

SOIL TESTS

Determinand	Laboratory	MRL	Accreditation		Lab Test Method Ref	Summary
			UKAS	MCERTS		
Explosives	BAE	shown below	√	√	ESAL/QC/4k and ESAL/QC/4n	Overnight 2:1 solvent extraction of prepared soil samples. Analysis of extracts by Isocratic and Gradient High Performance Liquid Chromatography incorporating Ultra Violet absorption detectors capable of dual wavelength detection. Analysis by GC-TEA for EGDN and NG down to 0.1 mg/Kg
NC		5000mg/kg				
HMX		2mg/kg				
RDX		2mg/kg				
EGDN		0.1mg/kg				
Tetryl		1mg/kg				
NG		0.1mg/kg				
TNT		0.5mg/kg				
PETN		5mg/kg				
HNS		0.5mg/kg				
Picrite		0.25mg/kg				
Picric Acid		0.1mg/kg				
2, 6 DNT		1mg/kg				
2, 4 DNT		1mg/kg				
Metals	BAE	Shown Below			ESAL/QC/4ICA P	Aqua Regia digestion of soil samples based on ISO11.466 using a semi sealed system to retain volatile elements of interest followed by analysis using ICP-OES.
AS		1mg/kg	√	√		
Cd		0.3m/kg	√	√		
Cu		2mg/kg	√	√		
Cr		3mg/kg	√	√		
Ni		3mg/kg	√	√		
Pb		2mg/kg	√	√		
Zn		3mg/kg	√	√		
Ba		5mg/kg	√	√		
Be		0.3mg/kg	√	√		
BI		2mg/kg	√	-		
Mg		20mg/kg	√	-		

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Mn		5mg/kg	√	√		
Mo		2mg/kg	√	√		
Sb		5mg/kg	-	-		
Sn		20mg/kg	√	-		
Sr		5mg/kg	√	-		
Ti		4mg/kg	√	-		
V		3mg/kg	√	√		
Mercury		1mg/kg	√	√		
Selenium		1mg/kg	√	√		
Phosphorous		10mg/kg	√	√		
PAH	BAE	0.1mg/kg	√	√	ESAL/QC/4s	Overnight 2:1 Dichloromethane extraction of prepared soils followed by analysis using a fully automated GC-MS system.
SVOC	BAE	1 - 4 mg/kg	√		ESAL/QC/4w	An air - dried sample of soil is extracted with dichloromethane. The extract is concentrated and analysed by GC-MS.
TPH	BAE	Shown below	√	√	ESAL/QC/4v, ESAL/QC/4PRO	
C5 – C6		1.5mg/kg				For the PRO range, an as-received sub-sample of soil is extracted with methanol. The extract is analysed by Headspace GC-MS. For the DRO range, an air-dried sub-sample of soil is extracted with Dichloromethane. The extract is analysed by GC-FID.
C6 – C8		2mg/kg				
C8 – C10		1mg/kg				
C10 – C12		2mg/kg				
C12 – C16		10mg/kg				
C16 – C21		10mg/kg				
C21 – C35		20mg/kg				
MTBE		0.5mg/kg				
Benzene		0.5mg/kg				
Toluene		0.5mg/kg				
Ethyl Benzene		0.5mg/kg				
m,p-Xylene		0.5mg/kg				
o-Xylene		0.5mg/kg				
TPHCWG	BAE	Shown below	√	-	ESAL/QC/PRO AROMATIC, ESAL/QC/DRO FRAC	

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Benzene Toluene Ethyl Benzene m,p-Xylene o-Xylene MTBE C5-C6 aliphatic >C6-C8 aliphatic >C8-C10 aliphatic >C10-C12 aliphatic >C12-C16 aliphatic >C16-C21 aliphatic >C21-C35 aliphatic >C8-C10 aromatic >C10-C12 aromatic >C12-C16 aromatic >C16-C21 aromatic		0.02 mg/kg 0.10 mg/kg 0.10 mg/kg 0.10 mg/kg 0.10 mg/kg 0.10 mg/kg 1.5 mg/kg 2.0 mg/kg 1.0 mg/kg 2.0 mg/kg 20 mg/kg 20 mg/kg 20 mg/kg 1.00 mg/kg 1.00 mg/kg 1.00 mg/kg 1.00 mg/kg				<p>For the PRO range, an as-received sub-sample of soil is extracted with methanol. The extract is analysed by Headspace GC-MS. For the DRO range, an air-dried sub-sample of soil is extracted with Dichloromethane. The extract is analysed by GC-FID.</p> <p>Aliphatic and aromatic fractions are separated using an automated SPE system for DRO compounds and by Selective Ion Monitoring for PRO compounds.</p>
PCB's	Bodycote, Runcorn	Shown below	√	√	SOP 10	Samples are pre-extracted with propan-2-ol and then extracted into hexane. This extract is then concentrated prior to clean up with an alumina silver nitrate column. PCB's are determined by GC-ECD.
PCB 28 PCB 52 PCB 101 PCB 118 PCB 138 PCB 153 PCB 180		5µg/kg				
PCB's	Bodycote, Clydebank	Shown below	√	√	GCMS	
PCB28 PCB52 PCB101 PCB118						Samples are pre-extracted with propan-2-ol and then extracted into hexane. This extract is then concentrated prior to clean up

