

# Reducing Mine Site Costs using a Handheld Infrared Technology for Measuring Total Petroleum Hydrocarbons (TPH) in Soil

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## Background

Fortescue Metals Group (Fortescue) is one of the world's largest iron ore producers located in the Pilbara region of Western Australia. In an industry that relies on the intensive use of heavy earthmoving machinery, hydrocarbon spills pose a potential risk to the environment. Fortescue, along with Ziltek, have invested in research and technology to ensure this risk is mitigated and controlled.

The hydrocarbon management approach involves excavating the contaminated soil and taking it to a biofarm area. There nutrients and water are added and the soil is aerated to stimulate natural microorganisms to degrade the hydrocarbons over time (see Figure 1). By leveraging RemScan's technology, staff are able to ensure all contaminated material is removed while avoiding the transfer of excess material to the biofarm.

To ensure the efficiency of spill management, Fortescue uses a handheld portable infrared detector (marketed as RemScan™) for the rapid and accurate measurement of TPH (C<sub>10</sub> to C<sub>40</sub>) in soil. This presents a viable alternative to off-site laboratory analysis which, in this remote and harsh environment, is logistically challenging, time-consuming and relatively costly.

This study will present how Fortescue is applying this infield technology to minimise, mitigating and remediate the impacts of its operations and reduce operating costs.



Figure 1: Biofarm area at an FMG mine site

## Methods

Representative soils were collected from each mine site, and a site-specific calibration model was constructed for each site to calibrate the RemScan unit. This minimizes interference from soil properties such as carbonates and organic matter and differences in soil mineralogy. The calibration model is summarised in Figure 2 below. The fact that the RemScan versus Laboratory data points are so close to the Y=X line shows the high accuracy of the calibration model.

Once calibrated, infrared units were deployed to site and Fortescue staff were fully trained in how to use the instruments during a half-day workshop. The RemScan units are now being used regularly for a variety of applications, reducing the requirements for laboratory analysis and allowing more accurate and rapid soil management decisions to be made.

For taking measurements at site, Fortescue staff scan air-dried samples with the RemScan unit and within 20 seconds a TPH concentration (C<sub>10</sub> to C<sub>36</sub> in mg/kg) is displayed on the instrument screen. The data is automatically recorded on an SD card which can be downloaded as an excel file; the output includes the date and time of the measurement, the sample ID (which can be manually adjusted for each reading as required) and the TPH concentration (mg/kg) and approximate moisture content.

