

Anna Harris  
TKD Architects Pty Ltd

26 October 2017

Dear Anna

**RE: Soil Vapour Investigation, Alexandria Park Community School, Park Road, Alexandria NSW**

## **1. INTRODUCTION & BACKGROUND**

The Alexandria Park Community School located on Park Road, Alexandria NSW (the site) will be redeveloped into a new school campus for primary and high school students. Coffey has previously undertaken a Detailed Site Investigation (DSI) for the site (ref: SYDEN199382-R01-Rev2) which identified several plausible pollutant linkages that required further consideration with respect to the proposed development. Volatile Halogenated Compounds (VHCs) were detected in the groundwater at location MW2<sup>1</sup>, and further investigations were recommended to determine if the VHCs identified in MW2 could potentially present an indoor vapour risk. Previous investigations revealed that the standing groundwater levels ranged between 9.533mAHD (MW1) and 10.683mAHD (MW3) (3.337 mbTOC to 2.427 mbTOC) indicating groundwater flows in a south-westerly direction. The main Chemicals of Potential Concern identified in groundwater within the DSI are Trichloroethene, Tetrachloroethene, cis-1,2-dichloroethene, 1,1,1-Trichloroethane and Vinyl Chloride, however based on the industrial history of the site, other Volatile Organic Compounds (VOCs) cannot be ruled out.

Coffey was engaged by TKD Architects Pty Ltd (TKD) to conduct a targeted soil vapour investigation in the area where VHCs were detected in groundwater (MW2). The location of the site is shown in Figure 1. The site layout is shown in Figure 2. The information and conclusions drawn from this investigation will be used to inform the Remedial Action Plan (RAP) that will be developed for the site. This investigation was conducted in accordance with Coffey's proposal dated 31 August 2017 (SYDEN199382-P04).

## **2. OBJECTIVES**

The objectives of this vapour investigation are to:

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<sup>1</sup> Total VHCs detected at 92 ug/L within groundwater at MW2.

- Identify the presence of Volatile Organic Compounds (VOCs)<sup>2</sup>, including VHCs in soil vapour (if present) at location MW2;
- Attempt to delineate the VOC vapours (if present); and
- Preliminary assessment of the indoor vapour risk posed to the future occupants of the site buildings.

### 3. SCOPE OF WORK

The scope of work for the soil vapour investigation are:

- Location of underground services using an experienced services location subcontractor, and set out of seven (7) proposed investigation locations;
- Drilling of seven (7) boreholes (SS1 to SS7) in areas surrounding MW2 to assess the lateral extent of soil vapour (if any);
  - Hand auger of the first 1.2m of each borehole to avoid striking possible underground services;
  - Driving of the BESST SimulProbe to a depth of 2.5m below ground surface (bgs), or directly above the groundwater table;
- Screening of soil samples within the first 1.2m at each borehole (during hand augering) for the presence of ionisable Volatile Organic Compounds (VOCs) using a calibrated Photoionization detected (PID);
- Deployment and opening of the BESST SimulProbe at a depth of 2.5m bgs at each borehole location;
- Screening soil vapour for presence of ionisable VOCs using a PID;
- Collection of a soil vapour sample using laboratory prepared Suma Canisters at each borehole location;
- Dispatch of soil vapour samples to a NATA accredited laboratory for analysis; and
- Preparation of this letter report, outlining the outcomes of the assessment.

### 4. SAMPLING PLAN & METHODOLOGY

At the time of preparing the DSI (Coffey, 2017), and the proposal for this soil vapour investigation, a point source for the VHCs within the groundwater could not be determined.

Subsequent to the development of the proposal, and prior to conducting these intrusive soil vapour investigation works, Coffey was advised that an underground storage tank (UST) was encountered by ProGroup (construction contractor) during construction works within the site (for the pop-up school 2). The approximate location of the UST is shown on Figure 2, and is located approximately 90m up gradient of MW2. Coffey was advised by TKD that the UST (total volume unknown) was partially filled water containing a hydrocarbon odour, and that the water (approximately 4000L) was subsequently pumped out by a waste removal contractor. Coffey understands that ProGroup have sought advice from another consultancy in relation to the handling of the UST. It is understood that the tank remains in-situ.

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<sup>2</sup> The discovery of a previously unknown UST warranted analysis of an extended VOC suite.

The newly discovered UST represents a potential (former) source for the VHCs observed within groundwater at MW2, since it is located up gradient. Coffey proposed to conduct some investigation locations around the UST, at the time of conducting the intrusive vapour investigation, however construction activities restricted access to the pop-up school 2 site where the UST is located. As a result, drilling locations could not be established immediately adjacent the UST to assess the vapour conditions surrounding the tank and no assessment of vapour was completed around the tank.

Borehole drilling, logging and sampling was undertaken by an experienced Coffey environmental scientist in accordance with the sampling methodology and QA / QC procedures summarised in Table 4.1.

**Table 4.1: Borehole Drilling, Logging and Vapour Sampling Methodology**

Activity	Details
Date of Fieldwork	28 <sup>th</sup> September 2017
Assessment Locations	<p>Investigation locations are shown on Figure 2. Investigation locations installed during this programme of fieldwork included:</p> <ul style="list-style-type: none"> <li>• SS1: Positioned immediately adjacent MW2, to identify the presence of VOCs at MW2.</li> <li>• SS2: Positioned up gradient to MW2, to assess lateral extent of VOC vapours (if present). Location is also downgradient of the UST, however it is approximately 90m away from the UST.</li> <li>• SS3: Positioned up gradient to MW2, to assess lateral extent of VOC vapours (if present). Location is also downgradient of the UST.</li> <li>• SS4: Positioned up and cross gradient to MW2, to assess lateral extent of VOC vapours (if present).</li> <li>• SS5: Positioned down gradient to MW2, to assess lateral extent of VOC vapours (if present).</li> <li>• SS6: Positioned down gradient to MW2, to assess lateral extent of VOC vapours (if present).</li> <li>• SS7: Positioned cross gradient to MW2 to assess lateral extent of VOC vapours (if present).</li> </ul>
Borehole Drilling	<p>Boreholes SS1 to SS7 were drilled using a hand auger for the first 1.2m, at which point the "BESST SimulProbe" was driven to a final depth of 2.5m below the ground surface, which is located directly above the groundwater table.</p> <p>No soil samples were collected during drilling.</p>
Soil Logging	<p>Soil for the first 1.2m was logged in general accordance with the relevant Coffey Standard Operating Procedure (SOP) and the United Soil Classification System (USCS) by a qualified and experienced Coffey scientist. Soil headspace measurements and indicators of potential contamination, (e.g. staining, odorous soils, or other man-made inclusions) were also noted on the borehole logs. Borehole logs are presented in Appendix A.</p> <p>Soil could not be logged from 1.2m to 2.5m as the BESST SimulProbe was used to advance this interval.</p>
Soil Screening for volatile organic compounds	<p>Soil headspace screening was carried out for the presence of VOC using a Photo-ionisation Detector (PID) fitted with a 10.6eV lamp which was calibrated by the equipment supplier at the start of the fieldworks to 0.0ppm and 100ppm using isobutylene calibration gas. Calibration records are presented in Appendix C. It should be noted that the PID with a 10.6eV lamp may not be capable of ionizing certain VHCs, hence the PID screening results may not reflect concentrations of VHCs accurately.</p>

Activity	Details
	Soil headspace screening was undertaken on soils within the first 1.2m at discrete depths at each borehole location by placing a small quantity of soil inside a zip-locked plastic bag and sealed. The sample was agitated and then the plastic bag was pierced using the tip of the PID. The readings on the PID were observed and the maximum reading recorded on the field log sheet. The soil headspace measurements are presented in each borehole log.
<b>Besst Simul Probe</b>	<p>The BESST SimulProbe was opened at a depth of 2.5m below ground surface (directly above the groundwater table) at each borehole location. The PID was used to purge the LDPE tubing within the probe (and record PID values) for a period of three minutes, before laboratory prepared Suma Vapour Canisters were attached to obtain a representative soil vapour sample directly above the groundwater table at each borehole location.</p> <p>For more information on the BESST SimulProbe technology, refer to fact sheet within Appendix E.</p>
<b>Soil Vapour Sampling</b>	<p>Soil vapour sampling was conducted with laboratory supplied 1.4L Suma canisters. Each Suma canister was received at an internal pressure of approximately -30 psi. IPA was used as a tracer chemical, and placed within the shroud during vapour sampling to determine the effectiveness of the connection seals. The concentration of VOCs within the shroud was measured with a PID during sampling, and recorded on the sampling form. The flow restrictor connectors were each leak tested prior to sampling. Flow restrictors were set at 60mL/min. The Suma canisters were sampled until the internal pressure of the canister reached approximately -5 psi. The duration of sampling for each Suma canister was</p> <p>Laboratory canister calibration certificates are presented in Appendix C.</p>
<b>Duplicate Vapour Samples</b>	One duplicate vapour sample was collected during the investigation. A duplicate flow restrictor sampling train was used to allow extraction of soil vapour to the primary sample, and duplicate sample simultaneously.
<b>Soil Cuttings</b>	Soil cuttings from each borehole were used as backfill to reinstate each borehole upon completion of sampling.

## 5. Scope of Laboratory Analysis

The contaminants of concern for identified in the DSI (Coffey, 2017) were used to determine the required laboratory analysis for vapour samples.

Soil vapour samples were analysed for the following parameters:

- Suite VOCs by USEPA Method TO15 (SS1 to SS3 only);
- Trichloroethene, Tetrachloroethene, cis-1,2-dichloroethene, 1,1,1-Trichloroethane and Vinyl Chloride (all samples);
- Total Recoverable Hydrocarbons (SS1 to SS3 only);
- Methane (all samples); and
- General Gases (Carbon Dioxide, Carbon Monoxide, Hydrogen, Helium, Oxygen) (all samples).

## 6. Chain of Custody Records & Analytical Results

Soil vapour analytical results are summarised in the Table 1. Certified laboratory reports and Chain of Custody documentation are included in Appendix D.

