



Analysing Contaminated Soil On-site with Portable XRF

ENVIRONMENTAL ANALYSIS

Bill Radosevich, Environmental Market Specialist, NITON Analyzers, Thermo Electron Corporation, 3415 Pillsbury Avenue, Minneapolis, MN 55408 USA Mobile: +1 612-670-9660 Fax: +1 612-825-1102 Email: william.radosevich@thermo.com Web: www.thermo.com



Rapid, accurate, on site determination of lead, arsenic and other heavy metal levels in soil is a powerful tool in efforts to rebuild and revitalise abandoned and under-utilised industrial properties. Government initiatives to encourage assessment, clean-up and re-use of brownfields are increasing demand for these often otherwise desirable locations, and obviously, the owners of these contaminated sites are eager to return them to commercial use.

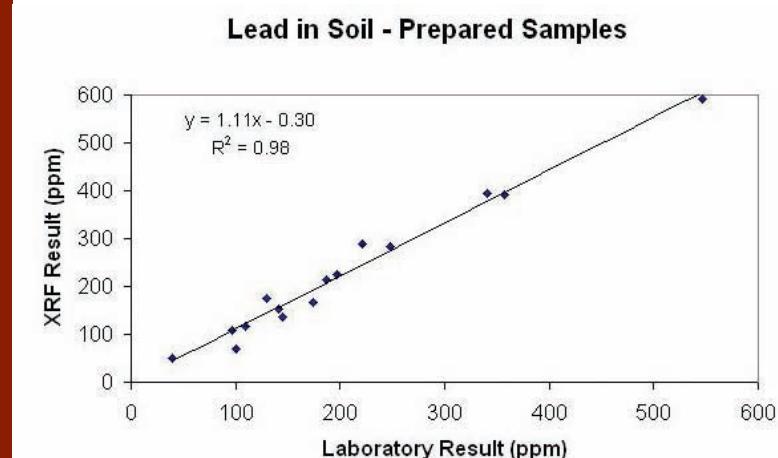
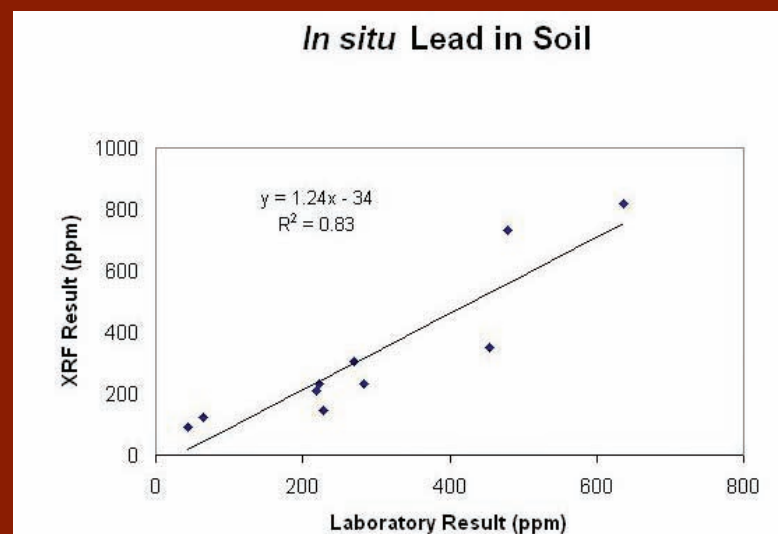
In the case of heavy metals (typically Pb, As, Cd, Cr, Hg, Zn, Cu, Ni, Mn, Se), the technology of choice is field portable x-ray fluorescence (XRF) analysis. Thermo Electron's NITON field portable XRF analysers offer a number of advantages for expediting site characterisation and cleanup.

The ability to simultaneously identify multiple contaminants in real time offers an advantage in designing remediation strategies. The NITON Analyser's ability to provide results in seconds allows for extensive geographic profiling which details metal contaminants and quantifies their levels, all without missing 'hot spots'. And finally, the ability to produce laboratory-quality results in the field can decrease remediation costs significantly by reducing downtime waiting for traditional wet lab results.

Multiple Element Analysis in real time

Fernando Serrano and David Sterling, Ph.D, led a team from Saint Louis University's School of Public Health to La Oroya, Peru in August 2005 to collect soil samples from the area surrounding a Doe Run Smelter (formerly owned by a government-owned company, Centromin). They performed their analysis using Thermo Electron's NITON XLi 723 analyser.