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PCB138 PCB153 PCB180		1µg/kg				with an alumina silver nitrate column. PCB's are determined by GC-ECD.
VOCs	BAE	25-100µg/kg	√	√	ESAL/QC/4t	An as - received soil sample is treated with matrix modifier, sealed in a glass vial and analysed by headspace GC-MS.
Sulphur	BAE	20mg/kg	√	√	ESAL/QC/4u	Overnight 5:1 Dichloromethane extraction of prepared soils followed by analysis of extracts by Isocratic High Performance Liquid Chromatography incorporating UV absorption detectors.
Sulphate	BAE	50mg/kg	√	√	ESAL/QC/TOT SULPHATE	10:1 Concentrated Hydrochloric Acid extraction of soil sample followed by analysis using ICP-OES.
Hexamine	Bodycote	0.5mg/kg	-	-	AN42	Hexamine, dimethylamine and diphenylamine are extracted from solid samples into dichloromethane (1:1 solid/liquid extraction) by sonication and mechanical shaking. An aliquot of the solvent layer is vialled and analysed by GCMS against appropriate calibration standards.
Dimethylaniline	Bodycote	0.5mg/kg				
Diphenylamine	Bodycote	0.5mg/kg				
Carbamite	BAE	5mg/kg	-	-	ESAL/QC/CARBAMITE	Overnight 2:1 solvent extraction of prepared soil samples. Analysis of extracts by Isocratic and Gradient High Performance Liquid Chromatography incorporating Ultra Violet absorption detectors capable of dual wavelength detection.
Perchlorate	Bodycote	1mg/kg	-	-	AN50	Anions (including chlorate/perchlorate) are extracted from soil samples into water then analysed directly by ion chromatography, with conductivity detection.
Asbestos	Bodycote	0.001%	√	-	ASB/01	A preliminary visual examination of the whole of the bulk sample is made to assess the sample type and the required sample treatment (if any): where possible a representative sub-sample may be taken at this stage. Sample treatment is undertaken (if required) to release or isolate fibres. A detailed and thorough search under the stereo microscope is made to classify the fibre types present. Representative fibres are mounted in appropriate RI liquids on microscope slides and the different fibrous components are identified using a polarised light microscope.
pH		0.1 Unit	-	-	ESAL/QC/pH	An aqueous soil suspension is prepared and the pH is measured using a calibrated pH meter.

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Organic Matter	Terra Tek	0.10%	√	-	BS1377: 3: 1990	Organic matter in soil is oxidised with potassium dichromate in the presence of concentrated sulphuric acid. The excess dichromate is titrated with ferrous sulphate using diphenylamine as an external indicator. The organic matter content is calculated from the amount of dichromate used during the oxidation process based on an empirical relationship.
Moisture Content	Terra Tek	-	-	√	BS1377: 2: 1990	Soil samples are dried to a constant mass at 107.5 +/- 2.5°C. The difference in mass of an amount of soil before and after the drying procedure shall be used to calculate the dry matter contents on a mass basis.
Calorific Value	Bodycote	0.001MJ/kg	-	-	Subcontracted to Knights Energy, Largs	The calorific value of the sample is determined by combustion of the sample in a controlled environment under ~30 bars pressure of Oxygen.
Leachate: (Ba, pH, As, B, Be, Cd, Cr, Cu, Hg, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, V, Zn)	Bodycote	N/A	N/A	N/A	AN04	A mass of sample is weighed out and a volume of water 10 times its weight is added. The sample is then shaken for 24 hours and filtered through a 0.45µm membrane filter. The samples are then subjected to the test method as detailed in the Groundwater Test summary table.