## 7. Quality Assurance / Quality Control

The following section describes the Quality Assurance (QA) and Quality Control (QC) protocols adopted during the field sampling and laboratory analysis.

### 7.1. QA/QC Indicators

QA/QC indicators are based on the analysis of field and laboratory quality control sample results, and in accordance with AS 4482.1(2005) *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil* (Parts 1 and 2). Specific indicators for field and laboratory QA/QC samples are shown in Table 7.1.

**Table 7.1: QA/QC Indicators**

Type of Quality Control Sample	Control Limit
Duplicate Samples	<p>For vapour samples, the following applied:</p> <ul style="list-style-type: none"> <li>If the reported concentration is less than 4 times the Limit of Reporting (LOR), then no limit applies and reasonableness of Relative Percent Difference (RPD) will be considered;</li> <li>If the recorded concentration is 4 or more times LOR then a RPD of 50% will apply.</li> </ul>
IPA Leak Test During Sampling	A maximum IPA concentration of 1% of the PID reading (in ppm) within the shroud is applicable.

### 7.2. Field QA/QC

The vapour sampling was conducted by a Coffey environmental scientist who holds experience in conducting environmental sampling activities. The sampling was undertaken in accordance with Coffey's SOP which has been developed on relevant industry guidance including the National Environment Protection (Assessment of Contamination) Measure 1999 as amended (NEPC, 2013).

One duplicate sample was collected during the sampling programme. The primary/duplicate sample combinations are summarised in Table 7.2.

**Table 7.2: Summary of Primary/Duplicate and Triplicate Sample Pairs**

Sample Date	Primary Sample	Duplicate	Triplicate
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28/09/2017	SS1	DUP01	N/A
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The ratio of primary samples to duplicate samples analysed equates to 14.3%, which exceeds the recommended frequency of 5% set out within AS4482.1 (2005), and hence is considered adequate for the purpose of this assessment.

Comparison of the analytical results of the primary and duplicate sample pair are summarised within Table 2 along with their calculated RPD values.

In summary, the RPD values for the primary and duplicate sample pair were below the control limits set out within Table 7.2, indicating good reproducibility.

No IPA was detected within any of the sample canisters, indicating that the connections were sealed to an acceptable level.

### 7.3. Laboratory QA/QC

Analysis was carried out on standard turnaround by ALS (Smithfield), a NATA accredited laboratory. In accordance with NATA accreditation requirements, the project laboratory performed an internal QA/QC assessment. The assessment is typically described as a multi-level approach whereby standard laboratory control procedures are implemented, including laboratory duplicates, method blanks, matrix spikes and surrogate spikes. Laboratory QC analytical results for soil vapour are summarised below:

- Analysis of samples was undertaken by laboratories who hold NATA accredited methods for the chemical parameters requested.
- The laboratory confirmed that samples were received in an appropriate condition for analysis and an attempt to chill was evident.
- Samples were received in the appropriate laboratory supplied Suma canisters.
- Samples received, extracted and analysed within the appropriate holding time.
- No target analytes were detected in any of the method blanks.
- RPDs for laboratory duplicate samples were reported to be within the acceptable tolerances for all samples.
- Percentage recovery results for matrix spikes were within the acceptable range.
- Percentage recovery results for surrogate samples were within the acceptable range
- Laboratory control spike samples recoveries were reported to be within acceptable tolerances for all samples, with the exception of Carbon disulphide and Vinyl Bromide, which fell very slightly below the acceptable limits. The two chemicals were not considered as COPCs for the site, hence this is not considered to influence the outcomes of this assessment.

### 7.4. Data Quality Assessment

Based on an assessment of the field and laboratory QA/QC data, Coffey considers that the data from this sampling event is representative of subsurface conditions at the sampling locations at the time of sampling. It is assessed that the sampling, sample handling procedures, data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations generally are in accordance with the Schedules B2 and B3 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC 2013). It is considered that the data is directly useable and can be considered to represent the conditions of the sampling locations at the time of sampling.

## 8. ASSESSMENT CRITERIA

As an initial screening tool, the soil vapour results have been compared to the ASC NEPM (NEPC, 2013) soil vapour HSLs for vapour intrusion, and the interim soil vapour HILs for volatile organic chlorinated compounds (VOCCs). The HSL-A (residential) has been adopted in order to assess the potential human health risk to the future occupants of the school buildings following redevelopment. Since the site is underlain by sandy soil, the HSL criteria for 'sand' soil type has been adopted.

The adopted soil vapour assessment criteria are presented in Table 1 and summarised in the table below.

**Table 8.1 – Adopted Soil Vapour Assessment Criteria, BTEXN, TRH and volatile organic chlorinated compounds (mg/m<sup>3</sup>)**

Analyte	Soil Vapour HSLs, Residential A, 2 m to 4 m, SAND	Interim Soil Vapour HILs for VOCCs, Residential A
Benzene	6	-
Ethylbenzene	2,200	-
Toluene	7,300	-
Total Xylenes	1,500	-
Naphthalene	6	-
F1: TRH C <sub>6</sub> -C <sub>10</sub> minus BTEX	1,300	-
F2: TRH >C <sub>10</sub> -C <sub>16</sub> less naphthalene	1,200	-
Trichloroethene (TCE)	-	0.02
1,1,1 Trichloroethane	-	60
Tetrachloroethene (PCE)	-	2
Cis-1,2-dichloroethene	-	0.08
Vinyl chloride	-	0.03
Total Recoverable Hydrocarbons (TRH)	LOR <sup>3</sup>	-

NL: Not Limiting

NE: Not Established

LOR: Limit of Reporting

## 9. FIELD OBSERVATIONS

### 9.1. Ground Conditions Encountered

The inferred subsurface profile encountered during the borehole drilling and installation of the monitoring wells revealed fill was present in all locations to the maximum depth of hand auger (1.2m). The subsurface profile from 1.2m to 2.5m could not be determined as the method (BESST SimulProbe) did not return soil cuttings to the surface. The subsurface profile within BH2 (MW2) observed during previous investigations revealed that natural alluvial sands were present from 1.3m below ground surface to the end of borehole (6m below ground surface). The observed ground

<sup>3</sup> LOR has been selected as an initial screening level.



conditions were generally consistent with previous investigations conducted on site. Borehole logs are presented in Appendix A.

Soil within the first 1.2m from the subsurface of the site was screened in the field using a PID for the presence of ionisable VOCs. Soil headspace measurements ranged between 0.1ppm and 1.0ppm<sup>4</sup>, which indicates a low potential for detectable concentrations of ionisable VOCs to be present. No stained soils or odours were noted in samples of fill. No asbestos containing material (ACM) was observed at any of the borehole locations.

Anthropogenic (man-made) material was observed within the fill material in all of the boreholes and generally consisted of fragments of asphalt, brick and concrete.

Groundwater inflow was not encountered during drilling.

## **9.2. Soil Vapour Sampling**

Soil vapour field sampling sheets are presented in Appendix B. PID measurements were taken during purging of the LDPE tubing, prior to sampling. PID measurements during purging ranged between 0.4ppm and 2.0ppm, which indicates a low potential for detectable concentrations of ionisable VOCs<sup>4</sup> to be present.

## **10. SOIL VAPOUR RESULTS**

Soil vapour analytical results are presented in Table 1.

The concentrations of VOCs within samples SS1 to SS7 fell below the adopted assessment criteria, with the exception of TCE in samples SS3 (0.0226 mg/m<sup>3</sup>) and SS7 (0.0827 mg/m<sup>3</sup>).

### **10.1. Preliminary Health Risk Assessment**

Based on the CSM presented within the Coffey (2017) DSI, the screening assessment indicated the indoor inhalation health risks<sup>5</sup> to future occupants of the school buildings required further evaluation.

This vapour investigation has revealed that concentrations of TCE have exceeded adopted soil vapour screening levels in SS3 and SS7. Given the samples were obtained from a depth of 2.5m below ground surface, the adopted screening levels were developed for vapours immediately beneath a concrete foundation slab and hence are considered to be conservative. In order to reflect additional attenuation as vapours migrate from greater depths in the subsurface, a more appropriate attenuation factor was applied to estimate indoor air concentrations for comparison to indoor air screening criteria.

A study of the data sets and uncertainties used to derive generic indoor air:subslab vapour attenuation factors were reviewed by Brewer et al (2014<sup>6</sup>) and refined based on seasonal variability on building ventilation processes and other factors. On the basis the site is located in a warm climate, Coffey consider it is more appropriate that an attenuation factor of 0.002 be applied to the reported vapour concentrations to estimate indoor levels and compared to the USEPA Indoor Air Regional Screening Levels<sup>7</sup> derived for a residential setting<sup>5</sup>.

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<sup>4</sup> The limitations of the PID to detect VHC should be noted

<sup>5</sup> Indoor vapour risk within the CSM assumes slab on ground, and no basements. The indoor vapour risk considered sensitive receptors such as young school children.

<sup>6</sup> Brewer (2014), Estimation of Generic Subslab Attenuation Factors for Vapor Intrusion Investigations.

<sup>7</sup> United States Environmental Protection Agency (USEPA), Regional Screening Levels, June 2017.

Following the application of the attenuation factor, the estimated TCE concentrations ( $4.52 \times 10^{-5}$  mg/m<sup>3</sup> and  $1.654 \times 10^{-4}$  mg/m<sup>3</sup>) in indoor associated with subsurface soil vapour measured at SS3 and SS7 respectively, fall below the USEPA Indoor Air Regional Screening Levels for residential use (0.48 mg/m<sup>3</sup>), indicating the inhalation health risk is considered to be low and acceptable at these locations.

## 10.2. Data Gaps & Uncertainty

The discovery of the UST within the pop-up school 2 area represents a possible former source for the VHCs identified within the groundwater at MW2, and within the soil vapour samples. Since access could not be obtained to the area surrounding the UST during this investigation, the vapour conditions surrounding the UST is currently unknown. In addition, since the site, and surrounding areas are known to have been widely used for industrial activities previously, the presence of further unidentified sources cannot be ruled out.

