APPLICATION NOTE - 26

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X-MET8000 Expert Geo

X-MET8000 Expert Geo for on-site contaminants screening in soil

BACKGROUND

Heavy metals such as lead (Pb), cadmium (Cd), or mercury (Hg) occur naturally in the earth's crust. They have been used for years in many applications, from industrial to agricultural to domestic, sometimes leading to their concentration in specific geographical areas, such as old industrial and mining sites.

Exposure to these heavy metals and other pollutants can be detrimental to human health, even at low levels. This is why their use is now widely restricted, and many countries around the world have stringent rules and regulations in place to limit exposure. For example, the soil in sites to be used for residential and recreational developments (e.g. playgrounds) must be tested for contents of toxic metals. If the levels found are above the regulated limits, a soil remediation plan must be put in place before any development work can be undertaken. Agricultural land assessment for food crop growing is also carried out widely to ensure food safety.

INSTRUMENTATION

Handheld X-ray fluorescence (HHXRF) analysers are commonly used for the rapid determination of toxic metals in soil and sediment. Their use is often prescribed in environment protection agencies' guidelines such as US EPA Method 6200, as they offer rapid, on-site screening for heavy metals, dramatically reducing the need for laboratory analyses and their associated cost.

Hitachi High-Tech's X-MET8000 Expert Geo HHXRF analyser has been designed to meet today and tomorrow's environmental screening challenges. Its large area silicon-drift detector (SDD) and revolutionary BOOST™ technology provide up to 10 times the sensitivity of other HHXRF models, delivering the low limits of detection needed to meet regulations, and outstanding precision for results you can trust, day after day. There is no need for restandardisation or detector cooldown periods between analyses, even in hot weather.

When mineralogy varies significantly between sites, users can use the X-MET's unique matrix correction to adjust calibrations and improve accuracy further.

IP54 rated and tested to MIL-STD 810G for vibration, shock and drop (Method 514.6, Procedure I, Category 4; Method 516.6, Procedures I and IV), the X-MET8000 Expert Geo is rugged and won't let you down.

It is easy to use and fast, enabling users to identify and locate contaminants hotspots in real time, and complete surveys faster.

SAMPLE PREPARATION

The sample preparation is simple. For screening purposes, all you need to do is to remove debris (e.g. leaves, small rocks) before testing the soil directly. However, for best accuracy, samples must be dried (water content should be less than 10%), ground into a fine powder (~100µm), and analysed in a sample cup fitted with thin polypropylene film.

It is good practice to check the analyser's protective window for contamination. To do so, a blank check sample is provided with the X-MET, and the window should be changed if contamination is suspected (i.e. elements that are not present in the blank are being identified).

Sample cups are measured with the portable stand for full user protection against scattered radiations.

PERFORMANCE AND RESULTS

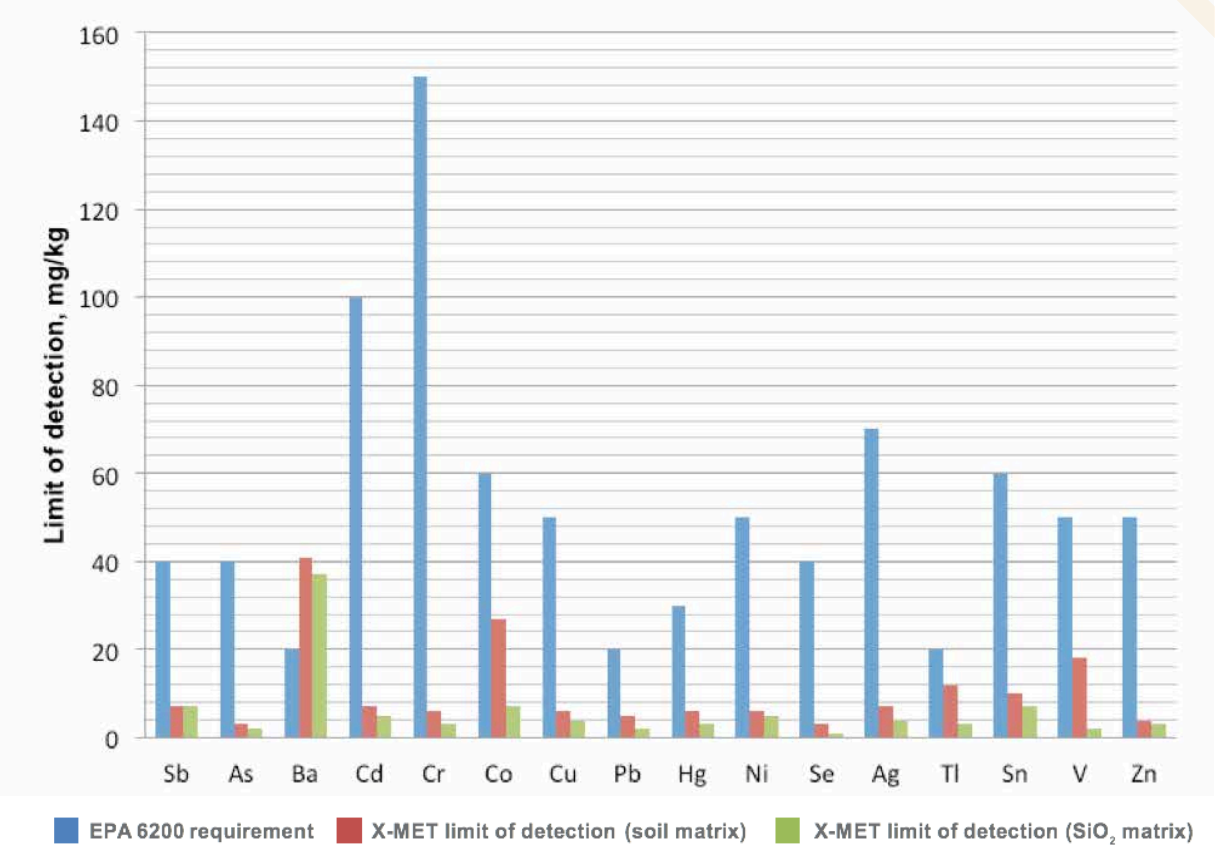
The X-MET8000 Expert Geo is factory-calibrated. Its Soil Fundamental Parameters (FP) calibration is semi-quantitative method that has been optimised for the analysis of soil matrices. It relies on the principles of physics to calculate the measured sample's elemental composition. FP methods can be typically used for a wide variety of sample types and matrices.

