Study of HUDs Risk Assessment Methodology in Three U.S. Communities

Final Report

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The U.S. Department of Housing and Urban Development
Office of Healthy Homes and Lead Hazard Control

By
The National Center for Healthy Housing

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APPENDIX B: ENROLLMENT PROCEDURES FOR RISK ASSESSMENT STUDY AND STUDY PROTOCOLS

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B1. Enrollment Procedures for Risk Assessment Study

Milwaukee Enrollment Process: The Milwaukee Health Department (MHD) was responsible for the prevention and control of childhood lead poisoning in the City of Milwaukee. The MHD was a partner of the Center in this research project. The local Program Manager for Milwaukee was a contract employee of the city and is housed at MHD.

The City of Milwaukee had an aggressive blood lead testing program including eight public clinics and programs, and many physicians in the private sector, who regularly test new pediatric clients. Through this testing program, children were identified for recruitment into the study. In addition to the eligibility criteria discussed in the study design section of the report, children had to be tested by venous sampling within the 21 days of recruitment to be eligible. In order to maintain the quality of the blood lead data being used in this study, eligibility were restricted to children whose blood lead levels were reported by pre-approved laboratories.

The Project's Laboratory QA/QC Manager identified laboratories that demonstrated an ability to contribute a large number of subjects with venous sampling. Based on the approval program identified in the Project's Quality Control and Quality Assurance Plan, the following laboratories were approved for this project: MHD's Blood Lead Laboratory, SmithKline Beecham Clinical Laboratories, and Aurora Consolidated Laboratories.

Wisconsin state law requires that laboratories report Milwaukee blood lead testing results to the MHD, where the data are entered into a Stellar Data Base system. The Stellar Data Base system was used as one of two sources of information about children who may be eligible for participation in the study. The local Program Manager used the Stellar records to obtain contact information about children. A lab record file in Stellar contains the child's name, date of birth, address/phone number, and date, location and results of the blood draw and the name of the laboratory performing the test. The Stellar database also contains a number of other files on poisoned children that can be linked: information on a child's medical history, previous addresses, sibling relationships, any environmental investigations done by the MHD and health events such as chelation or treatment for lead by physicians.

Early use of the Stellar system indicated that often the laboratories reported blood lead results too slowly to allow recruitment of children within 21 days of their blood draw so a secondary source of potential subjects was established. Two health clinics (Downtown Health Center and the Martin Luther King Health Center) were recruited to send weekly a list of children whose blood had been tested for lead. These clinics were selected because they used Project approved blood lead laboratories. Each clinic only used one blood lead laboratory.

Each week the clinics submitted a list of reports that included: the child's name, date of birth, Parent/Guardian's name, address/phone number, date of the blood lead collection, and whenever available, the blood lead result. The clinics only sent names of children who were within the one to three year eligibility requirement. Once a child had been successfully recruited and enrolled in the study, the full Stellar database record was examined to confirm the final blood lead results.

The local Program Manager used the tax assessor's database to confirm that the residence of all potentially eligible subjects was built prior to 1950. If the address was not listed, other sources, such as the city engineering department, was used to confirm the year of construction.

The local Program Manager attempted to contact the families of children who appear eligible using the telephone numbers found in the child's records in the Stellar database or from the health center reports. If the telephone number was missing or no longer in service, attempts were made to contact the families through telephone directories, reverse directories and unannounced home visits. If contact was successful, the local Program Manager tried to recruit the family into the study following procedures found in the eligibility checklist and telephone contact scripts found in the IRB package for the study.

New York City Enrollment Process: The New York City Department of Health (NYC DOH) was responsible for the prevention and control of childhood lead poisoning in the five boroughs of the city. It assisted the Center in this project by agreeing to provide names and addresses of children with certain blood lead levels to the local Program Manager for possible recruitment of these children and their dwellings into the study. This information was provided for a short duration of time in the summer of 1998 and with strict requirements regarding confidentiality. The terms of the agreement are spelled out in a memorandum of understanding signed June 10, 1998 between the Center and the NYC DOH.

According to New York State law, all one and two year old children must be tested for blood lead. Further, New York State requires that laboratories report the blood lead data to the State Department of Health within 5 days of analysis. The State electronically transfers the data for New York City children to the NYC DOH on a daily basis. The data are entered into a computer system maintained by the Lead Poisoning Prevention Program, Planning and Data Management Unit (LPPPP). The data maintained in the computer system include the name, address, telephone number, date of birth, sex and ethnicity of the child, the name of the parent(s), the name of the person performing the blood test, the laboratory performing the analysis, and the blood lead result.

The LPPPP also receives daily reports of blood lead testing from the NYC DOH's Bureau of Laboratories. Only blood lead tests performed by the Bureau itself were available from this source. The information LPPPP received from the Bureau of Laboratories was more recent than that from the State of New York reporting mechanism but the latter data system contained more complete demographic information than the Bureau of Laboratories' reports.

To identify children for recruitment in the study, information from both the NYC DOH and the Bureau of Laboratories were reviewed daily. The same general process was used for identifying children from both data sources. Each morning, data from the Bureau of Laboratories and the New York State Department of Health were downloaded by a NYC DOH employee. After downloading the Bureau of Laboratories data, listings were provided to the local Program Manager for processing.

The local Program Manager only recruited children who met the following eligibility criteria: child is 12-36 months of age at time of blood sampling; venous draws only; incident

cases only (Blood leads ≥ 10 μg/dL is first test only); the family interview and environmental inspection can be scheduled within 21 days of the blood draw; and child resides in a dwelling built pre-1950.

In order to maintain the quality of the blood lead data being used in this study, eligibility was also restricted to children whose blood lead levels were reported by pre-approved laboratories. Laboratories that demonstrated an ability to contribute a large number of subjects with venous sampling were considered for selection by the Project's Laboratory QA/QC Manager. Based on the approval program identified in the Project's Quality Control and Quality Assurance Plan, the following laboratories were approved for this project: the Bureau of Laboratories, SmithKline Beecham Clinical Laboratories (NY), Quest Diagnostics Incorporated (NJ), Laboratory Corporation of America Holdings (NY), and Columbia Presbyterian Medical Center Pediatric Hematology Laboratory.