## 11. CONCLUSIONS

The investigation conducted did not identify the presence of VOCs at location MW2 (represented by soil vapour sample SS1). TCE was detected above the adopted soil vapour screening levels at location SS3 and SS7, however a subsequent preliminary health risk assessment has revealed that the potential future indoor vapour risk associated with a slab on ground building is considered to be low and acceptable at these locations.

Coffey recommends that the area surrounding the UST be investigated to determine the vapour conditions present, once access can be obtained. The former use of the site, and adjacent areas for industrial uses should also be considered, as it is considered likely that other sources within the site, or adjacent areas have not yet been identified. This should be considered further within the Remedial Action Plan for the site.

## 12. CLOSURE

We trust the above report meets your current requirements. If you have any further queries regarding the information presented herein, please do not hesitate to contact us.

For and on behalf of Coffey

Alex Ructtinger  
Senior Environmental Consultant

Tony Scott  
Senior Principal

Tables

Figures

Appendices

# Important information about your **Coffey** Environmental Report

## **Introduction**

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

## **Your report has been written for a specific purpose**

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

## **Limitations of the Report**

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept apprised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statutes and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

## **Interpretation of factual data**

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

### **Recommendations in this report**

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

### **Report for benefit of client**

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

### **Interpretation by other professionals**

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such

assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

### **Data should not be separated from the report**

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

### **Responsibility**

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

## Tables

TABLE 1  
Soil Vapour Analytical Results

Chem_Group	ChemName	Units	EQL	NEPM 2013 Interim Soil Vapour HILs for VOCs	USEPA Regional Screening Levels	NEPM 2013 Soil Vapour HSLs for Vapour Intrusion (2m to 4m)	WellCode						
							SS1	SS2	SS3	SS4	SS5	SS6	SS7
							Sampled_Date-Time	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
VOCs in Air by USEPA 1015+ - E	2-isopropyltoluene	ppmv	0.05					<0.05	<0.05	<0.05	-	-	-
	Ethyl tert-Butyl Ether (ETBE)	ppmv	0.05					<0.05	<0.05	<0.05	-	-	-
	tert-Amyl Methyl Ether (TAME)	ppmv	0.05					<0.05	<0.05	<0.05	-	-	-
	tert-butyl alcohol	ppmv	0.05					<0.05	<0.05	<0.05	-	-	-
BTXN	Benzene	mg/m3	0.1			6		<0.1	<0.1	<0.1	-	-	-
	Ethylbenzene	mg/m3	0.22			2200		<0.22	<0.22	<0.22	-	-	-
	Toluene	mg/m3	0.19			7300		<0.19	<0.19	<0.19	-	-	-
	Xylene (m & p)	mg/m3	0.43					<0.43	<0.43	<0.43	-	-	-
	Xylene (o)	mg/m3	0.22					<0.22	<0.22	<0.22	-	-	-
	Xylene Total	mg/m3	0.65			1500		<0.65	<0.65	<0.65	-	-	-
IPA	Naphthalene	mg/m3	0.1			6		<0.1	<0.1	<0.1	-	-	-
	2-Propanol	mg/m3	0.12					<0.12	<0.12	<0.12	-	-	-
MAH	1,2,4-trimethylbenzene	mg/m3	0.24					<0.24	<0.24	<0.24	<0.12	<0.12	<0.12
	1,3,5-trimethylbenzene	mg/m3	0.24					<0.24	<0.24	<0.24	-	-	-
	1-methyl-4 ethyl benzene	mg/m3	0.24					<0.24	<0.24	<0.24	-	-	-
	Isopropylbenzene	mg/m3	0.25					<0.25	<0.25	<0.25	-	-	-
	n-butylbenzene	mg/m3	0.27					<0.27	<0.27	<0.27	-	-	-
	n-propylbenzene	mg/m3	0.25					<0.25	<0.25	<0.25	-	-	-
	sec-butylbenzene	mg/m3	0.27					<0.27	<0.27	<0.27	-	-	-
	Styrene	mg/m3	0.21					<0.21	<0.21	<0.21	-	-	-
	tert-butylbenzene	mg/m3	0.27					<0.27	<0.27	<0.27	-	-	-
	1,2-Dichlorotetrafluoroethane	mg/m3	0.35					<0.35	<0.35	<0.35	-	-	-
other	Freon 113	mg/m3	0.38					<0.38	<0.38	<0.38	-	-	-
	Isocane	mg/m3	0.23					<0.23	<0.23	<0.23	-	-	-
	Propene	mg/m3	0.09		3100			0.225	<0.09	<0.09	-	-	-
Solvents	1,4-Dioxane	mg/m3	0.18					<0.18	<0.18	<0.18	-	-	-
	Methyl Ethyl ketone	mg/m3	0.15					<0.15	<0.15	<0.15	-	-	-
	2-hexanone (M&B)	mg/m3	0.2					<0.2	<0.2	<0.2	-	-	-
	4-Methyl-2-pentanone	mg/m3	0.2					<0.2	<0.2	<0.2	-	-	-
	Acetone	mg/m3	0.12					<0.12	<0.12	<0.12	-	-	-
	Acetonitrile	mg/m3	0.08					<0.08	<0.08	<0.08	-	-	-
	Acrylonitrile	mg/m3	0.11					<0.11	<0.11	<0.11	-	-	-
	Allyl chloride	mg/m3	0.16					<0.16	<0.16	<0.16	-	-	-
	Carbon disulfide	mg/m3	0.16					<0.16	<0.16	<0.16	-	-	-
	Cyclohexane	mg/m3	0.17					<0.17	<0.17	<0.17	-	-	-
	Ethanol	mg/m3	0.09					<0.09	<0.09	<0.09	-	-	-
	Ethyl acetate	mg/m3	0.18					<0.18	<0.18	<0.18	-	-	-
	Heptane	mg/m3	0.2					<0.2	<0.2	<0.2	-	-	-
	Hexane	mg/m3	0.18					<0.18	<0.18	<0.18	-	-	-
	MTBE	mg/m3	0.18					<0.18	<0.18	<0.18	-	-	-
	Tetrahydrofuran	mg/m3	0.15					<0.15	<0.15	<0.15	-	-	-
	Vinyl acetate	mg/m3	0.18					<0.18	<0.18	<0.18	-	-	-
	1,1,1,2-tetrachloroethane	mg/m3	0.34		60			<0.34	<0.34	<0.34	-	-	-
	1,1,1-trichloroethane	mg/m3	0.27					<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
	1,1,2,2-tetrachloroethane	mg/m3	0.34					<0.34	<0.34	<0.34	-	-	-
VHC	1,1,2-trichloroethane	mg/m3	0.27					<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
	1,1-dichloroethane	mg/m3	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	1,1-dichloroethene	mg/m3	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	1,2,4-trichlorobenzene	mg/m3	0.37					<0.37	<0.37	<0.37	-	-	-
	1,2-dibromoethane	mg/m3	0.38					<0.38	<0.38	<0.38	-	-	-
	1,2-dichlorobenzene	mg/m3	0.3					<0.3	<0.3	<0.3	-	-	-
	1,2-dichloroethane	mg/m3	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	1,2-dichloropropane	mg/m3	0.23					<0.23	<0.23	<0.23	-	-	-
	1,3-dichlorobenzene	mg/m3	0.3					<0.3	<0.3	<0.3	-	-	-
	1,4-dichlorobenzene	mg/m3	0.3					<0.3	<0.3	<0.3	-	-	-
	2-chlorotoluene	mg/m3	0.26					<0.26	<0.26	<0.26	-	-	-
	Benzyl chloride	mg/m3	0.26					<0.26	<0.26	<0.26	-	-	-
	Bromodichloromethane	mg/m3	0.34					<0.34	<0.34	<0.34	-	-	-
	Bromoform	mg/m3	0.52					<0.52	<0.52	<0.52	-	-	-
	Bromomethane	mg/m3	0.19					<0.19	<0.19	<0.19	-	-	-
	Carbon tetrachloride	mg/m3	0.31					<0.31	<0.31	<0.31	-	-	-
	Chlorobenzene	mg/m3	0.23					<0.23	<0.23	<0.23	-	-	-
	Chlorodibromomethane	mg/m3	0.43					<0.43	<0.43	<0.43	-	-	-
	Chloroethane	mg/m3	0.13					<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
	Chloroform	mg/m3	0.24					<0.24	<0.24	<0.24	-	-	-
	Chloromethane	mg/m3	0.1					<0.1	<0.1	<0.1	-	-	-
	cis-1,2-dichloroethene	mg/m3	0.02	0.08				<0.02	<0.02	0.0321	<0.02	<0.02	<0.02
	cis-1,3-dichloropropene	mg/m3	0.23					<0.23	<0.23	<0.23	-	-	-
	Dichlorodifluoromethane	mg/m3	0.25					<0.25	<0.25	<0.25	-	-	-
	Dichloromethane	mg/m3	0.17					<0.17	<0.17	<0.17	-	-	-



