	µg/m^2/min
Formaldehyde		0.13	0.12	0.14
Acetaldehyde		7.19	9.51	9.41
Acetone		9.54	13.64	11.62
Propanal		nd	0.13	nd
MEK		1.12	1.70	1.58
Benzaldehyde		0.52	0.58	0.65
2-Pentanone		0.47	0.72	0.59
n-Pentanal		0.57	1.03	0.71

nd = not detected

Table A26. Phase 2 Superthickener, Cooling Pond and Dry Residue PAH Emission Rate

PAHs	Client ID	Superthickener	Cooling Pond	Dry Residue
	Date	01/03/2005	01/03/2005	22/02/2005
	Geotech ID	DT030305.D	DT030309.D	DT022508.D
		ng/m2/min	ng/m2/min	ng/m2/min
Naphthalene		34.38	7.49	13.49
Acenaphthylene		1.74	1.36	nd
Acenaphthene		2.43	0.39	nd
Fluorene		1.82	nd	nd
Phenanthrene		1.23	0.33	nd
Chrysene		0.82	0.23	0.22

nd = not detected

Table A27. Phase 1 Lower Dam TO17 VOC and TO11 Carbonyl Emission Rate (Phase 1 only)

VOCs by WIENV 31	Client ID	Lower Dam 1	Lower Dam 2
TO17	Tube No	A08278	A15036
	Geotech ID	10280404.D	10280416.D
		µg/m^2/min	µg/m^2/min
Acetone		NM	11.19
Benzene		0.95	nd
Toluene		0.24	nd
MEK		nd	0.28
heptane		2.28	nd
Methyl cyclohexane		0.17	nd
Carbonyls by WIENV 34	**Client ID**	**Lower Dam 1**	**Lower Dam 2**
TO11	Tube No	922803912.00	922803919.00
	Geotech ID	HP102840.D	HP102821.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd
Acetaldehyde		0.65	2.53
Acetone		6.29	12.67

Table A28. Phase 1 ROCP2 TO17 VOC and TO11 Carbonyl Emission Rate (Phase 1 only)

VOCs by WIENV 31	**Client ID**	**ROCP2-1**	**ROCP2-2**
TO17	Tube No	C06214	A63757
	Geotech ID	10280406.D	10280418.D
		µg/m^2/min	µg/m^2/min
Acetone		NM	10.39
Benzene		0.35	0.24
MEK		nd	0.74
MIBK		nd	0.22
Carbonyls by WIENV 34	**Client ID**	**ROCP2-1**	**ROCP2-2**
TO11	Tube No	922803910.00	922803914.00
	Geotech ID	HP102832.D	HP102817.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd
Acetaldehyde		7.08	nd
Acetone		3.90	0.87

Table A29. Phase 1 Oxalate TO17 VOC and TO11 Carbonyl Emission Rate (Phase 1only)

VOCs by WIENV 31	Client ID	Oxalate	Oxalate
TO17	Tube No	A09661	C06646
	Geotech ID	10280410.D	10280422.D
		µg/m^2/min	µg/m^2/min
Acetone		nd	8.82
Benzene		2.20	1.73
Toluene		0.82	0.82
Benzaldehyde		0.42	0.36
MEK		nd	2.74
MPK		0.15	0.38
Heptane		0.17	nd
Phenol		0.10	0.22
Dibutylamine		9.07	17.93
2 Ethyl Hexanol		0.88	1.85
Carbonyls by WIENV 34	**Client ID**	**Oxalate**	**Oxalate**
TO11	Tube No	979701749.00	979701705.00
	Geotech ID	HP102819.D	HP102838.D
		µg/m^2/min	µg/m^2/min
Formaldehyde		nd	nd
Acetaldehyde		1.09	2.61
Acetone		2.79	10.21

Table A30. Phase 1 Wet Sand TO17 VOC and TO11 Carbonyl Emission Rate (Phase 1 only)

VOCs by WIENV 31	**Client ID**	**Sand 28/10**
TO17	Tube No	A13190
	Geotech ID	10280404.D
		µg/m^2/min
Acetone		119.91
Benzene		1.12
Benzaldehyde		1.47
Aceto-phenone		2.37
2-methyl naphthalene		107.92
MEK		13.64
MPK		0.89
Phenol		0.12
Carbonyls by WIENV 34	**Client ID**	Sand 28/10
TO11	Tube No	979701772.00
	Geotech ID	HP110309.D
		µg/m^2/min
Formaldehyde		nd
Acetaldehyde		nd
Acetone		nd

Appendix B

Laboratory Results

Phase 1

GHD
PO Box Y3106
Perth WA 6832

November 22, 2004

Attention: Mark Goldstone
Your Ref No: 61-15324
Our Ref No: ENV 04-314

REPORT ON SAMPLE ANALYSIS

Introduction:

Fourteen liquid samples, seventeen TO17 tubes and fourteen DNPH tubes were received on the 28th October 2004, it was requested that the samples be analysed to determine a number of components.

Methods of Analysis:

The TO17 tubes were analysed to determine the amount of Volatile Organic Compounds according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The DNPH tubes were analysed to determine the amount of aldehydes and keytones according to WIENV 34 (based on USEPA TO5 and TO11A). The caustic solutions were analysed to determine the amount of VOCs present by purge and trap gas chromatography mass spectrometry using WIENV 38 based on US EPA Methods 5030 and 8260B. TOC and carbonate are being determined by SGS laboratories. Sodium and aluminium were determined by atomic adsorption spectroscopy.

Results

The results are tabulated on the following worksheet.

GEOTECHNICAL SERVICES

Nigel West
Senior Chemist

Angela Downey
Environmental Chemist

(I) RESULTS

Matrix: Mixed

VOCs by WIENV 31	Client ID	Lower Dam 1	Lower Dam 2	ROA2-1	ROA2-2	ROCP2-1	ROCP2-2	Cooling Pond 1	Cooling Pond 1	Rows Pond 1	Cooling Pond 2
	Tube No	A08278	A15036	A13823	A00360	C06214	A63757	A14306	A70218	A12078	A11389
	Geotech ID	10280404.D	10280416.D	10280405.D	10280417.D	10280406.D	10280418.D	10280407.D	10280409.D	10280408.D	10280421.D
Analyte	PQL (ug)	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
acetone	0.005	Not Monitored	0.57	Not Monitored	0.82	Not Monitored	0.530	Not Monitored	Not Monitored	Not Monitored	2.5
hexatriene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
benzene	0.005	0.050	nd	nd	nd	0.018	0.012	0.15	0.60	nd	nd
pyridine	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
toluene	0.005	0.013	nd	nd	nd	nd	nd	0.028	0.083	nd	0.010
ethyl-benzene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,3-xylene	0.005	nd	nd	0.025	nd	nd	nd	nd	0.010	nd	nd
ethynyl-benzene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
styrene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1,2-xylene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
benzaldehyde	0.005	nd	nd	nd	nd	nd	nd	0.047	0.20	nd	0.016
1,3,5-trimethyl-benzene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
benzonitrile	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
benzofuran	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
aceto-phenone	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
naphthalene	0.005	nd	nd	nd	nd	nd	nd	0.006	0.018	nd	nd
quinoline	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1H-indole	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2-methyl naphthalene	0.005	nd	nd	nd	nd	nd	nd	0.006	0.014	nd	0.010
1-methyl naphthalene	0.005	nd	nd	nd	nd	nd	nd	nd	0.012	nd	0.006
biphenyl	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
acenaph-thylene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
acenaph-thene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
dibenzo-furan	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
9H-fluorene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MEK	0.005	Not Monitored	0.014	Not Monitored	nd	Not Monitored	0.037	Not Monitored	Not Monitored	Not Monitored	0.37
MPK	0.005	nd	nd	nd	nd	nd	nd	0.038	0.15	nd	0.037
3 methyl butanal	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
heptane	0.005	0.120	nd	nd	nd	nd	nd	nd	nd	nd	nd
MIBK	0.005	nd	nd	nd	nd	nd	0.011	nd	0.02	nd	nd
DMDS	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
dimethylacetamide	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
phenol	0.005	nd	nd	nd	nd	nd	nd	0.014	nd	nd	nd
nitrobenzene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
methyl cyclohexane	0.005	0.009	nd	nd	nd	nd	nd	nd	nd	nd	nd
dimethylformamide	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Iodomethane	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
indene	0.005	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Semi-quantitive Results											
Dibutylamine	0.01	nd	nd	nd	nd	nd	nd	0.05	0.17	0.61	0
2 Ethyl Hexanol	0.01	nd	nd	nd	nd	0.01	nd	0.17	0.84	0.02	0

	Client ID	Lower Dam 1	Lower Dam 2	ROA2-1	ROA2-2	ROCP2-1	ROCP2-2	Cooling Pond 1	Cooling Pond 1	Rows Pond 1	Cooling Pond 2
Carbonyls by WIENV 34		Lower Dam 1	Lower Dam 2	ROA2-1	ROA2-2	ROCP2-1	ROCP2-2	Cooling Pond 1	Cooling Pond 1	Rows Pond 1	Cooling Pond 2
		922803912	922803919	922803911	922803917	922803910	922803914	922803918		922803913.00	922803916.00
		HP102840.D	HP102821.D	HP102824.D	HP102815.D	HP102832.D	HP102817.D	HP102842.D		HP102813.D	HP102834.D
	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug
Formaldehyde	0.2	nd	0.19	0.46	0.2	0.2	nd	1.2		0.26	0.44
Acetaldehyde	0.2	0.39	0.86	2.3	0.99	2	nd	2.8		0.53	9.70
Acetone	0.2	2.2	3.80	11	4.8	1.6	0.84	8.4		0.78	14.00
Propanal	0.2	nd	nd	nd	nd	nd	nd	nd		nd	0.49
MEK	0.2	nd	nd	1.4	nd	nd	nd	1.1		nd	1.60
iso-Butanal	0.2	nd	nd	nd	nd	nd	nd	nd		nd	nd
Benzaldehyde	0.2	nd	nd	nd	nd	nd	nd	0.32		nd	0.78
2-Pentanone	0.2	nd	nd	0.35	nd	nd	nd	nd		nd	0.33
n-Pentanal	0.2	nd	nd	0.22	nd	nd	nd	nd		nd	0.57
p-Tolualdehyde	0.2	nd	nd	nd	nd	nd	nd	nd		nd	nd
2-Hexanone	0.2	nd	nd	nd	nd	nd	nd	nd		nd	nd
Hexanal	0.2	nd	nd	nd	nd	nd	nd	nd		nd	nd

VOCs by WIENV 38		Lower Dam 1	Lower Dam 2	ROA2-1	ROA2-2	ROCP2-1	ROCP2-2	Cooling Pond 1		Rows 1	Cooling Pond 2
		#7	#8	#5	#6	#11	#12	#1		#3	#2
		PT110209.D	PT110210.D	PT110207.D	PT110208.D	PT110214.D	PT110213.D	PT110203.D		PT110205.D	PT110307.D
	PQL (mg/L)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L
1,3, 5 Hexatriene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
heptane	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
methyl cyclohexane	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
benzene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
MIBK	0.01	nd	nd	nd	nd	nd	nd	nd		nd	nd
DMDS	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
toluene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
ethylbenzene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
1,3-xylene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
ethynylbenzene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
1,2-xylene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
styrene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
benzofuran	0.03	nd	nd	nd	nd	nd	nd	nd		nd	nd
1,3,5-trimethylbenzene	0.003	nd	nd	nd	nd	nd	nd	nd		nd	nd
indene	0.01	nd	nd	nd	nd	nd	nd	nd		nd	nd
2 Methyl Nap	0.03	nd	nd	nd	nd	nd	nd	nd		nd	nd
1 Methyl Nap	0.03	nd	nd	nd	nd	nd	nd	nd		nd	nd

Others		Lower Dam 1	Lower Dam 2	ROA2-1	ROA2-2	ROCP2-1	ROCP2-2	Cooling Pond 1		Rows 1	Cooling Pond 2
	PQL	#7	#8	#5	#6	#11	#12	#1		#3	#2
Carbonate (mg/L)	10 mg/L	120	120	22000	22000	10000	8700	17000		3000	22000
TOC (mg/L)	1 mg/L	12	10	1500	1500	630	470	1200		120	1300
Sodium by AAS (mg/L)	0.1 mg/L	20	19	11900	12200	4800	4600	9700		1600	10100
Aluminium by AAS (mg/L)	0.5 mg/L	1.2	1.0	3560	3580	510	390	2990		190	3080

nd = not detected

(I) RESULTS

Matrix: Mixed

VOCs by WIENV 31	Cooling Pond 2	Rows Pond 2	26th Oct	26th Oct	27th Oct	27th Oct	Sand 28/10	Dry Mud 28/10	Wet Mud 28/10		Untitled
	A70310	A73725	A09661	C06646	A13714	A10353	A13190	A14300	A12494		A70014
	10280419.D	10280420.D	10280410.D	10280422.D	10280411.D	10280423.D	10280404.D	10280416.D	10280405.D		10280412.D
Analyte	total ug	total ug	total ug	total ug	total ug	total ug	total ng	total ng	total ng		total ug
acetone	12.5	0.106	Not Monitored	0.44	Not Monitored	66.9	5020	87	3370		Not Monitored
hexatriene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
benzene	0.124	0.160	0.075	0.084	0.035	0.052	47	42	9		nd
pyridine	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
toluene	0.017	0.063	0.028	0.040	0.11	0.11	nd	110	nd		nd
ethyl-benzene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
1,3-xylene	nd	nd	nd	nd	0.033	0.008	nd	nd	nd		nd
ethynyl-benzene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
styrene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
1,2-xylene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
benzaldehyde	0.093	nd	0.020	0.023	0.181	0.19	67	31	24		0.008
1,3,5-trimethyl-benzene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
benzonitrile	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
benzofuran	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
aceto-phenone	nd	nd	nd	nd	nd	nd	99	61	44		nd
naphthalene	0.011	nd	nd	nd	0.025	nd	nd	nd	nd		nd
quinoline	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
1H-indole	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
2-methyl naphthalene	0.011	nd	nd	nd	0.067	0.067	5	nd	nd		nd
1-methyl naphthalene	0.009	nd	nd	nd	0.047	0.046	nd	nd	nd		nd
biphenyl	nd	nd	nd	nd	0.009	0.009	nd	nd	nd		nd
acenaph-thylene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
acenaph-thene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
dibenzo-furan	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
9H-fluorene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
MEK	2.3	nd	Not Monitored	0.13	Not Monitored	10	570	87	260		Not Monitored
MPK	0.12	nd	0.005	0.02	0.41	0.7	37	15	16		nd
3 methyl butanal	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
heptane	0.009	0.708	0.006	nd	0.009	0.010	nd	nd	20		nd
MIBK	0.014	nd	nd	nd	0.069	nd	nd	nd	nd		nd
DMDS	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
dimethylacetamide	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
phenol	nd	nd	0.004	0.011	nd	nd	5	nd	nd		nd
nitrobenzene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
methyl cyclohexane	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
dimethylformamide	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
Iodomethane	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
indene	nd	nd	nd	nd	nd	nd	nd	nd	nd		nd
Semi-quantitive Results											
Dibutylamine	1	nd	0	1	nd	nd					nd
2 Ethyl Hexanol	1	nd	0	0	1	1					nd

	Cooling Pond 2	Rows Pond 2	26th Oct	26th Oct	27th Oct	27th Oct	Sand 28/10	Dry Mud 28/10	Wet Mud 28/10		Untitled
Carbonyls by WIENV 34	Cooling Pond 2	Rows Pond 2	26th Oct	26th Oct	27th Oct	27th Oct	Sand 28/10	Dry Mud 28/10	Wet Mud 28/10		
		922803915.00	979701749	979701705	979701719	979701735	979701772	979701729	979701638		
		HP102811.D	HP102819.D	HP102838.D	HP110306.D	HP102830.D	HP110309.D	HP110315.D	HP110311.D		
	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug	total ug		
Formaldehyde		0.22	nd	nd	0.41	0.2	1.1	1.4	nd		
Acetaldehyde		nd	0.49	0.86	35.00	32	0.21	2	0.23		
Acetone		0.52	1.3	3.1	120.00	86	0.32	7	2.20		
Propanal		nd	nd	nd	nd	0.97	nd	nd	nd		
MEK		nd	nd	0.4	14.00	9.5	nd	0.77	nd		
iso-Butanal		nd	nd	nd	0.55	0.33	nd	nd	nd		
Benzaldehyde		nd	nd	nd	0.20	1.2	nd	0.28	nd		
2-Pentanone		nd	nd	nd	4.20	2.2	nd	nd	nd		
n-Pentanal		nd	nd	nd	1.30	1.3	nd	0.47	nd		
p-Tolualdehyde		nd	nd	nd	nd	nd	nd	nd	nd		
2-Hexanone		nd	nd	nd	nd	nd	nd	nd	nd		
Hexanal		nd	nd	nd	nd	nd	nd	nd	nd		

VOCs by WIENV 38		Rows 2	Oxalate 2 26/10	Oxalate 26/10	hickener 1 27/1	Thickener 2 27/10			
		#4	#14	#13	#9	#10			
		PT110206.D	PT110306.D	PT110305.D	PT110211.D	PT110212.D			
		mg/L	mg/L	mg/L	mg/L	mg/L			
1,3, 5 Hexatriene		nd	nd	nd	nd	nd			
heptane		nd	nd	nd	nd	nd			
methyl cyclohexane		nd	nd	nd	nd	nd			
benzene		nd	nd	nd	nd	nd			
MIBK		nd	nd	nd	0.011	nd			
DMDS		nd	nd	nd	nd	nd			
toluene		nd	nd	nd	0.004	nd			
ethylbenzene		nd	nd	nd	nd	nd			
1,3-xylene		nd	nd	nd	nd	nd			
ethynylbenzene		nd	nd	nd	nd	nd			
1,2-xylene		nd	nd	nd	nd	nd			
styrene		nd	nd	nd	nd	nd			
benzofuran		nd	nd	nd	nd	nd			
1,3,5-trimethylbenzene		nd	nd	nd	nd	nd			
indene		nd	nd	nd	nd	nd			
2 Methyl Nap		nd	nd	nd	nd	nd			
1 Methyl Nap		nd	nd	nd	nd	nd			

Others		Rows 2	Oxalate 2 26/10	Oxalate 26/10	hickener 1 27/1	Thickener 2 27/10		
		#4	#14	#13	#9	#10		
Carbonate (mg/L)		3000	46000	48000	22000	22000		
TOC (mg/L)		140	6200	6200	1500	1500		
Sodium by AAS (mg/L)		1700	27000	26000	12300	12200		
Aluminium by AAS (mg/L)		200	4300	4200	3900	3900		

nd = not detected

(I) RESULTS

Matrix: Mixed

VOCs by WIENV 31	Method Blank
	1028040.D
Analyte	total ug
acetone	nd
hexatriene	nd
benzene	nd
pyridine	nd
toluene	nd
ethyl-benzene	nd
1,3-xylene	nd
ethynyl-benzene	nd
styrene	nd
1,2-xylene	nd
benzaldehyde	nd
1,3,5-trimethyl-benzene	nd
benzonitrile	nd
benzofuran	nd
aceto-phenone	nd
naphthalene	nd
quinoline	nd
1H-indole	nd
2-methyl naphthalene	nd
1-methyl naphthalene	nd
biphenyl	nd
acenaph-thylene	nd
acenaph-thene	nd
dibenzo-furan	nd
9H-fluorene	nd
MEK	nd
MPK	nd
3 methyl butanal	nd
heptane	nd
MIBK	nd
DMDS	nd
dimethylacetamide	nd
phenol	nd
nitrobenzene	nd
methyl cyclohexane	nd
dimethylformamide	nd
Iodomethane	nd
indene	nd
Semi-quantitive Results	
Dibutylamine	nd
2 Ethyl Hexanol	nd

	Method Blank

Carbonyls by WIENV 34	Method Blank
	HP102808.D
	total ug
Formaldehyde	nd
Acetaldehyde	nd
Acetone	nd
Propanal	nd
MEK	nd
iso-Butanal	nd
Benzaldehyde	nd
2-Pentanone	nd
n-Pentanal	nd
p-Tolualdehyde	nd
2-Hexanone	nd
Hexanal	nd

VOCs by WIENV 38	Method Blank
	PT110304.D
	mg/L
1,3, 5 Hexatriene	nd
heptane	nd
methyl cyclohexane	nd
benzene	nd
MIBK	nd
DMDS	nd
toluene	nd
ethylbenzene	nd
1,3-xylene	nd
ethynylbenzene	nd
1,2-xylene	nd
styrene	nd
benzofuran	nd
1,3,5-trimethylbenzene	nd
indene	nd
2 Methyl Nap	nd
1 Methyl Nap	nd

Others	Method Blank
Carbonate (mg/L)	nd
TOC (mg/L)	nd
Sodium by AAS (mg/L)	nd
Aluminium by AAS (mg/L)	nd

nd = not detected

GHD
PO Box Y3106
Perth WA 6832

November 10, 2004

Attention: Mark Goldstone
Your Ref No: 6115324
Our Ref No: ENV 04-322

REPORT ON SAMPLE ANALYSIS

Introduction:

Three TO17 tubes and four DNPH tubes were received on the 3rd November 2004, it was requested that the samples be analysed to determine a number of components.

