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SOIL SAMPLING & CHEMICAL ANALYSIS
BRAEHEAD OF ARRY BY KEITH

1.0 INTRODUCTION

The following outlines a summary of the chemical analysis results of a targeted focussed contaminated land investigation on a site at Braehead Quarry near Keith, in Moray.

The site lies adjacent to a former landfill operated by Moray Council. The proposed development, a single dwelling house is to be located on land that did not form part of the landfill. The site however is part of the former quarry and lime extraction works as can be seen by the former stone built kilns adjacent to the site.

The underlying strata is well-compacted quarry waste from the former works seen as firm to stiff grey slightly sandy clay.

2.0 INVESTIGATION

The purpose of the soil sampling was to confirm the absence and/or presence of potential soil and shallow groundwater contamination arising from past activities on the site namely the adjacent landfill and the quarry works. The potential source of any contamination affecting development will be the back-filled materials from the quarry works and any migration from the landfill. Records indicate that the landfill was licensed for domestic waste disposal where much of the waste was also set alight forming small bonfires. A trial pitting exercise was designed to assess the above which comprised the excavation of 5 trial pits into underlying natural strata. The location of the trial pits is seen on the attached sketch plan.

Table 1. Summary of Chemical Analysis Test Results

	CLEA Soil Guideline Values	Soil Code Values	Dutch Intervention Value	TP1 0.50m	TP1 1.00m	TP 2 0.50m	TP2 1.00m	TP 3 0.50m	TP3 1.00m	TP4 0.50m	TP 4 1.00m	TP 5 0.50m	TP5 1.00m
pH				6.5	6.1	6.4	6.2	6.1	6.8	6.4	6.3	6.3	6.1
Arsenic	20			15	9	17	8	16	9	21	14	23	7
Cadmium	1/28 (1)			2.9	<1.0	2.6	<1.0	3.1	1.0	1.3	<1.0	1.8	<1.0
Chromium (Total)	150			31	5	28	8	38	6	47	17	42	3
Mercury	8			0.4	0.2	0.4	<0.1	0.5	0.1	0.3	0.3	0.2	<0.1
Nickel	50			27	<1.0	33	<1.0	2.1	1.8	2.2	<1.0	1.9	<1.0
Selenium	35			1.1	<0.10	1.8	<0.10	2.1	1.2	2.2	<0.10	1.9	<0.10
Lead	450			89	9	182	12	200	14	202	19	196	6
Copper		80/100/135/200 (2)		42	4.4	68	1.6	72	2.2	55	7.6	61	3.2
Zinc		200/300 (3)		114	31	98	2	87	15	105	87	92	4
Boron		3 (4)		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
<i>TPM Speciated</i>													
CRD				<10		<10		<10		<10		<10	
DKO				<10		<10		<10		<10		<10	
MRO				<10		<10		<10		<10		<10	
Total TPM			1000	<10		<10		<10		<10		<10	

pH

pH levels ranged from 6.1 (TP1, 3 & 5) to 6.8 (TP3 1.00m) with an average pH value of 6.3 indicating slightly acidic conditions.

CLEA Priority Contaminants

Concentrations have been assessed with reference to a residential with garden end use. This is the most appropriate of the CLEA assessment criteria and results observed to fall below these guideline values can be deemed suitable for any future use.

All metal concentrations analysed were below their respective SGV concentrations for the CLEA priority contaminants (arsenic, cadmium, chromium, lead, mercury, nickel and selenium).

Phytotoxic Metals

All levels of metals determinands were below respective Soil Code values.

Boron levels were below the 'Normal Concentration range in Soil' value of 3mg/kg provided in ICRCCL 23/79, being below analytical detection limits.

Total Petroleum Hydrocarbons (TPH)

Five samples were selected for speciated TPH analysis. Samples were also below analytical detection limits.

BTEX and PAH

Five samples were selected for Benzene, Toluene, Ethylbenzene and Xylene (BTEX) and speciated Polycyclic Aromatic Hydrocarbon (PAH) analysis. All samples analysed were below analytical detection limits.

Volatile Organic Compounds (VOCs)

Two samples were analysed for VOC analysis. VOC concentration was shown to be below the analytical detection limit in all samples analysed.



GAS MONITORING
BRAHEAD BY KEITH

INTRODUCTION :

LDG - Grampian Soil Surveys were retained by Mr & Mrs K Cowie to undertake the survey.

The survey was carried out in order to monitor, if present, any gas migration from the adjacent landfill site to the site of the proposed dwelling house.

SITE WORK :

At five locations gas monitoring points were installed to a depth of 4m bgl. The locations of the gas monitoring installations were decided taking in to account the site boundary and the proposed location of the dwelling house. Four are located along the boundary and one at the location of the proposed house. The attached site plan indicates the locations of the monitoring points.

Installations

Trial pits were initially machine excavated to a depth of 4m bgl. Prior to back filling a 4.5metre length of steel casing, 200mm internal diameter was placed into the pit.



The pit was then back filled using the excavated material ensuring that the pipe remained vertical and secure. At 0.30m below ground thick plastic sheeting was laid over the trial pits with a slot for the steel pipe and then covered with further excavated materials to existing ground level.

The 50mm diameter slotted gas-monitoring pipe was then placed inside the steel casing. Pea gravel, 5-10mm size, was poured into the steel casing to surround the slotted pipe and well packed. The steel casing was then pulled free of the trial pit leaving the slotted pipe with gravel pack surround. At 0.30m below existing ground level the installation was sealed using bentonite pellets and a gas tap was installed on the pipe for monitoring.