TABLE 1  
Soil Vapour Analytical Results

TKD Architects  
Alexandria Park Community School

		Field_ID		SS1	SS2	SS3	SS4	SS5	SS6	SS7
		WellCode								
		Sampled_Date-Time		28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017	28/09/2017
Chem_Group	ChemName	Units	EQL	NEPM 2013 Interim Soil Vapour HILs for VOCs	USEPA Regional Screening Levels	NEPM 2013 Soil Vapour HSLs for Vapour Intrusion (2m to 4m)				
	Hexachlorobutadiene	mg/m3	0.53			<0.53	<0.53	<0.53	-	-
	Trichloroethene	mg/m3	0.0054	0.02	0.48	<0.0054	<0.0054	0.0226	<0.0054	<0.0054
	Tetrachloroethene	mg/m3	0.34	0.02		<0.34	<0.34	<0.34	<0.34	<0.34
	trans-1,2-dichloroethene	mg/m3	0.2			<0.2	<0.2	<0.2	<0.2	<0.2
	trans-1,3-dichloropropene	mg/m3	0.23			<0.23	<0.23	<0.23	-	-
	Trichlorofluoromethane	mg/m3	0.28			<0.28	<0.28	<0.28	-	-
	Vinyl chloride	mg/m3	0.0051	0.03		<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
	1,3-butadiene	mg/m3	0.11			<0.11	<0.11	<0.11	-	-
VOCs	2-Chloro-1,3-butadiene	mg/m3	0.18			<0.18	<0.18	<0.18	-	-
	Acrolein	mg/m3	0.11			<0.11	<0.11	<0.11	-	-
	Diisopropyl ether	mg/m3	0.21			<0.21	<0.21	<0.21	-	-
	Methyl Methacrylate	mg/m3	0.21			<0.21	<0.21	<0.21	-	-
	Vinyl bromide (bromoethene)	mg/m3	0.22			<0.22	<0.22	<0.22	-	-
Total Recoverable Hydrocarbons	C6-C10	mg/m3	20			<20	<20	<20	-	-
	C6-C10 minus BTEX (F1)	mg/m3	20			<20	<20	<20	-	-
	C10-C16	mg/m3	40			<40	<40	<40	-	-
	C10-C16 minus Naphthalene (F2)	mg/m3	40			<40	<40	<40	-	-



TABLE 2  
Primary and Duplicate Sample Results

TKD Architects  
Alexandria Park Community School

Field Duplicates (AIR)  
Filter: ALL

SDG	ALSE-Newcastle 03-Oct-17	ALSE-Newcastle 03-Oct-17	RPD
Field ID	SS1	DUP01	
Sampled Date/Time	28/09/2017 15:00	28/09/2017 15:00	

Chem_Group	ChemName	Units	EQL			
IPA	2-Propanol	mg/m3	0.12	<0.12	<0.12	0
VHC	1,1,1-trichloroethane	mg/m3	0.27	<0.27	<0.27	0
	1,1,2-trichloroethane	mg/m3	0.27	<0.27	<0.27	0
	1,1-dichloroethane	mg/m3	0.2	<0.2	<0.2	0
	1,1-dichloroethene	mg/m3	0.2	<0.2	<0.2	0
	1,2-dichloroethane	mg/m3	0.2	<0.2	<0.2	0
	Chloroethane	mg/m3	0.13	<0.13	<0.13	0
	cis-1,2-dichloroethene	mg/m3	0.02	<0.02	<0.02	0
	Trichloroethene	mg/m3	0.0054	<0.0054	<0.0054	0
	Tetrachloroethene	mg/m3	0.34	<0.34	<0.34	0
	trans-1,2-dichloroethene	mg/m3	0.2	<0.2	<0.2	0
	Vinyl chloride	mg/m3	0.0051	<0.0051	<0.0051	0

\*RPDs have only been considered where a concentration is greater than 0 times the EQL.

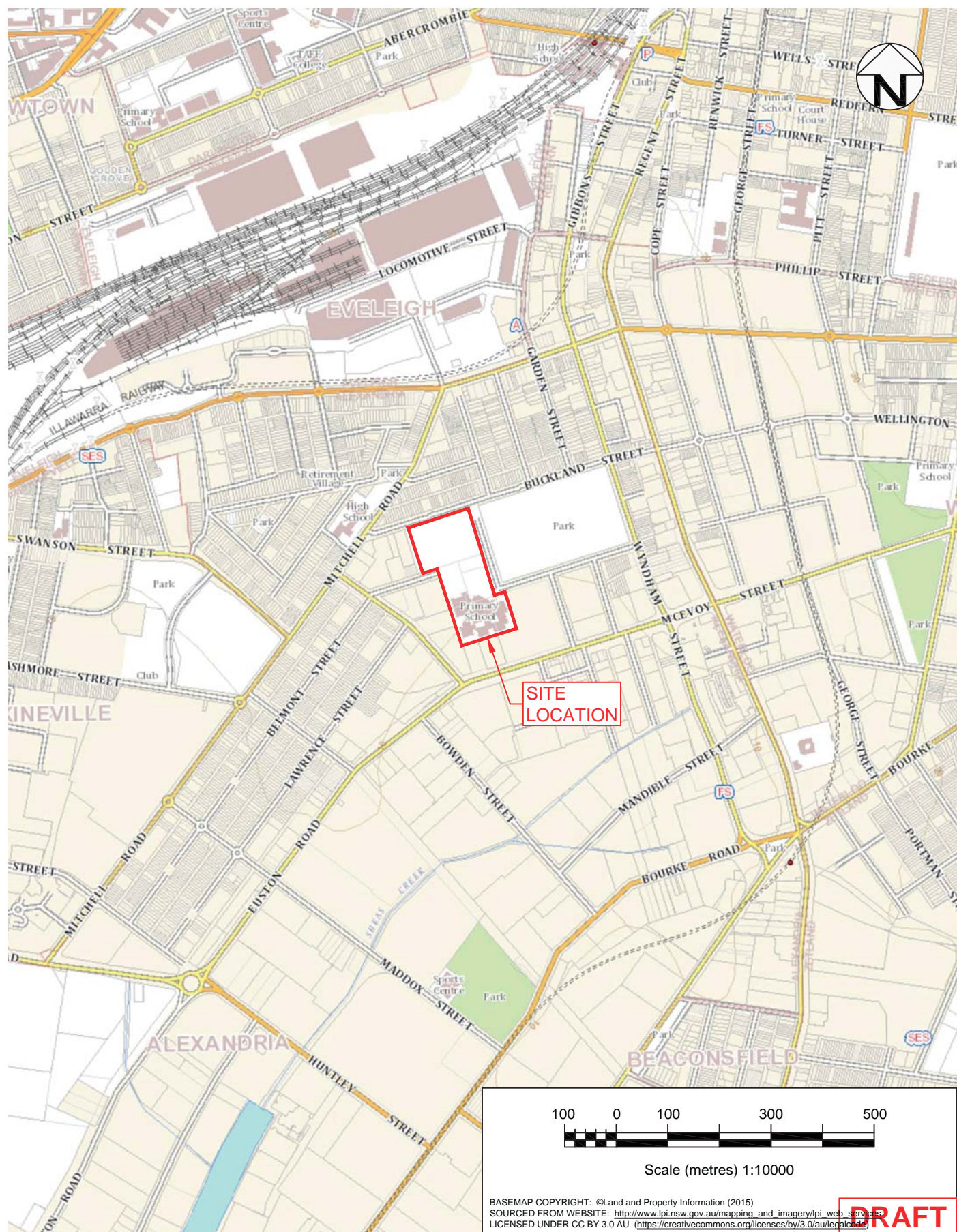
\*\*High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 200 (0-10 x EQL); 50 (10-20 x EQL); 30 ( > 20 x EQL )

\*\*\*Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Filter: ALL



## Figures



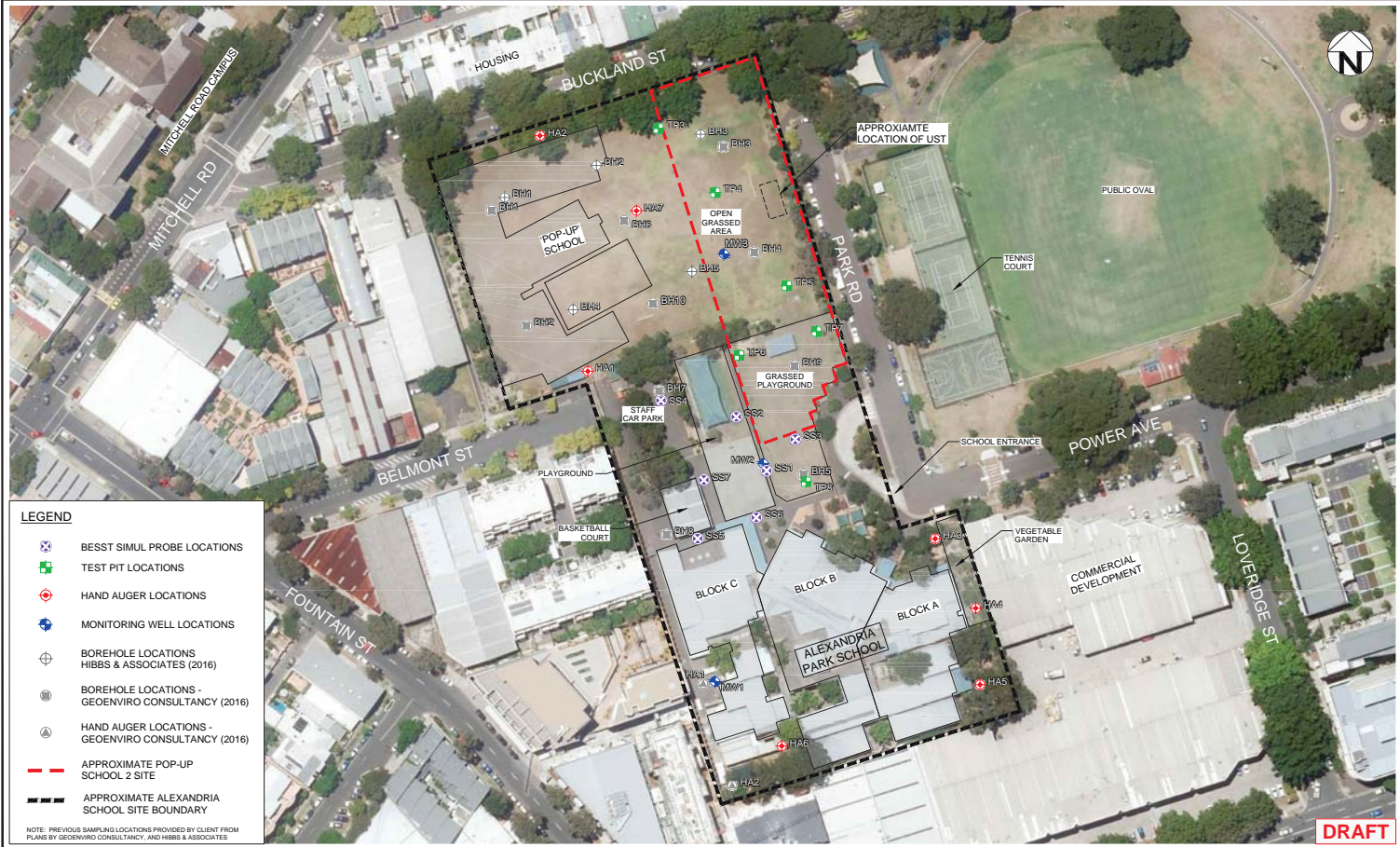
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drawn	AR / AW
approved	ML
date	10 / 10 / 17
scale	AS SHOWN
original size	A4

