

RAPID ANALYSIS OF TOTAL PETROLEUM HYDROCARBONS IN SOIL

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What is RemScan?

- Handheld infrared instrument for the direct measurement of TPH in soil
- The user simply pulls the trigger for a 15 second readout of TPH ($C_{10} - C_{36}$) in mg/kg
- No consumables or chemicals required



Handheld Soil Screening Tools

Tool	Technology	Analytes
XRF	X-Ray fluorescence	Heavy metals
PID	Photo-ionisation	Volatile organics
RemScan™	Infrared	Petroleum hydrocarbons



Independent Evaluation - Battelle

- Independent validation was seen as an important pre-requisite to a US market launch
- Battelle was engaged by Ziltek in Aug 2013 to undertake an independent evaluation
- Followed the protocol of the Environmental Technology Verification (ETV) Program



Test Site 1

- Marines base
- Bioremediation area
- Various fuel and soil types
- 'Worst case scenario'





Test Site 2

- Navy base
- Former jet fuel storage tank area
- Sandy profile
- Cores drilled to assist with sample collection





Methodology Overview

Collect 100 soil samples from each site

Air dry, mix, screen
(Battelle, Duxbury, MA)

Analyze for TPH C₁₀ to C₃₆ using EPA Method 8100

Lab data for
60 samples

Lab data for
40 samples

ZILTEK

BATTELLE

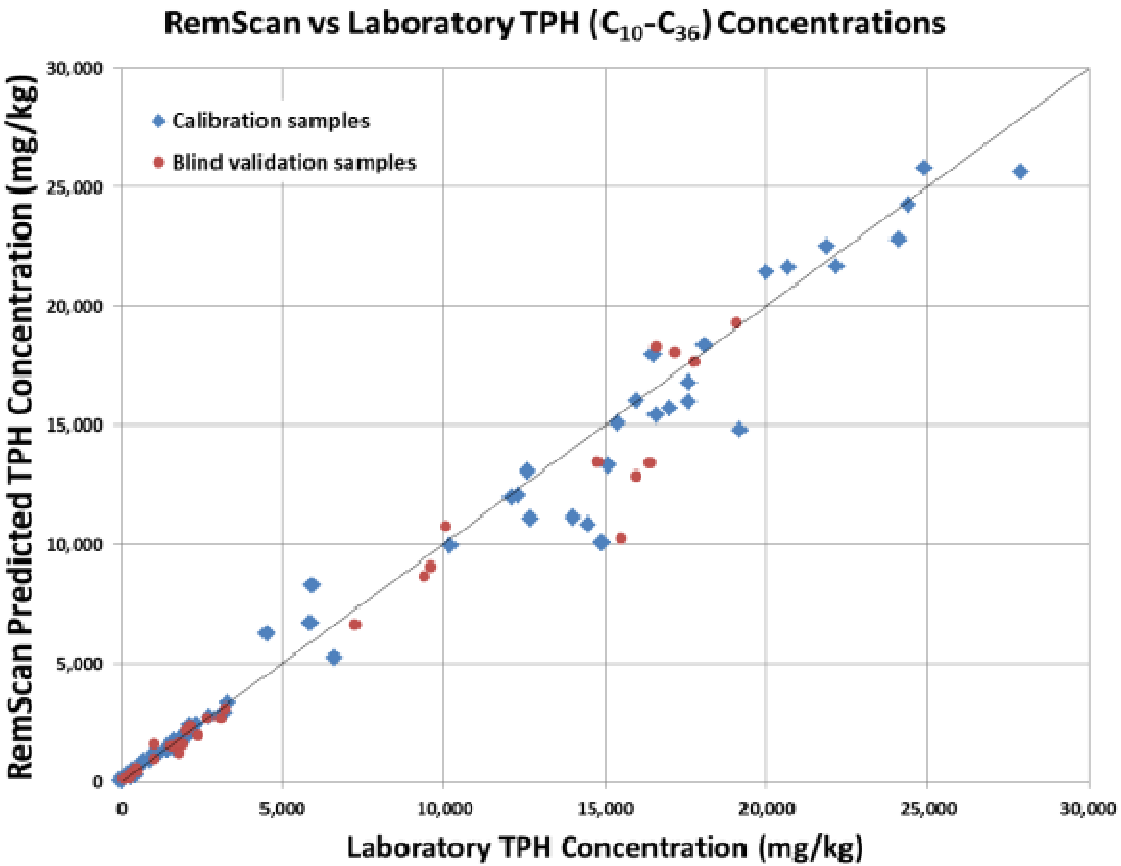
Build and load models
into RemScan

Scan 40 samples and
compare with lab data*

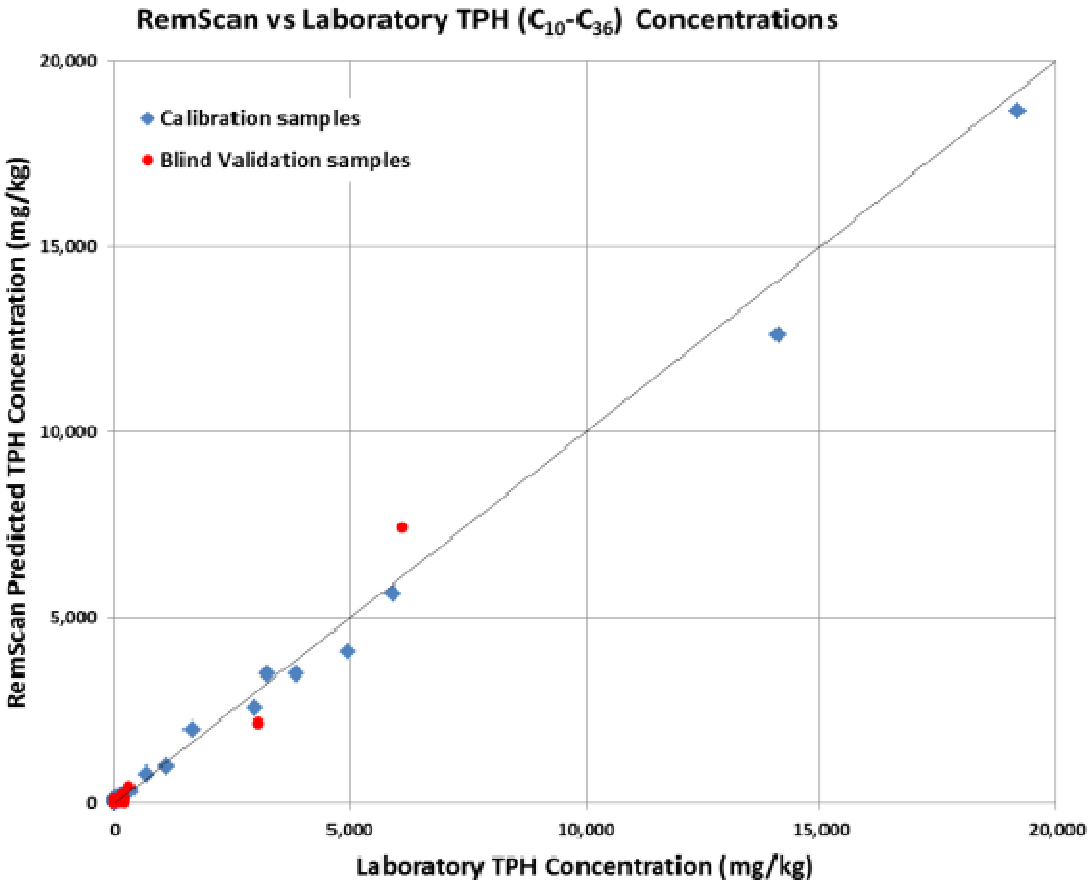
* Trained Battelle staff also filled out a usability questionnaire



Results Site 1



Results Site 2



True and False Positives/Negatives

Criteria: 1,000 mg/kg TPH	Site 1		Site 2	
	Number	%	Number	%
False Positives	0	0	0	0
False Negatives	0	0	0	0
True Positives	28	76	2	6