Dr. Sterling is impressed by the speed and accuracy of the instrument, but especially likes the custom calibration that allows the Project to test for Eu, La, Ba, Cs, Te, Sb, Sn, Cd, Ag, Pd, Mo, U, Zr, Sr, Rb, Pb, Se, Pt, As, Hg, W, Zn, Cu, Co, Fe, Mn, Cr, and Ti simultaneously. "The NITON analyser let us cut costs and time without cutting corners."



For in situ soil testing, the NITON 700 Series analyser rarely needs site-specific calibrations. Sophisticated software corrects automatically for most variations in soil-sample chemistry and density.

Rapid Site characterisation

At a brownfield in Southeastern Australia¹, the use of field portable XRF to rapidly profile the site provided an obvious solution in response to the problems caused by the remoteness of the site. The project was a large property with suspected wide-spread arsenic contamination. Project goals required a rapid assessment of the site to determine "hot spots" of arsenic, and progress monitoring of remediation efforts. Traditional wet-lab analysis would require time-consuming shipping and expensive analysis of samples.

In this case, the time constraints were the critical parameter. The Thermo Electron NITON XRF instrument was the perfect analytical tool to meet these demands. Operators performed hundreds of tests directly on the ground to thoroughly profile the arsenic contamination pattern. Once hot-spots were mapped out, remediation could begin immediately. The NITON instrument software integrates seamlessly with GPS, permitting error-free sample locating and documentation.

NITON analysers are also completely non-destructive, allowing a sub-set of samples to be sent for confirmatory laboratory analysis.

Fast, Accurate results

A large Canadian power company needed to assess arsenic levels in soil around several of their facilities located throughout Canada. In this case, accuracy was the critical parameter. The company required a very accurate analysis of a limited number of samples at each site. Because many of their facilities are in remote locations, laboratory turnaround times often take weeks.



For this reason, the appropriate testing method required that samples be carefully prepared by sieving out the larger particles such as small rocks and organic matter, then grinding the remaining soil to an average particle size of 125 μm , producing a fine homogeneous powder. The powder was placed in standard XRF sample cups prior to taking the reading.

Remediation

The XRF analyser is also a valuable tool during remediation efforts. For many sites, remediation mainly consists of soil removal. A “dig and test” process can be employed to ensure that only contaminated soil is treated or removed, saving time and disposal costs. Layers of soil can be removed and the freshly exposed soil tested again with the NITON XRF instrument, providing information on the depth of contamination. This allows the operator to stop digging when results drop below action levels.

One town in Connecticut contained an abandoned rifle and hand gun firing range. The property had a potential buyer, but the sale was contingent upon the expedited removal or abatement of approximately 270 tons of lead-contaminated soil.

The remediation plans required that lead be removed to below 500 ppm in soil. In order to meet the buyer’s deadlines, the project manager needed to provide rapid turnaround of sample results. Rapid identification and targeting of “hot spots” would permit efficient soil removal by minimising the excavation depth.

The project manager, Fuss & O’Neil, selected a Thermo Electron NITON x-ray fluorescence (XRF) analyser as the primary tool for site evaluation and removal decisions, and to provide “real time” measurements for remediation activities.

The majority of the 200 total samples of were analysed in a two day period at a cost of ~ \$15 per sample. Conventional wet lab analysis would have cost twice as much, and taken additional, and expensive, days. “Per sample costs would have dropped significantly had we used (this equipment) for a longer period” stated Fuss & O’Neil.

The remediation effort was conducted in only 4 days using the NITON analyser. The rapid turnaround also eliminated the potential loss of the property sale by their client.

The use of portable XRF analysis for remediation monitoring will expedite site clearance and keep analytical costs low. Site managers are able to eliminate the guesswork in determining if concentrations are below action levels.

This strategy reduces analytical costs, since only one set of clearance samples are sent for laboratory confirmation. Moreover, the likelihood of a failed clearance is virtually eliminated, thus reducing costly remobilizations of remediation crews for continued work if laboratory analysis indicates arsenic levels exceed action levels.

References

- 1 M. Ridings, A.J Shorter, CSIRO Tropical Agriculture, 306 Carmody Road, St. Lucia,Q4067, Australia*
- and*
- J. Bawden-Smith, JBS Environmental Services & Technologies Pty Ltd, PO Box 1480 Bondi Junction, NSW 1355, Australia.*