Children were eligible for the study only if they resided in a targeted area and in pre-1950 built housing. The targeted area for the study is upper Manhattan and selected areas of Brooklyn where the NYC DOH was not conducting a concurrent study. The targeted area was defined by the following zip codes in Manhattan and Brooklyn, respectively:

Manhattan

10026 10027 10029 10030 10031 10032 10033 10034 10035 10037 10039 10040

Brooklyn

11201 11203 11204 11207 11209 11210 11211 11212 11214 11215 11217 11218 11219

11220 11222 11223 11224 11226 11228 11229 11230 11231 11232 11234

11235 11236 11237 11239

Children not living in the target areas were eliminated from the pool of eligible participants. The addresses of all children who remained eligible for the study were matched with data in the New York City Department of Finance's Fairtax database to establish the year of construction of the dwelling. Only children living in housing built prior to 1950 remained eligible.

The local Program Manager checked the records of any child with a blood lead levels ≥10 μg/dL. The child's entire blood lead testing history was searched on the computer to make sure that the report of lead poisoning is the first such occurrence for the child. Only children with newly found elevations remained eligible for the study.

The local Program Manager attempted to contact the families of all remaining eligible children using the telephone numbers found in the child's records in the blood lead databases. If the telephone number was missing or no longer in service, attempts were made to contact the families through telephone directories, reverse directories etc. When contact was successful, the local Program Manager tried to recruit the family into the study following procedures found in the eligibility checklist and telephone contact scripts found in the IRB package for the study.

In Milwaukee and New York City, the enrollment process continued until a total of 75 children have been successfully recruited and interviewed at each site: 37-38 with blood lead levels < 10 μg/dL, and 37-38 with blood lead levels ≥ 10 μg/dL.

Baltimore County Enrollment Process: In Baltimore County, although over 83% of the housing stock was estimated to contain lead-based paint in 1995, only 2.1% of the children aged 1 - 6 were tested for lead. Sixty percent of the County's housing stock was built between 1950 and 1978 (170,439 units), both single and multifamily units. Housing built at that time is located throughout the County but a number of communities contain both a large number and large percent of these units, so these communities were targeted for recruitment.

The study used Baltimore County birth records to establish a sampling frame consisting of children between the ages of 12 and 36 months living in homes built between 1950 and 1978. The sampling frame consisted of children born between June 30, 1995 and June 1, 1997, living in Baltimore County housing built between 1950 and 1978. The addresses of these children, at their birth, were matched with the list of properties built between 1950 and 1978 as recorded on the Tax Assessment Data Base. Merging of electronic records was performed by the Baltimore County Department of Health (D of H). Letters were sent to parents of children identified in this merge by the Maryland State Registrar on DHMH letterhead, informing families of the study and inviting them to participate. A pamphlet on lead developed by Maryland Department of the Environment (MDE) and a return post card were included with the letter. In accordance with state law, the matched birth records were maintained by D of H and the Center did not have direct access to individual records. The D of H provided the Center with summary statistics for children and homes in the full sampling frame, the group of responders and the group of non-responders so that epidemiological comparisons could be made.

Although Baltimore County was not involved in the direct collection of data, full cooperation with this study was provided by the Baltimore County Departments of Health; Environmental Protection and Resource Management; Permits and Development Management; and Office of Community Conservation.

After the mailing to potential participants, interviewers contacted families who returned postcards or called for more information. Families were called systematically until the family had been contacted or until at least six calls had been unsuccessful. Once families were contacted, a telephone assessment of eligibility was made using a standardized checklist. Eligible families were then invited to participate in the study. If more than one child was eligible in a given household, one child was chosen at random. If the parent or legal guardian requested it, any age-eligible child was also tested, but this information was not used for the study.

An interviewer scheduled appointments with each prospective participating family and met with an adult (parent or legal guardian) at the home who could give consent for the study (environmental testing, interview and blood sampling of the child). If the family granted permission, the field personnel then made an appointment for environmental testing of the home. The blood lead testing, interview and environmental testing for an enrolled household were conducted within a three-week period, preferably at the same time.

Chapter 1: Introduction/Baseline Program Information

Introduction

This document was written to provide standardized protocols for a study of the HUD Risk Assessment procedures. The study is funded by the US Department of Housing and Urban Development. The study was designed and will be administered by the National Center for Lead-Safe Housing ("the Center"). The Center will work with three sites: Milwaukee, Baltimore County, MD, and New York City. In Milwaukee, the Center will work in collaboration with the City of Milwaukee Health Department (MHD). MHD will serve at the local program manager and oversee the day-to-day implementation of the study. In Baltimore County, the Center will work with the Baltimore County Department of Health to design the project but the County will not be involved in the program management or day-to-day operations. Similarly, the Center will work with the New York City Department of Health (NYC DOH) on the design of the project but NYC DOH will not be involved in program management or day-to-day operations. NYC DOH will provide contact information about potential study subjects.

This document specifies the procedures to be followed by the Center, its collaborators, and its subcontractors. It describes the procedures for collecting the data, the forms and codes to be used for recording data and associated quality assurance activities. The forms are grouped together at the end of this document.

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Appendices (Blood Sampling Protocols)

Purpose of the Evaluation

The primary goal of this study is to assess under what conditions HUD's risk assessment and lead hazard screening protocols are accurate predictors of children's lead exposure. The study will attempt to identify ways to improve the accuracy and increase the cost effectiveness of the protocols. To address these goals, the Center will conduct a detailed multi-media environmental assessment of residential lead in a variety of housing and link those results to children's blood lead levels. The resulting data set will serve as a test bed for a number of statistical analyses which address many of the key issues regarding the identification of housing that contributes to the problems of childhood lead poisoning.

The study has the following goals:

1. To assess the ability of the current HUD risk assessment protocols to predict dwelling units that are likely to house children having elevated blood lead levels, and assess the effect of modifying the protocols.
2. To assess the ability of the current HUD lead hazard screen protocols to predict the need for risk assessments, to predict dwelling units that are likely to house children having elevated blood lead levels and to assess the effect of modifying the protocols.
3. To describe the contribution of friction and impact surfaces to floor dust lead loadings.
4. To assess the ability of the current HUD paint film quality classification system to predict rooms and dwelling that are likely to have elevated dust lead loadings.
5. To estimate the effect of dust lead measurement error on dust lead loadings.

Specific objectives leading to the first goal include:

a. How well do the current risk assessment protocols predict that a dwelling unit will house a child above (or below) a specified blood lead level?

b. Would a fixed set of dust sample locations affect the predictive power of the risk assessment?

c. Would the collection of composite dust wipe samples instead of single-surface dust wipe samples affect the predictive power of the risk assessment?

d. If samples were collected from additional locations, fewer locations and/or alternative locations, could the predictive power of the risk assessment improve?

e. What are the costs (or cost savings) associated with any modification of the risk assessment protocols?

f. What other factors affect the effectiveness of the risk assessment?