**coffey**   
A TETRA TECH COMPANY

client:	TKD ARCHITECTS PTY LTD		
project:	ALEXANDRIA PARK COMMUNITY SCHOOL PARK ROAD, ALEXANDRIA, NSW		
title:	SITE LOCATION		
project no:	754-SYDNEY199382-L02	figure no:	FIGURE 1
		rev:	A





LEGEND					NOTES				
	BESST SIMUL PROBE LOCATIONS				NOTE: PREVIOUS SAMPLING LOCATIONS PROVIDED BY CLIENT FROM PLANS BY GEOENVIRO CONSULTANCY, AND HIBBS & ASSOCIATES				
	TEST PIT LOCATIONS								
	HAND AUGER LOCATIONS								
	MONITORING WELL LOCATIONS								
	BOREHOLE LOCATIONS								
	BOREHOLE LOCATIONS - GEOENVIRO CONSULTANCY (2016)								
	HAND AUGER LOCATIONS - GEOENVIRO CONSULTANCY (2016)								
	APPROXIMATE POP-UP SCHOOL 2 SITE								
	APPROXIMATE ALEXANDRIA SCHOOL SITE BOUNDARY								

no.	description	drawn	approved	date
A	ORIGINAL ISSUE			

10	0	20	40	60
Scale (metres) 1:1250				

drawn	AR / AW
approved	ML
date	10 / 10 / 17
scale	AS SHOWN
original size	A3

client: TKD ARCHITECTS PTY LTD	
project: ALEXANDRIA PARK COMMUNITY SCHOOL PARK ROAD, ALEXANDRIA, NSW	
title: SITE LAYOUT	
project no: 754-SYDEN199382-L02	figure no: FIGURE 2
rev: A	

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## **Appendix A – Soil Logs**

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS1**

Sheet 1 of 1

Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3								ASPHALT	D			No observed staining, odours or ACM.
				0.2ppm		0.5			FILL (Gravelly SAND): Fine to coarse grained, dark brown to grey, fine to coarse gravels, with some low plasticity clay and fragments of asphalt, concrete and sandstone.				
				0.2ppm		1.0							
				1.0ppm		1.5							
SP						2.0			NO CORE				
						2.5							
				E+0.4ppm		3.0			Borehole SS1 terminated at 2.5m				
method				support		notes, samples, tests				classification symbols and soil description		consistency/density index	
DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				M mud C casing penetration 1 2 3 4 no resistance ranging to refusal water 10/1/98 water level on date shown water inflow water outflow		U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal				based on unified classification system  moisture D dry M moist W wet Wp plastic limit WL liquid limit		VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS2**

Sheet 1 of 1






Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3			0.2ppm		0.5			<b>FILL (Gravelly SAND):</b> Fine to coarse grained, dark brown to grey, fine to coarse gravels, with some low plasticity clay and fragments of asphalt, concrete and brick.	D			No observed staining, odours or ACM.
			0.2ppm		1.0								
			0.9ppm		1.5								
					2.0								
SP						2.5			<b>NO CORE</b>				
						3.0							
				E+1.0ppm					Borehole SS2 terminated at 2.5m				
<b>method</b> DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				<b>support</b> M mud C casing <b>penetration</b> 1 2 3 4  <b>water</b>  10/1/98 water level on date shown  water inflow  water outflow		<b>notes, samples, tests</b> U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal			<b>classification symbols and soil description</b> based on unified classification system  <b>moisture</b> D dry M moist W wet Wp plastic limit WL liquid limit		<b>consistency/density index</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense		

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS3**

Sheet 1 of 1

Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3			0.1ppm		0.5			<b>FILL (Gravelly SAND):</b> Fine to coarse grained, dark brown to grey, fine to coarse gravels, with some low plasticity clay and sandstone cobbles and fragments of concrete and brick.	D			No observed staining, odours or ACM.
			0.1ppm		1.0								
			0.2ppm		1.5								
					2.0								
SP						2.5			<b>NO CORE</b>				
						3.0							
				E+1.5ppm					Borehole SS3 terminated at 2.5m				
<b>method</b> DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				<b>support</b> M mud C casing <b>penetration</b> 1 2 3 4  no resistance ranging to refusal <b>water</b>  10/1/98 water level on date shown  water inflow  water outflow		<b>notes, samples, tests</b> U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal			<b>classification symbols and soil description</b> based on unified classification system <b>moisture</b> D dry M moist W wet Wp plastic limit WL liquid limit		<b>consistency/density index</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense		

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS4**

Sheet 1 of 1





Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3								<b>FILL (Gravelly SAND):</b> Fine to coarse grained, dark brown to grey, fine to coarse gravels, with some low plasticity clay and sandstone and brick cobbles.	D			No observed staining, odours or ACM.
				0.2ppm		0.5							
				0.4ppm		1.0							
				0.1ppm		1.5							
SP						2.0			<b>NO CORE</b>				
						2.5							
				E+2.0ppm		3.0			Borehole SS4 terminated at 2.5m				
method				support		notes, samples, tests				classification symbols and soil description		consistency/density index	
DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				M mud C casing <b>penetration</b> 1 2 3 4  <b>water</b>  10/1/98 water level on date shown  water inflow  water outflow		U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal				based on unified classification system  <b>moisture</b> D dry M moist W wet Wp plastic limit WL liquid limit		VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	



# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS5**

Sheet 1 of 1





Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3								ASPHALT	D			No observed staining, odours or ACM.
				0.2ppm		0.5			FILL (Gravelly SAND): Fine to coarse grained, brown to grey to yellow, fine to coarse gravels, with some low plasticity clay and fragments of asphalt, concrete, brick and sandstone.				
				0.7ppm									
				0.4ppm		1.0							
SP						1.5			NO CORE				
						2.0							
						2.5							
				E+0.5ppm					Borehole SS5 terminated at 2.5m				
						3.0							
<b>method</b> DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				<b>support</b> M mud C casing <b>penetration</b> 1 2 3 4  no resistance ranging to refusal <b>water</b>  10/1/98 water level on date shown  water inflow  water outflow		<b>notes, samples, tests</b> U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal				<b>classification symbols and soil description</b> based on unified classification system  <b>moisture</b> D dry M moist W wet Wp plastic limit WL liquid limit		<b>consistency/density index</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS6**

Sheet 1 of 1





Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3								ASPHALT	D			No observed staining, odours or ACM.
				0.2ppm		0.5			FILL (Gravelly SAND): Fine to coarse grained, brown to grey to yellow, fine to coarse gravels, with some low plasticity clay and fragments of asphalt, concrete, brick and sandstone.				
				0.7ppm		1.0							
				0.9ppm		1.5							
SP						2.0			NO CORE				
						2.5							
				E+0.9ppm		3.0			Borehole SS6 terminated at 2.5m				
<b>method</b> DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				<b>support</b> M mud C casing <b>penetration</b> 1 2 3 4  no resistance ranging to refusal <b>water</b>  10/1/98 water level on date shown  water inflow  water outflow		<b>notes, samples, tests</b> U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal				<b>classification symbols and soil description</b> based on unified classification system  <b>moisture</b> D dry M moist W wet Wp plastic limit WL liquid limit		<b>consistency/density index</b> VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	

# Engineering Log - Borehole

Client: **TKD Architects Pty Ltd**

Principal:

Project: **Alexandria Park Community School**

Borehole Location: **Refer to Figure 2**

Borehole No. **SS7**

Sheet 1 of 1

Office Job No.: **SYDEN199382**

Date started: **28.9.2017**

Date completed: **28.9.2017**

Logged by: **AR**

Checked by: **ML**

drill model and mounting:		PowerProbe Track		Easting:		slope: -90°		R.L. Surface:					
hole diameter:		50 mm		Northing		bearing:		datum: AHD					
drilling information				material substance									
method	penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro- meter kPa	structure and additional observations
HA	1 2 3								ASPHALT	D			No observed staining, odours or ACM.
				0.4ppm		0.5			FILL (Gravelly SAND): Fine to coarse grained, brown to grey, fine to coarse gravels, with some low plasticity clay and fragments of concrete and brick.				
				0.9ppm		1.0							
SP						1.5			NO CORE				
						2.0							
						2.5							
				E+0.6ppm		3.0			Borehole SS7 terminated at 2.5m				
method				support		notes, samples, tests				classification symbols and soil description		consistency/density index	
DT diatube PT push tube SS solid stem flight auger HS hollow stem flight auger VT V Bit, T Bit AH air hammer CP cable percussive HA hand auger NDD non-destructive digging RC rock corer				M mud C casing penetration 1 2 3 4 no resistance ranging to refusal water 10/1/98 water level on date shown water inflow water outflow		U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal				based on unified classification system  moisture D dry M moist W wet Wp plastic limit WL liquid limit		VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	

## **Appendix B – Soil Vapour Sampling Forms**

Soil Vapour Sampling

Job No:

SYDEN 194382

Sampler:

Alex. R

Date:

28-9-17

Location:

Alexandria Park  
School

Weather:

Overcast

Time:

Location ID →		SS1	SS2	SS3	SS4	SS5	SS6	SS7	
Canister ID		3017	1289	1095	869	<del>100</del> 1302	5050	1301	
Initial Canister Pressure		-30	-30	-30	-30 <del>21</del>	-30	-30	-30	
Leak Test IPA (Yes/No)		✓	✓	✓	✓	✓	✓	✓	
Leak Test He (Yes/ No)		x	No	No	No	No	No	No	
Flow Restrictor setting (ml/Min)		60	60	60	60	60	60	60	
Purge time (min)		7	3	3	3 <del>min</del>	3	3	3 <del>min</del>	
Purge Volume (ml)		240	240	240	240	240	240	240	
Start Canister Pressure (PSI)		-30	-30	-30	-30	-30	-30	-30	
Start Time		13:55	11:55	13:20	10:10	15:55	14:55	11:00	
Final Pressure (PSI)		-6	-5	-5	-5	-5	<del>100</del> -5	-5	
Finish Time		14:35	12:15	13:35	10:30	16:15	15:35	11:20	
PID Shroud (ppm) (IPA testing)		100	150	100	90	87	125	190	
PID Purge (ppm)		0.1	1.0	1.5	2.0	0.5	0.9	0.6	
Sample train ID		001	041	011	047	054	004	044	
Relative Pressure									
Only If gas analyser is being used	CH <sub>4</sub> (%)								
	CO <sub>2</sub> (%)								
	O <sub>2</sub> (%)								
	CO (%)								
	H <sub>2</sub> S (%)								
	Balance								
Comments		All sampling trains leaks tested.							