Methods of Analysis:

The TO17 tubes were analysed to determine the amount of Volatile Organic Compounds according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The DNPH tubes were analysed to determine the amount of aldehydes and ketones according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheet.

GEOTECHNICAL SERVICES

Nigel West
Senior Chemist

Angela Downey
Environmental Chemist

(I) RESULTS

Matrix: Mixed		Sand 28/10	28/10	28/10					Blank
VOCs from TO17 tube by WIENV 31	Tube No	A13190	A14300	A12494					
	Geotech ID	10280404.D	10280416.D	10280405.D					1028040.D
Analyte	PQL (ng)	total ng	total ng	total ng					total ng
acetone	5	5020	87	3370					nd
hexatriene	5	nd	nd	nd					nd
benzene	5	47	42	9					nd
pyridine	5	nd	nd	nd					nd
toluene	5	nd	110	nd					nd
ethyl-benzene	5	nd	nd	nd					nd
1,3-xylene	5	nd	nd	nd					nd
ethynyl-benzene	5	nd	nd	nd					nd
styrene	5	nd	nd	nd					nd
1,2-xylene	5	nd	nd	nd					nd
benzaldehyde	5	67	31	24					nd
1,3,5-trimethyl-benzene	5	nd	nd	nd					nd
benzonitrile	5	nd	nd	nd					nd
benzofuran	5	nd	nd	nd					nd
aceto-phenone	5	99	61	44					nd
naphthalene	5	nd	nd	nd					nd
quinoline	5	nd	nd	nd					nd
1H-indole	5	nd	nd	nd					nd
2-methyl naphthalene	5	5	nd	nd					nd
1-methyl naphthalene	5	nd	nd	nd					nd
biphenyl	5	nd	nd	nd					nd
acenaph-thylene	5	nd	nd	nd					nd
acenaph-thene	5	nd	nd	nd					nd
dibenzo-furan	5	nd	nd	nd					nd
9H-fluorene	5	nd	nd	nd					nd
MEK	5	570	87	260					nd
MPK	5	37	15	16					nd
3 methyl butanal	5	nd	nd	nd					nd
heptane	5	nd	nd	20					nd
MIBK	5	nd	nd	nd					nd
DMDS	5	nd	nd	nd					nd
dimethylacetamide	5	nd	nd	nd					nd
phenol	5	5	nd	nd					nd
nitrobenzene	5	nd	nd	nd					nd
methyl cyclohexane	5	nd	nd	nd					nd
dimethylformamide	5	nd	nd	nd					nd
Iodomethane	5	nd	nd	nd					nd
indene	5	nd	nd	nd					nd

Carbonyls from DNPH tube by WIENV 34	GHD ID				979701772	979701638	979701710	979701729	
	Geotech ID				HP110309.D	HP110311.D	HP110313.D	HP110315.D	HP102808.D
	PQL (total ug)				total ug	total ug	total ug	total ug	total ug
Formaldehyde	0.2				1.1	nd	nd	1.4	nd
Acetaldehyde	0.2				0.21	0.23	1.6	2	nd
Acetone	0.2				0.32	2.20	10	7	nd
Propanal	0.2				nd	nd	nd	nd	nd
MEK	0.2				nd	nd	0.92	0.77	nd
iso-Butanal	0.2				nd	nd	nd	nd	nd
Benzaldehyde	0.2				nd	nd	nd	0.28	nd
2-Pentanone	0.2				nd	nd	nd	nd	nd
n-Pentanal	0.2				nd	nd	nd	0.47	nd
p-Tolualdehyde	0.2				nd	nd	nd	nd	nd
2-Hexanone	0.2				nd	nd	nd	nd	nd
Hexanal	0.2				nd	nd	nd	nd	nd

nd = not detected

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &							
Mark Goldstone	Our Ref No	Env 04-347	Samples Received	19-Nov-04	**Disclaimer:** Geotech has analysed the derivatised samples provic		
GHD	Your Ref No	6115324	Samples Analysed	22-Nov-04	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.36	0.17	0.39	0.37	0.33
		Errors + / - %	11.7	11.7	11.7	11.8	12.2
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
CP1 # 0979701610	HP112205.D	100	nd	nd	1.86	nd	nd
ST3 # 0979701615	HP112207.D	100	0.752	4.16	16.6	nd	nd
ST2 # 0979701634	HP112209.D	100	0.903	9.09	31.8	nd	nd

Volume of Extract (mL)	5				
nd	Not Detected				
Daily Calibration	HP112203.D	Pass	1.0	ppm standard	
Multipoint Calibration	HP111811.D				
MDL Lab No	HP111815.D				
Precision Lab No	HP111827.D				
Column Efficiency	HP111816.D				

Processed By	Angela Downey	Checked By	Nigel West	Date	**26/11/2004**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

Test Report for Analysis of Carb TO11A								
Mark Goldstone	Our Ref No	ded by methods based						
GHD	Your Ref No							
Sample Name	Lab Number	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
		0.31	0.17	0.47	0.39	0.25	0.47	0.17
		11.8	12.1	12.1	13.2	13.0	13.6	12.8
		Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
CP1 # 0979701610	HP112205.D	nd	nd	nd	nd	nd	nd	nd
ST3 # 0979701615	HP112207.D	nd	nd	nd	nd	nd	nd	nd
ST2 # 0979701634	HP112209.D	nd	nd	nd	nd	nd	nd	nd

Volume of Extract (mL)	5
nd	Not Detected
Daily Calibration	HP112203.D
Multipoint Calibration	HP111811.D
MDL Lab No	HP111815.D
Precision Lab No	HP111827.D
Column Efficiency	HP111816.D

Processed By	Angela Downey

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

GHD
239 Adelaide Terrace
Perth WA 6004

December 1, 2004

Attention: L. Jefferys
Your Ref No: 0456
Our Ref No: ENV 04-349

REPORT ON ANALYSIS OF GAS BAGS

Introduction:

Two TO17 tubes and two DNPH impregnated tubes were received on 23/11/04, and analysed according to the instructions on your chain of custody 0456.

Methods of Analysis:

The tubes were analysed to determine the amount of Volatile Organic Carbon according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17).The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &

L. Jeffreys	Our Ref No	Env 04-249	Samples Received	23-Nov-04	**Disclaimer:** Geotech has analysed the derivatised samples provi		
GHD	Your Ref No	61/15324	Samples Analysed	24-Nov-04	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.36	0.17	0.39	0.37	0.33
		Errors + / - %	11.7	11.7	11.7	11.8	12.2
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
# 0979701714 CD	HP112405.D	100	2.96	1.95	1.5	nd	nd
# 0979701691 UCD	HP112407.D	100	3.31	0.821	0.802	nd	nd

Volume of Extract (mL)	5					
nd	Not Detected					
Daily Calibration	HP112403.D	Pass	1.0	ppm standard		
Multipoint Calibration	HP111811.D					
MDL Lab No	HP111815.D					
Precision Lab No	HP111827.D					
Column Efficiency	HP111816.D					

Processed By	Angela Downey	Checked By	Nigel West	Date	**26/11/2004**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

TO11A)

ded by methods based

iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
0.31	0.17	0.47	0.39	0.25	0.47	0.17
11.8	12.1	12.1	13.2	13.0	13.6	12.8
Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

	L.Jefferys	Our Ref No	Env 04-349	Samples Received	23-Nov-04	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.
	GHD	Your Ref No	61/15324	Samples Analysed	23-Nov-04	Geotech has determined the VOCs by thermal desorption GC-MS

Tube No	Sample ID	Date	Time	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
					Units	ng	ng	ng	ng	ng	ng	ng
					Error +/- %	13.7	13.1	12.7	13.0	13.8	12.8	7.4
	Detection Limits. Based on Sample Volume on tube			A09988	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank			1	11230402.D	nd	nd	nd	nd	nd	nd	nd
A12374	K-VCD			1	11230413.D	820	nd	nd	51	nd	nd	nd
A09988	K-CD			1	11230412.D	540	nd	nd	33	nd	nd	nd
						(1000 ng)		(1000 ng)		(400 ng)		
				chkstd	11230411.D	1170.0	nd	1140.0	nd	482.0	nd	nd
	Daily Calibration	100ng std		10 ng solids	11230409.D	104	95	105	99	106	99	100
	Multipoint Calibration	Liquid Stds		Solid Standards								
		Blank #A70014		0 ng	11230402.D	nd	nd	73.5	nd	nd	nd	nd
		10ng std #A14330		1 ng	11230406.D	nd	nd	73.5	23.6	nd	8.7	9.7
		20ng std #A13823		2 ng	11230407.D	nd	4.8	73.5	13.2	8.1	3.4	4.8
		50ng std #A70012		5 ng	11230408.D	50.4	43.8	73.5	47.7	47.5	42.2	44.1
		100ng std #A61949		10 ng	11230409.D	103.7	95.4	73.5	98.9	105.6	99.4	99.7
		200ng std #C06407		20 ng	11230410.D	254.3	222.6	73.5	216.3	221.2	224.2	220.2
		500ng std #A13704		50 ng	11230403.D	547.3	551.6	73.5	493.0	540.7	553.6	547.9
		1000ng std #A08278		100 ng	11230404.D	972.1	965.6	73.5	801.5	966.9	953.8	956.8

Comments 10ng std not used for the majority of samples. (see attached worksheet for further details)

1st Precision Lab No 09200411.D

Lab Blank Lab No 11230402.D Should have the same Lab No as the Lab Blank in F9

Multipoint Calibration Check Pass From TO15 Worksheet

Daily Calibration Check Pass From TO15 Worksheet

BFB Lab Number 11230402.D Should have the same first four numbers in the Lab No as the samples

nd Not Detected

Errors Determined /Without Sampling

Initials

Processed By Angela Downey **Checked By** Nigel West **Date** 30-Nov-04

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Geotechnical Services

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

Compounds by in-House Metho

Samples Received	23-Nov-04
Samples Analysed	23-Nov-04

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	12.6	12.8	12.6	13.4	12.8	12.6	12.9	14.2	12.7	13.1	15.0	13.1	12.9
A09988	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	11230402.D	nd	nd	nd	nd	11.0	nd	nd	nd	nd	nd	nd	nd	nd
1	11230413.D	nd	nd	nd	nd	nd	nd	6.8	nd	nd	nd	nd	nd	nd
1	11230412.D	nd	nd	nd	nd	nd	nd	6.9	nd	nd	nd	nd	nd	nd
		(50 ng)								(10 ng)	(50 ng)			
chkstd	11230411.D	54.0	nd	nd	nd	nd	nd	nd	nd	9.5	55.6	nd	nd	nd
10 ng solids	11230409.D	111	99	100	100	83	99	90	98	11	106	9	90	101
Solid Standards														
0 ng	11230402.D	nd	nd	nd	nd	11.0	nd	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	28.8	10.3	6.5	16.5	20.6	7.1	27.6	15.1	13.5	39.1	1.3	1.3	29.4
2 ng	11230407.D	22.7	7.3	nd	9.2	13.7	nd	22.7	4.4	21.8	21.7	nd	nd	18.3
5 ng	11230408.D	60.0	41.2	42.5	42.8	35.5	40.3	45.4	46.4	54.0	55.4	26.9	26.9	52.0
10 ng	11230409.D	111.2	98.9	100.0	99.5	83.0	99.3	90.0	98.2	113.8	106.3	89.8	89.8	101.0
20 ng	11230410.D	244.9	213.9	239.5	205.8	162.3	222.4	185.9	210.6	218.0	218.6	170.4	170.4	216.5
50 ng	11230403.D	563.6	552.9	560.1	535.7	501.5	576.2	509.6	542.9	535.1	541.4	572.8	572.8	528.8
100 ng	11230404.D	939.1	970.3	943.8	771.1	773.9	750.6	789.1	480.4	620.7	895.0	1163.0	1163.0	623.7

samples. (see attached worksheet for fur

ne Lab No as the Lab Blank in F9
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ne first four numbers in the Lab No as th

Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received	23-Nov-04
Samples Analysed	23-Nov-04

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	3 methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.3	15.2	12.9	12.8	12.9	No data	No data	No data	No data	12.6	12.6	15.3	13.7	12.5	12.8	12.6
A09988	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	11230402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11230413.D	1.2	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11230412.D	1.3	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
																(50 ng)	
chkstd	11230411.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	35.4	nd
10 ng solids	11230409.D	9	9	10	8	10	No Data	No Data	No Data	No Data	108	96	94	103	112	108	109
Solid Standards																	
0 ng	11230402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	20.1	12.5	16.5	12.4	16.4	No Data	No Data	No Data	No Data	3.9	11.3	11.5	nd	13.8	12.3	25.6
2 ng	11230407.D	23.6	16.4	22.2	16.3	21.3	No Data	No Data	No Data	No Data	15.3	7.5	17.0	4.2	1.3	8.3	5.3
5 ng	11230408.D	48.2	43.8	54.1	41.3	53.6	No Data	No Data	No Data	No Data	53.7	44.7	47.7	46.8	46.8	43.1	60.4
10 ng	11230409.D	92.0	93.0	101.7	83.0	103.1	No Data	No Data	No Data	No Data	107.9	96.1	94.1	102.9	111.5	108.1	108.6
20 ng	11230410.D	191.9	193.3	215.5	190.2	210.3	No Data	No Data	No Data	No Data	227.5	212.3	230.3	236.6	217.3	198.6	229.8
50 ng	11230403.D	507.3	527.0	534.4	467.8	529.2	No Data	No Data	No Data	No Data	493.4	526.8	474.7	557.1	561.4	548.5	472.5
100 ng	11230404.D	634.0	991.5	974.1	1012.9	923.5	No Data	No Data	No Data	No Data	970.2	983.4	1004.1	964.0	964.9	978.4	796.2

samples. (see attached worksheet for fu

ne Lab No as the Lab Blank in F9
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ne first four numbers in the Lab No as th

Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received	23-Nov-04
Samples Analysed	23-Nov-04

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	methylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.9	13.5	13.7	12.6	15.5	12.7					
A09988	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	11230402.D	nd	nd	nd	nd	nd	nd		11230411.D			
1	11230413.D	nd	nd	nd	nd	nd	nd		11230411.D			
1	11230412.D	nd	nd	nd	nd	nd	nd		11230411.D			
chkstd	11230411.D	nd	nd	nd	nd	nd	nd				Lab No 11230411.D	E
10 ng solids	11230409.D	11	81	92	97	98	86				acetone, hexatriene, MEK, M 15	N
Solid Standards											benz, hept, MIBK, me cyhe 12	D
0 ng	11230402.D	1.7	nd	nd	nd	nd	18.4				pyr, DMS dimethylacet/forma Not Corrected	
1 ng	11230406.D	8.8	17.2	3.3	15.4	6.6	36.8				tol 17	O
2 ng	11230407.D	11.1	12.6	9.4	nd	17.3	32.7				C2 Benz 7	F
5 ng	11230408.D	37.1	36.9	57.2	50.5	51.1	54.2				solids and MNs Not Corrected	
10 ng	11230409.D	109.4	81.0	92.2	97.4	97.9	86.0				quinoline indole 10	R
20 ng	11230410.D	231.3	187.4	251.8	249.3	214.3	175.9					E
50 ng	11230403.D	553.5	554.7	485.0	493.7	500.3	441.8					P
100 ng	11230404.D	741.6	489.5	642.5	690.1	690.1	526.7					O
												R

samples. (see attached worksheet for fur | T

ne Lab No as the Lab Blank in F9
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ne first four numbers in the Lab No as th

Nigel West **Date**

GEOTECH

2002 and is sample No 4

GHD
239 Adelaide Terrace
Perth WA 6004

December 1, 2004

Attention: L. Jefferys
Your Ref No: 0458
Our Ref No: ENV 04-351

REPORT ON ANALYSIS OF GAS BAGS

Introduction:

Two TO17 tubes and two DNPH impregnated tubes were received on 24/11/04, and analysed according to the instructions on your chain of custody 0458.

Methods of Analysis:

The tubes were analysed to determine the amount of Volatile Organic Carbon according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17).The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &							
L. Jeffreys	Our Ref No	Env 04-351	Samples Received	24-Nov-04	**Disclaimer:** Geotech has analysed the derivatised samples provi		
GHD	Your CoC No	0458	Samples Analysed	26-Nov-04	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.36	0.17	0.39	0.37	0.33
		Errors + / - %	11.7	11.7	11.7	11.8	12.2
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
1274300474/K-DP	HP112605.D	100	0.80	0.33	1.1	nd	nd
1274300475/K-CW	HP112607.D	100	0.70	0.29	0.88	nd	nd
Volume of Extract (mL)	2						
nd	Not Detected						
Daily Calibration	HP112603.D	Pass	1.0	ppm standard			
Multipoint Calibration	HP111811.D						
MDL Lab No	HP111815.D						
Precision Lab No	HP111827.D						
Column Efficiency	HP111816.D						
Processed By	Joanne Menegazzo	Checked By	Angela Downey	Date	**29/11/2004**		
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services					

Test Report for Analysis of Carb & TO11A)									
L. Jeffreys	Our Ref No	ided by methods based							
GHD	Your CoC No								
Sample Name	Lab Number	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal	End of Report
		0.31	0.17	0.47	0.39	0.25	0.47	0.17	
		11.8	12.1	12.1	13.2	13.0	13.6	12.8	
		Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	
1274300474/K-DP	HP112605.D	nd	nd	nd	nd	nd	nd	nd	
1274300475/K-CW	HP112607.D	nd	nd	nd	nd	nd	nd	nd	

Volume of Extract (mL)	2
nd	Not Detected
Daily Calibration	HP112603.D
Multipoint Calibration	HP111811.D
MDL Lab No	HP111815.D
Precision Lab No	HP111827.D
Column Efficiency	HP111816.D

Processed By
Joanne Menegazzo
Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

END OF REPORT

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

	L. Jefferys	Our Ref No	Env 04-351	Samples Received	24-Nov-04	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.
	GHD	Your Ref No	0458	Samples Analysed	26-Nov-04	Geotech has determined the VOCs by thermal desorption GC-MS

Tube No	Sample ID	Date	Time	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
					Units	ng	ng	ng	ng	ng	ng	ng
					Error +/- %	13.7	13.1	12.7	13.0	13.8	12.8	7.4
	Detection Limits. Based on Sample Volume on tube			A11215	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank			1	11260404.D	nd	nd	nd	nd	nd	nd	nd
A11215	K-DP			1	11260406.D	nd	nd	nd	nd	nd	nd	nd
C06676	K-CW			1	11260407.D	150	nd	nd	nd	nd	nd	nd
						(1000 ng)		(1000 ng)		(400 ng)		
				chkstd	11260423.D	1450.0	nd	1150.0	nd	446.0	nd	nd
	Daily Calibration	100ng std		10 ng solids	11260403.D	100	99	101	89	103	96	97
	Multipoint Calibration	Liquid Stds		Solid Standards								
		Blank #A70014		0 ng	11230402.D	nd	nd	nd	nd	nd	nd	nd
		10ng std #A14330		1 ng	11230406.D	nd	nd	3.8	23.6	nd	8.7	9.7
		20ng std #A13823		2 ng	11230407.D	nd	4.8	18.1	13.2	8.1	3.4	4.8
		50ng std #A70012		5 ng	11230408.D	50.4	43.8	56.9	47.7	47.5	42.2	44.1
		100ng std #A61949		10 ng	11230409.D	103.7	95.4	114.5	98.9	105.6	99.4	99.7
		200ng std #C06407		20 ng	11230410.D	254.3	222.6	197.6	216.3	221.2	224.2	220.2
		500ng std #A13704		50 ng	11230403.D	547.3	551.6	491.2	493.0	540.7	553.6	547.9
		1000ng std #A08278		100 ng	11230404.D	972.1	965.6	999.2	801.5	966.9	953.8	956.8

Comments 10ng std not used for the majority of samples. (see attached worksheet for further details)