Specific objectives leading to the second goal include:

a. How well do the current lead hazard screen protocols predict that a dwelling unit will house a child above (or below) a specified blood lead level, what is the effect of modifications to them, and are there other factors that limit their predictive power?

b. What is the probability that a dwelling unit that fails the lead hazard screen will also fail a full risk assessment?

Specific objectives leading to the third goal include:

a. Do friction and impact surfaces on windows and doors contribute to floor dust lead levels?

Specific objectives leading to the fourth goal include:

a. Are interior surfaces coated with lead-based paint that are classified as "poor" by the risk assessment predictive of elevated dust lead loadings?

b. If the definition of surfaces in poor condition was modified, would the ability of the paint film classification system to predict dust lead loadings improve?

c. Is the current paint film classification system replicable by two risk assessors?

Specific objectives leading to the fifth goal include:

a. How much does measurement error affect the results of dust wipe sampling?

General Scope of Work/Enrollment Criteria

The Risk Assessment study will collect data from Milwaukee, Baltimore County, Maryland and New York City. These three jurisdictions were chosen because of the different ages and types of housing stock, and the presence of strong, capable local partners to help manage the study. The study population will include units housing a child, one to three years of age, who has lived at the residence for at least six months prior to enrollment. A comprehensive set of environmental tests will be taken in each home, including a visual inspection, XRF inspection, dust wipes, paint chips, soil and water samples. In addition, blood leads levels will be collected or reported from one eligible child in the family and a family interview will be administered. These tests will

occur within three weeks of each other, and all the data will be collected within one five month summer "season" in order to reduce confounding factors.

Enrollment Process Overview: The following enrollment procedures will apply to all three jurisdictions. A unit will be eligible for inclusion in this study if:

1) a child between 12 and 36 months of age has been in residence in their present home for at least six months prior to the study start date; and

2) that child has not been chelated in the last six months.

Only one eligible child per household will be included in the study. Each jurisdiction will have other conditions for eligibility (described below). All families who participate in the study will receive a small monetary incentive that will reimburse them for their time and any inconvenience related to study participation. Formal signed consent forms will be obtained before any interviews or environmental tests take place. Finally, the environmental testing will be completed in the home either prior to or concurrent with the family receiving information on the benefits of lead specific cleaning, to reduce the likelihood of cleaning prior to the environmental testing. We plan to enroll enough children to generate complete data for 75 units in both NYC and Milwaukee, and 100 units built between 1950 and 1978 in Baltimore County. (More units will be identified in Baltimore because the housing stock is less homogeneous.)

In both New York City and Milwaukee, children and properties will be recruited using the existing blood lead surveillance data bases. The sample population will be stratified into two groups on the basis of blood lead level: those with blood lead levels below 10 μg/dL, and those with blood lead levels equal to or greater than 10 μg/dL. This case-control study design facilitates the investigation of rare events - elevated blood lead status in the general population - and allows efficient use of resources to find differences between children who have elevated blood lead versus those who do not. Because blood lead testing in Baltimore County has been minimal, particularly in newer properties, we will follow a cross-sectional study design. Blood lead samples will be drawn concurrently with the environmental sampling, so the population cannot be stratified on the basis of blood lead level. Combining the two study designs will result in an analysis approach based on the case-control design. Specific enrollment procedures for each jurisdiction are described below.

Milwaukee Enrollment Process: The Milwaukee Health Department (MHD) is responsible for the prevention and control of childhood lead poisoning in the City of Milwaukee. The MHD is a partner of the Center in this research project. The local Program Manager for Milwaukee is a contract employee of the city and is housed at MHD.

The City of Milwaukee has an aggressive blood lead testing program including eight public clinics and programs, and many physicians in the private sector, who regularly test new pediatric clients. Through this testing program, children will be identified for recruitment into the study. In addition to the eligibility criteria listed above, children must be tested by venous sampling within the past 21 days to be eligible. In order to maintain the quality of the blood lead data being used in this study, eligibility will be also restricted to children whose blood lead levels were reported by pre-approved laboratories.

Laboratories that demonstrated an ability to contribute a large number of subjects with venous sampling were considered for selection by the Project's Laboratory QA/QC Manager. Based on the approval program identified in the Project's Quality Control and Quality Assurance Plan, the following laboratories were approved for this project: MHD's Blood Lead Laboratory, SmithKline Beecham Clinical Laboratories, and Aurora Consolidated Laboratories.

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Early use of the Stellar system indicated that often the laboratories reported blood lead results too slowly to allow recruitment of children within 21 days of their blood draw so a secondary source of potential subjects was established. Two health clinics (Downtown Health Center and the Martin Luther King Health Center) were recruited to send weekly a list of children whose blood had been tested for lead. These clinics were selected because they used Project approved blood lead laboratories. Each clinic only uses one blood lead laboratory.

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The local Program Manager will use the tax assessor's database to confirm that the residence of all potentially eligible subjects was built prior to 1950. If the address is not listed, other sources, such as the city engineering department, will be used to confirm the year of construction.

The local Program Manager will attempt to contact the families of children who appear eligible using the telephone numbers found in the child's records in the Stellar database or from the health center reports. If the telephone number is missing or no longer in service, attempts will be made to contact the families through telephone directories, reverse directories and unannounced home visits. If contact is successful, the local Program Manager will try to recruit the family into the study following procedures found in the eligibility checklist and telephone contact scripts found in the IRB package for the study.

New York City Enrollment Process: The New York City Department of Health (NYC DOH) is responsible for the prevention and control of childhood lead poisoning in the five boroughs of the city. It is assisting the Center in this project by agreeing to provide names and addresses of children with certain blood lead levels to the local Program Manager for possible recruitment of these children and their dwellings into the study. This information is being provided for a short duration of time in the summer of 1998 and with strict requirements regarding confidentiality. The terms of the agreement are spelled out in a memorandum of understanding signed June 10, 1998 between the Center and the NYC DOH.

According to New York State law, all one and two year old children must be tested for blood lead. Further, New York State requires that laboratories report the blood lead data to the State Department of Health within 5 days of analysis. The State electronically transfers the data for New York City children to the NYC DOH on a daily basis. The data are entered into a computer system maintained by the Lead Poisoning Prevention Program, Planning and Data Management Unit (LPPPP). The data maintained in the computer system include the name, address, telephone number, date of birth, sex and ethnicity of the child, the name of the parent(s), the name of the person performing the blood test, the laboratory performing the analysis, and the blood lead result.