Benchtop stand for optimum productivity when testing high volumes of sample cups

Portable stand for field analysis of sample cups

LOW LIMITS OF DETECTION TO MEET CURRENT AND FUTURE STANDARD METHODS:

The graph below shows that the X-MET's limits of detection comfortably meet these set in EPA Method 6200 for the RCRA elements (using 60 seconds analysis per filter). For barium (Ba), simply increase the measurement time to match the required limit of detection.



The X-MET8000 Expert Geo also enables users to screen soil samples for compliance with the GB15618 standard. Limits of detection are the smallest amounts of elements that the analyser can detect above the background noise, but with a very low confidence level (usually 1%). Limits of quantitation are the smallest amounts an analyser can measure with confidence. To establish whether an instrument can meet a specific standard, users must ensure that the analyser's limits of quantitation are equal or below the control limits set in the standard. If lower limits of quantitation are required, then simply increase the analysis time.

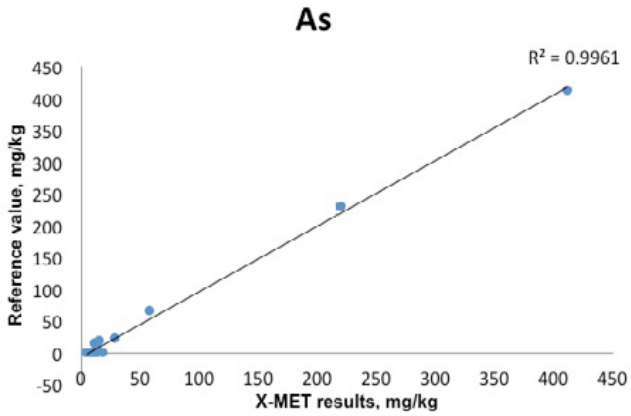
Regulated elements	Limit of detection (mg/kg)	Limit of quantitation (mg/kg)	GB 15618-2008 limits (mg/kg)		
			Live land use	Business land use	Industrial land use
Cd	5	16	10	20	20
Hg	4	14	4	20	20
As	2	7	50	70	70
Pb	4	12	300	600	600
Cr	4	14	400	800	1000
Cu	4	14	300	500	500
Ni	4	14	150	200	200
Zn	3	9	500	700	700
Se	2	7	40	100	100
Co	19	64	50	300	300
V	13	42	200	250	250
Sb	5	16	30	40	40

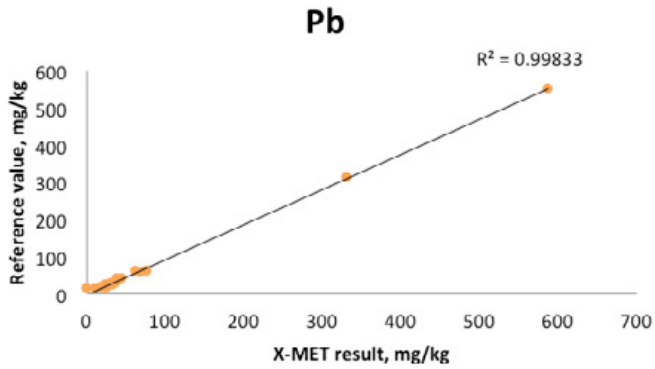
Note: limits of detection and limits of quantitation are defined for tests using 120 seconds per filter, i.e. a total measurement time of 240 seconds for all elements.