1st Precision Lab No	09200411.D	
Lab Blank Lab No	11260404.D	Should have the same Lab No as the Lab Blank in F9
Multipoint Calibration Check	Pass	From TO15 Worksheet
Daily Calibration Check	Pass	From TO15 Worksheet
BFB Lab Number	11260404.D	Should have the same first four numbers in the Lab No as the samples
nd	Not Detected	
Errors Determined	/Without Sampling	
Initials		

Processed By Angela Downey **Checked By** Nigel West **Date** 01-Dec-04

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

Compounds by in-House Metho

Samples Received	24-Nov-04
Samples Analysed	26-Nov-04

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	12.6	12.8	12.6	13.4	12.8	12.6	12.9	14.2	12.7	13.1	15.0	13.1	12.9
A11215	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	11260404.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	11260406.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	11260407.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		(50 ng)								(10 ng)	(50 ng)			
chkstd	11260423.D	53.7	nd	nd	nd	nd	nd	nd	nd	9.5	49.2	nd	nd	nd
10 ng solids	11260403.D	121	98	95	92	83	95	89	88	10	97	8	83	105
Solid Standards														
0 ng	11230402.D	nd	nd	nd	nd	11.0	nd	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	28.8	10.3	6.5	16.5	20.6	7.1	27.6	15.1	13.5	39.1	1.3	1.3	29.4
2 ng	11230407.D	22.7	7.3	nd	9.2	13.7	nd	22.7	4.4	21.8	21.7	nd	nd	18.3
5 ng	11230408.D	60.0	41.2	42.5	42.8	35.5	40.3	45.4	46.4	54.0	55.4	26.9	26.9	52.0
10 ng	11230409.D	111.2	98.9	100.0	99.5	83.0	99.3	90.0	98.2	113.8	106.3	89.8	89.8	101.0
20 ng	11230410.D	244.9	213.9	239.5	205.8	162.3	222.4	185.9	210.6	218.0	218.6	170.4	170.4	216.5
50 ng	11230403.D	563.6	552.9	560.1	535.7	501.5	576.2	509.6	542.9	535.1	541.4	572.8	572.8	528.8
100 ng	11230404.D	939.1	970.3	943.8	771.1	773.9	750.6	789.1	480.4	620.7	895.0	1163.0	1163.0	623.7

samples. (see attached worksheet for fur

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ne first four numbers in the Lab No as th

Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received 24-Nov-04
Samples Analysed 26-Nov-04

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	3 methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.3	15.2	12.9	12.8	12.9	No data	No data	No data	No data	12.6	12.6	15.3	13.7	12.5	12.8	12.6
A11215	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	11260404.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11260406.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11260407.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
																(50 ng)	
chkstd	11260423.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	41.6	nd
10 ng solids	11260403.D	96	9	10	9	10	No Data	No Data	No Data	No Data	108	94	113	110	70	73	106
Solid Standards																	
0 ng	11230402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	20.1	12.5	16.5	12.4	16.4	No Data	No Data	No Data	No Data	3.9	11.3	11.5	nd	13.8	12.3	25.6
2 ng	11230407.D	23.6	16.4	22.2	16.3	21.3	No Data	No Data	No Data	No Data	15.3	7.5	17.0	4.2	1.3	8.3	5.3
5 ng	11230408.D	48.2	43.8	54.1	41.3	53.6	No Data	No Data	No Data	No Data	53.7	44.7	47.7	46.8	46.8	43.1	60.4
10 ng	11230409.D	92.0	93.0	101.7	83.0	103.1	No Data	No Data	No Data	No Data	107.9	96.1	94.1	102.9	111.5	108.1	108.6
20 ng	11230410.D	191.9	193.3	215.5	190.2	210.3	No Data	No Data	No Data	No Data	227.5	212.3	230.3	236.6	217.3	198.6	229.8
50 ng	11230403.D	507.3	527.0	534.4	467.8	529.2	No Data	No Data	No Data	No Data	493.4	526.8	474.7	557.1	561.4	548.5	472.5
100 ng	11230404.D	634.0	991.5	974.1	1012.9	923.5	No Data	No Data	No Data	No Data	970.2	983.4	1004.1	964.0	964.9	978.4	796.2

samples. (see attached worksheet for fu

ne Lab No as the Lab Blank in F9
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Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received	24-Nov-04
Samples Analysed	26-Nov-04

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	methylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.9	13.5	13.7	12.6	15.5	12.7					
A11215	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	11260404.D	nd	nd	nd	nd	nd	nd		11260423.D			
1	11260406.D	nd	nd	nd	nd	nd	nd		11260423.D			
1	11260407.D	2.81	nd	nd	nd	nd	nd		11260423.D			
chkstd	11260423.D	nd	nd	nd	nd	nd	nd				Lab No 11260423.D	E
10 ng solids	11260403.D	8	90	132	73	121	85				acetone, hexatriene, MEK, M 31	N
Solid Standards											benz, hept, MIBK, me cyhe 13	D
0 ng	11230402.D	1.7	nd	nd	nd	nd	18.4				pyr, DMS dimethylacet/forma Not Corrected	
1 ng	11230406.D	8.8	17.2	3.3	15.4	6.6	36.8				tol 10	O
2 ng	11230407.D	11.1	12.6	9.4	nd	17.3	32.7				C2 Benz 7	F
5 ng	11230408.D	37.1	36.9	57.2	50.5	51.1	54.2				solids and MNs Not Corrected	
10 ng	11230409.D	109.4	81.0	92.2	97.4	97.9	86.0				quinoline indole Not Corrected	R
20 ng	11230410.D	231.3	187.4	251.8	249.3	214.3	175.9					E
50 ng	11230403.D	553.5	554.7	485.0	493.7	500.3	441.8					P
100 ng	11230404.D	741.6	489.5	642.5	690.1	690.1	526.7					O
												R

samples. (see attached worksheet for fur — T

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ne first four numbers in the Lab No as th

Nigel West **Date**

GEOTECH

2002 and is sample No 4

GHD
239 Adelaide Terrace
Perth WA 6004

December 1, 2004

Attention: L. Jefferys
Your Ref No: 0461
Our Ref No: ENV 04-356

REPORT ON ANALYSIS OF GAS BAGS

Introduction:

Three TO17 tubes and four DNPH impregnated tubes were received on 25/11/04, and analysed according to the instructions on your chain of custody 0461.

Methods of Analysis:

The tubes were analysed to determine the amount of Volatile Organic Carbon according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17).The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets. The GC-MS failed during the analysis of tube A14250 (KW), no data is available for this sample

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &

L. Jeffreys	Our Ref No	Env 04-356	Samples Received	25-Nov-04	**Disclaimer:** Geotech has analysed the derivatised samples provi		
GHD	Your CoC No	0461	Samples Analysed	26-Nov-04	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.14	0.07	0.15	0.15	0.13
		Errors + / - %	11.7	11.7	11.7	11.8	12.2
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
1274300471/K1	HP112609.D	100	0.62	0.29	0.40	nd	< 0.2
1274300472/K1	HP112611.D	100	0.94	0.37	0.40	nd	< 0.2
1274300469/UCW	HP112613.D	100	0.62	0.90	0.40	< 0.2	< 0.2

Volume of Extract (mL)	2			
nd	Not Detected			
Daily Calibration	HP112603.D	Pass	1.0	ppm standard
Multipoint Calibration	HP111811.D			
MDL Lab No	HP111815.D			
Precision Lab No	HP111827.D			
Column Efficiency	HP111816.D			

Processed By	Joanne Menegazzo	Checked By	Angela Downey	Date	**29/11/2004**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

TO11A)

ded by methods based

iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
0.12	0.07	0.19	0.16	0.10	0.19	0.07
11.8	12.1	12.1	13.2	13.0	13.6	12.8
Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

	L.Jefferys	Our Ref No	Env 04-356	Samples Received	25-Nov-04	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.
	GHD	Your Ref No	0461	Samples Analysed	26-Nov-04	Geotech has determined the VOCs by thermal desorption GC-MS

Tube No	Sample ID	Date	Time	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
					Units	ng	ng	ng	ng	ng	ng	ng
					Error +/- %	13.7	13.1	12.7	13.0	13.8	12.8	7.4
	Detection Limits. Based on Sample Volume on tube			B16431	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank			1	11260404.D	nd	nd	nd	nd	nd	nd	nd
B16431	K1			1	11260408.D	290	nd	nd	31	nd	nd	nd
C06705	UCW			1	11260410.D	nd	nd	nd	nd	nd	nd	nd
A14250	K2			1	11260409.D	Sample lost due to instrument failure.						
						(1000 ng)		(1000 ng)		(400 ng)		
				chkstd	11260423.D	1450.0	nd	1150.0	nd	446.0	nd	nd
	Daily Calibration	100ng std		10 ng solids	11260403.D	100	99	101	89	103	96	97
	Multipoint Calibration	Liquid Stds		Solid Standards								
		Blank #A70014		0 ng	11230402.D	nd	nd	nd	nd	nd	nd	nd
		10ng std #A14330		1 ng	11230406.D	nd	nd	3.8	23.6	nd	8.7	9.7
		20ng std #A13823		2 ng	11230407.D	nd	4.8	18.1	13.2	8.1	3.4	4.8
		50ng std #A70012		5 ng	11230408.D	50.4	43.8	56.9	47.7	47.5	42.2	44.1
		100ng std #A61949		10 ng	11230409.D	103.7	95.4	114.5	98.9	105.6	99.4	99.7
		200ng std #C06407		20 ng	11230410.D	254.3	222.6	197.6	216.3	221.2	224.2	220.2
		500ng std #A13704		50 ng	11230403.D	547.3	551.6	491.2	493.0	540.7	553.6	547.9
		1000ng std #A08278		100 ng	11230404.D	972.1	965.6	999.2	801.5	966.9	953.8	956.8

Comments 10ng std not used for the majority of samples. (see attached worksheet for further details)

1st Precision Lab No 09200411.D

Lab Blank Lab No 11260404.D Should have the same Lab No as the Lab Blank in F9

Multipoint Calibration Check Pass From TO15 Worksheet

Daily Calibration Check Pass From TO15 Worksheet

BFB Lab Number 11260404.D Should have the same first four numbers in the Lab No as the samples

nd Not Detected

Errors Determined Without Sampling

Initials

Processed By Angela Downey **Checked By** Nigel West **Date** 01-Dec-04

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

Compounds by in-House Metho

Samples Received	25-Nov-04
Samples Analysed	26-Nov-04

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	12.6	12.8	12.6	13.4	12.8	12.6	12.9	14.2	12.7	13.1	15.0	13.1	12.9
B16431	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	11260404.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	11260408.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	11260410.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	11260409.D													
		(50 ng)								(10 ng)	(50 ng)			
chkstd	11260423.D	53.7	nd	nd	nd	nd	nd	nd	nd	9.5	49.2	nd	nd	nd
10 ng solids	11260403.D	121	98	95	92	83	95	89	88	10	97	8	83	105
Solid Standards														
0 ng	11230402.D	nd	nd	nd	nd	11.0	nd	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	28.8	10.3	6.5	16.5	20.6	7.1	27.6	15.1	13.5	39.1	1.3	1.3	29.4
2 ng	11230407.D	22.7	7.3	nd	9.2	13.7	nd	22.7	4.4	21.8	21.7	nd	nd	18.3
5 ng	11230408.D	60.0	41.2	42.5	42.8	35.5	40.3	45.4	46.4	54.0	55.4	26.9	26.9	52.0
10 ng	11230409.D	111.2	98.9	100.0	99.5	83.0	99.3	90.0	98.2	113.8	106.3	89.8	89.8	101.0
20 ng	11230410.D	244.9	213.9	239.5	205.8	162.3	222.4	185.9	210.6	218.0	218.6	170.4	170.4	216.5
50 ng	11230403.D	563.6	552.9	560.1	535.7	501.5	576.2	509.6	542.9	535.1	541.4	572.8	572.8	528.8
100 ng	11230404.D	939.1	970.3	943.8	771.1	773.9	750.6	789.1	480.4	620.7	895.0	1163.0	1163.0	623.7

samples. (see attached worksheet for fur

ne Lab No as the Lab Blank in F9
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Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received	25-Nov-04
Samples Analysed	26-Nov-04

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	3 methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.3	15.2	12.9	12.8	12.9	No data	No data	No data	No data	12.6	12.6	15.3	13.7	12.5	12.8	12.6
B16431	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	11260404.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11260408.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	16	nd	nd	nd	nd	nd	nd
1	11260410.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	11260409.D																
																(50 ng)	
chkstd	11260423.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	41.6	nd
10 ng solids	11260403.D	10	9	10	9	10	No Data	No Data	No Data	No Data	108	94	113	110	70	73	106
Solid Standards																	
0 ng	11230402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1 ng	11230406.D	20.1	12.5	16.5	12.4	16.4	No Data	No Data	No Data	No Data	3.9	11.3	11.5	nd	13.8	12.3	25.6
2 ng	11230407.D	23.6	16.4	22.2	16.3	21.3	No Data	No Data	No Data	No Data	15.3	7.5	17.0	4.2	1.3	8.3	5.3
5 ng	11230408.D	48.2	43.8	54.1	41.3	53.6	No Data	No Data	No Data	No Data	53.7	44.7	47.7	46.8	46.8	43.1	60.4
10 ng	11230409.D	92.0	93.0	101.7	83.0	103.1	No Data	No Data	No Data	No Data	107.9	96.1	94.1	102.9	111.5	108.1	108.6
20 ng	11230410.D	191.9	193.3	215.5	190.2	210.3	No Data	No Data	No Data	No Data	227.5	212.3	230.3	236.6	217.3	198.6	229.8
50 ng	11230403.D	507.3	527.0	534.4	467.8	529.2	No Data	No Data	No Data	No Data	493.4	526.8	474.7	557.1	561.4	548.5	472.5
100 ng	11230404.D	634.0	991.5	974.1	1012.9	923.5	No Data	No Data	No Data	No Data	970.2	983.4	1004.1	964.0	964.9	978.4	796.2

samples. (see attached worksheet for fu

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Nigel West **Date**

GEOTECH

2002 and is sample No 4

Compounds by in-House Metho

Samples Received	25-Nov-04
Samples Analysed	26-Nov-04

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	methylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.9	13.5	13.7	12.6	15.5	12.7					
B16431	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	11260404.D	nd	nd	nd	nd	nd	nd		11260423.D			
1	11260408.D	3.2	nd	nd	nd	nd	nd		11260423.D			
1	11260410.D	nd	nd	nd	nd	nd	nd		11260423.D			
1	11260409.D								11260423.D			
chkstd	11260423.D	nd	nd	nd	nd	nd	nd				Lab No 11260423.D	E
10 ng solids	11260403.D	8	90	132	73	121	85				acetone, hexatriene, MEK, M 31	N
Solid Standards											benz, hept, MIBK, me cyhe 13	D
0 ng	11230402.D	1.7	nd	nd	nd	nd	18.4				pyr, DMS dimethylacet/forma Not Corrected	
1 ng	11230406.D	8.8	17.2	3.3	15.4	6.6	36.8				tol 10	O
2 ng	11230407.D	11.1	12.6	9.4	nd	17.3	32.7				C2 Benz 7	F
5 ng	11230408.D	37.1	36.9	57.2	50.5	51.1	54.2				solids and MNs Not Corrected	
10 ng	11230409.D	109.4	81.0	92.2	97.4	97.9	86.0				quinoline indole Not Correctec	R
20 ng	11230410.D	231.3	187.4	251.8	249.3	214.3	175.9					E
50 ng	11230403.D	553.5	554.7	485.0	493.7	500.3	441.8					P
100 ng	11230404.D	741.6	489.5	642.5	690.1	690.1	526.7					O
												R
												T

samples. (see attached worksheet for fur

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Nigel West **Date**

GEOTECH

2002 and is sample No 4

GHD
239 Adelaide Terrace
Perth WA 6004

December 22, 2004

Attention: L. Jefferys / Dr M Goldstone
Your Ref No: 6115324
Our Ref No: ENV 04-372

REPORT ON ANALYSIS OF GAS BAGS

Introduction:

Two TO17 tubes and two DNPH impregnated tubes were received on 16/12/04, and analysed according to the instructions on your chain of custody 0461.

Methods of Analysis:

The tubes were analysed to determine the amount of Volatile Organic Carbon according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17).The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &

L. Jeffreys	Our Ref No	Env 04-372	Samples Received	16-Dec-04	**Disclaimer:** Geotech has analysed the derivatised samples provi		
GHD	Your Job No	6115324	Samples Analysed	17-Dec-04	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.29	0.14	0.14	0.14	0.14
		Errors + / - %	11.7	11.7	11.7	11.8	12.2
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
1274300476 - teflon	HP121708.D	100	1.32	< 0.2	0.54	nd	< 0.2
1274300477 - nalopthane	HP121710.D	100	2.01	0.23	0.70	nd	< 0.2

Volume of Extract (mL)	2			
nd	Not Detected			
Daily Calibration	HP121703.D	Pass	1.0	ppm standard
Multipoint Calibration	HP121705.D			
MDL Lab No	HP111815.D			
Precision Lab No	HP111827.D			
Column Efficiency	HP111815.D			

Processed By	Joanne Menegazzo	Checked By	Nigel West	Date	**22/12/2004**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

TO11A)

ded by methods based

iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
0.14	0.14	0.14	0.14	0.14	0.14	0.14
11.8	12.1	12.1	13.2	13.0	13.6	12.8
Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
< 0.2	nd	nd	nd	nd	nd	nd
< 0.2	< 0.2	nd	nd	nd	nd	nd

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

	Mark Goldstone	Our Ref No	Env 04-372	Samples Received	16-Dec-04	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.
	GHD	Your Ref No	61/5324	Samples Analysed	21-Dec-04	Geotech has determined the VOCs by sampling of the bag/s before thermal desorption GC-MS

Tube No	Sample ID	Date	Time	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
					Units	ng	ng	ng	ng	ng	ng	ng
					Error +/- %	13.7	13.1	12.6	13.0	13.8	12.9	13.7
	Detection Limits. Based on Sample Volume on tube			A12353	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank			1	12210402.D	nd	nd	nd	nd	nd	5.0	nd
353 - naloptl	04-372 14/12			1	12210405.D	nd	nd	nd	nd	nd	nd	nd
10347 - tefl	04-372 14/12			1	12220402.D	9.1	nd	nd	nd	nd	nd	nd
						(1000 ng)		(1000 ng)		(400 ng)		
				chkstd	12210408.D	1300.0	nd	1800.0	nd	440.0	5.3	3.5
	Daily Calibration	100ng std		10 ng solids	12200409.D	130	53	80	120	120	120	160
	Multipoint Calibration	Liquid Stds		Solid Standards								
		Blank #A72153		0 ng	12200402.D	nd	nd	nd	nd	nd	7.7	5.0
		10ng std #A70251		1 ng	12200406.D	18.6	9.4	16.2	8.9	10.8	9.7	7.7
		20ng std #A70014		2 ng	12200407.D	22.5	21.5	17.3	17.4	6.8	26.1	24.1
		50ng std #C06215		5 ng	12200408.D	62.4	40.0	41.5	56.0	51.8	49.7	47.4
		100ng std #A09645		10 ng	12200409.D	127.5	53.0	79.9	117.2	124.6	118.4	158.5
		200ng std #A13888		20 ng	12200410.D	161.0	176.1	204.4	208.6	195.1	199.9	181.2
		500ng std #A63757		50 ng	12200403.D	511.2	419.2	463.1	521.6	461.7	491.3	477.8
		1000ng std #A11144		100 ng	12200404.D	1022.9	1131.5	842.2	1072.9	872.1	1069.5	1079.6

Comments 10ng std not used for the majority of samples. (see attached worksheet for further details)

1st Precision Lab No	11230409.D	
Lab Blank Lab No	12210402.D	Should have the same Lab No as the Lab Blank in F9
Multipoint Calibration Check	Fail RRT	From TO15 Worksheet
Daily Calibration Check	Pass	From TO15 Worksheet
BFB Lab Number	12210402.D	Should have the same first four numbers in the Lab No as the samples
nd	Not Detected	
Errors Determined	With Sampling	
Initials		

