



Sampling and Analysis of Soil Gas using Canisters

INTRODUCTION

Interest in **Soil Gas** has increased significantly in recent years as the focus has broadened from direct measurements of soil contamination to human exposure risks through Vapour Intrusion. This change is reflected in the **Vapour and Soil Gas Investigations** section of the draft 2011 National Environment Protection Measure (NEPM) for **Contaminated Sites**, which states: "Soil vapour measurements may be considered to be a more accurate assessment of vapour risks than measurements from bulk soil or groundwater."

ALS CAPABILITIES

The ALS Newcastle *Centre of Excellence for Air* offers comprehensive **NEPM compliant Soil Gas Analyses** utilizing canisters. This complements existing ALS **Ambient & Indoor Air** capabilities, all of which are required for a complete Vapour Intrusion Conceptual Site Model and potential remediation strategies.

ALS NATA accreditation includes some **Petroleum Hydrocarbons** listed in the NEPM plus a broad range of other VOCs e.g. Chlorinated Hydrocarbons, Alcohols, Ketones, Aldehydes, CFCs, Ethers, Esters, Nitriles, Carbon Disulfide, and Saturated Heterocyclics. Testing capabilities are being extended to include further hydrocarbon bands (TRH), SVOCs and sulfur gases. ALS can also facilitate light hydrocarbon analysis (including methane) and permanent gases (CO₂, CO and O₂). ALS LORs meet NEPM table 1A(2) and 1A(5) criteria.

REPORTING

In the absence of client-provided field data, results are reported based on a soil gas temperature of 15°C and pressure of 101.3kpa. If no field data was provided, reported results could bias by a relatively low 12% for a significant change in soil gas temperature e.g. 8°C and pressure e.g. 3kpa."

ALS METHOD CODES: EP101-SG

LOR: Typically 0.05 - 20 mg/m³

Reference Methods: USEPA TO14ar & TO15r



SOIL GAS SAMPLING EQUIPMENT

NEPM stipulates that **sample size should be minimized**. ALS provides 1.4L 'Mini-Cans' and flow restrictors, which allow an upper gas flow limit to be set during sampling.

The ALS sampling kit includes: evacuated, individually verified clean, 'Mini-Cans' with **critical orifice flow restrictors and quick connect snap-lock valves**, which minimize potential for contamination during transit and reducing the need for tools in the field; **T fittings and pressure gauges** to allow purging and leak testing prior to sampling; plus **Laboratory-calibrated flow controllers**, which facilitate a range of flow rates, including the lower flows recommended for clay and compacted soils (with no field adjustment necessary); plus an acceptance form, a packing list, a canister specific COC and Canister Verification Report Reference.

The sampling train is lined with inert Silonite™, a coating that limits surface catalysed reactions and ensures sample stability over time. The train is designed for easy connection to ¼" OD tubing using industry standard Swagelok™ fittings.

ALS has a strong focus on ensuring that project requirements are clearly communicated. Forms record the equipment ALS is supplying, detailing any common additional items that may be required and whether or not ALS provides these.

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ADVANTAGES OF USING CANISTERS FOR SOIL GAS

Sampling of Soil Gas via canister has numerous advantages over other methods. These include ease of use, robustness of technique, broad applicability to a wide range of sampling conditions and analytical demands. A comparison of the various Soil Gas options is provided below.

Advantages offered by Sampler Type	Canisters	Sorbents (e.g. TD)	Bags (Tedlar®)
• Sample is suitable for Grab sampling	✓	✗	✓
• Sample is suitable for Integrated sampling	✓	✓	✓
Allows multiple measurements on the original sample	✓	✗	✓
Holding times: Samples are stable (ambient conditions) for up to 30 days	✓	✗	✗
Applicability/Versatility: Can capture almost all components of interest	✓	✗	✗
Range of contaminant levels: Suitable for a wide concentration range	✓	✗	✓
Suitable for analysis of high humidity samples (e.g. from very wet soil)	✓	✗	✗
Allows testing of Soil Chemistry Indicators (CO ₂ , CO, O ₂)	✓	✗	✓
Suitable for methane and light hydrocarbons e.g. C10-C16 as per NEPM	✓	✗	✓
Safety / Ease of use: No pumps, ignition sources or site flow measurement	✓	✗	✗

GUIDELINE LEVELS

The interim Health Investigation Levels (HILs) and Health Screening Levels (HSLs) for Soil Gas contaminants detailed in the draft 2011 NEPM for Assessment of Site Contamination are met with ALS LORs typically five times below the guideline (see adjacent for VOCs and below for draft NEPM guidelines for BTEXN and Hydrocarbon analyses on one matrix category).

Table 1A(2) Interim health investigation levels for volatile organic chlorinated compounds

	Residential A	Residential B	Recreational C	Commercial/Industrial D
Chemical	Interim soil gas HIL** (mg/m ³)			
TCE	2	2	-	15
1,1,1-TCA	260	260	-	1800
PCE	10	10	-	70
cis-1,2-dichloroethene	2	2	-	10
vinyl chloride	0.3	0.3	-	2

Table 1A(5) HSLs soil gas (mg/m³)

Chemical ⁽⁶⁾	HSL A (low density residential)					HSL B (high density residential) ⁽⁴⁾				
	0 to <1m	1m to <2m	2m to <4m	4m to <8m	8m+	0 to <1m	1m to <2m	2m to <4m	4m to <8m	8m+
<i>Sand(sand, sandy clay, sandy clay loam, sandy loam, loamy sand, loam, sandy silt and silty sand)</i>										
Toluene	1,500	4,400	8,600	17,000	34,000	1,300	3,800	7,300	15,000	29,000
Ethylbenzene	390	1,300	2,500	5,100	10,000	330	1,100	2,200	4,300	8,700
Xylenes	260	880	1,800	3,600	7,200	220	750	1,500	3,000	6,100
Naphthalene	0.9	4	7	15	30	0.8	3	6	10	25
Benzene	1	3	7	15	25	1	3	6	10	20
C6-C10	210	750	1,500	3,100	6,300	180	640	1,300	2,600	5,300
>C10-C16	160	650	1,400	2,800	NL	130	560	1,200	2,400	4,800

TECHNICAL SUPPORT

Guidance on the choice of sampling equipment is available upon request and technical queries should be directed to the ALS Centre of Excellence for Air in Newcastle on (02) 4968 9433 or newcastle@alsglobal.com.

LOGISTICS and SUPPLY

Equipment should be ordered directly through ALS Newcastle, given the technical requirements. These will be road couriered to your site or office. Samples can be delivered via other ALS Environmental offices, however for the fastest turnaround, canisters should be returned direct to ALS Newcastle. Note that Dangerous Goods Transport Regulations may apply after sampling if the cylinder is pressurised or contains significant levels of hazardous materials. Equipment rental is included in the cost of analysis (subject to prompt return).

REFERENCES

National Environment Protection (Assessment of Site Contamination) Measure April 2011 (2010 Draft for Comment)

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