All samples taken from 2.5m bgs using Rockwell drilling Simulprobe Best technology.

## **Appendix C – Equipment Calibrations**





## GAS CANISTER SAMPLING GUIDE

## SAMPLING FROM WELLS AND SAMPLE LINES

# SOIL VAPOUR, BOREHOLE AND LANDFILL GAS SAMPLING

## Sampling Guidance

The Australian Guidelines for Soil Vapour sampling contained in the 2011 draft National Environment Protection Measure for Assessment of Site Contamination include two critical criteria for successful soil vapour sampling.

The guidelines state that sample size should be minimised and the maximum flow rate for vapour extraction should be limited to a maximum of 200 ml/min. These guidelines are based on the principle that the extraction rate for vapour should be balanced by resupply from the surrounding pore gas. In more compacted soils, these considerations are even more critical and flow rates should be reduced accordingly to avoid disturbing the equilibrium and introducing bias.

These guidelines also stress the importance of leak checks and purging sample lines before taking the sample for analysis.

## CANISTER SAMPLING EQUIPMENT

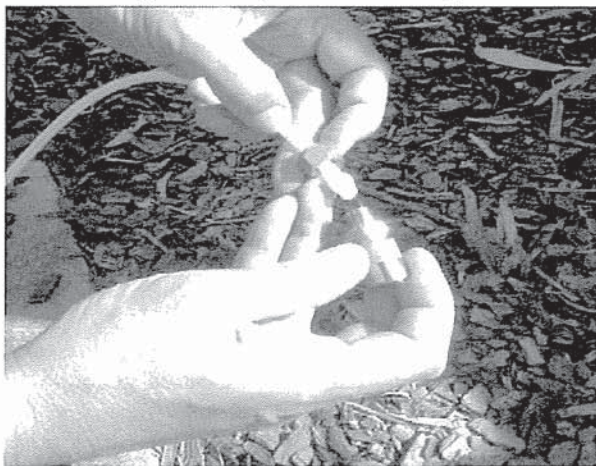
ALS supplies sealed, individually certified Critical Orifice Flow Restrictors for sampling from wells, boreholes, sub-slab and other enclosed space environments. These Flow Restrictors are assembled with appropriate critical orifice restrictors for your project specific requirements. They are dispatched evacuated, and labelled with a unique identification number. **Restrictors should never be dismantled by the user.** Flow Restrictors are configured for attachment to any 1/4" tubing using the supplied quick connect QT™ fittings, Swagelok™ nuts and ferrules.

## PREPURGE AND SAMPLING PROCEDURES

The equipment supplied by ALS is configured to allow pre-purging of the entire sample line prior to sample collection. Quick connect QT™ fittings are used to minimise the need for tools and make setup quick and secure. If the following procedure is followed, no ambient air will be introduced into the sampling system, and soil chemistry indicators such as oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) levels can be determined using field instruments prior to sampling.

**TIP: Use the supplied gauges to check the canister and Flow Restrictor are under full vacuum before commencing.**

### Connecting the Sample Line to the QT™ Valve

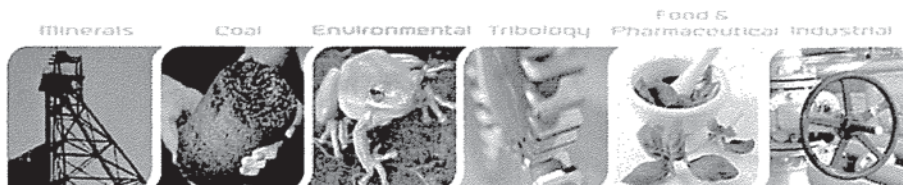


1. Attach a 1/4" sample line to the sample source (e.g. the well head nipple).
2. Connect this sample line to the female QT™ Quick Connect valve as shown (left)
3. Connect the supplied male QT™ Quick Connect valve to the line from your purge pump or O<sub>2</sub>/CO<sub>2</sub> meter, attach the purge pump/field meter using the QT™ connection and purge 3-5 line volumes.

**TIP: O<sub>2</sub>/CO<sub>2</sub> and other field measurements can be taken at this stage.**

4. Disconnect the pump from the sample line at the QT™ valve.
5. Attach the pre-purged sample line to the male QT valve on the evacuated Flow Restrictor.





## GAS CANISTER SAMPLING GUIDE

## SAMPLING FROM WELLS AND SAMPLE LINES

**TIP:** At this stage, the vacuum shown on the gauge will begin to fall as gas is drawn into the restrictor from the well. The gauge will stabilise at the well pressure/vacuum and the restrictor will contain only soil vapour.

If the vacuum shown on the gauge does not fall steadily to atmospheric or positive pressure ( $>-2$  psig), this indicates that the Flow Restrictor or sample line may be blocked or immersed in water, or that pore gas flow is severely restricted. In the former situations, the sample line must be cleared before continuing. If this check indicates low Soil Gas Permeability, consider using a slower flow rate Flow Restrictor.

6. Assemble the tripod over the male QT valve on the canister and loosely position the Flow Restrictor over the valve as shown (right). DO NOT fasten the Flow Restrictor to the canister properly at this stage as this initiates sampling.

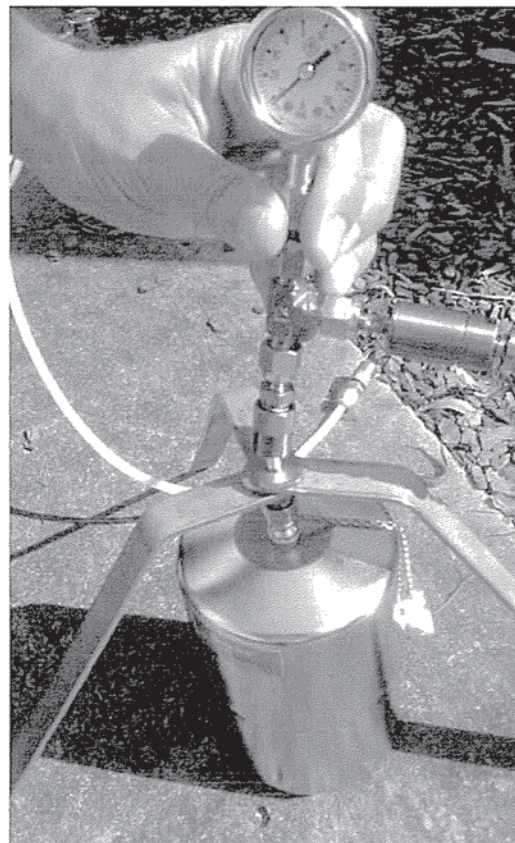
**TIP:** Record the Canister Serial Number against the ID of the Flow Restrictor (on the central T-Connection) on the COC.

7. When ready, connect the Flow Restrictor to the canister to initiate sampling. From this point the vacuum gauge will indicate the pressure differential between the restrictor and the canister. Over the sampling period, this differential will decrease until the vacuum gauge reads  $\sim 0$  psig.

**TIP:** The sample flow can be checked during sampling by detaching the sample canister. The vacuum should fall to ambient pressure as in Step 6.

**TIP:** Evidence of the integrity of the entire sampling system can be demonstrated by shrouding the canister sampling system and blanketing it with a tracer gas such as helium. Analysis for this tracer can then be requested on the Chain of Custody submitted to the laboratory.

8. On completion of sampling, disconnect the Flow Restrictor from the canister, remove all QT valves from the sampling lines and place the travel cap over the valve on the canister. Ship all ALS equipment back to the laboratory for analysis and cleaning using the containers supplied.



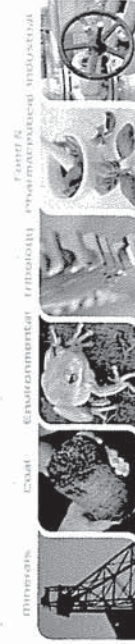
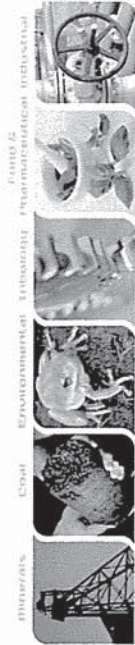
Attaching the Flow Restrictor to the canister

## NOTES

Ordering and use of ALS Canisters and Canister Sampling Equipment constitutes acceptance of the following terms:

1. This equipment remains the property of ALS Laboratory Group. Irreparably damaged or missing equipment and any equipment not returned within 40 days will be charged to the client at a replacement cost per unit equal to 15 weeks rent, less any rental costs already paid.
2. This canister sampling equipment is provided solely for the use of the nominated client. Responsibility for ensuring the equipment is not damaged and for returning this equipment to ALS remains with the nominated client until all equipment is returned to the ALS Group.
3. Unless otherwise agreed in writing, if equipment is not returned within the agreed rent free period after dispatch, the quoted rental fees above will apply per week per unit thereafter. If equipment is returned unused, unless agreed in writing, the quoted rental fees above will apply per week per unit from ALS dispatch.
4. Charges will apply for cleaning and maintenance of equipment disassembled, marked or defaced by the client. Please attach labels for sample identification and recording of field data.