The installations were clearly indicated with a marker peg.

Monitoring

The first set of readings were taken on the 16th May 2003 and continued fortnightly with the last readings for this report taken on the 9th August 2003.

Gas Monitoring Readings

The gas installations were monitored using a Gas Data LMS, ref. GSS LMSX2. Calibration due 15th November 2003.

The readings are tabulated below :-

16 May 2003

Location	G1	G2	G3	G4	G5
Time	12:05	12:18	12:23	12:29	12:35
Atmospheric Pressure (mb)	997	997	998	997	997
Air Temperature (°C)	20.2	20.3	20.1	20.2	20.1
Borehole Gas Temperature (°C)	17.2	17.6	17.1	17.4	17.1
CH ₄ (%)	Steady State	0.0	0.0	0.0	0.0
CO ₂ (%)	Steady State	2.1	0.3	0.7	0.6
O ₂ (%)	Steady State	18.1	19.8	19.3	20.0

30 May 2003

Location	G1	G2	G3	G4	G5
Time	11:45	11:55	12:06	12:16	12:22
Atmospheric Pressure (mb)	934	954	955	955	955
Air Temperature (°C)	14.1	14.2	14.1	14.3	14.2
Borehole Gas Temperature (°C)	9.1	9.6	9.6	9.5	8.9
CH ₄ (%)	0.0	0.0	0.0	0.0	0.0
CO ₂ (%)	1.8	0.2	0.6	0.4	0.6
O ₂ (%)	19.2	19.9	19.5	20.0	19.7

16 June 2003

Location	G1	G2	G3	G4	G5
Time	14:42	14:53	14:59	15:05	15:11
Atmospheric Pressure (mb)	989	989	989	989	989
Air Temperature (°C)	13.1	15.2	15.2	15.4	15.4
Borehole Gas Temperature (°C)	12.5	12.8	13.2	14.9	13.9
CH ₄ (%)	0.0	0.0	0.0	0.0	0.0
CO ₂ (%)	1.6	0.2	0.4	0.4	0.4
O ₂ (%)	19.4	19.8	19.8	19.9	19.9

26 June 2003

Location	G1	G2	G3	G4	G5
Time	08:32	08:38	08:46	08:58	09:05
Atmospheric Pressure (mb)	996	996	996	996	995
Air Temperature (°C)	17.5	17.5	17.5	17.5	17.5
Borehole Gas Temperature (°C)	15.2	15.7	16.1	15.2	15.3
CH ₄ (%)	0.0	0.0	0.0	0.0	0.0
CO ₂ (%)	1.0	0.0	0.2	0.0	0.4
O ₂ (%)	19.7	20.1	19.9	20.2	19.8

12 July 2003

Location	G1	G2	G3	G4	G5
Time	18:06	18:12	18:20	18:28	18:36
Atmospheric Pressure (mb)	1003	1003	1003	1003	1003
Air Temperature (°C)	21.3	21.5	21.3	21.4	21.4
Borehole Gas Temperature (°C)	17.5	17.3	17.9	18.1	16.9
CH ₄ (%)	0.0	0.0	0.0	0.0	0.0
CO ₂ (%)	0.5	0.0	0.0	0.0	0.0
O ₂ (%)	19.9	20.1	20.2	20.2	20.1

23 July 2003

Location	G1	G2	G3	G4	G5
Time	15:20	15:28	15:34	15:40	15:50
Atmospheric Pressure (mb)	1009	1009	1009	1008	1009
Air Temperature (°C)	21.5	21.5	21.4	21.4	21.4
Borehole Gas Temperature (°C)	17.6	17.5	17.9	16.2	15.8
CH ₄ (%)	0.0	0.0	0.0	0.0	0.0
CO ₂ (%)	0.5	0.0	0.0	0.0	0.0
O ₂ (%)	19.8	20.2	20.2	20.1	20.1

9 August 2003

Location	G1	G2	G3	G4	G5
Time	09:10	09:15	09:22	09:30	09:38
Atmospheric Pressure (mb)	1012	1011	1011	1011	1011
Air Temperature (°C)	20.9	21.1	21.1	21.2	20.8
Borehole Gas Temperature (°C)	17.1	17.2	16.8	15.2	18.1
CH ₄ (%)	Steady State	0.0	0.0	0.0	0.0
CO ₂ (%)	Steady State	0.4	0.0	0.0	0.1
O ₂ (%)	Steady State	19.8	20.1	20.2	19.9

CONCLUSIONS:

From the readings taken during the monitoring period of 16 May to 9 August 2003 it is shown that :-

1. there is no concentration of methane, CH₄, gas flow from the landfill site to the proposed house site.
2. although the concentration of carbon dioxide, CO₂, in G1 exceeds the 1.5%* by volume the flow is shown to decrease with time. (* Dept. Environment - Waste Management Paper No. 26A : Landfill Completion)

RECOMMENDATIONS:

The presence of landfill vapours should continue to be monitored during the development of the site.

Construction design should counter the risk of vapour accumulation. For this an impermeable gas membrane should be constructed in accordance with BRE papers BR212 : Construction of new buildings on gas contaminated land (1991) and BR414 : Protective measures for housing on gas contaminated land (2001). Further ventilation below the floorboards should also prevent vapour accumulation.

For and on behalf of LDG – Grampian Soil Surveys (UK) Limited

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 Senior Engineer

25 August 2003