True Negatives	9	24	34	94
Totals	37	100	36	100

Results Summary

	Site 1	Site 2	Vendor Claims Met
Accuracy *	9.4%	N/A**	<input checked="" type="checkbox"/>
Repeatability (10 scans)	1.8%	3.3%	<input checked="" type="checkbox"/>
Detection limit (1 sd)	66 mg/kg	64 mg/kg	<input checked="" type="checkbox"/>
False results (1,000 mg/kg)	Nil	Nil	<input checked="" type="checkbox"/>
Battery life	Full day of continuous use with one battery swap		
Throughput rate	10 to 20 samples per hour		
Operational cost	No incremental cost		
Breakeven cost threshold	7 sampling days (1,400 samples)		
Formal training required	Two hours		
Infield calibration time	Three minutes every hour		

* Calculated using samples with TPH values of 5,000 to 10,000 mg/kg

** Insufficient data available



Limitations

Limitation	Solution
The need to air-dry soils to <5% free moisture	<ul style="list-style-type: none">• RemScan will notify the user of % free moisture• A portable soil drying kit is now available
The need to build site-specific soil calibration models	<ul style="list-style-type: none">• We are developing a universal soil calibration model• Predicted a certified soil standard within 11%

Portable Soil Drying Kit



Soil Type	Temperature Setting		
	25°C	30°C	35°C
Sand	3 min	3 min	3 min
Loam	6 min	5 min	4 min
Clay	18 min	13 min	8 min



Commercial Application

- Launched in Australia in 2012/13
- Now available for purchase in the USA
- Global trials underway with several oil majors
- Typical oil industry applications:
 - Rapid spill response and validation
 - Bioremediation monitoring
 - Site assessment and compliance
 - Exploration



Further Information

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