

Data Quality in Lead Dust Wipe Measurements

Handheld Thermo Scientific Niton XRF Analyzers Provide Lab-quality Data on Dust Wipe Analysis in the Field



Considerable investment has been made in studies to determine the usefulness of handheld x-ray fluorescence (XRF) spectroscopy for the analysis of dust wipes on-site. With an estimated 38 million (40%) housing units in the United States having lead-based paint inside the dwelling, outside the dwelling, or both,¹ this is an issue that has a significant effect on public health policy.

A study by researchers at the University of Cincinnati determined that “Providing site specific recommendations to a family while public health staff are already at the home site can often be more efficient and helpful to the family and others involved.”²

Non-destructive methods that provide real-time analytical data prove invaluable when conducting a risk assessment or after abatement of a lead hazard. Approximately 16% of all homes have a dust lead hazard in excess of the regulatory guidelines³, while one study⁴ showed that 20% of the housing units undergoing abatement did not pass initial testing to allow re-occupancy of the dwellings. This study was conducted when the thresholds were much less stringent than they are today, resulting in higher initial testing failure rates.

Even the most experienced lead abatement contractors only pass clearance an average of 95% of the time on their first attempt. The costs of recalling the crew, recleaning, and retesting can be exceeded by the cost and inconvenience to the occupants. These inflated costs and stretched timelines have a direct impact on the number of housing units the community can abate, since public funding for these activities is limited. An on-site analytical method that

Area	Clearance Standard (µg/ft ²)
Window Wells	400
Window Sills	250
Floors	40
Niton Analyzer Limit of Detection	10 µg/wipe*

*Instrument Detection Limit (IDL). Actual detection limits will vary based upon x-ray detector, sample characteristics, and length of measurement

Table 1: Lead dust re-occupancy requirements

conclusively determines whether clearance criteria have been met while the abatement workers are still on-site will eliminate the remobilization and recleaning associated with failed clearance tests. At the same time, this method allows for reoccupancy of the dwelling in less time, at a lower cost, and with less inconvenience to the occupants.

In November 2001, and again in January 2003, the US EPA Environmental Technology Verification Program (ETV), in conjunction with one of their verification organizations, Oak Ridge National Laboratory, undertook an “Environmental Technology Verification Report: Lead in Dust Wipe Detection Technology” to evaluate the performance of commercially available field analytical technologies for analyzing dust wipe samples for lead.

We demonstrated a number of our analyzers, including “traditional” isotope-based and miniature x-ray tube-based instruments. The Thermo Scientific Niton XLt 700 was evaluated during this study, and its overall performance was characterized as being “...precise, and in good linear agreement to an NLLAP laboratory.”⁵ Similarly the Niton® XL-300

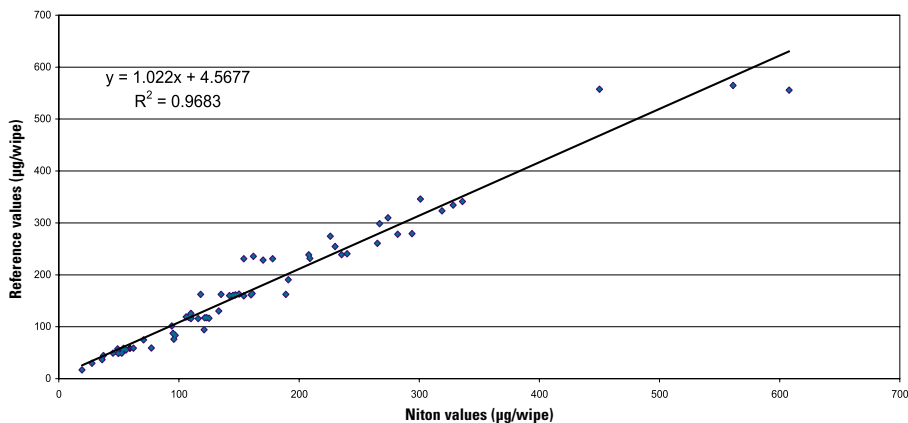


Figure 1: Pb in dust wipe comparison

(which was replaced by the Niton XLi/p 300 Series analyzers) was characterized as being "...very precise, and in strong linear agreement."⁶ The Niton XL-700 (replaced by the Niton XLi/p 700 Series) was shown to be "...very precise, and in good linear agreement."⁷

To eliminate the potential for inter-instrument bias, each of our XRF units analyzed its own individual blind set of 160 dust wipe samples containing unknown amounts of lead, ranging in concentration from ≤ 2 to 1,500 micrograms Pb/wipe. The samples were concentrated around the current clearance levels listed in Table 1 to determine "how well (the technology) performs relative to a conventional, fixed-site, analytical method for the analysis of dust wipes for lead"⁸ and evaluated the performance as compared to previous rounds of ELPAT⁹ testing.

The EPA's Environmental Technology Verification Reports were released in August 2002 and in September 2003 and are available at their website: www.epa.gov/etv/verifications/verification-index.html

Results

Data from all the Thermo Scientific Niton analyzers showed excellent agreement with the estimated lead value for the range of samples analyzed; correlations indicate an R^2 better than 0.97 for all instruments (see Figure 1).

Additional analysis of the data yielded a very interesting result. When comparing our XRF analyzer results with those of the NLLAP accredited laboratory, all our instruments reported fewer false negatives (defined as a result below the 40 µg/wipe action level where the "Estimated Pb" is above 40 µg/wipe) than the NLLAP accredited reference lab.

Conclusions

The dust wipe protocol that uses the Thermo Scientific Niton XRF analyzer is an extremely accurate and effective tool for public health departments and other lead-industry professionals. Whether analyzing

dust wipes from a risk assessment while still at the project site, or guaranteeing that final samples after abatement will pass clearance at an NLLAP accredited laboratory, our suite of XRF analyzers is uniquely suited to make more efficient use of the limited resources available to treat lead hazards effectively. Independent testing has continued to prove the instruments' accuracy, precision, and reliability.

Based on an unprecedented response from users, our analyzers are under review as an accepted methodology for accreditation as a field-portable laboratory in the EPA's ELPAT program, allowing field analysis of dust wipes for Clearance and Risk Assessments in minutes.

References

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- 8 Environmental Technology Verification Plan, Verification Test Plan, Evaluation of Field Portable Measurement Technologies for Lead in Dust Wipes, US EPA ORD and Oak Ridge National Laboratory, Nov. 2001.
- 9 Environmental Lead Proficiency Analytical Testing program, administered by the American Industrial Hygiene Association.

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