The LPPPP also receives daily reports of blood lead testing from the NYC DOH's Bureau of Laboratories. Only blood lead tests performed by the Bureau itself are available from this source. The information LPPPP receives from the Bureau of Laboratories is more recent than that from the State of New York reporting mechanism but the latter data system contains more complete demographic information than does the Bureau of Laboratories' reports.

To identify children for recruitment in the study, information from both the NYC DOH and the Bureau of Laboratories will be reviewed daily. The same general process will be used for identifying children from both data sources. Each morning, the data from the Bureau of Laboratories and the New York State Department of Health will be downloaded by a NYC DOH employee. After downloading the Bureau of Laboratories data, listings will be provided to the local Program Manager for processing.

The local Program Manager will only recruit children who meet the following eligibility criteria: child is 12-36 months of age at time of blood sampling; venous draws only; incident cases only (Blood leads $\geq$ 10 μg/dL is first test only); the family interview and environmental inspection can be scheduled within 21 days of the blood draw; and child resides in a dwelling built pre-1950.

In order to maintain the quality of the blood lead data being used in this study, eligibility will be also restricted to children whose blood lead levels were reported by pre-approved laboratories. Laboratories that demonstrated an ability to contribute a large number of subjects with venous sampling were considered for selection by the Project's Laboratory QA/QC Manager. Based on the approval program identified in the Project's Quality Control and Quality Assurance Plan, the following laboratories were approved for this project: the Bureau of Laboratories, SmithKline Beecham Clinical Laboratories (NY),

Quest Diagnostics Incorporated (NJ), Laboratory Corporation of America Holdings (NY), and Columbia Presbyterian Medical Center Pediatric Hematology Laboratory.

Children will be eligible for the study only if they reside in a targeted area and in pre-1950 built housing. The targeted area for the study is upper Manhattan and selected areas of Brooklyn where the NYC DOH is not conducting a concurrent study. The targeted area is defined by the following zip codes in Manhattan and Brooklyn, respectively:

Manhattan

10026 10027 10029 10030 10031 10032 10033 10034 10035 10037 10039 10040

Brooklyn

11201 11203 11204 11207 11209 11210 11211 11212 11214 11215 11217 11218 11219 112

Children not living in the target areas will be eliminated from the pool of eligible participants. The addresses of all children who remain eligible for the study will be matched with data in the New York City Department of Finance's Fairtax database to establish the year of construction of the dwelling. Only children living in housing built prior to 1950 will remain eligible.

The local Program Manager will check the records of any child with a blood lead levels ≥10 μg/dL. The child's entire blood lead testing history will be searched on the computer to make sure that the report of lead poisoning is the first such occurrence for the child. Only children with newly found elevations will remain eligible for the study.

The local Program Manager will attempt to contact the families of all remaining eligible children using the telephone numbers found in the child's records in the blood lead databases. If the telephone number is missing or no longer in service, attempts will be made to contact the families through telephone directories, reverse directories etc. If contact is successful, the local Program Manager will try to recruit the family into the study following procedures found in the eligibility checklist and telephone contact scripts found in the IRB package for the study.

In Milwaukee and New York City, the enrollment process will continue until a total of 75 children have been successfully recruited and interviewed at each site: 37-38 with blood lead levels < 10 μg/dL, and 37-38 with blood lead levels ≥ 10 μg/dL. We expect to be able to schedule risk assessments within one week of identification of candidate children and anticipate that all risk assessments will be done within three weeks of the date that the blood sample was drawn, most within two weeks. Because Milwaukee and New York City have excellent reporting systems and excellent relationships with their respective communities, we believe this process will yield sufficient numbers of families who will agree to participate in this study.

Baltimore County Enrollment Process: In Baltimore County, although over 83% of the housing stock is thought to contain lead-based paint, only 2.1% of the children aged 1 - 6 were tested for lead in 1995. Sixty percent of the County's housing stock was built between 1950 and 1978 (170,439 units), both single and multifamily units. Housing built at that time is located throughout the County but a number of communities contain both a

large number and large percent of these units, where we will expect to conduct much of our work. Nineteen thousand children between the ages of 12 and 36 months reside in Baltimore County and many are located in communities where our target housing is located.

The study will use Baltimore County birth records to establish a sampling frame consisting of children between the ages of 12 and 36 months living in homes built between 1950 and 1978. The sampling frame will consist of children born between June 30, 1995 and June 1, 1997, living in Baltimore County housing built between 1950 and 1978. The addresses of these children, at their birth, will be matched with the list of properties built between 1950 and 1978 as recorded on the Tax Assessment Data Base. Merging of electronic records will be performed by the Baltimore County Department of Health (D of H). We estimate 2,500 - 3,000 potentially eligible children will be identified by this process. Letters will be sent to parents of children identified in this merge by State Registrar Julia Davidson-Randall on DHMH letterhead, informing families of the study and inviting them to participate. A pamphlet on lead developed by Maryland Department of the Environment (MDE) and a return post card will be included with the letter. Costs for the data merge and the mailing by DHMH will be borne by the Center. In accordance with state law, the matched birth records will be maintained by D of H and the Center will not have direct access to individual records. The D of H will provide the Center with summary statistics for children and homes in the full sampling frame, the group of responders and the group of non-responders so that epidemiological comparisons can be made.

Although Baltimore County is not involved in the direct collection of data, full cooperation with this study is being provided by the Baltimore County Departments of Health; Environmental Protection and Resource Management; Permits and Development Management; and Office of Community Conservation.

After the mailing to potential participants, interviewers will contact families who return postcards or call for more information. Families will be called systematically until the family has been contacted or until at least six calls, made in the morning, afternoon, and evening, have been unsuccessful. Once families have been contacted, a telephone assessment of eligibility will be made using a standardized checklist. Eligible families will then be invited to participate in the study. If more than one child is eligible in a given household, one child will be chosen randomly. However, if the parent or legal guardian wishes, another age-eligible child also will be tested, but this information will not be used for the study.