Processed By Nigel West **Checked By** Joanne Menegazzo **Date** 22-Dec-04

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th

Compounds by in-House Metho

Samples Received	16-Dec-04
Samples Analysed	21-Dec-04

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	12.6	12.8	12.7	13.4	12.8	12.6	12.9	14.2	12.7	13.1	14.9	13.1	12.9
A12353	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	12210402.D	nd	nd	nd	9.9	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	12210405.D	nd	nd	nd	5.50	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	12220402.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		(50 ng)								(10 ng)	(50 ng)			
chkstd	12210408.D	17.0	nd	nd	9.9	nd	nd	nd	nd	8.7	64.0	nd	nd	nd
10 ng solids	12200409.D	220	110	150	110	120	110	110	160	11	79	48	480	100
Solid Standards														
0 ng	12200402.D	nd	nd	nd	16.5	nd	3.0	nd	nd	nd	2.5	nd	nd	nd
1 ng	12200406.D	5.0	10.3	9.2	16.4	10.4	11.2	10.6	16.8	1.4	8.2	1.2	12.5	11.7
2 ng	12200407.D	8.3	18.7	12.0	33.5	17.7	23.7	nd	19.9	3.3	8.2	1.2	11.8	22.7
5 ng	12200408.D	45.7	44.6	41.2	44.1	48.4	50.5	52.0	48.8	5.6	58.4	5.6	55.7	50.9
10 ng	12200409.D	222.9	113.0	151.0	108.5	115.6	109.3	112.1	158.2	11.5	79.3	48.2	481.9	102.1
20 ng	12200410.D	231.9	202.2	143.4	207.0	188.2	207.3	207.4	202.9	20.3	200.6	22.3	223.4	205.3
50 ng	12200403.D	667.4	455.2	426.4	512.1	454.3	498.9	449.4	495.5	49.4	490.6	57.9	579.5	493.8
100 ng	12200404.D	1628.5	992.5	1018.9	1119.3	851.8	1020.6	863.9	980.8	100.6	911.0	116.1	1161.0	1014.2

samples. (see attached worksheet for fur

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Joanne Menegazzo **Date**

Compounds by in-House Metho

Samples Received 16-Dec-04
Samples Analysed 21-Dec-04

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	3 methyl butanal	heptane	MIBK	DMDS	dimethylace tamide
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.3	15.2	12.9	12.8	12.9	No data	No data	No data	No data	12.6	12.6	15.3	13.7	12.5	12.8	12.7
A12353	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	12210402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	11.4	9.0	nd	12.0
1	12210405.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	12220402.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
																(50 ng)	
chkstd	12210408.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	8.7	11.0	60.0	14.0
10 ng solids	12200409.D	9	11	11	10	11	No Data	No Data	No Data	No Data	110	110	58	150	96	52	91
Solid Standards																	
0 ng	12200402.D	0.9	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	12.9	13.5	nd	17.3
1 ng	12200406.D	1.3	1.7	1.3	1.4	1.2	No Data	No Data	No Data	No Data	10.7	14.1	nd	10.0	10.3	14.6	6.6
2 ng	12200407.D	3.2	4.1	2.5	2.1	2.2	No Data	No Data	No Data	No Data	21.9	17.7	12.3	38.8	27.4	21.2	26.6
5 ng	12200408.D	5.3	6.0	5.2	5.4	5.2	No Data	No Data	No Data	No Data	53.8	51.4	60.7	46.3	21.6	40.2	66.3
10 ng	12200409.D	9.4	11.0	11.2	9.6	11.1	No Data	No Data	No Data	No Data	114.5	109.9	57.9	145.6	96.4	52.5	91.2
20 ng	12200410.D	21.4	20.7	20.0	19.9	20.1	No Data	No Data	No Data	No Data	201.8	225.0	175.3	168.5	206.8	170.7	220.2
50 ng	12200403.D	51.5	52.1	51.0	50.2	50.3	No Data	No Data	No Data	No Data	532.8	504.6	525.0	617.5	450.6	492.2	535.8
100 ng	12200404.D	107.2	104.1	103.9	104.0	110.0	No Data	No Data	No Data	No Data	895.0	949.1	951.1	1028.6	1085.2	833.0	1086.4

samples. (see attached worksheet for fur

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Joanne Menegazzo **Date**

Compounds by in-House Metho

Samples Received 16-Dec-04
Samples Analysed 21-Dec-04

Sample	Compound	phenol	nitrobenzene	methyl cyclohexane	dimethylformamide	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.9	13.5	13.7	12.7	15.5	12.7					
A12353	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	12210402.D	nd	nd	8.6	20.7	nd	nd		12210408.D			
1	12210405.D	nd	nd	nd	nd	nd	nd		12210408.D			
1	12220402.D	nd	nd	nd	nd	6.5	nd		12210408.D			
chkstd	12210408.D	nd	2.6	8.6	21.0	nd	nd					
10 ng solids	12200409.D	15	160	120	97	92	140					
Solid Standards												
0 ng	12200402.D	1.1	nd	nd	24.2	nd	nd					
1 ng	12200406.D	1.8	9.5	1.3	15.0	11.3	9.2					
2 ng	12200407.D	3.8	18.3	nd	35.9	nd	11.2					
5 ng	12200408.D	4.6	46.1	32.1	51.3	27.1	47.8					
10 ng	12200409.D	15.4	160.2	116.0	97.1	92.3	140.4					
20 ng	12200410.D	18.8	212.9	176.3	221.5	152.0	206.4					
50 ng	12200403.D	52.7	563.7	243.7	562.5	378.2	478.1					
100 ng	12200404.D	102.6	1037.2	417.9	1153.0	778.7	874.7					

Lab No	12210408.D	E
acetone, hexatriene, MEK, M	23	N
benz, hept, MIBK, me cyh	44	D
pyr, DMS dimethylacet/forma	17	
tol	9	O
C2 Benz	Not Corrected	F
solids and MNs	Not Corrected	
quinoline indole	22	R
		E
		P
		O
		R
		T

samples. (see attached worksheet for fur

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Joanne Menegazzo **Date**

THE ODOUR UNIT PTY LIMITED

THE ODOUR UNIT

Showroom 1
16-32 Hulme Court
Myaree
WA 6154

Phone: +61 8 9330 9476
Facsimile: +61 8 9330 1868
Email:tschulz@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Leanne Jefferys	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Kwinana	Email	ljefferys@ghd.com.au
Sampling Method	Not specified	Sampling Team	Paige Gunnell

Order details:

Order requested by	Paige Gunnell	Order accepted by	Natasha Bowden
Date of order	08/11/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Clayton Hough

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Wednesday, 24 November 2004 Report Number / Panel Roster Number: PER20041123

T. Schulz
Principal and Managing Director

N. Bowden
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution Factor	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
CD	PC40908	22/11/2004 14:25 hrs	23/11/2004 15:01 hrs	5	10	-	-	362	362	Wetlands
UCD	PC40909	22/11/2004 16:20 hrs	23/11/2004 15:26 hrs	5	10	-	-	208	208	Wetlands

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041123	52	$20 \leq \chi \leq 80$	1,450	36	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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Internet: www.odourunit.com.au
ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Mark_Goldstone@ghd.com.au
Sampling Method	IFH	Sampling Team	Paige Gunnell (GHD)

Order details:

Order requested by	Dr. Mark Goldstone	Order accepted by	Natasha Bowden
Date of order	22/09/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Natasha Bowden

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Wednesday, 3 November 2004 Report Number / Panel Roster Number: PER20041030

T. Schulz
Principal and Managing Director

N. Bowden
Authorised Signatory

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
ROCP2-2	PC40831	29/10/04 13:00hrs	30/10/04 11:13hrs	5	10	-	-	274	274	Mouldy
Cooling Pond – Free Sample	PC40832	29/10/04 14:45hrs	30/10/04 11:45hrs	5	10	-	-	256	256	Mouldy
ROCP2-1	PC40830	29/10/04 10:30hrs	30/10/04 12:19hrs	5	10	-	-	478	478	Mouldy

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041030	52	$20 \leq \chi \leq 80$	1,450	36	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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Internet: www.odourunit.com.au
ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Mark_Goldstone@ghd.com.au
Sampling Method	IFH	Sampling Team	Paige Gunnell (GHD)

Order details:

Order requested by	Dr. Mark Goldstone	Order accepted by	Natasha Bowden
Date of order	22/09/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Clayton Hough

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Wednesday, 3 November 2004 Report Number / Panel Roster Number: PER20041029

T. Schulz
Principal and Managing Director

C. Hough
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
Dry Mud	PC40827	28/10/04 11:50hrs	29/10/04 15:05hrs	5	10	-	-	137	137	Slight metallic
Wet Mud	PC40828	28/10/04 15:10hrs	29/10/04 15:54hrs	5	10	-	-	1,550	1,550	Greasy / dirty
Wet Sand	PC40829	28/10/04 16:45hrs	29/10/04 15:30hrs	5	10	-	-	1,550	1,550	Greasy / dirty

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041029	52	$20 \leq \chi \leq 80$	1,450	36	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Mark_Goldstone@ghd.com.au
Sampling Method	IFH	Sampling Team	Paige Gunnell (GHD)

Order details:

Order requested by	Dr. Mark Goldstone	Order accepted by	Natasha Bowden
Date of order	22/09/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Clayton Hough

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Wednesday, 3 November 2004 Report Number / Panel Roster Number: PER20041028

T. Schulz
Principal and Managing Director

C. Hough
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
Super Thickener 1	PC40825	27/10/04 no time given	28/10/04 15:08hrs	5	10	-	-	8,780	8,780	Sharp chemical
Super Thickener 2	PC40826	27/10/04 no time given	28/10/04 15:34hrs	5	10	-	-	10,800	10,800	Sharp chemical

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041028	52	$20 \leq \chi \leq 80$	1,550	33	Yes

Comments None.

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Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Mark_Goldstone@ghd.com.au
Sampling Method	IFH	Sampling Team	Paige Gunnell (GHD)

Order details:

Order requested by	Dr. Mark Goldstone	Order accepted by	Natasha Bowden
Date of order	22/09/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Clayton Hough

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Tuesday, 2 November 2004 Report Number / Panel Roster Number: PER20041027

T. Schulz
Principal and Managing Director

C. Hough
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
Oxalate 1	PC40808	26/10/04 10:10hrs	27/10/04 11:20hrs	5	10	-	-	315	315	Light caustic / humid
Oxalate 2	PC40809	26/10/04 12:20hrs	27/10/04 11:45hrs	5	10	-	-	239	239	Light caustic / humid

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041027	52	$20 \leq \chi \leq 80$	1,550	33	Yes

Comments None.

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ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Mark_Goldstone@ghd.com.au
Sampling Method	IFH	Sampling Team	Paige Gunnell (GHD)

Order details:

Order requested by	Dr. Mark Goldstone	Order accepted by	Natasha Bowden
Date of order	22/09/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Natasha Bowden

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Tuesday, 2 November 2004 Report Number / Panel Roster Number: PER20041026

T. Schulz
Principal and Managing Director

N. Bowden
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
Lower Dam 1	PC40806	25/10/2004 12:10hrs	26/10/2004 16:38hrs	5	8	-	-	1,450	1,450	Wetlands
Lower Dam 2	PC40807	25/10/2004 16:00hrs	26/10/2004 17:08hrs	5	10	-	-	1,660	1,660	Wetlands

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041026	52	$20 \leq \chi \leq 80$	1,260	41	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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Internet: www.odourunit.com.au
ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Paige Gunnell	Facsimile	(08) 9429 6555
Sampling Site	Alcoa	Email	Paige_Gunnell@ghd.com.au
Sampling Method	Not specified	Sampling Team	Paige Gunnell

Order details:

Order requested by	Paige Gunnell	Order accepted by	Natasha Bowden
Date of order	15/11/2004	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Natasha Bowden

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Monday, 20 December 2004 Report Number / Panel Roster Number: PER20041216

T. Schulz
Principal and Managing Director

N. Bowden
Authorised Signatory

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution Factor	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
GHD 1	PC41020	15/12/2004 12:00hrs	16/12/2004 13:13hrs	5	10	-	-	60	60	Slight sweet / musty
GHD 2	PC41021	15/12/2004 14:30hrs	16/12/2004 13:39hrs	5	10	-	-	56	56	Slight sweet / musty
GHD 3	PC41022	15/12/2004 16:00hrs	16/12/2004 14:05hrs	5	10	-	-	56	56	Slight sweet / musty

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER20041216	52	$20 \leq \chi \leq 80$	1,100	47	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

END OF DOCUMENT

Phase 2

GHD House
239 Adelaide Terrace
Perth WA 6004

February 23, 2005

Attention: Mark Goldstone
Your Ref No: 6115324
Our Ref No: ENV 05-053

REPORT ON ANALYSIS OF ALCOA SAMPLES

Introduction:

Twenty three TO17 tubes and eighteen DNPH impregnated tubes were received 18/02/05, these were analysed in accordance with the chain of custody (0102-0105).

Methods of Analysis:

The tubes were analysed to determine the amount of Volatile Organic Compounds according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17).The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 & TO11A)

Mark Goldstone	Our Ref No	Env 05-053				Samples Received	18-Feb-05	**Disclaimer:** Geotech has analysed the derivatised samples provided by methods based on the analytical components of USEPA TO11A and TO5.										
GHD	Your Ref No	6115324				Samples Analysed	18-Feb-05											
Sample Name	Lab Number	Analyte				Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
		Detection Limit (ug)				0.14	0.07	0.15	0.15	0.13	0.12	0.07	0.19	0.16	0.10	0.19	0.07
		Errors + / - %				11.7	11.7	11.8	11.8	11.9	12.7	12.0	12.1	12.5	17.8	12.9	11.8
		% Sample Used				Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
1.0ug/ml std	HP021804.D	100				1.05	1.05	1.00	1.03	1.06	1.06	1.02	1.05	1.03	1.00	1.02	1.02
1274300028	Lab DNPH blank tube	100	Hood	Time	Date	(0.10)	nd	(0.11)	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305376	HP021821.D	100	perspex	19:19	14/02/2005	2.47	nd	0.48	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305375	HP021845.D	100	stainless	18:36	14/02/2005	6.64	2.30	0.68	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305379	HP021825.D	100	perspex	21:05	14/02/2005	2.45	0.58	0.44	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305370	HP021847.D	100	stainless	21:05	14/02/2005	3.43	0.82	0.50	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305372	HP021843.D	100	perspex	0:08	15/02/2005	6.48	0.62	0.44	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305378	HP021823.D	100	stainless	0:08	15/02/2005	1.50	0.35	0.36	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305377	HP021819.D	100	perspex	3:07	15/02/2005	1.50	0.51	0.42	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305374	HP021809.D	100	stainless	3:07	15/02/2005	1.32	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305373	HP021841.D	100	perspex	6:04	15/02/2005	1.22	0.51	0.42	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274305371	HP021817.D	100	stainless	6:04	15/02/2005	1.20	0.43	0.34	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304759	HP021833.D	100	perspex	9:12	15/02/2005	1.18	1.21	0.46	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304756	HP021835.D	100	stainless	9:12	15/02/2005	1.64	1.91	0.58	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304758	HP021811.D	100	perspex	12:03	15/02/2005	4.13	1.31	0.58	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304750	HP021813.D	100	stainless	12:03	15/02/2005	7.16	2.36	1.26	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304757	HP021839.D	100	perspex	14:56	15/02/2005	3.57	0.43	1.10	nd	0.35	nd	nd	nd	nd	nd	nd	nd
1274304753	HP021831.D	100	stainless	14:56	15/02/2005	3.41	nd	0.72	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304993	HP021815.D	100	lab			2.67	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1274304996	HP021837.D	100	lab			4.89	nd	0.40	nd	nd	nd	nd	nd	nd	nd	nd	nd

Volume of Extract (mL)	2				
nd	Not Detected				
Daily Calibration	HP021803.D	Pass	1.0	ppm standard	
Multipoint Calibration	HP111811.D				
MDL Lab No	HP111815.D				
Precision Lab No	HP111827.D				
Column Efficiency	HP111816.D				

Processed By	Angela Downey	Checked By	Nigel West	Date	**22/02/2005**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

Mark Goldstone	Our Ref No		Env 05-053	Samples Received	18-Feb-05	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.	
GHD	Your Ref No		6115324	Samples Analysed	18-Feb-05	Geotech has determined the VOCs by thermal desorption GC-MS	

Tube No	Sample ID	Date	Hood	Time	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
						Units	ng	ng	ng	ng	ng	ng	ng
						Error +/- %	15.4	13.6	13.1	14.1	14.5	13.6	14.3
	Detection Limits. Based on Sample Volume on tube				A72261	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank				1	02180502.D	nd	nd	nd	nd	nd	nd	nd
A11293	05-053 11	14/02/2005	perspex	18:36	1	02180514.D	Not analysed	nd	nd	nd	nd	nd	nd
A11144	05-053 6	14/02/2005	stainless	18:36	1	02180509.D	nd	nd	130	nd	5.90	nd	7.30
A14502	05-053 10	14/02/2005	perspex	21:05	1	02180513.D	No analytical data- high levels of moisture in sample caused mass spec to cut out						
A1	05-053 5	14/02/2005	stainless	21:05	1	02180508.D	No analytical data- high levels of moisture in sample caused mass spec to cut out						
C06289	05-053 14	15/02/2005	perspex	0:08	1	02180518.D	Not analysed	nd	nd	nd	nd	nd	nd
A15036	05-053 8	15/02/2005	stainless	0:08	1	02180511.D	nd	nd	nd	nd	nd	nd	nd
A72258	05-053 17	15/02/2005	perspex	3:07	1	02180521.D	Not analysed	nd	nd	nd	nd	nd	nd
C06252	05-053 16	15/02/2005	stainless	3:07	1	02180520.D	Not analysed	nd	nd	nd	nd	nd	nd
B16433	05-053 23	15/02/2005	perspex	6:04	1	02180527.D	Not analysed	nd	nd	nd	8.90	nd	6.80
A72158	05-053 12	15/02/2005	stainless	6:04	1	02180516.D	Not analysed	nd	nd	nd	nd	nd	nd
A12416	05-053 18	15/02/2005	perspex	9:12	1	02180522.D	Not analysed	nd	6.40	nd	nd	nd	nd
C06646	05-053 20	15/02/2005	stainless	9:12	1	02180524.D	Not analysed	nd	nd	nd	nd	nd	nd
B15881	05-053 7	15/02/2005	perspex	12:03	1	02180510.D	nd	nd	nd	nd	nd	nd	nd
A11389	05-053 1	15/02/2005	stainless	12:03	1	02180504.D	nd	nd	5.30	nd	nd	nd	nd
A09645	05-053 9	15/02/2005	perspex	14:56	1	02180512.D	nd	nd	nd	nd	nd	nd	nd
A14439	05-053 22	15/02/2005	stainless	14:56	1	02180526.D	Not analysed	nd	nd	nd	nd	nd	nd
A72261	05-053 2	11/02/2005	lab		1	02180505.D	nd	nd	nd	nd	nd	nd	nd
A62959	05-053 21	11/02/2005	lab		1	02180525.D	Not analysed	nd	nd	nd	nd	nd	nd
A70014	05-053 4	11/02/2005	lab		1	02180507.D	nd	nd	nd	nd	22.0	nd	nd
B16830	05-053 3	11/02/2005	lab		1	02180506.D	nd	nd	nd	nd	nd	nd	nd
B15517	05-053 13	16/02/2005			1	02180517.D	Not analysed	nd	nd	nd	65.0	nd	16.0
A01467	05-053 15	16/02/2005			1	02180519.D	Not analysed	nd	nd	nd	25.0	6.70	29.0
A72151	05-053 19	16/02/2005			1	02180523.D	Not analysed (1000 ng)	nd	nd (1000 ng)	nd	14.0 (400 ng)	nd	nd
					chkstd	02180534.D	1300.0	nd	1100.0	nd	430.0	nd	nd
	Daily Calibration			100ng std	10 ng solids	02180503.D	110	110	110	98	100	100	95
	Multipoint Calibration			Liquid Stds	Solid Standards								
				Blank #A11369	0 ng	02090502.D	nd	9.4	nd	nd	nd	nd	nd
				10ng std #A11408	1 ng	02090506.D	17.4	18.1	0.6	2.6	3.5	10.7	19.3
				20ng std #A14330	2 ng	02090507.D	nd	29.1	11.4	2.3	8.8	10.8	17.8
				50ng std #A10058	5 ng	02090508.D	24.3	59.5	44.3	29.3	47.0	45.3	49.2
				100ng std #A08348	10 ng	02090509.D	104.2	103.1	104.1	97.0	100.7	99.9	107.8
				200ng std #A70150	20 ng	02090510.D	205.6	205.3	201.9	195.6	202.7	197.6	202.8
				500ng std #A15002	50 ng	02090503.D	466.8	491.6	489.6	484.6	528.9	505.0	496.0
				1000ng std #A1035	100 ng	02090504.D	873.2	979.4	1028.1	819.6	1154.8	1001.3	983.8