## AIR SAMPLING EQUIPMENT

## DISPATCH RECORD

Inquiries: Client Services - Newcastle Phone: +61 (02) 4014 2500 E-mail: samples.newcastle@alsenviro.com

Dispatch to:	Coffey	ALS Use ONLY
Client / Office:	Alex Ructlinger	Request Received By: HW 20/9
Contact:	0427 235 873	Deliver By: Asap
Telephone:		Dispatched By: asap
ALS Quotation:		Workorder:
Delivery Address:	Level 19, Tower B - Citadel Tower 799 Pacific Hwy Chatswood NSW 2067	Agreed Rent Free Period: 14 days

SPECIAL INSTRUCTIONS:

## Air Sampling Equipment Request

## CANISTERS

No	Canister Type	Size	Gauge	Valve	Cap	Rental <sup>1</sup>
13	Minican™	1.4L	No	QT	Yes	\$120 ea

Leak Checked	Certified OK
US	26/9/17

## CONNECTORS AND FLOW CONTROL DEVICES

No	Equipment Type	Duration (min)	Flow (ml/min)	T- Piece	Gauge	Certified	Sealed / Vacuum	Connection (Conduit, Hose, Sample)	No. Returned	Rental <sup>1</sup>
11	Soil Gas Sampling Train		60ml	No	Yes	Yes	Yes / Yes	Q		Incl Above
1	Duplicate Soil Gas Sampler		60ml	Yes	Yes	Yes	Yes / Yes	Q		Incl Above
12	Female QT Connectors		-	-	-	-	-	Q		\$120 ea. Replacement
1	Male QT Connector		-	-	-	-	-	Q		\$120 ea. Replacement
1	Pressure Gauge - QT		-	-	-	-	Yes / Yes	Q		\$250 ea. Replacement
	Sampling Kit Case - Soil Gas		-	-	-	-	Yes	NA		\$200 Replacement
	Tripod		-	-	-	-	-	NA		\$80 ea. Replacement
	1/4" Swagelok connectors and ferrules (spares)		-	-	-	-	-	-		\$5 ea. Replacement

Other (specify)

<sup>1</sup> Refer to Acceptance of Terms

ALS use only		
Sampling Guide Included (Y/N)	Packed by:	Dispatch Time / Date
Number of Boxes:	2	26/9/17
Consignment Note Number:	ESN009394276	
Courier / Dispatcher:	TNT	Consignment Dispatched by:

ENFMCD01.1

11-05-11

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11-05-11

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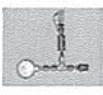

Environ Airtech - Ecology - Canberra - Geology - Gladstone - Melbourne - Newcastle - Sydney - Perth - Wollongong - Victoria - Queensland - Tasmania - Western Australia

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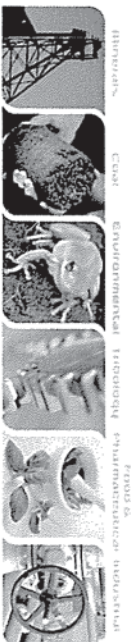
## AIR SAMPLING EQUIPMENT

## DISPATCH RECORD

## ALS SUPPLIED EQUIPMENT





Item	Quantity	Item Description	Serial Nos
	13	1.4 L Silonite Mini-Can with QT Valve	723 1301 736 1302 840 1304 869 3017 1079 5050 1095 5053 1289
	11	Soil Gas Duplicate Sampling Train (Compact) with QT Connections - 60ml/min #3	004 078 011 104 041 105 044 106 047 054 059
	1	Soil Gas Duplicate Sampling Train with QT Connections - 60ml/min #3	100

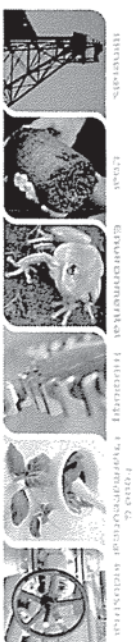




#### AIR SAMPLING EQUIPMENT

#### DISPATCH RECORD

Item	Quantity	Item Description	Serial Nos
	1	Vacuum Gauge with female QT Connection (-30 kPa)	020
	12	Female QT to 1/4" tube connector	
	1	Male QT to 1/4" tube connector	
		Tripod	



#### AIR SAMPLING EQUIPMENT

#### DISPATCH RECORD

##### Acceptance of Terms:

Acceptance and use of the accompanying ALS Air Sampling Equipment constitutes acceptance of the following terms:

1. This equipment remains the property of ALS Laboratory Group.
  2. Subject to the conditions below and unless stated otherwise in the relevant quotation, the supply and use of this equipment is included the price of analysis.
  3. No responsibility is accepted by ALS for equipment requirements that have been incorrectly or incompletely specified by the client. Interfacing of ALS equipment with other sampling equipment or structures is solely the client's responsibility.
  4. Sampling equipment is configured and supplied based on client specified requirements. ALS will take all reasonable care to meet these specifications, but will not accept responsibility for changes in equipment calibration or failures during transit. Replacement equipment will be provided at no charge if required.
  5. Equipment calibration and verification records are available for review on request. Verification reports are provided with equipment and electronic copies are available on request.
  6. This air sampling equipment is provided solely for the use of the nominated client. Responsibility for ensuring the equipment is not damaged and for returning this equipment to ALS remains with the nominated client until all equipment is returned to the ALS Group.
  7. Unless otherwise agreed in writing, if equipment is not returned within the agreed rent free period after dispatch, the quoted rental fees above will apply per week per unit thereafter. If equipment is returned unused, the cleaning fees quoted will apply (1 weeks rental charge). If sampling equipment return is delayed, please contact the laboratory prior to expiry of the rent free period to negotiate and extension.
  8. Irreparably damaged equipment and any equipment not returned within 40 days will be charged to the client at a replacement cost per unit equal to 15 weeks rent, less rental costs already paid.
  9. Cleaning costs will apply for equipment marked or defaced by the client. Please attach labels for
- If these conditions are not acceptable please return all equipment to ALS Newcastle immediately.

#### EQUIPMENT SUPPLY AND LOGISTICS

Additional air sampling equipment can be ordered through any ALS Environmental Laboratory and supplied direct to your site or office by courier. For the fastest turnaround, equipment should be returned direct to Newcastle Laboratory.

ALS Environmental, Newcastle  
5/585 Maitland Road  
Mayfield West, NSW 2304

Note that Dangerous Goods Transport Regulations may apply after sampling if the air cylinders are pressurised or contain hazardous materials.

ENHAC081.1 11-06-11

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## Canister Verification Report

**Canister No:** 723

<b>Specified Purpose:</b>	USEPA TO15 (Extended Suite) Ambient Air	<b>Verification Date:</b>	21-Sep-2017
		<b>Valid To (At least):</b>	19-Oct-2017
		<b>Verification File:</b>	170921_13.D
<b>Canister Type:</b>	Entech Silonite - 'MiniCan'	<b>Last Stability Check:</b>	31-Mar-2015
<b>Canister Size:</b>	1400mL	<b>Next Check Scheduled:</b>	29-Mar-2020
<b>Valve Type:</b>	QT - Quick Connect	<b>Analyst:</b>	Dale Sample
<b>Dispatch Pressure:</b>	<0.01 psia	<b>Approved for Dispatch by:</b>	<i>[Signature]</i> 26/9/17

### Canister Verification Protocol

Canisters are verified 'fit for purpose' for the requested analyses and applications (if known). For most applications, canisters are verified clean according to the requirements of USEPA method TO15.

Each verification involves a check for contamination, leaks and damage to valves. Stability checks are performed after 5 years or if damage to the canister is suspected, then every two years, within the designated holding time to ensure each canister is capable of holding the target chemicals without significant degradation.

ALS METHOD CODE: EP101

REFERENCE METHOD: Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) in air collected in specially-prepared Canisters and analysed by Gas Chromatography/Mass Spectrometry (GC/MS)

ALS METHOD CODE: EP104

Target Compound	Alt. Name	Qualifiers	Verification	Result
			Goal (<) ppbv	
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform		0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride		0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride		0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride		0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride		0.2	<0.2
1,2-Dichloroethane	Ethylene chloride		0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene		0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide		0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene		0.2	<0.2
1,2-Dichloropropane	Propylene dichloride		0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene		0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene		0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene		0.2	<0.2
Benzene	Cyclohexatriene		0.2	<0.2
Bromomethane	Methyl bromide		0.2	<0.2
Tetrachloromethane	Carbon tetrachloride		0.2	<0.2
Chlorobenzene	Phenyl chloride		0.2	<0.2
Chloroethane	Ethyl chloride		0.2	<0.2
Chloroform	Trichloromethane		0.2	<0.2
Chloromethane	Methyl chloride		0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene		0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene		0.2	<0.2
Ethylbenzene	Phenyl ethane		0.2	<0.2
Freon 12	Dichlorodifluoromethane		0.2	<0.2
Freon 11	Trichlorofluoromethane		0.2	<0.2
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane		0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane		0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene		0.2	<0.2

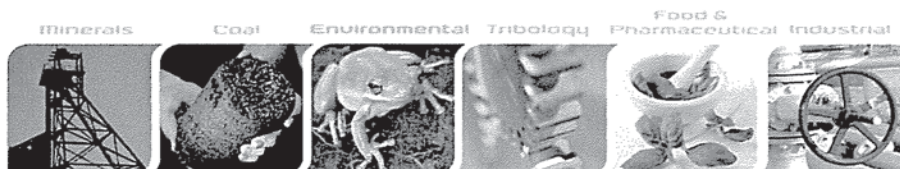
Qualifiers - F: Fails Stability Check, V: Fails Verification

