Healthy Homes Grantees in Region IV, Southeast, Caribbean

Name of Grantee: Research Triangle Institute
Name of Project: Design and Construction of A Low Cost Instrument For The Collection and Analysis of Environmental Contaminants
Amount Awarded: $ 220,082
Year of Grant: 2001
Contact Info:
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Project Partners:

Summary of Project Activities:

The adverse health effects resulting from exposure of young children to environmental lead (Pb) have been a major concern for many years. It is now common knowledge that chronic exposure to even low levels of lead can result in impairment of the central nervous system, mental retardation, and behavioral disorders. Dust containing lead from deteriorating paint and/or tracked in soil is the major source of exposure for children. In addition to risk posed by dust in occupied dwellings, there is also an issue of dust remaining after repairs, maintenance, or abatement.

According to the U.S. Department of Housing and Urban Development's (HUD's) Rule 1012, housing properties covered under some 48 Federal programs must be tested for lead in dust, if leaded paint or other coatings suspected of containing lead are disturbed in anyway. The currently accepted method for this testing (clearance) is to wipe a known area with a small, ASTM-approved wipe and submit the wipe to a laboratory for analysis. It has been estimated that over 2.4 million wipe samples will be collected and analyzed during the coming year because of the 1012 Rule. Major problems with wipes are collection variability due to wipe condition and operator usage, and also delays in laboratory analysis of the wipes.

This research project will develop a new instrument for the rapid, accurate, low cost measurement of lead (and other metals) in dust using a combination of an efficient Total Dust vacuum and a portable X-ray fluorescence (XRF) instrument. Using dry or wet vacuum, the Total Dust Vacuum will collect all dislodgeable, residual surface materials (dust) and collect it on a filter for XRF measurement. The project will provide HUD with the research data to illustrate the utility and practicality of this new tool for the collection and analysis of environmental contaminants (i.e., Pb). It is believed that this new instrument will provide efficient and reproducible sample collection, while yielding immediate sample analysis results. This, in turn, will provide information to make on-site decisions about the presence of risk or requirements for clearance, and will offer significant monetary savings because of the reduced need for laboratory analysis.

The development of the instrument will be carried out in a series of sequential, logical steps. The Total Dust Vacuum will be further developed to yield efficient collection for all common types of dusts and surfaces. Instrumental parameters to be

optimized include, nozzle and wand design, airflow, collection filter type, and vacuum pump design. In the laboratory, variables including dust type (micro glass beads, NIST SRMS, EPLAT samples), size of dust particles, and surfaces to be measured (new and aged linoleum and wood flooring, cast concrete) will be evaluated. For example, consideration will be given to the facts that smaller particles (<200 gm diameter) stick more readily to children's hands and are more biologically active, but that particle size is not necessarily a good predictor of children's blood lead levels.

Knowing that some floors are "sticky," a liquid releasing or wetting agent will be identified or developed, for wet vacuuming. Accordingly, a filter impregnated with an ion exchange agent to collect any solubilized Pb will be developed and tested. The Niton Model XL-703A portable XRF, modified for air filter analysis, will be evaluated with the filter(s) selected for dry and wet vacuuming. Filters will be spiked for this testing. Although lead will be the primary concern in this instrument development, measurement of chromium (Cr), nickel (Ni), arsenic (As), and selenium (Se) will also be investigated. After optimizations, the components will be incorporated into a single vacuum/XRF instrument and the complete, portable system will be evaluated for the analytics listed above. This laboratory evaluation will include the same testing parameters used for the Total Dust Vacuum alone.

Product Outcomes/Outputs:

After successful engineering, procedure and protocol development, the instrument will be tested in residences in the Research Triangle area of North Carolina. A total of 10 dwellings undergoing risk assessment or abatement will be evaluated, with 24 samples collected in each residence. Test locations will include difficult-to-sample places like window wells; areas larger than one foot will be sampled and composite samples will be collected. For each vacuum/XRF sample, a wipe (or wipes in the case of composites) will be collected for comparison. Filters and wipe samples collected in the field will then be analyzed in RTI laboratories using inductively coupled plasma atomic emission spectroscopy (ICP-AES) for the analytics measured by XRF in the field. A statistical comparison of the field and laboratory results will be performed to evaluate the applicability of the proposed instrument. This work, when successfully completed, will make great strides toward achieving HUD's goal of having a "low cost analytical technique for the rapid, on-site determination of environmental contaminants."