Comments fail biphenyl

1st Precision Lab No 11230409.D

Lab Blank Lab No 02180502.D — Should have the same Lab No as the Lab Blank in F9

Multipoint Calibration Check Pass — From TO15 Worksheet

Daily Calibration Check Pass — From TO15 Worksheet

BFB Lab Number 02180502.D — Should have the same first four numbers in the Lab No as the samples

nd Not Detected

Errors Determined Without Sampling

Initials

Processed By Angela Downey — **Checked By** Joanne Menegazzo **Date** 23-Feb-05

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Geotechnical Services

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

pounds by in-House Method W

Samples Received	18-Feb-05
Samples Analysed	18-Feb-05

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.2	13.2	13.3	13.5	13.8	12.7	13.1	14.0	12.9	13.0	22.0	13.1	13.0
A72261	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	02180502.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180514.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180509.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180513.D													
1	02180508.D													
1	02180518.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180511.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180521.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180520.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180527.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180516.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180522.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180524.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180510.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180504.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180512.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180526.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180505.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180525.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180507.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180506.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02180517.D	nd	nd	nd	nd	nd	nd	nd	nd	69.9	nd	nd	8.40	21.0
1	02180519.D	nd	nd	6.40	nd	nd	nd	nd	nd	28.0	nd	5.90	59.0	24.0
1	02180523.D	nd (50 ng)	nd	nd	nd	nd	nd	nd	nd	nd (10 ng)	nd (50 ng)	nd	nd	nd
chkstd	02180534.D	54.0	nd	nd	nd	nd	nd	nd	nd	9.2	41.0	nd	nd	nd
10 ng solids	02180503.D	110	100	110	97	110	100	120	110	10	100	8	83	95
Solid Standards														
0 ng	02090502.D	nd	nd	nd	26.0	16.3	21.7	20.1	5.3	nd	nd	nd	nd	nd
1 ng	02090506.D	9.7	7.2	3.6	56.9	28.2	33.2	20.1	20.9	1.4	13.5	1.6	15.8	13.7
2 ng	02090507.D	20.1	15.9	11.1	36.3	29.3	37.5	32.0	20.5	2.1	22.5	2.9	28.9	21.8
5 ng	02090508.D	50.5	48.4	46.9	65.3	58.5	66.2	59.2	50.8	5.2	49.6	5.1	51.4	50.5
10 ng	02090509.D	100.0	100.1	99.9	101.7	99.1	103.6	98.5	97.1	11.4	99.1	7.1	71.2	100.3
20 ng	02090510.D	202.0	198.7	199.7	199.3	188.8	187.0	189.8	190.1	20.3	198.7	19.4	194.1	225.3
50 ng	02090503.D	462.6	493.8	497.8	429.4	509.8	377.5	431.6	490.6	27.0	472.7	41.1	411.4	345.5
100 ng	02090504.D	806.8	959.7	946.5	295.1	790.8	271.7	538.4	168.4	21.3	835.6	89.9	899.1	303.9

me Lab No as the Lab Blank in FS
ieet
ieet
me first four numbers in the Lab No as

Joanne Menegazzo **Date**
s

GEOTECH

ample No

pounds by in-House Method W

Samples Received 18-Feb-05
Samples Analysed 18-Feb-05

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.1	12.6	12.9	13.1	12.9	No data	No data	No data	No data	14.6	13.5	14.5	13.9	13.3	13.6	12.4
A72261	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	02180502.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180514.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180509.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	44.0	19.0	nd	19.0	nd	nd	nd
1	02180513.D																
1	02180508.D																
1	02180518.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180511.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180521.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180520.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180527.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	9.20	nd	nd	nd
1	02180516.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180522.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180524.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180510.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180504.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180512.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	17.0	nd	nd	nd	nd	nd	nd
1	02180526.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180505.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180525.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180507.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180506.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180517.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	6.70	nd	nd	nd	nd	nd
1	02180519.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02180523.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
																(50 ng)	
chkstd	02180534.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	53.0	nd
10 ng solids	02180503.D	9	9	8	2	6	No Data	No Data	No Data	No Data	73	92	91	110	93	96	99
Solid Standards																	
0 ng	02090502.D	1.7	nd	nd	nd	1.4	No Data	No Data	No Data	No Data	nd	nd	2.1	4.1	nd	nd	nd
1 ng	02090506.D	3.4	1.5	1.4	nd	2.3	No Data	No Data	No Data	No Data	nd	3.9	2.1	18.9	nd	nd	nd
2 ng	02090507.D	6.4	2.0	2.4	nd	3.2	No Data	No Data	No Data	No Data	nd	13.7	17.4	22.6	nd	nd	nd
5 ng	02090508.D	10.0	5.3	5.0	3.2	6.0	No Data	No Data	No Data	No Data	nd	45.5	47.6	60.4	24.4	3.0	nd
10 ng	02090509.D	14.7	10.1	10.1	10.1	10.2	No Data	No Data	No Data	No Data	102.9	103.1	103.3	104.3	105.9	92.3	93.4
20 ng	02090510.D	24.4	21.0	19.8	21.4	19.8	No Data	No Data	No Data	No Data	210.4	201.6	204.9	204.9	207.4	200.0	319.7
50 ng	02090503.D	40.6	57.0	57.9	89.9	52.4	No Data	No Data	No Data	No Data	537.8	530.8	464.9	445.1	742.9	857.4	1300.5
100 ng	02090504.D	47.2	49.3	54.9	79.9	71.2	No Data	No Data	No Data	No Data	925.1	1052.4	1008.2	840.8	1221.9	1553.2	1607.0

me Lab No as the Lab Blank in F9
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Joanne Menegazzo **Date**
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GEOTECH

ample No

pounds by in-House Method W

Samples Received 18-Feb-05
Samples Analysed 18-Feb-05

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	ethylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.5	13.5	13.9	12.4	15.9	13.0					
A72261	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	02180502.D	nd	nd	nd	nd	nd	nd		02180534.D			
1	02180514.D	nd	nd	nd	nd	Not analysed.	nd	0	02180534.D		tol 7	
1	02180509.D	nd	nd	nd	nd	nd	nd	225	02180534.D		C2 Benz 7	O
1	02180513.D							0	02180534.D		solids and MNs Not Correcte	F
1	02180508.D							< 5	02180534.D		quinoline indole Not Corrected	
1	02180518.D	nd	nd	nd	nd	Not analysed.	nd	0	02180534.D			R
1	02180511.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D			E
1	02180521.D	nd	nd	nd	nd	Not analysed.	nd	< 5	02180534.D			P
1	02180520.D	nd	nd	nd	nd	Not analysed.	nd	0	02180534.D			O
1	02180527.D	6.00	nd	nd	nd	Not analysed.	nd	< 5	02180534.D	refined hydrocarbons, possibly diesel, present		R
1	02180516.D	7.40	nd	nd	nd	Not analysed.	nd	7	02180534.D	refined hydrocarbons, possibly diesel, present		T
1	02180522.D	nd	nd	nd	nd	Not analysed.	nd		02180534.D			
1	02180524.D	nd	nd	nd	nd	Not analysed.	nd		02180534.D			
1	02180510.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D			
1	02180504.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D			
1	02180512.D	nd	nd	nd	nd	nd	nd	17	02180534.D			
1	02180526.D	nd	nd	nd	nd	Not analysed.	nd	0	02180534.D			
1	02180505.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D		Lab No 02180534.D	
1	02180525.D	nd	nd	nd	nd	Not analysed.	nd	< 5	02180534.D	acetone, hexatriene, MEK, MPK	23	E
1	02180507.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D	benz, hept, MIBK, me cyhex	9	N
1	02180506.D	nd	nd	nd	nd	nd	nd	< 5	02180534.D	pyr, DMS dimethylacet/formamide	6	D
1	02180517.D	nd	nd	nd	nd	Not analysed.	nd	187	02180534.D			
1	02180519.D	nd	nd	nd	nd	Not analysed.	nd	184	02180534.D			
1	02180523.D	nd	nd	nd	nd	Not analysed.	nd	< 5	02180534.D			
chkstd	02180534.D	nd	nd	nd	nd	nd	nd					
10 ng solids	02180503.D	10	100	120	120	120	110					
Solid Standards												
0 ng	02090502.D	0.7	24.8	17.9	nd	4.5	nd					
1 ng	02090506.D	2.5	47.8	27.5	nd	29.8	nd					
2 ng	02090507.D	6.2	73.2	33.7	8.1	23.0	nd					
5 ng	02090508.D	10.4	134.7	70.5	42.3	54.0	24.2					
10 ng	02090509.D	16.8	221.8	102.8	98.9	103.2	99.3					
20 ng	02090510.D	23.3	312.9	203.9	195.1	204.8	188.7					
50 ng	02090503.D	51.7	672.7	363.7	402.7	528.3	760.8					
100 ng	02090504.D	80.9	957.4	537.8	369.8	924.5	677.4					

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Joanne Menegazzo **Date**
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GEOTECH

ample No

GHD House
239 Adelaide Terrace
Perth WA 6004

February 28, 2005

Attention: Mark Goldstone
Your Ref No: 6115324
Our Ref No: ENV 05-059

INTERIM REPORT ON ANALYSIS OF SAMPLES

Introduction:

Nine TO17 tubes, one PAH tube, fourteen liquid samples and eight DNPH impregnated tubes were received 24/02/05, these were analysed in accordance with the chain of custody.

Methods of Analysis:

The amount of Volatile Organic Compounds was determined according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A). The PAH's were determined according to WIENV 44 (based on USEPA TO13) solvent extraction followed by GCMS. BTEX compounds were determined based on WIENV 38 (based on USEPA 5030 and 8260).

Results

The results are tabulated on the following worksheets.

Comments

Three of the TO17 tubes were not analysed for acetone or iodomethane. One tube (A72153) had high levels of moisture which caused the mass spectrometer to fail, no data was collected for this sample. Subsequent samples were then screened for moisture which meant that no iodomethane or acetone data could be collected. The amount of Acetone on the first four tubes (A10069, B16859, A63757 and A14314) was significantly out of the calibration range. Sample A13110 appeared to have no compounds present and the internal standard had been washed ofF, this indicates a high volume of moisture had passed through the tube.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5

Mark Goldstone	Our Ref No				Env 05-059	Samples Received	24-Feb-05	**Disclaimer:** Geotech has analysed the der	
GHD	Your Ref No				6115324	Samples Analysed	25-Feb-05	on the analytical components of USEPA TO	
Sample Name	Lab Number				Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal
					Detection Limit (ug)	0.14	0.07	0.15	0.15
					Errors + / - %	11.7	11.7	11.8	11.8
					% Sample Used	Total ug	Total ug	Total ug	Total ug
1.0ug/ml std	HP022507.D	Date	Time	Hood	100	1.05	1.02	1.03	1.01
Tube Blank	HP022508.D				100	nd	nd	nd	nd
1274304754	HP022511.D	18/02/2005	21.11	P	100	1.91	2.63	6.34	nd
1274304752	HP022515.D	18/02/2005	21.11	S	100	2.19	1.31	3.33	nd
1274304990	HP022519.D	19/02/2005	3.04	P	100	2.65	0.90	4.77	nd
1274304995	HP022513.D	19/02/2005	3.04	S	100	1.77	0.35	2.81	2.75
1274304755	HP022517.D	19/02/2005	9.30	P	100	1.81	2.09	3.11	nd
1274304751	HP022524.D	19/02/2005	9.30	S	100	1.81	1.79	3.65	0.22
1274304997	HP022526.D	19/02/2005	13.25	P	100	0.30	1.33	2.41	nd
1274304998	HP022520.D	19/02/2005	13.25	S	100	0.26	1.38	4.05	nd

Volume of Extract (mL)	2				
nd	Not Detected				
Daily Calibration	HP022506.D	Pass	1.0	ppm standard	
Multipoint Calibration	HP111811.D				
MDL Lab No	HP111815.D				
Precision Lab No	HP111827.D				
Column Efficiency	HP111816.D				

Processed By	Angela Downey	Checked By	Nigel West	Date	**28/02/2005**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

& TO11A)

ivatised samples provided by methods based
011A and TO5.

MEK	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
0.13	0.12	0.07	0.19	0.16	0.10	0.19	0.07
11.9	12.7	12.0	12.1	12.5	17.8	12.9	11.8
Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
1.07	1.06	1.03	1.07	1.05	1.01	1.04	1.04
nd	nd	nd	nd	nd	nd	nd	nd
0.46	nd	0.34	nd	nd	nd	nd	nd
0.27	nd	nd	nd	nd	nd	nd	nd
0.48	nd	nd	nd	nd	nd	nd	nd
0.33	nd	nd	nd	nd	nd	nd	nd
nd	0.23	nd	nd	nd	nd	nd	nd
0.35	nd	0.44	nd	nd	nd	nd	nd
0.31	nd	0.20	nd	nd	nd	nd	nd
0.40	nd	nd	nd	nd	nd	nd	nd

(I) RESULTS

Matrix: TO17 PAH tube

Client ID		Analyte	Naphthalene	acenaphthylene	acenaphthene	fluorene	phenanthrene	anthracene	fluoranthene	pyrene	benzo(a)anthracene	chrysene	enzo(b)fluoranthene	enzo(k)fluoranthen	benzo(a)pyrene	no(123cd)pyri	benzo(ah)anthrace	nzo(ghi)perylene	nd -- not detected
		Geotech ID	PQL (ug)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	ctical quantitation limit
Blank		DT022502.D	ug	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
SS tube 1	22/02	DT022508.D	ug	7.53	nd	nd	nd	0.06	nd	nd	nd	nd	0.16	nd	nd	nd	nd	nd	nd	

nd -- not detected
PQL-- Practical quantitation limit

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

Mark Goldstone		Our Ref No	Env 05-059	Samples Received	24-Feb-05	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.	
GHD		Your Ref No	6115324	Samples Analysed	24-Feb-05	Geotech has determined the VOCs by thermal desorption GC-MS	

Tube No	Sample ID	Date	Time	Hood	Sample Volume(mLs)	Compound	acetone	hexatriene	benzene	pyridine	toluene	ethyl-benzene	1,3-xylene
						Units	ng	ng	ng	ng	ng	ng	ng
						Error +/- %	15.4	13.6	13.1	14.1	14.5	13.6	14.3
	Detection Limits. Based on Sample Volume on tube				A10069	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank				1	02240502.D	nd	nd	nd	nd	nd	nd	nd
B16859	Env 05-059				1	02240505.D	2700.00	nd	nd	nd	15.00	nd	nd
A63757	Env 05-059	19/02/2005	3.04	P	1	02240506.D	15000.00	nd	nd	nd	nd	nd	nd
A13110	Env 05-059				1	02240510.D	t delay: Not an	nd	40.00	nd	nd	nd	nd
A70303	Env 05-059				1	02240508.D	930.00	nd	8.70	nd	nd	nd	nd
A10353	Env 05-059				1	02240511.D	t delay: Not an	nd	nd	nd	nd	nd	nd
A14314	Env 05-059				1	02240507.D	3400.00	nd	nd	nd	nd	nd	nd
A72153	Env 05-059				1	02240509.D	No Data as moisture caused Mass Spec to fail						
A10347	Env 05-059				1	02240512.D	t delay: Not an	nd	11.00	nd	2.66	nd	nd
A10069	Env 05-059				1	02240504.D	10000.00	nd	3.54	nd	nd	nd	nd
							(1000 ng)		(1000 ng)		(400 ng)		
					chkstd	02240514.D	1300.0	nd	1100.0	nd	460.0	nd	nd
			Daily Calibration	100ng std	10 ng solids	02240503.D	83	100	110	89	110	110	110
			Multipoint Calibration	Liquid Stds	Solid Standards								
				Blank #A1136	0 ng	02090502.D	nd	9.4	nd	nd	nd	nd	nd
				10ng std #A114	1 ng	02090506.D	17.4	18.1	0.6	2.6	3.5	10.7	19.3
				20ng std #A143	2 ng	02090507.D	nd	29.1	11.4	2.3	8.8	10.8	17.8
				50ng std #A100	5 ng	02090508.D	24.3	59.5	44.3	29.3	47.0	45.3	49.2
				100ng std #A08	10 ng	02090509.D	104.2	103.1	104.1	97.0	100.7	99.9	107.8
				200ng std #A70	20 ng	02090510.D	205.6	205.3	201.9	195.6	202.7	197.6	202.8
				500ng std #A15	50 ng	02090503.D	466.8	491.6	489.6	484.6	528.9	505.0	496.0
				1000ng std #A10	100 ng	02090504.D	873.2	979.4	1028.1	819.6	1154.8	1001.3	983.8

Comments fail biphenyl
1st Precision Lab No 11230409.D
Lab Blank Lab No 02240502.D Should have the same Lab No as the Lab Blank in F9
Multipoint Calibration Check Pass From TO15 Worksheet
Daily Calibration Check Pass From TO15 Worksheet
BFB Lab Number 02240502.D Should have the same first four numbers in the Lab No as the samples
nd Not Detected
Errors Determined Without Sampling
Initials

Processed By Angela Downey **Checked By** Nigel West **Date** 28-Feb-05

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Geotechnical Services

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

ompounds by in-House Method

Samples Received	24-Feb-05
Samples Analysed	24-Feb-05

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.2	13.2	13.3	13.5	13.8	12.7	13.1	14.0	12.9	13.0	22.0	13.1	13.0
A10069	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	02240502.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02240505.D	nd	nd	nd	nd	nd	nd	nd	nd	2.14	nd	nd	8.70	nd
1	02240506.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	4.95
1	02240510.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	54.00	8.70
1	02240508.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02240511.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.14
1	02240507.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02240509.D													
1	02240512.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.78	6.00
1	02240504.D	nd	nd	nd	nd	nd	nd	nd	nd	3.49	nd	nd	9.00	8.70
		(50 ng)								(10 ng)	(50 ng)			
chkstd	02240514.D	51.0	nd	nd	nd	nd	nd	nd	nd	11.0	45.0	nd	nd	nd
10 ng solids	02240503.D	110	110	110	89	100	90	95	97	10	92	9	94	89
Solid Standards														
0 ng	02090502.D	nd	nd	nd	26.0	16.3	21.7	20.1	5.3	nd	nd	nd	nd	nd
1 ng	02090506.D	9.7	7.2	3.6	56.9	28.2	33.2	20.1	20.9	1.4	13.5	1.6	15.8	13.7
2 ng	02090507.D	20.1	15.9	11.1	36.3	29.3	37.5	32.0	20.5	2.1	22.5	2.9	28.9	21.8
5 ng	02090508.D	50.5	48.4	46.9	65.3	58.5	66.2	59.2	50.8	5.2	49.6	5.1	51.4	50.5
10 ng	02090509.D	100.0	100.1	99.9	101.7	99.1	103.6	98.5	97.1	11.4	99.1	7.1	71.2	100.3
20 ng	02090510.D	202.0	198.7	199.7	199.3	188.8	187.0	189.8	190.1	20.3	198.7	19.4	194.1	225.3
50 ng	02090503.D	462.6	493.8	497.8	429.4	509.8	377.5	431.6	490.6	27.0	472.7	41.1	411.4	345.5
100 ng	02090504.D	806.8	959.7	946.5	295.1	790.8	271.7	538.4	168.4	21.3	835.6	89.9	899.1	303.9