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ALS METHOD COVER LIST

Target Compound	Alt. Name	Qualifiers	Verification	Result
			Goal (<) ppbv	
Dichloromethane	Methylene chloride		0.2	<0.2
m- & p-Xylene	1,3 & 1,4 -Dimethylbenzene		0.4	<0.4
o-Xylene	1,2-Dimethylbenzene		0.2	<0.2
Styrene	Vinyl benzene		0.2	<0.2
Tetrachloroethene	PCE / Perchloroethylene		0.2	<0.2
Toluene	Methyl Benzene		0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene		0.2	<0.2
Trichloroethene	TCE / Trichloroethylene		0.2	<0.2
Vinyl chloride	Chloroethene		0.2	<0.2
1,2,4-Trichlorobenzene			0.2	<0.2
1,3-Butadiene	Biethylene		0.2	<0.2
1,4-Dioxane	p-Dioxane		0.2	<0.2
2,2,4-Trimethylpentane	Isooctane		0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene		0.2	<0.2
Acetone	2-Propanone		0.2	<0.2
Allyl chloride	3-Chloropropene		0.2	<0.2
Bromodichloromethane	Dichlorobromomethane		0.2	<0.2
Bromoform	Tribromomethane		0.2	<0.2
Carbon disulfide	CS2		0.2	<0.2
Cyclohexane			0.2	<0.2
Dibromochloromethane	Chlorodibromoethane		0.2	<0.2
Ethyl acetate	Acetic ester		0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol		0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone		0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone		0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone		0.2	<0.2
Methyl tert-butyl ether	MTBE		0.2	<0.2
n-Heptane			0.2	<0.2
n-Hexane			0.2	<0.2
Propene	Propylene		0.2	<0.2
Tetrahydrofuran	THF		0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene		0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester		0.2	<0.2
Bromoethene	Vinyl bromide		0.2	<0.2
Benzyl chloride	α-Chlorotoluene		0.2	<0.2
Ethanol	Ethyl alcohol		0.2	<0.2
Acetonitrile	Methyl cyanide		0.2	<0.2
Acrolein	2-Propenal		0.2	<0.2
Acrylonitrile	2-Propenenitrile		0.2	<0.2
tert-Butyl alcohol	TBA		0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene		0.2	<0.2
Diisopropyl Ether	DIPE		0.2	<0.2
Ethyl tert-butyl ether	ETBE		0.2	<0.2
tert-Amyl methyl ether	TAME		0.2	<0.2
Methyl methacrylate	MMA		0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride		0.2	<0.2
Isopropylbenzene	Cumene		0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene		0.2	<0.2
n-Propylbenzene	Phenyl propane		0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene		0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene		0.2	<0.2
2-Isopropyltoluene	o-Cymene		0.2	<0.2
n-Butylbenzene	Phenyl butane		0.2	<0.2
Naphthalene			0.2	<0.2

Qualifiers - F: Fails Stability Check, V: Fails Verification

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## Canister Verification Report

**Canister No:** 736

<b>Specified Purpose:</b>	USEPA TO15 (Extended Suite) Ambient Air	<b>Verification Date:</b>	21-Sep-2017
		<b>Valid To (At least):</b>	19-Oct-2017
		<b>Verification File:</b>	170921_15.D
<b>Canister Type:</b>	Entech Silonite - 'MiniCan'	<b>Last Stability Check:</b>	15-Jan-2015
<b>Canister Size:</b>	1400mL	<b>Next Check Scheduled:</b>	14-Jan-2020
<b>Valve Type:</b>	QT - Quick Connect	<b>Analyst:</b>	Date Sample
<b>Dispatch Pressure:</b>	<0.01 psia	<b>Approved for Dispatch by:</b>	15 26/9/17

### Canister Verification Protocol

Canisters are verified 'fit for purpose' for the requested analyses and applications (if known). For most applications, canisters are verified clean according to the requirements of USEPA method TO15.

Each verification involves a check for contamination, leaks and damage to valves. Stability checks are performed after 5 years or if damage to the canister is suspected, then every two years, within the designated holding time to ensure each canister is capable of holding the target chemicals without significant degradation.

ALS METHOD CODE: EP101

REFERENCE METHOD: Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) in air collected in specially-prepared Canisters and analysed by Gas Chromatography/Mass Spectrometry (GC/MS)

ALS METHOD CODE: EP104

Target Compound	Alt. Name	Qualifiers	Verification	Result
			Goal (<) ppbv	
1,1,1-Trichloroethane	1,1,1-TCA / Methyl chloroform		0.2	<0.2
1,1,2,2-Tetrachloroethane	R-130 / Acetylene tetrachloride		0.2	<0.2
1,1,2-Trichloroethane	Vinyl trichloride		0.2	<0.2
1,1-Dichloroethane	Ethylidene chloride		0.2	<0.2
1,1-Dichloroethene	1,1-DCE / Vinylidene chloride		0.2	<0.2
1,2-Dichloroethane	Ethylene chloride		0.2	<0.2
1,2,4-Trimethylbenzene	Pseudocumene		0.2	<0.2
1,2-Dibromoethane	EDB / Ethylene dibromide		0.2	<0.2
1,2-Dichlorobenzene	o-Dichlorobenzene		0.2	<0.2
1,2-Dichloropropane	Propylene dichloride		0.2	<0.2
1,3,5-Trimethylbenzene	Mesitylene		0.2	<0.2
1,3-Dichlorobenzene	m-Dichlorobenzene		0.2	<0.2
1,4-Dichlorobenzene	p-Dichlorobenzene		0.2	<0.2
Benzene	Cyclohexatriene		0.2	<0.2
Bromomethane	Methyl bromide		0.2	<0.2
Tetrachloromethane	Carbon tetrachloride		0.2	<0.2
Chlorobenzene	Phenyl chloride		0.2	<0.2
Chloroethane	Ethyl chloride		0.2	<0.2
Chloroform	Trichloromethane		0.2	<0.2
Chloromethane	Methyl chloride		0.2	<0.2
cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene		0.2	<0.2
cis-1,3-Dichloropropene	cis-1,3-Dichloropropylene		0.2	<0.2
Ethylbenzene	Phenyl ethane		0.2	<0.2
Freon 12	Dichlorodifluoromethane		0.2	<0.2
Freon 11	Trichlorofluoromethane		0.2	<0.2
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane		0.2	<0.2
Freon 114	1,2-Dichlorotetrafluoroethane		0.2	<0.2
Hexachlorobutadiene	Hexachloro-1,3-Butadiene		0.2	<0.2

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Target Compound	Alt. Name	Qualifiers	Verification	Result
			Goal (<) ppbv	
Dichloromethane	Methylene chloride		0.2	<0.2
m- & p-Xylene	1,3 & 1,4 -Dimethylbenzene		0.4	<0.4
o-Xylene	1,2-Dimethylbenzene		0.2	<0.2
Styrene	Vinyl benzene		0.2	<0.2
Tetrachloroethene	PCE / Perchloroethylene		0.2	<0.2
Toluene	Methyl Benzene		0.2	<0.2
trans-1,3-Dichloropropene	trans-1,3-Dichloropropylene		0.2	<0.2
Trichloroethene	TCE / Trichloroethylene		0.2	<0.2
Vinyl chloride	Chloroethene		0.2	<0.2
1,2,4-Trichlorobenzene			0.2	<0.2
1,3-Butadiene	Biethylene		0.2	<0.2
1,4-Dioxane	p-Dioxane		0.2	<0.2
2,2,4-Trimethylpentane	Isooctane		0.2	<0.2
4-Ethyltoluene	p-Ethyltoluene		0.2	<0.2
Acetone	2-Propanone		0.2	<0.2
Allyl chloride	3-Chloropropene		0.2	<0.2
Bromodichloromethane	Dichlorobromomethane		0.2	<0.2
Bromoform	Tribromomethane		0.2	<0.2
Carbon disulfide	CS2		0.2	<0.2
Cyclohexane			0.2	<0.2
Dibromochloromethane	Chlorodibromoethane		0.2	<0.2
Ethyl acetate	Acetic ester		0.2	<0.2
Isopropyl alcohol	Isopropanol / 2-Propanol		0.2	<0.2
Methyl butyl ketone	MBK / 2-Hexanone		0.2	<0.2
Methyl ethyl ketone	MEK / 2-Butanone		0.2	<0.2
Methyl isobutyl ketone	MIBK / 4-Methyl-2-pentanone		0.2	<0.2
Methyl tert-butyl ether	MTBE		0.2	<0.2
n-Heptane			0.2	<0.2
n-Hexane			0.2	<0.2
Propene	Propylene		0.2	<0.2
Tetrahydrofuran	THF		0.2	<0.2
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene		0.2	<0.2
Vinyl acetate	Acetic acid vinyl ester		0.2	<0.2
Bromoethene	Vinyl bromide		0.2	<0.2
Benzyl chloride	α-Chlorotoluene		0.2	<0.2
Ethanol	Ethyl alcohol		0.2	<0.2
Acetonitrile	Methyl cyanide		0.2	<0.2
Acrolein	2-Propenal		0.2	<0.2
Acrylonitrile	2-Propenenitrile		0.2	<0.2
tert-Butyl alcohol	TBA		0.2	<0.2
2-Chloroprene	2-Chloro-1,3-butadiene		0.2	<0.2
Diisopropyl Ether	DIPE		0.2	<0.2
Ethyl tert-butyl ether	ETBE		0.2	<0.2
tert-Amyl methyl ether	TAME		0.2	<0.2
Methyl methacrylate	MMA		0.2	<0.2
1,1,1,2-Tetrachloroethane	R-130a / Acetylene trichloride		0.2	<0.2
Isopropylbenzene	Cumene		0.2	<0.2
2-Chlorotoluene	o-Chlorotoluene		0.2	<0.2
n-Propylbenzene	Phenyl propane		0.2	<0.2
tert-Butylbenzene	1,1-Dimethylethylbenzene		0.2	<0.2
sec-Butylbenzene	1-Methylpropylbenzene		0.2	<0.2
2-Isopropyltoluene	o-Cymene		0.2	<0.2
n-Butylbenzene	Phenyl butane		0.2	<0.2
Naphthalene			0.2	<0.2

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