The interviewer will arrive at the prospective participating family's home by appointment and with proper identification, and will meet with an adult (parent or legal guardian) in the household who can give consent for the study (environmental testing, interview and blood sampling of the child). A clear, concise description of the study, including risks and benefits will be presented. The interviewer will answer respondent questions, or, if unable, make a notation for the site coordinator to talk with the respondent. The respondent will then be asked to sign a formal consent form to allow the study to proceed and will be given a copy of the signed consent form. If the family grants permission, the field personnel will make an appointment for environmental testing of the home. The blood lead testing, interview and environmental testing for an enrolled household will be

conducted within a three week period, preferably at the same time. If the respondent is unwilling to participate, field personnel will thank them for their time and ask why they are declining to participate. No pressure will be applied if the respondent is reluctant or refuses to answer that question. If the interviewer determines that the parent or legal guardian is mentally ill or mentally retarded, s/he will evaluate the individual's ability to provide informed consent using a standardized checklist form and proceed only if the individual is determined capable.

All field staff who conduct family interviews will be experienced in interviewing techniques. The Center staff will train all interviewers in interview procedures to be used in this study, including procedures for maintaining confidentiality and privacy. Informed consent must be given by the parent or legal guardian before any testing or interviewing can be done. All environmental risk assessors will also be trained in procedures for maintaining confidentiality and privacy during the course of the study. The collection of data from families living in Baltimore County will take place within one five-month summer "season", June through October 1998, in order to reduce confounding factors.

Families will be informed of the results of all environmental testing and the blood lead test for their child. If the family wishes, results of the blood lead test will be sent to the child's health care provider. All families who participate in the study will receive a small monetary incentive. Children who provide a blood specimen will receive a book or toy. Formal signed consent forms will be obtained before any interviews, blood draws, or environmental testing take place. All families will receive information about any identified lead hazards and how to do lead-specific cleaning at the time of the environmental inspection. Finally, all families contacted about participation in the study will receive general information on lead and lead-specific cleaning after the environmental testing of their home.

Families with a child found to have a minimally elevated blood lead level ($\geq$ 15 μg/dL) will receive follow-up from the Baltimore County D of H to ensure the child is re-tested in accordance with CDC guidelines. Families living in a home in which lead hazards have been found (but the child's blood lead level is not elevated) will be given a list of Baltimore County resources, should they request help in eliminating the hazards identified.

All blood lead levels will be reported by the lab to MDE's Childhood Lead Registry, as required by law. Blood lead levels $\geq$ 15 μg/dL will be reported directly by the Center to Baltimore County D of H for follow-up. The results of environmental testing on a specific home will only be shared with Baltimore County officials if a child has a BLL requiring intervention ($\geq$ 20 μg/dL).

FORM 01 - BUILDING AND DWELLING UNIT INFORMATION

A. General Information

Program information needed to enter the dwelling and family into the study will be collected on Form 01. This information consists of baseline dwelling characteristics and baseline information about the resident household. A Form 01 will be completed for each enrolled dwelling unit. Contact information for the resident family and property owner is also included.

Responsibility for the completion of this form will be shared by the local program manager and the risk assessor. Both parties will work together to develop a plan to gather the data most accurately and record this information on the form.

1. Identifier

Each dwelling unit and household will be assigned a unique ID number by the local program manager. A detailed description of the identifier is discussed in Section B. The identification of the dwelling is critical because it will be the principal link for comparing data across forms. The street address is included for quality assurance so that the program manager can confirm that the ID assigned to a specific dwelling is the correct ID for that dwelling.

Program managers will assign the basic identifiers prior to the visit to the field. Pre-assigning the identifiers should reduce the number of data errors in the field.

2. Addresses and Contact Information

Program managers will collect basic information identifying the address of dwelling unit and the names and contact numbers for parents/legal guardians of each enrolled child in the study. This information will be recorded on Form 01. The risk assessor will be responsible for verifying this information on-site.

3. Baseline Dwelling Characteristics

General information on the age, tenure, size, and number of floors and dwelling units in a building is collected to understand the housing stock that is addressed in the study. Many of these factors have been shown to be related to the presence of lead-based paint and lead-based paint hazards in other parts of the country.

The baseline dwelling characteristics will be recorded on Form 01 by the program manager and the risk assessor. Information on the year of construction and value of the *dwelling unit* should be collected by the program manager from city/county records. For example, the year of construction can often be reliably obtained from the tax records or a deed on file. This information will be recorded on Form 01 before the form is transferred to the risk assessor. The risk assessor will be responsible for completing the other observations on Form 01. The risk assessor should also verify that the age and value of the housing are reasonable. If this information appears to be in

error, the risk assessor should use his/her professional experience to correct the information.

B. Evaluation Program Identifier

In order that all data collected for the study can be appropriately associated with a particular dwelling unit, a detailed identification system has been established for this project.

Form 01 - Building and Dwelling Unit Information will be used to assign these codes and to collect basic program information from a variety of sources.

Proper assignment of the identifier will be critical for the study. The identifier includes the site of data collection, the building ID and dwelling unit ID.

FIELD	DESCRIPTION	WIDTH (# of characters)	ALLOWABLE VALUES
Site	Locality where data are being collected	1	1 = Baltimore County 2 = Milwaukee 3 = New York City
Building ID	A unique consecutively numbered code for each physical structure in which dwellings are enrolled	4	1001 - Baltimore County will begin with 1, Milwaukee 2, and New York City 3.
Dwelling Unit	Use 00000 for single family homes Otherwise use apt. number or some other designation	5	00000 = Single Family DU 00001-ZZZZZ - Multi. DU

C. General Information for All Forms

At the bottom of each form, the person completing the form will print his or her initials in the appropriate box along with the date. Once an environmental form is completed, it will be turned over to a person at the inspection firm who will review the form. Once the inspector/reviewer has verified that all boxes/fields on a form have been completed correctly, the inspector will write his or her name in the box titled ‘name of inspector’. The form will then be submitted to the local program manager who will conduct a review of all forms. After each form has been reviewed and corrected as necessary, the local program manager will print his or her name in the box titled ‘name of reviewer’. All forms can then be prepared for shipment to the Center for data entry.

FORM 02 - SKETCH

Accurate sketches are critical to the success of the study because they contain the room/location identifiers that will be used throughout the study. Failure to sketch and label the floor plan accurately and to assign room identifiers correctly to all associated forms will limit the success of the data analysis.

The risk assessor will draw a separate sketch of the exterior site plan and of each interior floor that is accessible to the residents of the dwelling unit. For example, if the enrolled family lives on the second floor of a two-flat with an accessible basement, four separate sketches are required (exterior site, basement, first floor stairway, and the second floor hall/apartment). Each sketch will be recorded on a different Form 02. The location of the sketch will be marked at the top of each form. For example, E = exterior, BA= basement, 01=first floor, and 02=second floor.