› the same Lab No as the Lab Blank in F
Worksheet

Worksheet

› the same first four numbers in the Lab I

Nigel West **Date**

Services

GEOTECH

02 and is sample No 4

ompounds by in-House Method

Samples Received	24-Feb-05
Samples Analysed	24-Feb-05

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.1	12.6	12.9	13.1	12.9	No data	No data	No data	No data	14.6	13.5	14.5	13.9	13.3	13.6	12.4
A10069	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	02240502.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	5.8	nd	nd	nd	nd
1	02240505.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	140.00	11.00	nd	nd	nd	nd	nd
1	02240506.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	1900.00	93.00	47.00	220.00	nd	nd	nd
1	02240510.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	47.00	nd	nd	nd	nd	nd
1	02240508.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	120.00	nd	5.80	nd	nd	nd	nd
1	02240511.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	290.00	43.00	5.80	nd	nd	nd	nd
1	02240507.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	1100.00	88.00	10.00	nd	nd	nd	nd
1	02240509.D																
1	02240512.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	91.00	200.00	7.60	nd	nd	nd	nd
1	02240504.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	810.00	200.00	5.80	nd	nd	nd	nd
																(50 ng)	
chkstd	02240514.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	61.0	nd
10 ng solids	02240503.D	10	9	9	5	9	No Data	No Data	No Data	No Data	110	99	110	110	91	94	110
Solid Standards																	
0 ng	02090502.D	1.7	nd	nd	nd	1.4	No Data	No Data	No Data	No Data	nd	nd	2.1	4.1	nd	nd	nd
1 ng	02090506.D	3.4	1.5	1.4	nd	2.3	No Data	No Data	No Data	No Data	nd	3.9	2.1	18.9	nd	nd	nd
2 ng	02090507.D	6.4	2.0	2.4	nd	3.2	No Data	No Data	No Data	No Data	nd	13.7	17.4	22.6	nd	nd	nd
5 ng	02090508.D	10.0	5.3	5.0	3.2	6.0	No Data	No Data	No Data	No Data	nd	45.5	47.6	60.4	24.4	3.0	nd
10 ng	02090509.D	14.7	10.1	10.1	10.1	10.2	No Data	No Data	No Data	No Data	102.9	103.1	103.3	104.3	105.9	92.3	93.4
20 ng	02090510.D	24.4	21.0	19.8	21.4	19.8	No Data	No Data	No Data	No Data	210.4	201.6	204.9	204.9	207.4	200.0	319.7
50 ng	02090503.D	40.6	57.0	57.9	89.9	52.4	No Data	No Data	No Data	No Data	537.8	530.8	464.9	445.1	742.9	857.4	1300.5
100 ng	02090504.D	47.2	49.3	54.9	79.9	71.2	No Data	No Data	No Data	No Data	925.1	1052.4	1008.2	840.8	1221.9	1553.2	1607.0

the same Lab No as the Lab Blank in F
Worksheet

Worksheet

the same first four numbers in the Lab I

Nigel West **Date**

Services

02 and is sample No 4

ompounds by in-House Method

Samples Received	24-Feb-05
Samples Analysed	24-Feb-05

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	methylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.5	13.5	13.9	12.4	15.9	13.0					
A10069	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	02240502.D	nd	nd	nd	nd	nd	nd		02240514.D			
1	02240505.D	11.00	nd	nd	nd	2.44	nd		02240514.D			
1	02240506.D	2.69	2.56	nd	nd	nd	nd		02240514.D			
1	02240510.D	4.07	2.16	nd	nd	t delay: Not ar	nd		02240514.D			
1	02240508.D	2.51	nd	nd	nd	nd	nd		02240514.D			
1	02240511.D	nd	nd	nd	nd	t delay: Not ar	nd		02240514.D			
1	02240507.D	2.90	nd	nd	nd	nd	nd		02240514.D			
1	02240509.D											
1	02240512.D	4.61	nd	nd	nd	t delay: Not ar	nd		02240514.D			
1	02240504.D	nd	nd	nd	nd	nd	nd		02240514.D			
chkstd	02240514.D	nd	nd	nd	nd	nd	nd					
10 ng solids	02240503.D	11	93	110	100	110	100					
Solid Standards												
0 ng	02090502.D	0.7	24.8	17.9	nd	4.5	nd					
1 ng	02090506.D	2.5	47.8	27.5	nd	29.8	nd					
2 ng	02090507.D	6.2	73.2	33.7	8.1	23.0	nd					
5 ng	02090508.D	10.4	134.7	70.5	42.3	54.0	24.2					
10 ng	02090509.D	16.8	221.8	102.8	98.9	103.2	99.3					
20 ng	02090510.D	23.3	312.9	203.9	195.1	204.8	188.7					
50 ng	02090503.D	51.7	672.7	363.7	402.7	528.3	760.8					
100 ng	02090504.D	80.9	957.4	537.8	369.8	924.5	677.4					

Lab No	02240514.D	E
acetone, hexatriene, MEK, M	23	N
benz, hept, MIBK, me cyhe	9	D
pyr, DMS dimethylacet/forma	18	
tol	13	O
C2 Benz	2	F
solids and MNs	9	
quinoline indole	Not Correctec	R
		E
		P
		O
		R
		T

the same Lab No as the Lab Blank in F
Worksheet

Worksheet

the same first four numbers in the Lab I

Nigel West **Date**

Services

02 and is sample No 4

GHD House
239 Adelaide Terrace
Perth WA 6004

February 28, 2005

Attention: Mark Goldstone
Your Ref No: 61/15324
Our Ref No: ENV 05-061

REPORT ON ANALYSIS OF TUBE SAMPLES

Introduction:

Four TO17 tubes and four DNPH impregnated tubes were received 25/02/05, these were analysed in accordance with the chain of custody (1108).

Methods of Analysis:

The tubes were analysed to determine the amount of volatile organic compounds according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

Results

The results are tabulated on the following worksheets.

Comments

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA

Mark Goldstone				Our Ref No	Env 05-061	Samples Received	25-Feb-05	**Disclaimer:** Geotech
GHD				Your Ref No	61/15324	Samples Analysed	25-Feb-05	on the analytical comp
Sample Name				Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone
					Detection Limit (ug)	0.14	0.07	0.15
					Errors + / - %	11.7	11.7	11.8
					% Sample Used	Total ug	Total ug	Total ug
1.0ug/ml std				HP022507.D	100	1.05	1.0	1.03
Tube Blank	Date	Time	Location	HP022509.D	100	nd	nd	nd
B	24/02/2005	13.33	Cooling Pond Inlet	HP022530.D	100	0.22	10.9	6.88
A	24/02/2005	15.05	Cooling Pond Berm	HP022529.D	100	nd	nd	7.60
C	24/02/2005	16.30	Cooling Pond Outlet	HP022532.D	100	nd	9.4	10.10
1274305255	24/02/2005	15.40	ROWS2	HP022534.D	100	5.20	0.6	0.68

Volume of Extract (mL)				2				
nd				Not Detected				
Daily Calibration				HP022506.D	Pass	1.0	ppm standard	
Multipoint Calibration				HP111811.D				
MDL Lab No				HP111815.D				
Precision Lab No				HP111827.D				
Column Efficiency				HP111816.D				

Processed By				Angela Downey	Checked By	Nigel West	Date	**28/02/2005**
Geotechnical Services					Geotechnical Services			
41-45 Furnace Road								
Welshpool Perth								
WA 6106 Australia								

A TO5 & TO11A)

has analysed the derivatised samples provided by methods based
ponents of USEPA TO11A and TO5.

Propanal	MEK	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
0.15	0.13	0.12	0.07	0.19	0.16	0.10	0.19	0.07
11.8	11.9	12.7	12.0	12.1	12.5	17.8	12.9	11.8
Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
1.01	1.07	1.06	1.03	1.07	1.05	1.01	1.04	1.04
nd	nd	nd	nd	nd	nd	nd	nd	nd
0.55	1.00	nd	0.94	0.27	0.80	nd	nd	nd
nd	0.98	nd	nd	0.25	0.22	nd	nd	nd
0.32	1.67	nd	0.54	0.52	0.45	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

Mark Goldstone		Our Ref No	Env 05-061	Samples Received	25-Feb-05	Disclaimer: Geotechnical Services has not been involved in the collection of these samples.	
GHD		Your Ref No	61/15324	Samples Analysed	25-Feb-05	Geotech has determined the VOCs by thermal desorption GC-MS	

Tube No	Sample ID	Date	Time	Location	Sample Volume(mLs)	Compound / Units	acetone ng	hexatriene ng	benzene ng	pyridine ng	toluene ng	ethyl-benzene ng	1,3-xylene ng
						Error +/- %	15.4	13.6	13.1	14.1	14.5	13.6	14.3
	Detection Limits. Based on Sample Volume on tube				A11071	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
	Lab Blank				1	02250502.D	nd	nd	nd	nd	nd	nd	nd
B16456	Env 05-061	24/02/2005	13.33	Cooling Pond Inlet	1	02250507.D		37.00	nd	nd	33.00	nd	7.40
A11071	Env 05-061	24/02/2005	15.05	Cooling Pond Berm	1	02250506.D	delay: Not	8.00	nd	nd	24.00	7.40	5.40
A15016	Env 05-061	24/02/2005	16.30	Cooling Pond Outlet	1	02250509.D		nd	30.00	nd	nd	nd	nd
A10755	Env 05-061	24/02/2005	15.40	ROWS2	1	02250508.D		nd	nd	nd	nd	nd	nd
							(1000 ng)		(1000 ng)		(400 ng)		
					chkstd	02240514.D	1300.0	nd	1100.0	nd	460.0	nd	nd
			Daily Calibration	100ng std	10 ng solids	02250503.D	160	100	120	110	110	110	100
			Multipoint Calibration	Liquid Stds	Solid Standards								
				Blank #A11369	0 ng	02090502.D	nd	9.4	nd	nd	nd	nd	nd
				10ng std #A11408	1 ng	02090506.D	17.4	18.1	0.6	2.6	3.5	10.7	19.3
				20ng std #A14330	2 ng	02090507.D	nd	29.1	11.4	2.3	8.8	10.8	17.8
				50ng std #A10058	5 ng	02090508.D	24.3	59.5	44.3	29.3	47.0	45.3	49.2
				100ng std #A08348	10 ng	02090509.D	104.2	103.1	104.1	97.0	100.7	99.9	107.8
				200ng std #A70150	20 ng	02090510.D	205.6	205.3	201.9	195.6	202.7	197.6	202.8
				500ng std #A15002	50 ng	02090503.D	466.8	491.6	489.6	484.6	528.9	505.0	496.0
				1000ng std #A10353	100 ng	02090504.D	873.2	979.4	1028.1	819.6	1154.8	1001.3	983.8

Comments	fail biphenyl		
1st Precision Lab No	11230409.D		
Lab Blank Lab No	02250502.D	Should have the same Lab No as the Lab Blank in F9	
Multipoint Calibration Check	Pass	From TO15 Worksheet	
Daily Calibration Check	Pass	From TO15 Worksheet	
BFB Lab Number	02250502.D	Should have the same first four numbers in the Lab No as the samples	
nd	Not Detected		
Errors Determined	Without Sampling		
Initials			
Processed By	Angela Downey	**Checked By** Nigel West	**Date** 28-Feb-05

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia
Geotechnical Services

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

ounds by in-House Method WI

Samples Received	25-Feb-05
Samples Analysed	25-Feb-05

Sample	Compound	ethynyl-benzene	styrene	1,2-xylene	benzaldehyde	1,3,5-trimethyl-benzene	benzonitrile	benzofuran	aceto-phenone	naphthalene	quinoline	1H-indole	2-methyl naphthalene	1-methyl naphthalene
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.2	13.2	13.3	13.5	13.8	12.7	13.1	14.0	12.9	13.0	22.0	13.1	13.0
A11071	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 0.50	< 5.0	< 5.0
1	02250502.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1	02250507.D	nd	nd	nd	nd	nd	nd	nd	nd	30.00	nd	nd	9.50	24.00
1	02250506.D	nd	nd	nd	nd	nd	nd	nd	nd	24.00	nd	nd	5.54	18.00
1	02250509.D	nd	nd	nd	nd	nd	nd	nd	nd	6.00	nd	nd	nd	6.70
1	02250508.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
		(50 ng)								(10 ng)	(50 ng)			
chkstd	02240514.D	51.0	nd	nd	nd	nd	nd	nd	nd	11.0	45.0	nd	nd	nd
10 ng solids	02250503.D	100	110	120	91	99	95	97	100	10	110	4	42	86
Solid Standards														
0 ng	02090502.D	nd	nd	nd	26.0	16.3	21.7	20.1	5.3	nd	nd	nd	nd	nd
1 ng	02090506.D	9.7	7.2	3.6	56.9	28.2	33.2	20.1	20.9	1.4	13.5	1.6	15.8	13.7
2 ng	02090507.D	20.1	15.9	11.1	36.3	29.3	37.5	32.0	20.5	2.1	22.5	2.9	28.9	21.8
5 ng	02090508.D	50.5	48.4	46.9	65.3	58.5	66.2	59.2	50.8	5.2	49.6	5.1	51.4	50.5
10 ng	02090509.D	100.0	100.1	99.9	101.7	99.1	103.6	98.5	97.1	11.4	99.1	7.1	71.2	100.3
20 ng	02090510.D	202.0	198.7	199.7	199.3	188.8	187.0	189.8	190.1	20.3	198.7	19.4	194.1	225.3
50 ng	02090503.D	462.6	493.8	497.8	429.4	509.8	377.5	431.6	490.6	27.0	472.7	41.1	411.4	345.5
100 ng	02090504.D	806.8	959.7	946.5	295.1	790.8	271.7	538.4	168.4	21.3	835.6	89.9	899.1	303.9

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Nigel West **Date**

GEOTECH

ample No 4

ounds by in-House Method WI

Samples Received	25-Feb-05
Samples Analysed	25-Feb-05

Sample	Compound	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	methyl butana	heptane	MIBK	DMDS	methylacetam
Volume(mLs)	Units	ng	ng	ng	ng	ng					ng	ng	ng	ng	ng	ng	ng
	Error +/- %	13.1	12.6	12.9	13.1	12.9	No data	No data	No data	No data	14.6	13.5	14.5	13.9	13.3	13.6	12.4
A11071	Lab No	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
																	Bag A
1	02250502.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
1	02250507.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	450.00	30.00	nd	76.00	nd	nd
1	02250506.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	520.00	5.80	nd	32.00	nd	nd
1	02250509.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	120.00	nd	nd	31.00	nd	nd
1	02250508.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd
																(50 ng)	
chkstd	02240514.D	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	61.0	nd
10 ng solids	02250503.D	11	10	10	6	9	No Data	No Data	No Data	No Data	100	100	100	120	110	110	120
Solid Standards																	
0 ng	02090502.D	1.7	nd	nd	nd	1.4	No Data	No Data	No Data	No Data	nd	nd	2.1	4.1	nd	nd	nd
1 ng	02090506.D	3.4	1.5	1.4	nd	2.3	No Data	No Data	No Data	No Data	nd	3.9	2.1	18.9	nd	nd	nd
2 ng	02090507.D	6.4	2.0	2.4	nd	3.2	No Data	No Data	No Data	No Data	nd	13.7	17.4	22.6	nd	nd	nd
5 ng	02090508.D	10.0	5.3	5.0	3.2	6.0	No Data	No Data	No Data	No Data	nd	45.5	47.6	60.4	24.4	3.0	nd
10 ng	02090509.D	14.7	10.1	10.1	10.1	10.2	No Data	No Data	No Data	No Data	102.9	103.1	103.3	104.3	105.9	92.3	93.4
20 ng	02090510.D	24.4	21.0	19.8	21.4	19.8	No Data	No Data	No Data	No Data	210.4	201.6	204.9	204.9	207.4	200.0	319.7
50 ng	02090503.D	40.6	57.0	57.9	89.9	52.4	No Data	No Data	No Data	No Data	537.8	530.8	464.9	445.1	742.9	857.4	1300.5
100 ng	02090504.D	47.2	49.3	54.9	79.9	71.2	No Data	No Data	No Data	No Data	925.1	1052.4	1008.2	840.8	1221.9	1553.2	1607.0

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Nigel West **Date**

ample No 4

ounds by in-House Method WI

Samples Received	25-Feb-05
Samples Analysed	25-Feb-05

Sample	Compound	phenol	nitrobenzene	ethyl cyclohexa	methylformam	Iodomethane	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Volume(mLs)	Units	ng	ng	ng	ng	ng	ng	ng	Check std		against chkstd	Report
	Error +/- %	13.5	13.5	13.9	12.4	15.9	13.0					
A11071	Lab No	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
		rtefacts										
1	02250502.D	nd	nd	nd	nd	nd	nd		02240514.D			
1	02250507.D	nd	nd	nd	nd		nd		02240514.D			
1	02250506.D	nd	nd	8.7	nd	delay: Not	nd		02240514.D			
1	02250509.D	nd	nd	nd	nd		nd		02240514.D			
1	02250508.D	nd	nd	nd	nd		nd		02240514.D			
chkstd	02240514.D	nd	nd	nd	nd	nd	nd					
10 ng solids	02250503.D	12	90	120	110	120	100					
Solid Standards												
0 ng	02090502.D	0.7	24.8	17.9	nd	4.5	nd					
1 ng	02090506.D	2.5	47.8	27.5	nd	29.8	nd					
2 ng	02090507.D	6.2	73.2	33.7	8.1	23.0	nd					
5 ng	02090508.D	10.4	134.7	70.5	42.3	54.0	24.2					
10 ng	02090509.D	16.8	221.8	102.8	98.9	103.2	99.3					
20 ng	02090510.D	23.3	312.9	203.9	195.1	204.8	188.7					
50 ng	02090503.D	51.7	672.7	363.7	402.7	528.3	760.8					
100 ng	02090504.D	80.9	957.4	537.8	369.8	924.5	677.4					

Lab No	02240514.D	E
acetone, hexatriene, MEK, M	23	N
benz, hept, MIBK, me cyhe	9	D
pyr, DMS dimethylacet/forma	18	
tol	13	O
C2 Benz	2	F
solids and MNs	9	
quinoline indole	Not Correcte	R
		E
		P
		O
		R
		T

e Lab No as the Lab Blank in F9
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e first four numbers in the Lab No as the

Nigel West **Date**

ample No 4

GHD House
239 Adelaide Terrace
Perth WA 6004

March 5, 2005

Attention: Mark Goldstone
Your Ref No: 6115324
Our Ref No: ENV 05-069

INTERIM REPORT ON ANALYSIS OF SAMPLES

Introduction:

Sixteen TO17 tubes, four PAH tubes and eighteen DNPH impregnated tubes were received 2/03/05, these were analysed in accordance with the chain of custody.

Methods of Analysis:

The amount of Volatile Organic Compounds was determined according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A). The PAH's were determined according to WIENV 44 (based on USEPA TO13) solvent extraction followed by GCMS.

Results

The results are tabulated on the following worksheets.

Comments

The tubes were analysed to determine the amount of volatile organic compounds according to WIENV 31 (based on the analytical section of US EPA TO15 and TO17). The TO17 tubes were not analysed for acetone or iodomethane. The amount of aldehydes and ketones was determined according to WIENV 34 (based on USEPA TO5 and TO11A).

The high volume PAH tubes were analysed to determine the amount of polyaromatic hydrocarbons (PAHs) using (described in US EPA TO13) solvent extraction followed by GCMS.