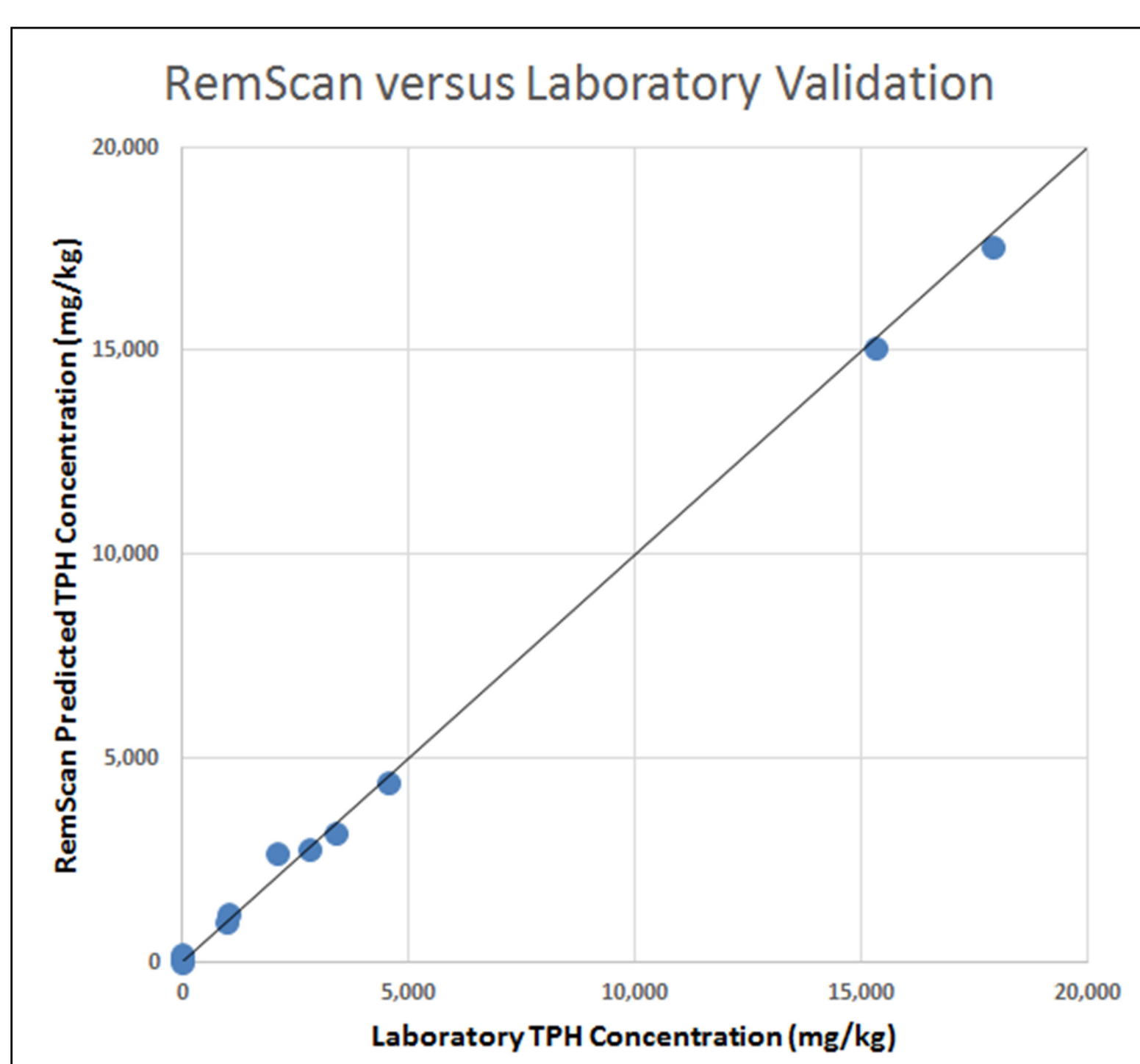


Figure 2: RemScan versus laboratory analysis for a RemScan calibration model

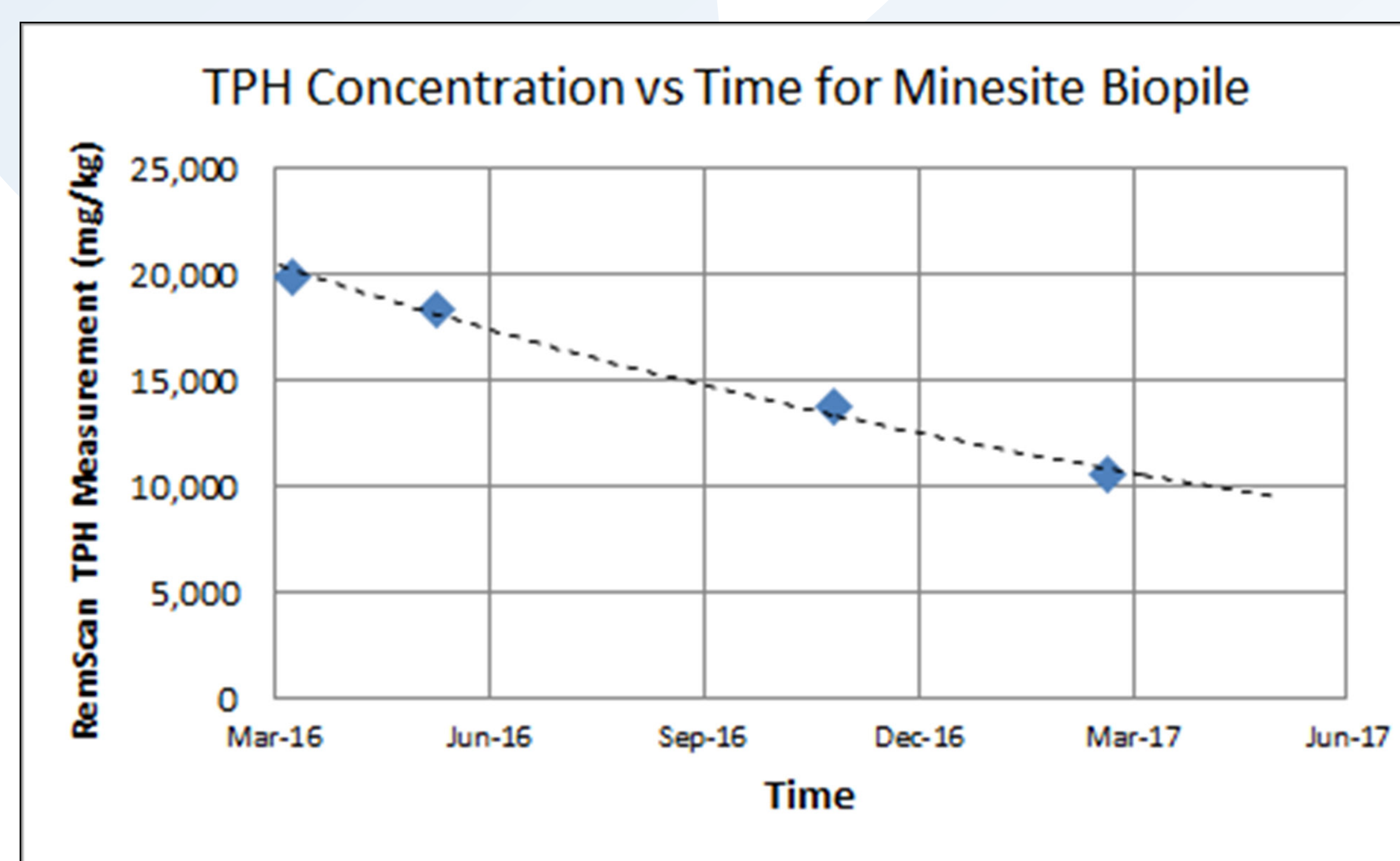


Figure 3: TPH degradation at the FMG biofarm over time as measured by RemScan

## Results and Discussion

The results in Figure 3 show the degradation of TPH in the biofarm at one of the Fortescue sites over the period March 2016 to June 2017. The steady degradation indicates that the bioremediation process is progressing as planned. All measurements were taken using the RemScan instrument, completely alleviating the need for laboratory analysis during the monitoring process. When the TPH concentration falls below the regulatory limit to reuse the soil, final validation samples will be sent for laboratory analysis.

The use of RemScan for monitoring the bioremediation process has three main benefits:

- Assists Fortescue in its efforts to minimise, mitigating and remediate the impacts of its operations;
- Collects more frequent data which increases confidence in the remediation outcomes; and
- Reduces the need for costly laboratory analysis.

Other onsite applications include (see Figures 4 and 5):

- Emergency spill response; more accurate spill delineation to reduce costly over- or under-excavation;
- Auditing contractor laydown areas prior to demobilization to reduce site liabilities.

Fortescue performed a cost-benefit analysis which estimates the cost savings per instrument per year to be more than 60,000 USD. This equates to a payback period of less than 12 months.



Figure 4: FMG mine site staff using RemScan in the field



Figure 5: Ziltek staff measuring oil spill at mine site

## Conclusion

The RemScan technology is being used at three remote Fortescue mine sites in Pilbara, Western Australia for day-to-day and emergency hydrocarbon management, bioremediation monitoring and laydown area auditing. Total cost savings of more than 60,000 USD per annum per unit are being reported.

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