All sketches for a dwelling unit will be oriented in the same direction. The bottom of the page will be the location of the street that is the street address of the unit. For example, if the dwelling is in on the corner of Vine and Pope and the address is 25A Vine St., the site plan should be drawn as though the risk assessor is standing on Vine facing the property. The street side of the house will be considered the "A" side. The remaining three sides of the building will be lettered B, C, and D in a clockwise direction. (The wall codes are pre-printed on Form 02.)

A number will be assigned to each sampling area. A sampling area will be identified as a room/location. Room/locations are comparable to the room equivalents defined in Chapter 7 of the HUD Guidelines. Each room/location will be clearly numbered on the appropriate page of Form 02.

The exterior site plan will include a "footprint" of the building where the residents live. The building exterior will generally be considered a single room/location. All other painted exterior structures on the site, including storage areas/sheds, porches and garages will be included on the exterior sketch. Each exterior structure will be considered a separate sampling location with unique room/location number. Porches and exterior stairways may be considered separate rooms if their numbering will clarify sampling locations, but their numbering is not required.

The interior sketches should indicate the locations of all interior rooms, basements, stairways, hallways, and balconies. Each of these locations will be considered to be separate room/location with a unique room/location number. Closets are considered to be part of the room in which they are located; they should *not* receive a separate room number. Walls, doorways, windows and stairways should be indicated on the sketch, but they do not have to be labeled.

Room/locations at a dwelling unit will be numbered sequentially, beginning with the exterior/site, moving to all other exterior locations, and then continuing with the interior of the building starting with the lowest level and working one's way up. Although it is recommended that rooms are numbered in a clockwise direction on each floor, the exact numbering system is at the discretion of the risk assessor as long as it is systematic and no rooms are missed. Stairways shall be numbered on the floor from

which they start, not on the floor to which they lead. No room/location number should be used more than once at the same property.

The risk assessor will complete the room/location chart on the right side of Form 02. Each room/location will be assigned a room function, using the codes on the Form.

For any room/location at a multifamily (more than single-family) building that is accessible to more than one household, Z will be added to the room function code. For example, a first floor common area lobby would be coded LZ. (The lobby on the interior of the enrolled dwelling unit would simply be coded with an L.) The use of the Z is important for the analyses so that common areas can be separated from the household's dwelling unit. All exterior room/locations at a multifamily building should be coded with a Z since they are accessible to multiple households. Thus, at a multifamily building, the exterior/site will be coded EZ.

Chapter 2: Visual Inspections and Sampling of Paint, Dust, Soil and Water

FORM 03 - VISUAL INSPECTION

A. General Information about the Building

The risk assessor will conduct a visual inspection of the building/dwelling unit. The inspector will describe general characteristics of the building and complete the risk assessment building visual inspection as described in Chapter 5 of the HUD Guidelines.

The general characteristics will describe:

- the exterior surface type of the building
- the principal heating and cooling systems used by the residents
- any evidence of local point sources for lead (in the four block area)

The exterior surface type question has space for two responses: the primary and the secondary exterior surface type. A secondary exterior surface type should be listed when the other surface type is more than narrow pieces of trim around the windows, doors and cornice. For example, at a building with a wooden soffit that is more than 2 feet wide, the secondary exterior surface type should be identified as wood. If a secondary exterior surface isn't present, the code "none" should be recorded.

B. Risk Assessment Building Visual Inspection

The risk assessor will use the building condition chart on Form 03 to assess the building condition. The chart is derived from Form 5.1 of the HUD Guidelines with two slight modifications. An assessment of the interior flooring ("flooring is loose, missing or cracked, carpeting badly deteriorated") has been added based on preliminary evidence that the condition of the flooring may have an impact on dust lead levels. A third column (N/A) has been added for components that are not present or cannot be assessed through reasonable means. For example, a flat roof that is not accessible through a public entrance and not visible from the ground would be coded N/A. The risk assessor is not expected to climb onto roofs or use extension ladders. Roofs and chimneys should be assessed from the ground.

Risk assessors should use their professional training and experience to determine the condition of the components. General guidelines will be provided to risk assessors as part of the training that will be required prior to the start of the field collection.

FORM 04 -WINDOW AND DOOR INVENTORY

An inventory of the windows and doors within the dwelling unit has been added to the basic risk assessment. While the basic risk assessment protocols call for an assessment of all painted surfaces that are susceptible to friction or impact, they do not count the

total number of these surfaces or the number of these surfaces that are unpainted. Such information may be very informative to an analysis of the importance of friction or impact surfaces to lead exposure.

The focus of this additional information collection will be limited to door and window components that have movable parts. In each room/location, the risk assessor will take an inventory of the windows and doors within the room. Doors will only be counted once per opening; in the room into which the door swings open. Openings without doors will not be counted as part of the inventory. Only passageway doors and closet doors will be counted; cabinet doors, doors to utility boxes (i.e., circuit breakers), or other similar doors will be excluded from the inventory.

Windows will be counted by the number of mechanical openings. A double-hung window will be counted as one window. Side-by-side casement windows will be counted as two windows. A window without a moveable part (e.g., a picture window) will not be included in the inventory. Transoms will also not be included in the inventory.

A. Inventory Procedures

1. Location of Component

For each door and window in the inventory, the room number, a wall code, and component code will be recorded. The wall code will use a letter and number to designate the exact location of the component. The letter (A,B,C,D) will designate the wall where the component is found. The letters will correspond to the letters on the sketch (Form 02); the A wall faces the road and the letters continue clockwise from there. The number will represent the number of the window or door on the wall. The numbers will be counted from left to right. Thus, if there are two windows on the A wall, the left window (when facing the window from the room) will be A1 and the right window will be A2. If there is only one window or door, it should be designated "letter"1 (e.g., A1, B1, etc.).

For passageway doors, the first column (Room Number) will be used to record the room into which the door swings. The second column (Other Room Number) will be used to record the room that the door swings away from. The “Other Room Number” column is only needed for passageway doors and should be left blank when closet doors and windows are inventoried.

As noted above, passageway doors should only be counted once per opening. However, when using the wall code to designate a door, all openings will be counted. As an example, consider a room (Room 05) with two doors on wall B. On the left is a passageway door that swings into Room 06 and on the right is a closet door. For the purposes of wall coding, the closet door will be designated as B2, even though the passageway door will not be counted in Room 05 because it swings into Room 06. This convention is used so that potential XRF test sites (i.e., the door casing) will match up with the inventory.