GEOTECHNICAL SERVICES

Angela Downey
Environmental Chemist

Nigel West
Senior Chemist

Test Report for Analysis of Carbonyl Derivatives by WIENV 34 (Based on the Analytical Sections of USEPA TO5 &							
Mark Goldstone	Our Ref No	Env 05-069	Samples Received	2-Mar-05	**Disclaimer:** Geotech has analysed the derivatised samples provic		
GHD	Your Ref No	6115324	Samples Analysed	2-Mar-05	on the analytical components of USEPA TO11A and TO5.		
Sample Name	Lab Number	Analyte	Formaldehyde	Acetaldehyde	Acetone	Propanal	MEK
		Detection Limit (ug)	0.14	0.07	0.15	0.15	0.13
		Errors + / - %	11.7	11.7	11.8	11.8	11.9
		% Sample Used	Total ug	Total ug	Total ug	Total ug	Total ug
1274304694	HP030209.D	100	0.35	29	38	0.81	3.5
1274304693	HP030208.D	100	0.44	28	41	0.75	4.2
1274305251	HP030216.D	100	0.20	11	15	nd	1.7
1274304695	HP030210.D	100	0.18	15	21	0.20	2.6
1274304699	HP030214.D	100	nd	0.39	2.5	nd	0.33
1274304605	HP030203.D	100	0.19	2.6	4.2	nd	0.48
1274305259	HP030219.D	100	0.15	1.6	6.0	nd	0.60
1274305250	HP030215.D	100	0.20	1.4	5.3	nd	0.60
1274304603	HP030202.D	100	0.14	0.6	2.2	nd	0.25
1274304696	HP030211.D	100	nd	0.7	4.8	nd	0.54
1274304690	HP030205.D	100	0.17	0.8	2.1	nd	0.29
1274304691	HP030206.D	100	0.22	1.8	3.2	nd	0.35
1274304697	HP030212.D	100	nd	nd	2.2	nd	nd
1274304608	HP030204.D	100	0.14	1.2	3.9	nd	0.44
1274304692	HP030207.D	100	0.25	0.82	4.8	nd	0.96
1274304698	HP030213.D	100	nd	nd	1.6	nd	0.31
1274304252	HP030201.D	100	0.21	15	18	nd	2.44
1274305254	HP030218.D	100	nd	nd	0.70	nd	nd
1274305253	HP030217.D	100	nd	nd	0.66	nd	nd

Volume of Extract (mL)	2				
nd	Not Detected				
Daily Calibration	HP030234.D	Pass	1.0	ppm standard	
Multipoint Calibration	HP111811.D				
MDL Lab No	HP111815.D				
Precision Lab No	HP111827.D				
Column Efficiency	HP111816.D				

Processed By	Angela Downey	Checked By	Nigel West	Date	**3/03/2005**
Geotechnical Services 41-45 Furnace Road Welshpool Perth WA 6106 Australia		Geotechnical Services			

Test Report for Analysis of Carb	TO11A							
Mark Goldstone	Our Ref No	ded by methods based						
GHD	Your Ref No							
Sample Name	Lab Number	iso-Butanal	Benzaldehyde	2-Pentanone	n-Pentanal	p-Tolualdehyde	2-Hexanone	Hexanal
		0.12	0.07	0.19	0.16	0.10	0.19	0.07
		12.7	12.0	12.1	12.5	17.8	12.9	11.8
		Total ug	Total ug	Total ug	Total ug	Total ug	Total ug	Total ug
1274304694	HP030209.D	0.25	1.0	1.0	1.5	nd	nd	nd
1274304693	HP030208.D	0.37	1.0	1.4	1.2	nd	nd	nd
1274305251	HP030216.D	nd	0.80	0.73	0.88	nd	nd	nd
1274304695	HP030210.D	nd	0.88	1.10	1.6	nd	nd	nd
1274304699	HP030214.D	nd	nd	nd	nd	nd	nd	nd
1274304605	HP030203.D	nd	nd	nd	2.2	nd	nd	nd
1274305259	HP030219.D	nd	nd	nd	0.29	nd	nd	nd
1274305250	HP030215.D	nd	nd	nd	nd	nd	nd	nd
1274304603	HP030202.D	nd	nd	nd	nd	nd	nd	nd
1274304696	HP030211.D	nd	nd	nd	nd	nd	nd	nd
1274304690	HP030205.D	nd	nd	nd	nd	nd	nd	nd
1274304691	HP030206.D	0.52	nd	nd	nd	nd	nd	nd
1274304697	HP030212.D	nd	nd	nd	nd	nd	nd	nd
1274304608	HP030204.D	nd	nd	nd	nd	nd	nd	nd
1274304692	HP030207.D	nd	nd	nd	nd	nd	nd	nd
1274304698	HP030213.D	nd	nd	nd	nd	nd	nd	nd
1274304252	HP030201.D	nd	1.0	0.91	1.1	nd	nd	nd
1274305254	HP030218.D	nd	nd	nd	nd	nd	nd	nd
1274305253	HP030217.D	nd	nd	nd	nd	nd	nd	nd

Volume of Extract (mL)	2
nd	Not Detected
Daily Calibration	HP030234.D
Multipoint Calibration	HP111811.D
MDL Lab No	HP111815.D
Precision Lab No	HP111827.D
Column Efficiency	HP111816.D

Processed By	Angela Downey

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

(I) RESULTS

Matrix: High Volume PAH tubes

			Analyte	Naphthalene	acenaphthylene	acenaphthene	fluorene	phenanthrene	anthracene	fluoranthene	pyrene	benzo(a)anthracene	chrysene	benzo(b)fluoranthene	benzo(k)fluoranthene	benzo(a)pyrene	indeno(123cd)pyrene	dibenzo(ah)anthracene	benzo(ghi)perylene
Client ID		**Geotech ID**	**PQL (ug)**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
Blank		DT030306.D	ug	0.44	nd	nd	nd	0.06	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Blank		DT030307.D	ug	nd	nd	nd	nd	0.06	nd	nd	nd	nd	0.08	nd	nd	nd	nd	nd	nd
ST	01/03	DT030305.D	ug	3.58	0.17	0.24	0.18	0.18	nd	nd	nd	nd	0.12	nd	nd	nd	nd	nd	nd
CP	01/03	DT030309.D	ug	1.20	0.18	0.05	nd	0.10	nd	nd	nd	nd	0.07	nd	nd	nd	nd	nd	nd

nd -- not detected
PQL– Practical quantitation limit

Test Report for Determination of Volatile Organic Compounds by in-House Method WIENV 31

	Mark Goldstone	Our Ref No	Env 05-069	Samples Received	2-Mar-05	Disclaimer: Geotechnical Services has not been involved in the collection of these									Known breakdown product of Tenax				Known breakdown product of Tenax		
	GHD	Your Ref No	6115324	Samples Analysed	2-Mar-05	samples. Geotech has determined the VOCs by thermal desorption GC-MS															
Tube No	Sample ID	Date	Time	Sample Volume(mLs)	Compound Units	acetone ng	hexatriene ng	benzene ng	pyridine ng	toluene ng	ethyl-benzene ng	1,3 and 1,4-xylene ng	ethynyl-benzene ng	styrene ng	1,2-xylene ng	benzaldehyde ng	1,3,5-trimethyl-benzene ng	benzonitrile ng	benzofuran ng	aceto-phenone ng	naphthalene ng	quinoline ng
					Error +/- %	15.4	13.6	13.1	14.1	14.5	13.6	14.3	13.2	13.2	13.3	13.5	13.8	12.7	13.1	14.0	12.9	13.0
	Detection Limits. Based on Sample Volume on tube			A01444	Lab No	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0
	Lab Blank			1	03020508.D	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.4	nd
A10106	IS Recovery mostly acceptable, large number of VOCs present			1	03040534.D	93000	2.05	140	nd	370	nd	nd	nd	nd	nd	nd	nd	nd	nd	230	2.4	nd
A72188	IS Recovery acceptable, large number of VOCs present			1	03020523.D	NA	nd	46	nd	220	nd	13.0	nd	nd	nd	nd	nd	nd	nd	330	5.6	nd
A12416	IS Recovery acceptable, large number of VOCs present			1	03020520.D	NA	nd	58	nd	200	nd	40.0	nd	nd	13.0	20	nd	nd	nd	340	7	nd
A72151	Poor Recovery of IS, results are approximations			1	03020521.D	NA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
A62959	IS Recovery acceptable			1	03020519.D	NA	nd	nd	nd	6.9	nd	nd	nd	nd	nd	18	nd	nd	nd	5.9	1.4	nd
C06289	IS Recovery acceptable			1	03020517.D	NA	nd	nd	nd	13	nd	nd	nd	nd	nd	64	nd	nd	nd	18	nd	nd
A00360	Poor Recovery of IS, large number of VOCs present, results are a			1	03020512.D	NA	nd	nd	nd	10	nd	nd	nd	270	nd	nd	nd	nd	nd	43	2.5	nd
A01444	Poor Recovery of IS, results are approximations			1	03020510.D	NA	nd	nd	nd	7.6	nd	nd	nd	nd	nd	nd	nd	nd	nd	12	1	nd
C06646	IS Recovery acceptable			1	03020516.D	NA	nd	nd	nd	8.2	nd	nd	nd	nd	nd	12	nd	nd	nd	94	nd	nd
A09661	IS Recovery acceptable			1	03020525.D	NA	nd	nd	nd	7.30	nd	nd	nd	nd	nd	nd	nd	nd	nd	19	1.1	nd
A11408	IS Recovery acceptable			1	03020524.D	NA	nd	nd	nd	9.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	48	nd	nd
C06252	IS Recovery acceptable			1	03020514.D	NA	nd	nd	nd	8.6	nd	nd	nd	nd	nd	25	nd	nd	nd	42	2.6	nd
B16430	IS Recovery acceptable			1	03020513.D	NA	nd	nd	nd	10	nd	nd	nd	nd	nd	nd	nd	nd	nd	14	nd	nd
A72163	IS Recovery acceptable, large number of VOCs present			1	03020522.D	NA	nd	19.0	nd	60	nd	nd	nd	nd	nd	nd	nd	nd	nd	120	12	nd
A72158	IS Recovery acceptable			1	03020518.D	NA	nd	nd	nd	3.54	nd	nd	nd	nd	nd	nd	nd	nd	nd	5.8	2.7	nd
A11293	IS Recovery acceptable			1	03020515.D	NA	nd	nd	nd	5.4	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.8	nd
						(1000 ng)		(1000 ng)		(400 ng)			(50 ng)								(10 ng)	(50 ng)
				chkstd	03020526.D	NA	nd	990.0	nd	390.0	nd	nd	40.0	nd	nd	nd	nd	nd	nd	6.6	8.9	62.0
	Daily Calibration	100ng std		10 ng solids	03020509.D	130	96	95	99	100	100	100	95	100	100	110	110	120	120	84	95	100
	Multipoint Calibration	Liquid Stds		Solid Standards																		
		Blank #A13110		0 ng	03010505.D	nd	nd	nd	nd	nd	nd	nd	0.8	nd	nd	nd	153.7	nd	nd	nd	nd	1.0
		10ng std #A11071		1 ng	03010506.D	nd	nd	nd	3.4	nd	nd	nd	11.9	nd	nd	nd	106.5	11.7	nd	nd	10.5	1.8
		20ng std #B16456		2 ng	03010507.D	nd	nd	nd	8.0	nd	nd	nd	28.4	nd	nd	nd	86.6	22.6	nd	nd	17.2	3.3
		50ng std #A72250		5 ng	03010508.D	17.9	10.5	13.1	2.6	12.0	11.9	11.9	11.4	12.3	12.7	13.0	550.7	586.6	6.3	10.9	10.2	nd
		100ng std #A15016		10 ng	03010509.D	25.3	21.9	25.0	5.5	22.7	23.0	22.6	22.1	22.7	24.1	23.8	1318.4	1195.2	14.2	19.8	23.6	nd
		200ng std #A12353		20 ng	03010510.D	52.2	40.7	44.3	15.2	42.5	42.3	42.8	44.6	42.4	43.4	51.5	2452.8	2288.2	27.6	41.2	43.2	nd
		500ng std #A61949		50 ng	03010503.D	370.4	389.9	400.3	366.3	439.8	443.0	449.3	682.1	444.8	453.5	316.4	262.3	397.0	143.4	128.7	300.8	49.4
		1000ng std #A72153		100 ng	03010504.D	1223.4	1231.2	1237.4	746.0	1383.4	1102.8	1103.7	904.4	1032.3	1105.2	35.9	417.1	276.3	186.9	18.4	202.2	84.4

Comments fail biphenyl and phenol

1st Precision Lab No 11230409.D

Lab Blank Lab No 03020508.D Should have the same Lab No as the Lab Blank in F9

Multipoint Calibration Check Pass From TO15 Worksheet

Daily Calibration Check Pass From TO15 Worksheet

BFB Lab Number 03020508.D Should have the same first four numbers in the Lab No as the samples

nd Not Detected

Errors Determined Without Sampling

Initials

Processed By Nigel West **Checked By** Not Checked **Date** 05-Mar-05

Geotechnical Services
41-45 Furnace Road
Welshpool Perth
WA 6106 Australia

Geotechnical Services

Lab Nos Month/Day/Yr/Sample No eg 10180204 is analysed on Oct 18th 2002 and is sample No 4

n-House Method

2-Mar-05				Known breakdown product of Tenax																			
2-Mar-05																							
Compound	1H-indole	2-methyl naphthalene	1-methyl naphthalene	biphenyl	acenaph-thylene	acenaph-thene	dibenzo-furan	9H-fluorene	9H-fluoren-9-one	phen-anthrene	fluor-anthene	pyrene	MEK	MPK	3 methyl butanal	heptane	MIBK	DMDS	nethylacetam	phenol	nitrobenzene	ethyl cyclohexa	ethylformam	Iodomethane
Units	ng	ng	ng	ng	ng	ng	ng	ng	No data	No data	No data	No data	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
Error +/- %	22.0	13.1	13.0	13.1	12.6	12.9	13.1	12.9					14.6	13.5	14.5	13.9	13.3	13.6	12.4	13.5	13.5	13.9	12.4	15.9
Lab No	< 0.50	< 5.0	< 5.0	< 0.50	< 0.50	< 0.50	< 5.0	< 0.50					< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50	< 5.0	< 5.0	< 5.0	< 5.0
																			Bag Artefacts					
03020508.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
03040534.D	nd	7.8	4.7	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	11000	410	nd	nd	9.5	48	nd	nd	3.1	nd	nd	71
03020523.D	nd	8	6.1	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	780	nd	nd	140	83	nd	nd	nd	nd	nd	NA
03020520.D	nd	16	12	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	1100	nd	nd	160	74	nd	nd	nd	nd	nd	NA
03020521.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	150	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020519.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	nd	nd	nd	nd	nd	nd	8.4	nd	nd	nd	NA
03020517.D	nd	20	10	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	120	nd	nd	26	nd	nd	0.20	nd	nd	nd	NA
03020512.D	nd	10	5.3	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	95	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020510.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020516.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	15	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020525.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	11	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020524.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	40	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
03020514.D	nd	8.8	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	93	nd	nd	nd	nd	nd	2.76	nd	nd	nd	NA
03020513.D	nd	3.4	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	23	nd	nd	24	nd	nd	nd	nd	nd	nd	NA
03020522.D	nd	23	17	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	1300	nd	nd	120	18	nd	nd	nd	nd	nd	NA
03020518.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	nd	nd	nd	nd	nd	nd	0.30	nd	nd	nd	NA
03020515.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	NA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	NA
																		(50 ng)						
03020526.D	nd	nd	nd	nd	nd	nd	nd	nd	No Data	No Data	No Data	No Data	nd	nd	nd	nd	4.9	48.0	nd	nd	nd	nd	nd	nd
03020509.D	74	120	100	120	89	89	88	98	No Data	No Data	No Data	No Data	120	90	97	100	97	92	92	98	90	98	98	89
03010505.D	nd	2.7	4.6	108.5	1.6	3.1	30.7	4.4	No Data	No Data	No Data	No Data	5.5	nd	nd	nd	802.8	803.0	845.5	4.7	2.2	nd	nd	nd
03010506.D	8.1	6.5	9.7	75.2	9.7	6.0	35.6	7.5	No Data	No Data	No Data	No Data	11.1	nd	nd	nd	866.9	803.0	952.9	7.5	4.5	nd	nd	nd
03010507.D	nd	13.0	16.4	66.5	24.1	14.1	46.3	15.6	No Data	No Data	No Data	No Data	24.0	nd	nd	nd	933.4	859.9	1073.7	13.5	13.6	nd	nd	nd
03010508.D	nd	8.6	8.4	83.5	8.5	nd	12.5	0.6	No Data	No Data	No Data	No Data	1071.5	12.4	11.9	13.6	nd	nd	nd	3.7	13.3	15.8	nd	13.6
03010509.D	1.2	19.8	19.2	143.5	18.1	1.0	21.8	1.3	No Data	No Data	No Data	No Data	2019.3	21.4	23.1	23.8	nd	nd	1.0	10.6	19.6	26.9	nd	31.3
03010510.D	4.3	42.3	33.7	258.1	38.4	2.1	39.2	2.6	No Data	No Data	No Data	No Data	3749.8	41.3	46.6	43.7	nd	nd	1.3	23.4	47.3	56.1	nd	39.2
03010503.D	259.5	274.0	245.3	281.9	368.3	182.4	362.3	290.2	No Data	No Data	No Data	No Data	568.8	424.3	374.1	410.2	921.9	922.2	935.7	241.9	572.3	439.1	487.2	443.3
03010504.D	602.1	239.5	201.5	279.5	539.4	263.2	432.8	583.9	No Data	No Data	No Data	No Data	1125.5	1239.6	1229.4	1245.0	921.3	921.1	949.9	353.0	162.9	853.9	415.7	1250.4

Blank in F9

the Lab No as the

Date

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n-House Metho

2-Mar-05						
2-Mar-05						
Compound	indene	Total Quantified VOC	Calibrated against	Comments	Correction for Calibration (%)	End of
Units	ng	ng	Check std		against chkstd	Report
Error +/- %	13.0					
Lab No	< 5.0					
03020508.D	nd		03020526.D			
03040534.D	nd		03020526.D			
03020523.D	nd		03020526.D			
03020520.D	nd		03020526.D			
03020521.D	nd		03020526.D			
03020519.D	nd		03020526.D			
03020517.D	nd		03020526.D			
03020512.D	nd		03020526.D			
03020510.D	nd		03020526.D			
03020516.D	nd		03020526.D			
03020525.D	nd		03020526.D			
03020524.D	nd		03020526.D			
03020514.D	nd		03020526.D			
03020513.D	nd		03020526.D			
03020522.D	nd		03020526.D			
03020518.D	nd		03020526.D			
03020515.D	nd		03020526.D			
03020526.D	nd			Lab No	03020526.D	E
03020509.D	90			acetone, hexatriene, MEK, MPK	Not Corrected	N
				benz, hept, MIBK, me cyhex	Not Corrected	D
03010505.D	nd			pyr, DMS dimethylacet/formamide	Not Corrected	
03010506.D	nd			tol	Not Corrected	O
03010507.D	nd			C2 Benz	Not Corrected	F
03010508.D	9.5			solids and MNs	Not Corrected	
03010509.D	15.5			quinoline indole	19	R
03010510.D	27.8					E
03010503.D	172.3					P
03010504.D	176.6					O
						R
						T

Blank in F9

the Lab No as the

Date

TECH

lo 4

THE ODOUR UNIT PTY LIMITED

THE ODOUR UNIT

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Internet: www.odourunit.com.au
ABN: 53 091 165 061

Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Paige_Gunnell@ghd.com.au
Sampling Method	Not specified	Sampling Team	Paige Gunnell, B. Deeley

Order details:

Order requested by	Paige Gunnell	Order accepted by	Natasha Bowden
Date of order	26/02/2005	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Natasha Bowden

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Thursday, 3 March 2004 Report Number / Panel Roster Number: PER20050226

T. Schulz
Principal and Managing Director

N. Bowden
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution Factor	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
RDA 5	PC50199	25/02/2005 02:00hrs	26/02/2005 10:01hrs	5	10	-	-	84 *	84 *	Musty
RDA 5	PC50200	25/02/2005 05:45hrs	26/02/2005 10:26hrs	5	8	-	-	76	76	Musty
RDA 5	PC50201	25/02/2005 08:26hrs	26/02/2005 11:02hrs	5	10	-	-	69	69	Musty
RDA 5	PC50202	25/02/2005 10:00hrs	26/02/2005 11:31hrs	5	10	-	-	60	60	Process liquor
RDA 5	PC50203	25/02/2005 11:30hrs	26/02/2005 12:37hrs	5	10	-	-	56	56	Musty
RDA 5	PC50204	25/02/2005 14:20hrs	26/02/2005 13:01hrs	5	10	-	-	74	74	Musty
RDA 5	PC50205	25/02/2005 17:30hrs	26/02/2005 13:26hrs	5	10	-	-	52	52	Musty
RDA 5	PC50206	25/02/2005 23:17hrs	26/02/2005 13:50hrs	5	10	-	-	79	79	Musty

* See comments below

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER2005.02.26	52	$20 \leq \chi \leq 80$	1,450	36	Yes

Comments AS/NZS4323.3:2001 states samples are to be analysed within 30hrs of collection. Sample PC50199 was analysed 32hrs after collection, therefore it does not meet the Australian Standard and is not NATA certified. GHD Comment - TOU misunderstood collection time, which was 0200 on 26/2/05

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THE ODOUR UNIT PTY LIMITED

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Accreditation Number: 14974

Form 06 - Perth Laboratory
Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	GHD	Telephone	(08) 9429 6558
Contact	Mark Goldstone	Facsimile	(08) 9429 6555
Sampling Site	Alcoa Wagerup	Email	Paige_Gunnell@ghd.com.au
Sampling Method	Not specified	Sampling Team	Paige Gunnell, B. Deeley

Order details:

Order requested by	Paige Gunnell	Order accepted by	Natasha Bowden
Date of order	01/03/2005	TOU Project #	1139.1
Order number	TBA	Project Manager	Natasha Bowden
Signed by	TBA	Testing operator	Clayton Hough

Investigated Item	Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag. Odour character is also assessed, however, this assessment is not covered by AS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Measuring Range	The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}or below setting 2^3. This is specifically mentioned with the results.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 25°C or less, with temperature fluctuations of less than ± 3 °C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES 200107V05
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $r = 0.384$ (20 September, 2004) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES 200107V05: $A = 0.147$ (20 September, 2004) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (four times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

Date: Thursday, 3 March 2004 Report Number / Panel Roster Number: PER20050301

T. Schulz
Principal and Managing Director

C. Hough
Authorised Signatory

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Sample Measurement Results

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution Factor	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
RDA 6	PC50216	28/02/2005 12:30hrs	01/03/2005 11:30hrs	5	10	-	-	478	478	Mud / cement
RDA 6	PC50217	28/02/2005 18:10hrs	01/03/2005 12:00hrs	5	10	-	-	338	338	Musty
RDA 6	PC50218	01/03/2005 24:03hrs	01/03/2005 12:30hrs	5	10	-	-	194	194	Musty
RDA 6	PC50219	01/03/2005 07:15hrs	01/03/2005 13:00hrs	5	10	-	-	256	256	Musty

THE ODOUR UNIT PTY LIMITED

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppm)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	PER2005.03.01	52	$20 \leq \chi \leq 80$	1,550	33	Yes

Comments None.