GROUNDWATER TESTS

Determinand	Laboratory	MRL	UKAS	Lab Test Method Ref	Summary
Explosives	BAE	50µg/l	√	ESAL/QC/4r	
NC HMX RDX EGDN Tetryl NG TNT PETN HNS Picrite Picrite Acid 2, 6 DNT 2, 4 DNT					Analysis of preconcentrated and filtered water samples by Isocratic and Gradient High Performance Liquid Chromatography incorporating Ultra Violet absorption detectors capable of dual wavelength detection
Explosives at Lower Detection Level	BAE	10µg/l	-	low surface water method	
NC HMX RDX EGDN Tetryl NG TNT PETN HNS Picrite					Analysis of preconcentrated and filtered water samples by Isocratic and Gradient High Performance Liquid Chromatography incorporating Ultra Violet absorption detectors capable of dual wavelength detection

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Picrite Acid 2, 6 DNT 2, 4 DNT					
Metals: (Al, B, Ba, Be, Ca, Cd, Cr, Cu, K, Mg, Mn, Mo, Na, Ni, Pb, Sn, Zn)	Bodycote	Various	√	AN47	For dissolved metals samples are filtered through a 0.45µm membrane filter. Metals are determined in the filtrate following acidification with nitric acid pH 2. This prevents the metals from adsorbing onto the surface of the container. Metal concentrations are determined by ICP-OES.
Metals: As Se Sb	Bodycote	0.1µg/l	√	AN37	Arsenic, selenium and antimony form volatile covalent hydrides when reduced with sodium borohydride. Samples are digested with hydrochloric acid – a hot digest is used for selenium analysis and for those samples where solids are present. Potassium iodide and ascorbic acid are added for arsenic and antimony analysis to convert all species to the appropriate hydride generation. The hydride produced is readily atomised and the resulting atoms are detected by atomic fluorescence.
Mercury	Bodycote	0.1µg/l	√	AN37	A mixture of acidic bromate and bromide is used to digest and preserve the sample. Tin(ii) chloride is used to reduce mercury to mercury vapour. The mercury vapour produced is detected by atomic fluorescence.
PAH (speciated)	Bodycote	0.05µg/l	√	GCM502	The sample is solvent extracted into dichloromethane prior to analysis by GCMSD in selective ion mode.
TPH	Bodycote	50µg/l	√	AN34	This analysis is referred to as TPH by GC-FID and is a measure of hydrocarbons associated with both gasoline range (C6-C9) and diesel range (C10-C40). Samples are analysed by solvent extraction followed by GC-FID.
VOC	Bodycote	5µg/l	√	AN15	P&T Extraction followed by GCMSD detection of a list of 59 compounds, with an option for qualitative identification of tentatively identified compounds
SVOC	Bodycote	1-5µg/l	√	AN42	A target suite of organic compounds is analysed using solvent extraction followed by GC-MS
Sulphide	Bodycote	0.1mg/l	√	AN45	Sulphide reacts with DPD and potassium dichromate to produce ethylene blue (or DPD blue). The concentration of sulphide is determined by measuring this blue complex using a spectrophotometer at 670nm.

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Sulphate	Bodycote	0.1mg.kg	√	AN50	Ion Chromatography
Chloride Nitrite Nitrate	Bodycote	0.1mg/kg	√	WAS036	Ion Chromatography
Ammonical Nitrogen	Bodycote	0.3mg/l	√	HAC 9	Colorimetry
Alkalinity as CaCO3	Bodycote	5mg/l	√	Blue Book	The total alkalinity is measured by autotitration of the sample with sulphuric acid standard solution with instrumental detection at endpoint at pH 4.5.
Hardness as CaCO3	Bodycote	1MG/L	√	AN10	These are calculated results from the Calcium and Magnesium results. Total Hardness as CaCO3 = (Ca * 2.5) + (Mg * 4.12).
Suspended Solids	Bodycote	2mg/l	√	GWC 5	Suspended matter is removed from a measured volume of sample by filtration under reduced pressure through a pre-treated, pre-weighed glass fibre filter paper and determined gravimetrically after washing and drying at 105°C. In addition samples containing oil or other organic liquids undergo a solvent wash before drying, whilst samples containing a high level of dissolved solids undergo a hot wash prior to drying.
pH	Bodycote	N/A	√	AN05	The pH is measured directly by pH probe, calibrated using buffer solutions of known pH
Electrical Conductivity	Bodycote	10µS/cm	√	AN28	The conductivity is measured using a conductivity meter, calibrated using a standard solution of known conductivity. The meter automatically compensates to give values at 20°C or 25°C depending on which is specified.
COD	Bodycote	5mg/l	√	AN25	Samples are oxidised by heating in vials with sulphuric acid and potassium dichromate. Mercuric sulphate and nitrate are used to suppress chloride interference. The chromate produced is determined colorimetrically using a spectrophotometer, which gives results directly in mg/l as Oxygen.
		10mg/l	√	DRL6	

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BOD	Bodycote	1mg/l	-	GWC 10	Samples are mixed with dilution water saturated with oxygen and containing nutrients, bacterial seed and ATU to suppress nitrification. The initial dissolved oxygen value is determined prior to leaving the samples to incubate in the dark for 5 days or 20 days. Robots with dissolved oxygen probes are used to take the dissolved oxygen readings at the beginning and end of the test.