The component code on this form will designate the specific subset of door or window in the inventory. The following codes will be used:

Component	Code
Door	D
Closet Door	CD
Window (casement)	Wc
Window (double-hung)	Wd
Window (other)	Wx

2. Paint Condition

For each component on the inventory, the risk assessor will record whether the component is painted or not. Painted surfaces will include surfaces covered with coatings such as varnish, shellac, or stains. Each door with paint on the door or jamb and each window with paint on the window sash or jamb will be considered a painted component. (A component with factory applied paint will not be considered painted.) For each *painted* component, the overall condition of the paint will be assessed. The paint condition will be judged using the same coding system described in the HUD Guidelines and on the bottom of page 2-7 of these protocols.

The risk assessor will also note whether the *painted* doors and windows rub while in operation. Each door with paint on the door or jamb and each window with paint on the window sash or jamb will be opened and shut to determine whether those surfaces are rubbing or binding. When the component is inaccessible or obstructed by the family's personal belongings, the risk assessor should not test the component for rubbing or binding. Inaccessible painted components should be recorded as "I". Whenever the component is <u>not</u> painted, the condition and rubbing/binding fields should be left blank.

3. Window Accessibility

For all windows in the inventory, three additional measures that may affect exposure will be considered:

Is the window sill or trough accessible?
How high is the sill from the floor?
Is there an air circulation system in the window such as an air conditioner or a fan?

Window accessibility will be measured using a six point scale:

1. Sill/Trough accessible (window opens freely; not blocked)
2. Sill/Trough partially blocked by large fixture/furniture; floor accessible
3. Sill/Trough partially blocked by large fixture/furniture; floor inaccessible
4. Sill/Trough completely blocked by large fixture/furniture
5. Trough inaccessible (painted or nailed/screwed shut)

6. All inaccessible (e.g. air conditioning unit)

Points 2, 3 and 4 should be answered in relation to a young child. The window is partially blocked (#2) when a piece of furniture sits in front of part of the window so that less than 2 linear feet of floor are accessible below the opening. The window is partially block (#3) but the floor is inaccessible when a fixture or piece a furniture sits in front of a window so that the sill is accessible to the child, but the floor immediately underneath the window is inaccessible. Examples include a window partially blocked by a bed, a couch or chair or a bathtub. A window is completely blocked (#4) when a piece of furniture or a fixture (such as a kitchen sink) is completely in front of the window and is higher than the sill or extends into the room so that a small child will not routinely reach the sill/trough. When a window does not open freely, then it is inaccessible and is not blocked.

Window height should be estimated by the risk assessor. Risk assessors may want to use a tape measure at first to become comfortable with these estimations. The height will be measured from the floor to the sill. The measurement will be to the nearest foot.

The risk assessor will record whether there is an air system in the window. This information will be used to measure any factors that could influence the “blow-in” of lead-contaminated dust from the exterior.

FORM 05 - XRF PAINT TESTING AND INSPECTION

A. General Information

Although this is a study of the risk assessment protocols, a complete paint inspection will be completed to determine the amount and levels of leaded paint present in the study homes. All painted components of the house should be tested. A component with factory applied paint will not be considered painted for this study. Furniture should only be tested if paint is loose/peeling, or is easily chewable (such as a painted crib).

All inspectors participating in this study will be certified as a paint inspector by the state where the work is being performed. Paint will be analyzed by portable x-ray fluorescence (XRF) analysis or laboratory analysis of paint chips when the surface is inaccessible by the XRF instrument.

1. Location of Components to Be Inspected/Tested

All testing combinations will be recorded on Form 05. Begin in a room/location and record all testing combinations within that room. Above the block of testing combinations, record the room/location number and the room function code from the sketch (Form 02). If there are more than 9 unique testing combinations within the same room, record the remaining testing combinations in the next available block. Make sure to record the room/location number and code above that block as well. Do not record testing combinations for more than one room/location in the same block.

For each testing combination, record the wall code, the component code and the substrate code. The wall code will be designated in the same way that it was for the window and door inventory (p. 2-2). Each testing combination should have a two character wall code (e.g., A1), except for ceilings, floors and furniture. For these components, the code N will be used as the wall code.

A component code will be assigned to each testing combination. Approved component codes can be found on the list on page 2-6. If a component code is not available for the component being tested, use one of the “other” codes to record the testing combination and briefly decribe the component in the notes box at the end of the row. Table 2.1 also includes a list of substrates and the appropriate conversions to the list of six substrates contained in the Performance Characteristics Sheets.

Table 2.1
Component Codes

Walls/Trim/Ceilings/Floors		Window	
CL	Ceiling	WC	Window Casing
F	Floor	WES	Window Exterior Sill
TM	Trim-Moldings (baseboard, chair rail, crown m)	WIS	Window Interior Sill
LW	Lower Wall	WJ	Window Jamb
UW	Upper Wall	WS	Window Sash
W	Wall	WW	Window Trough (Well)
OT	Other Trim Component	OW	Other Window Component
Doors		**Misc**	
D	Door	CA	Cabinet
DC	Door Casing* (test if dif from DJ)	CD	Cabinet Door* (test if dif from CA)
DJ	Door Jamb/Casing	FR	Furniture* (test if peeling)
DT	Door Threshold* (test if dif from F)	RD	Radiator
TR	Transom	S	Shelf
OD	Other Door Component	SP	Shelf Support* (test if dif from S)
		WP	Water Pipe (Hot Water Riser)
		O	Other
Stairs		***Substrate Codes***	
B	Baluster	*1=Brick*	
P	Post	*2=Concrete*	*(stone, cinder block, cementitious siding)*
HR	Hand Rail/Stair Railing	*3=Drywall*	*(ceiling tile)*
SS	Stair Skirt/Stringer	*4=Metal*	*(aluminum siding)*
T	Stair Tread/Riser	*5=Plaster*	*(stucco)*
OS	Other Stair Component	*6=Wood*	
		7=Other	*(i.e., painted vinyl)*
Exterior			
CN	Column	SO	Soffit
FA	Fascia	G	Gutter/Downspout

2. Paint Condition Coding

Risk assessors will visually inspect all painted surfaces to assess the paint film quality. Two classification systems will be used:

- paint film quality classification system per the HUD Risk Assessment Protocols (Table 2.2)
- paint deterioration classification system developed for this study (Table 2.3).

For both rating systems, the risk assessor will not measure the defective areas to determine the percentage of paint failure; visual estimation is adequate. The HUD paint film quality rating will be recorded on Form 05 in the column marked HUD Paint Condition. The study paint deterioration rating will be recorded in the column marked NCLSH Paint Deterioration. The inspector will also note whether the coating is paint or a different coating (i.e., stain, varnish).