Disclaimer: Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Limited for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Limited relinquishes The Odour Unit Pty Limited from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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Appendix C

Field Notes

Appendix C – List of Tables

Table C1. Phase 1 – Field Observations During Monitoring Program

Date	Location	Type of Sample	Sample ID	Sample Flow Rate	Hood Internal Temp (°C)	Ambient Temperature (°C)	Sweep Air Flow Rate (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)
19/10/2004	**Cooling Pond**	Odour	CP1	1800/min	38	25	5/5	1020	1035
		VOC	A70218	100ml/30sec	39	25	5/5	1020	1035
		VOC	A14306	100ml/30sec	40	27	5/5	1045	1055
		ALD	922803918	100ml/30sec	41	26	5/5	1107	1157
	Cooling Pond 2	Odour	CP2	1800/min	45	25		1400	1415
		VOC	A70310	100ml/30sec	44	24	5/5	1450	1459
		ALD	922803916	100ml/30sec	44	24	5/5	1345	1445
	Cooling Pond Free	VOC	A11389	100ml/30sec	N/A	N/A	N/A	1430	1440
20/10/2004	**ROWS Pond 1**	Odour	RP1	1800/min	26	25	5/5	1015	1030
		VOC	A12078	100ml/36sec	26	25	5/5	0937	0949
		ALD	922803913	100ml/30sec	26	25	5/5	1008	1058
	ROWS Pond 2	Odour	RP2	1800/min	26	25	5/3	1610	1620
		VOC	A73725	100ml/30sec	26	25	5/3	1610	1622
		ALD	0822803915	100ml/30sec	26	25	5/5	1425	1515

Date	Location	Type of Sample	Sample ID	Sample Flow Rate	Hood Internal Temp (°C)	Ambient Temperature (°C)	Sweep Air Flow Rate (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)
21/10/2004	**ROCP2**	Odour	ROCP2-1	1800/min	24	20	5/4	1100	1115
		VOC	C06215	100ml/30sec	25	20	5/5	945	955
		ALD	922803910	100ml/30sec	24	20	5/4	1100	1150
	ROCP2-2	Odour	ROCP2-2	1800/min	25	21	5/5	1540	1555
		VOC	A63757	100ml/30sec	25	21	5/5	1540	1550
		ALD	922803914	100ml/30sec	24	20	5/5	1335	1425
22/10/2004	**RDA2-1**	Odour	RDA2-1	1800/min	34	24	5/0	1100	1115
		VOC	A13823	100ml/30sec	34	22	5/5	0945	0955
		ALD	922803911	100ml/30sec	34	24	5/0	1100	1150
	RDA2-2	Odour	RDA2-2	1800min	38	24	5/5	1505	1520
		VOC	A00360	100ml/30sec	38	24	5/5	1505	1515
		ALD	922803917	100ml/30sec	33	23	5/4.5	1305	1355
25/10/2004	**Lower Dam 1**	Odour	LD1	1800/min	28	19	5/4	1120	1135
		VOC	A08278	100ml/40sec	25	18	5/4.5	1000	1014
		ALD	922803912	100ml/30sec	28	19	5/4	1120	1210
	Lower Dam 2	Odour	LD2	1800/min	32	24	5/5	1425	1440

Date	Location	Type of Sample	Sample ID	Sample Flow Rate	Hood Internal Temp (°C)	Ambient Temperature (°C)	Sweep Air Flow Rate (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)
		VOC	A15036	100ml/30sec	34	22	5/5	1330	1340
		ALD	922803919	100ml/30sec	33	24	5/5		
26/10/2004	**Oxalate 1**	Odour	Oxalate 1	1700/min	30	20	5/5	1030	1045
		VOC	A09661	100ml/44sec	30	20	5/5	1045	1055
		ALD	097901749	100mls/31secs	30	20	5/5	1056	1146
	Oxalate 2	Odour	Oxalate 2	1700	29	25	5/5	1245	1300
		VOC	A06466	100mls/31secs	29	25	5/5	1300	1310
		ALD	0979701705	100 mls/30secs	29	25	5/5	1311	1401
27/10/2004	**Super-Thcknr 1**	Odour	ST1	1700	37	24	5/5	1145	1200
		VOC	A13714	100ml/69secs	37	24	5/5	1228	1239.5
		ALD	0979701719	100ml/30secs	37	24	5/5	1252	1322
	Super – Thcknr 2	Odour	ST2	1700	37	24	5/5	1212	1227
		VOC	A10353	100mls/59secs	37	24	5/5	1240	1250
		ALD	0979701735	100mls/30secs	37	24	5/5	1323	1353
28/10/2004	**Wet Sand**	Odour	Wet Sand	1800 mls/min	34	29	5/5	1045	1100
		VOC	A1319054	100mls/54 secs	34	29	5/5	1100	1115

Date	Location	Type of Sample	Sample ID	Sample Flow Rate	Hood Internal Temp (°C)	Ambient Temperature (°C)	Sweep Air Flow Rate (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)
		ALD	0979701772	100mls/32 secs	34	29	5/5	1115	1205
	Dry Residue	Odour	Dry Residue	1800 mls/min	38	30	5/5	1240	1255
		VOC	A14300	100mls/58secs	38	30	5/5	1345	1405
		ALD	09791729	100mls/34secs	38	30	5/5	1255	1345
	Wet Residue	Odour	Wet Residue	1700 mls/min	35	30	5/5	1500	1515
		VOC	A12494	100mls/63secs	35	30	5/5	1515	1527
		ALD	0979701638	100mls/35secs	35	30	5/5	1527	1617
29/10/2004	**Cooling Pond Free**	Odour	CPF	1800	N/A	N/A	N/A	1440	1450
		ALD	979701710	100ml/30sec			N/A	1422	1512
10/11/2004	**Blank 1**	Odour	A1	1800			5/5	1348	1411
		VOC	A1	100ml/47sec			5/5	1348	1403
		ALD	979701741	100ml/30sec			5/5	1411	1501
	Blank 2	VOC	A13888	N/A			N/A	N/A	N/A
		ALD	979701727	N/A			N/A	N/A	N/A
	Blank 3		979701785	N/A			N/A	N/A	N/A
	Blank 4	Odour	A4	1800			5/5	1626	1640

Date	Location	Type of Sample	Sample ID	Sample Flow Rate	Hood Internal Temp (°C)	Ambient Temperature (°C)	Sweep Air Flow Rate (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)
		VOC	A14330	100ml/30sec			5/5	1700	1710
		ALD	979701698	100ml/30sec			5/5	1600	1650
17/11/2004	**Cooling Pond 1**	ALD	979701610	100ml/30sec	18	17	5/5	940	955
	Super thickener 1	ALD	979701721	100ml/30sec	35	17	5/5	1125	1130
	Super thickener 2	ALD	979701634	100ml/30sec	35	17	5/5	1134	1144
	Super thickener 3	ALD	979701615	100ml/30sec	35	17	5/5	1150	1155

Table C2. Phase 2 Dry Residue Run 1 - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
14/02/2005	**RDA5 run 1**	S	TO-11a	1274305375	1081	5/5	1836	1936	28	27.6
		P	TO-17	A11293	102	5/5	1836	1936	33	27.6
		S	TO-17	A11144	100	5/5	1836	1936	24.3	24.8
		P	TO-11a	1274305376	1114	5/5	1919	2019	24.0	24.8
		S	TO-17	A1	98	5/5	2105	2209	24.3	24.8
		P	TO-17	A14502	97	5/5	2105	2209	24	24.8
		S	TO-11a	1274305370	1215	5/5	2105	2209	21.6	22.6
		P	TO-11a	1274305379	1015	5/5	2105	2209	21.4	22.6
		S	TO-17	A15036	96	5/5	2408	108	21.6	22.6
		P	TO-17	C06289	95	5/5	2408	108	21.4	22.6
		P	TO-11a	1274305372	1079	5/5	2408	108	21.4	22.6
		S	TO-11a	1274305378	1053	5/5	2408	108	21.6	22.6
15/02/2005	**RDA5 run 1**	P	TO-11a	1274305377	1068	5/5	307	0407	20.6	21.6
		S	TO-11a	1274305374	1065	5/5	307	0407	20.7	21.6
		S	TO-17	C06252	95	5/5	307	0407	20.7	21.6
		P	TO-17	A72258	94	5/5	307	0407	20.6	21.6
		P	TO-17	B16433	187	5/5	604	704	21.7	23
		S	TO-17	A72158	94	5/5	604	704	21.2	23

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
		S	TO-11a	1274305371	1033	5/5	604	704	21.2	23
		P	TO-11a	1274305373	1027	5/5	604	704	21.7	23
15/02/2005	**RDA5 run 1**	S	TO-11a	1274304756	1065	5/5	912	1011	31.2	29.1
		P	TO-11a	1274304759	475	5/5	912	1011	41.3	29.1
		S	TO-17	C06646	94	5/5	912	1011	31.2	29.1
		P	TO-17	A12416	95	5/5	912	1010	41.3	29.1
		P	TO-11a	1274304758	469	5/5	1203	1303	53.8	34.3
		S	TO-11a	1274304750	469	5/5	1203	1303	40.6	34.3
		P	TO-17	B15881	207	5/5	1203	1303	53.8	34.3
		S	TO-17	A11389	205	5/5	1203	1304	40.6	34.3
		S	TO-17	A14431	100	5/5	1456	1554	46.4	36.3
		P	TO-17	A09645	106	5/5	1456	1554	38.8	36.3
		P	TO-11a	1274304757	1038	5/5	1456	1555	46.4	36.3
		S	TO-11a	1274304753	1064	5/5	1456	1556	38.8	36.3

Table C3. Phase 2 Dry Residue Run 2 - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
25/02/2005	**RDA 5 run 2**	P	TO-11a	1274305529	1074	5/5	412	512	17.2	17.2
		S	TO-11a	1274305524	1025	5/5	412	512	18.15	17.2
		S	TO-17	B16459	97	5/5	412	512	18.15	17.2
		P	TO-17	A72166	97	5/5	412	512	17.2	17.2
		P	TO-11a	1274305521	1012	5/5	703	803	25.75	25
		S	TO-11a	1274305520	979	5/5	703	803	26.4	25
		S	TO-17	A14506	93	5/5	703	803	26.4	25
		P	TO-17	A10482	91	5/5	703	803	25.75	25
		S	TO-11a	1274305528	982	5/5	1000	1103	43.1	41
		P	TO-11a	1274305522	988	5/5	1000	1103	46.25	41
		S	TO-17	B16449	98	5/5	1000	1103	43.1	41
		P	TO-17	C06514	95	5/5	1000	1103	46.25	41
		P	TO-11a	1274305525	1027	5/5	1300	1400	49.9	46
		S	TO-11a	1274305523	990	5/5	1300	1338	47.75	46
		S	TO-17	A01467	101	5/5	1300	1400	47.75	46
		P	TO-17	A13823	99	5/5	1300	1400	49.9	46
25/02/2005	**RDA 5 run 2**	P	TO-11a	1274305526	1031	5/5	1608	1710	31.4	30.8
		S	TO-11a	1274305527	1022	5/5	1608	1711	33	30.8

		S	TO-17	B15517	102	5/5	1608	1710	33	30.8
		P	TO-17	A10058	103	5/5	1608	1711	31.4	30.8
		odour				5/5	530	542		
		S	TO-11a	1274305545	1016	5/5	1900	2000	22.4	25.2
		P	TO-11a	1274305544	1022	5/5	1900	2000	23.5	25.2
		P	TO-17	A16087	99	5/5	1900	2000	23.5	25.2
		S	TO-17	A15036	99	5/5	1900	2000	22.4	25.2
		odour				5/5	2000	2012		
		P	TO-11a	1274305549	1007	5/5	2205	2305	18.6	23.5
		S	TO-11a	1274305548	1021	5/5	2205	2305	20.9	23.5
		S	TO-17	A09645	94	5/5	2205	2305	20.9	23.5
		P	TO-17	A11352	96	5/5	2205	2305	18.6	23.5
		odour				5/5	2205	2217		
		S	TO-11a	1274305543	1017	5/5	100	200	18	22.2
		P	TO-11a	1274305547	1009	5/5	100	200	17.5	22.2
		P	TO-17	A70150	94	5/5	100	200	17.5	22.2
		S	TO-17	A14502	93	5/5	100	200	18	22.2
		odour				5/5	200	212		

Table C4. Phase 2 Wet Residue Run 1 and Bitumen - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
16/02/2005	**Wet Bitumen**		TO-17	B15517	97	5/4.5	1150	1252	25.2	24.2
	PAHs		TO-17	A01467	214	5/5	1150	1450	32.4	30.8
	Dry Dry Bitumen		TO-17	A72151	100	5/5	1607	1712	25.8	25.8
18/02/2005	**RDA 3**	S	TO-11a	1274304752	1033	5/5	21.11	22.11	27.6	27.6
		P	TO-11a	1274304754	993	5/5	21.11	22.11	30.5	27.6
		S	TO-17	A72153	95	5/5	21.11	22.11	27.6	27.6
		P	TO-17	A10069	93	5/5	21.11	22.11	30.5	27.6
19/02/2005		S	TO-11a	1274304995	1049	5/5	3.04	4.04	35.5	28
		P	TO-11a	1274304990	997	5/5	3.04	4.04	35.5	28
		P	TO-17	A63757	96	5/5	3.04	4.04	35.5	28
		S	TO-17	A14314	94	5/5	3.04	4.04	35.5	28
19/02/2005		S	TO-11a	1274304751	946	5/5	9.3	10.3	29.6	23.1
		P	TO-11a	1274304755	1040	5/5	9.3	10.3	37.6	23.1
		S	TO-17	A70306(3)	91	5/5	9.3	10.3	29.6	23.1
		P	TO-17	A10347	94	5/5	9.3	10.3	37.6	23.1
19/02/2005		P	TO-11a	1274304997	1017	5/5	13.25	13.55	46.1	30.4
		S	TO-11a	1274304998	998	5/5	13.25	13.55	43.2	30.4
		S	TO-17	A10353	96	5/5	13.25	13.55	43.2	30.4
		P	TO-17	A13110	101	5/5	13.25	13.55	46.1	30.4

Table C5. Phase 2 Wet Residue Run 2 and Bitumen - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
28/02/2005	**RDA-6**	Perspex in	TO-11a	1274304608	1016	5/5	915	1020	30	30
28/02/2005	**RDA-6**	Perspex out	TO-11a	1274304603	1012	5/5	915	1020	30	30
28/02/2005	**RDA-6**	P	TO-11a	1274304605	985	5/5	1115	1216	36.4	36.4
28/02/2005	**RDA-6**	S	TO-11a	1274304692	1017	5/5	1115	1216	36.3	36.3
28/02/2005	**RDA-6**	P	TO-17	C06289	94	5/5	1115	1216	36.4	36.4
28/02/2005	**RDA-6**	S	TO-17	C06252	94	5/5	1115	1216	36.3	36.3
28/02/2005	**RDA-6**	Perspex in	TO-11a	1274304691	997	5/5	1300	1402	35.8	35.8
28/02/2005	**RDA-6**	Perspex out	TO-11a	1274304690	966	5/5	1300	1402	35.8	35.8
28/02/2005	**RDA-6**	S	TO-11a	1274305250	1015	5/5	1707	1807	24.3	23.5
28/02/2005	**RDA-6**	P	TO-11a	1274305259	1004	5/5	1707	1807	24.8	23.5
28/02/2005	**RDA-6**	S	TO-17	A11408	96	5/5	1707	1807	24.3	23.5
28/02/2005	**RDA-6**	P	TO-17	A00360	88	5/5	1707	1807	24.8	23.5
28/02/2005	**RDA-6**	P	TO-11a	1274304699	1004	5/5	2300	2401	17.4	15.2
28/02/2005	**RDA-6**	S	TO-11a	1274304698	1006	5/5	2300	2400	17.5	15.2
28/02/2005	**RDA-6**	P	TO-17	C06646	93	5/5	2300	2401	17.2	15.2
28/02/2005	**RDA-6**	S	TO-17	A09661	87	5/5	2300	2405	17.2	15.2
1/03/2005	**RDA-6**	P	TO-11a	1274304696	1022	5/5	550	650	16.6	16.0
1/03/2005	**RDA-6**	S	TO-11a	1274304697	958	5/5	550	650	16.8	16.0
1/03/2005	**RDA-6**	P	TO-17	B16430	93	5/5	550	650	16.6	16.0
1/03/2005	**RDA-6**	S	TO-17	A01444	87	5/5	550	650	16.8	16.0

Table C6. Phase 2 ROWS - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
24/02/2005	**ROWS1**	S	TO-11a	1274304994	997	5/5	1240	1340	35	35
	ROWS1	S	TO-17	A11369	104	5/5	1240	1340	35	35
	ROWS2	S	TO-17	A10755	99	5/5	1540	1640	31	31
	ROWS2	S	TO-11a	1274305255	1091	5/5	1540	1640	31	31
1/03/2005	**ROWS3A**	S	TO-17	A11293	75	5/5	1845	1945	25.5	24.3
	ROWS3A	S	TO-11a	1274305253	1030	5/5	1845	1945	25.5	24.3
	ROWS3B	S	TO-11a	1274305254	1000	5/5	2008	2046	24.6	24
	ROWS3B	S	TO-17	A72158	75	5/5	2008	2108	24.6	24

Table C7. Phase 2 Cooling Pond - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
24/02/2005	**Cooling Pond Inlet**	P	TO-11a	1274305256	1090	5/5	1333	1405	48	35
	Cooling Pond Inlet (b)	P	TO-17	B16456	97	5/5	1333	1405	48	35
	Cooling Pond Berm	P	TO-11a	1274305257	1090	5/5	1505	1524	66.8	52.6
	Cooling Pond Berm (a)	P	TO-17	A11071	97	5/5	1505	1526	66.8	52.6
	Cooling Pond Outlet	P	TO-11a	1274305258	1090	5/5	1630	1650	37	37
	Cooling Pond Outlet (c)	P	TO-17	A15016	97	5/5	1630	1650	37	37

Table C8. Phase 2 RDA2 - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
1/03/2005	**RDA 2**	SS	TO-11a	1274305251	1020	5/5	1100	1200	25	25
		SS	TO-17	A72151	132	5/5	1100	1200	25	25
		SS	TO-11a	1274304695	1019	5/5	1330	1430	30	30
		SS	TO-17	A62959	84	5/5	1330	1430	30	30
		SS	TO-17	A72163	74	5/5	1600	1715	25	25
		SS	TO-11a	1274304252	1027	5/5	1600	1700	25	25

Table C9. Phase 2 Superthickener - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
1/03/2005	**Superthickener**	P	TO-11a	1274304694	1014	5/5	10:30	10:50	55	25
		P	TO-17	A72188	93	5/5	10:30	10:50	55	25
		P	TO-11a	1274304693	1014	5/5	11:20	11:40	55	28
		P	TO-17	A12413	93	5/5	11:20	11:40	55	28
			T0-17 PAH	A16466	180	5/5	12:10	12:30	55	30
				A16466	120	5/5	12:30	14:10	55	30
			PAH	ST1	1800	5/5	12:10	12:30	55	30
				ST1	1200	5/5	12:30	14:10	55	30

Table C10. Phase 2 Cooling Pond and RDA5 (PAH Runs) - Field Observations During Monitoring Program

Date	Location	Hood	Type of Sample	Sample ID	Sample Flow Rate (mL/min)	Gas Flow (Start/Finish) (L/min)	Start Time (hh:mm)	End Time (hh:mm)	Temperature (°C)	Ambient Temperature (°C)
1/03/2005	**Cooling Pond**	SS	TO-17	A73693	140	5/19	1537	1830	35.7	33.7
	Cooling Pond	SS	PAH	CP1	1200	1200	1537	1830	35.7	33.7
22/02/2005	**RDA5**	SS	TO-17	B16859	146	5/5	1015	1645	34	33.03
22/02/2005	**RDA5**	SS	PAH	DM1	1800	5/5	1015	1715	34	33.03

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