

Background

A petrochemical plant in southern Taiwan was shut down at the end of 2015. AECOM carried out detailed soil and groundwater assessment and high concentrations of Total Petroleum Hydrocarbons (TPH) were found, mainly originating from base oil, lubricants and process byproducts. Site remediation activities officially started on 1st January, 2017. Around 14 hectares of land requires remediation over a 3-4 year period

According to the results of the site investigation, the remediation plan for the site will use a combination of biological treatment, soil washing, and thermal treatment. All of the contaminated soil will be excavated (down to several metres in some areas), and the appropriate remediation method will be chosen based on soil texture, contaminant levels and regulatory targets.

Biological treatment will be used for low TPH concentration soil. Soil washing and thermal treatment will used for higher TPH concentration soil with sandy or silty textures, respectively.

A handheld infrared instrument for the rapid measurement of TPH in soil (RemScan[®]) is being employed as a screening tool to help classify and segregate soils for the different remediation methods. The process flow chart is shown in Figure 1 including how RemScan is used.



Figure 1: Remediation Process Flow Chart

Rapid Measurement of Petroleum Hydrocarbons during Site Remediation

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Calibration and Accuracy of the Handheld Instrument

The handheld infrared instrument was calibrated using representative soils from the remediation site. The instrument was then validated by scanning selected soils and then sending the scanned soils to an external laboratory for TPH $(C_{10} \text{ to } C_{36})$ analysis using US EPA Method 3570:8015C. The result of the calibration modelling is shown in Figure 3. The tight clustering of points about the Y=X line demonstrates RemScan's high level of accuracy for this application.



Figure 2: In-field sampling prior to measurement with RemScan

Some validation samples were measured by both RemScan and the Laboratory and the results are presented in Table 1. There is very good agreement between the two sets of readings, again demonstrating the high level of accuracy of RemScan versus laboratory analysis.

Table 1:Validation of RemScan versus Laboratory for 4 Selected Site Samples

Sample Id	Lab (ALS) TPH (mg/kg)	RemScan TPH (mg/kg)*
S1	2,900	2,365
B-0.5m	4,570	4,410
B-5m	8,410	8,334
B-5.5m	42,100	41,648

*Average of 10 measurements with mixing between each measurement

After validation, the instrument was then used to segregate soils for the various remediation methods and to analyse samples before and after treatment.

Based on these results, the instrument is now being used as an integral part of the site remediation plan. This method of operation has been in use for more than 30 months, and about 6,000 samples are expected to be measured with RemScan over the 2.5 year project. The use of RemScan has resulted in savings of many thousands of dollars in operational and laboratory costs.



RemScan versus Laboratory TPH Measurement







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Figure 4: Measuring samples with RemScan after drying

Figure 5: Remediation Team

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