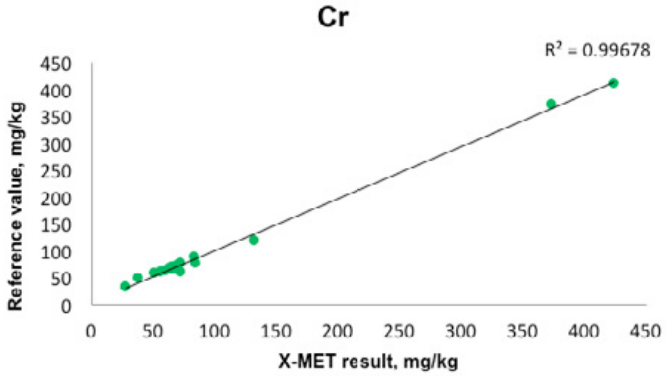
SAVE TIME AND MONEY WITH THE X-MET'S EXCELLENT ACCURACY:

Accurate results will enable users to identify contaminants hotspots on the go, and reduce the number of samples that need to be sent to the lab, thus significantly reducing costs.

The graphs below illustrate the X-MET's typical accuracy for some key elements in soil. The results were obtained by measuring a series of reference samples in cups with the analyser's soil application, for a total measurement time of 90 seconds. No calibration adjustments were made.

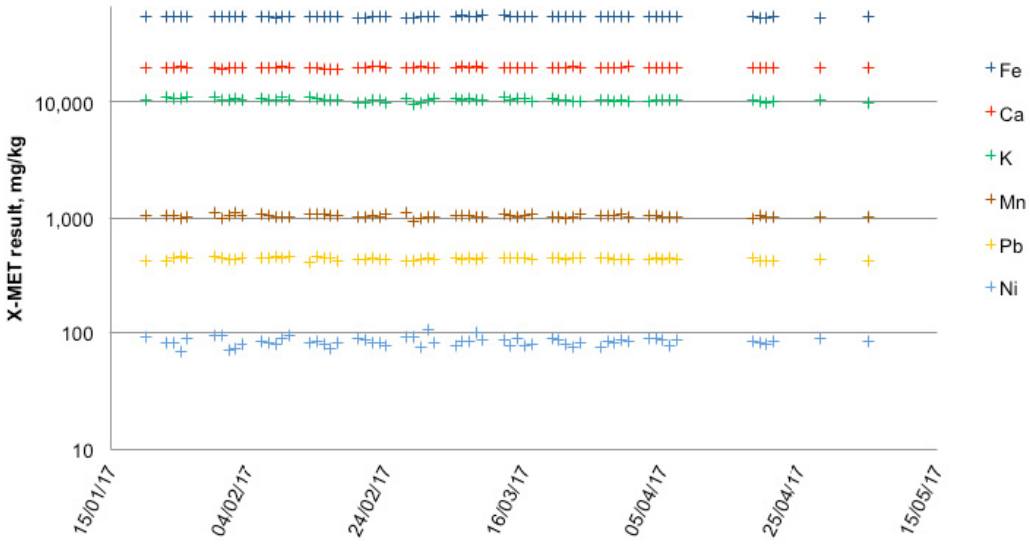






SUPERIOR PRECISION FOR RESULTS YOU CAN TRUST DAY AFTER DAY:

To demonstrate the X-MET8000 Expert Geo's outstanding precision, a soil reference sample was tested regularly over four months, with no restandardisation, recalibration or other adjustments. The graph below shows that the X-MET provides repeatable results, day in, day out, from high concentration elements right down to traces.



SUMMARY

Designed to withstand the harshest environments, the X-MET8000 Expert Geo provides the superior performance required to meet regulations for environmental soil screening. It is portable, easy to use, and helps make decisions on-site fast. By considerably reducing the number of samples sent to a laboratory, the X-MET helps you save both time and money.

ORDERING INFORMATION

The X-MET8000 Expert Geo Soil package (P/No. 54–4106591) comes pre-calibrated for soil applications. The package includes the waterproof, rugged carrying case, a lanyard, a wrist strap, 2 Li-ion batteries, a battery charger, the light radiation shield to minimise scattered radiations, the background plate to measure samples in bags and to standardise the background, a USB cable to connect to a PC/laptop, 5 replacement thin film windows, a soil and a blank check samples, the integrated camera, Bluetooth and WiFi connectivity, empirical calibration software and user manuals.

OPTIONAL EXTRAS ARE:

- Sample cups (P/No. 51-4106018 for a bag of 100).
- 4µm polypropylene film (P/No. 54-L73 for a roll of 100 m).
- Light stand and safety shield (P/No. 54-4106255. Note: fit in the carrying case).
- Benchtop stand (P/No. 54-4106313).
- Holster (P/No. 54-4106296) for hands-free transportation in the field.
- X-MET pole (P/No. 54-6008597) for improved ergonomics when measuring many samples at ground level.
- Bipod (P/No. 54-6007786) for hands-free analysis when using long measurement times.

Visit **www.hitachi-hightech.com/hha** for more information.

Hitachi High-Tech Analytical Science

Part number: 201/0617

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