Table 2.2 HUD Categories of Paint Film Quality

Type of Building Component	1 = Intact	2 = Fair	3 = Poor
Exterior components with large surface areas	Entire surface is intact	Less than or equal to 10 square feet	More than 10 square feet
Interior components With large surface Areas (walls, ceilings, floors, doors)	Entire surface is intact	Less than or equal to 2 square feet	More than 2 square feet
Interior and exterior Components with small surface areas (window sills, baseboards, soffits, trim)	Entire surface is intact	Less than or equal to 10 percent of the total surface area of the component	More than 10% of the total surface area of the component

Table 2.3 NCLSH Study Categories of Paint Deterioration

Type of Building Component	1	2	3	4	5
Exterior components with large surface areas	Intact	Less than or equal to 5 square feet	More than 5 ft^2 and less than or equal to 15 ft^2	More than 15ft^2 and less than or equal to 25 ft^2	More than 25 square feet
Interior components with large surface areas (walls, ceilings, floors, doors)	Intact	Less than or equal to 1 square foot	More than 1 ft^2 and less than or equal to 3 ft^2	More than 3 ft^2 and less than or equal to 10 ft^2	More than 10 square feet
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Intact	Less than or equal to 5% of the total surface area	More than 5% and less than or equal to 15% of surface area	More than 15% and less than or equal to 25%	More than 25% of the total surface area

B. XRF Paint Testing Protocols

Inspectors will use the XRF testing protocols described in Chapter 7 of the 1995 HUD Guidelines for the Evaluation and Control of Lead-Based Paint (revised 1997). The inspector will also follow the manufacturer's instructions and the EPA/HUD Performance Characteristics Sheet guidance for the specific XRF instrument used.

The following rules supplement or supersede the Chapter 7 protocols:

a. Only one reading will be taken from each testing combination, *including* walls.
b. For every window tested, five window components should be tested (if accessible): window sash, window jamb, window casing/apron, the window sill, and the window trough.
c. Treat trim moldings (baseboards, chair rails, crown moldings) as one testing combination in each room.
d. Test a floor in every room.
e. The paint chip sampling protocols will be superseded by the protocols found below in section C. ONLY components that cannot be tested with the XRF AND have loose, peeling paint will be have paint chips collected.

1. Calibration of XRF Instruments

The XRF instrument will be calibrated according to the manufacturer's instructions prior to testing each dwelling. If the instrument fails to pass the calibration test, testing should be stopped until the instrument is fixed or an alternate instrument is available to continue testing. Confirmation that the pre-testing calibration was successful will be recorded along with the time and temperature and the type of instrument being used

The inspector should continue to follow the manufacturer's recommendations for calibration throughout the day. After the final reading is taken, the calibration of the machine should be retested for study purposes. The inspector will record whether the final calibration test passed as well as the time and temperature.

2. Inconclusive/Inaccessible Readings

All inspectors participating in this study have agreed to use XRF instruments that do not have inconclusive ranges. NO readings in this study should be considered inconclusive based on the Performance Characteristics Sheet.

An XRF instrument may not be a viable measurement tool when the surface being tested is irregularly shaped or in an inaccessible location. If the XRF instrument cannot get an accurate reading and the paint on the surface is loose and peeling, then paint chips will be collected.

C. Paint Chip Collection Protocols

Paint chips will be collected by carefully removing the loose paint and placing it in a container for shipment to the lab. No more than 10 paint chips will be collected per dwelling unit.

Paint chip testing and analysis is for study purposes only, and is not conducted to identify all surfaces with lead-based paint. Therefore, unlike the HUD Guidelines:

- only loose, easily removable paint should be sampled,
- a scraper should not be used,
- the bottom layer of paint should not be collected if intact, and
- the sample should be reported in parts per million (ppm) and therefore does not need to be measured.

Because the paint chip analysis differs in its purpose and procedures from the XRF analysis, the paint chip results will be treated separately from the XRF results. The paint chip results will not be used to calculate average paint lead levels.

1. Materials

Materials Supplied by the Central Lab

- Centrifuge tubes (50 ml)
- Non-sterilized, non-powdered disposable gloves
- Laboratory Submittal Form

Other Supplies to be Supplied by the Program Manager/Risk Assessor

- Plastic sheeting
- Disposable wipes (to be used to clean the sampling device)
- Paint Sample Collection Form (Form 05)
- Permanent marker
- Trash bags

2. Sample Collection Procedures

NOTE: Collect all dust samples before any paint chip samples are collected. The risk assessor will prepare the area under the surface where the paint chips will be collected by laying down an appropriately-sized piece of plastic sheeting. The plastic sheeting should be large enough to catch any chips that might fall during the sampling process. The HUD Guidelines offers general guidance that the sheeting should be four feet by four feet.

After laying down the plastic, but prior to collecting samples, the risk assessor should remove the top from a centrifuge tube and put on disposable gloves. With a gloved hand, the risk assessor should remove as much peeling paint as possible from the surface. All paint chips that are removed should be placed in the centrifuge tube. If any chips have fallen onto the plastic, they should also be placed in the tube. When all loose paint has been removed from the surface, the risk assessor should seal the tube and label the container with the permanent marker.

The laboratory requires a minimum of 100 mg of paint (similar to 1/10th of a sugar packet) for analysis. If the risk assessor estimates that less than 100 mg of paint is loose and accessible, a paint chip from the surface should not be collected. The risk assessor should not use a scraper or knife to collect additional paint because the owner will not have granted permission for destructive paint sampling. The risk assessor should also not combine chips from two testing combinations in the same tube.

When the collection of the paint samples is completed, the risk assessor must be sure to clean up any dust and debris that fell on the plastic sheeting using a disposable wipe. The risk assessor should also clean any other surfaces where debris may have settled. If the plastic sheeting is well wiped after each sample, it may be used for the other samples in the dwelling. Otherwise, it should be placed in risk assessor's trash bag and removed from the dwelling when sampling is complete.

3. Laboratory Submittal

Risk assessors will submit samples to the central laboratory using the submittal forms that are specified by the lab. The risk assessor who collects the paint chip samples is responsible for the accurate completion of the laboratory submittal form. The sample numbers from Form 05 must be used on the laboratory submittal form. The risk assessor should confirm that all samples recorded on Form 05 are in fact present on the laboratory submittal form.

The risk assessor will be responsible for packaging all samples with the laboratory submittal sheets and shipping them to the central laboratory. (The National Center will be responsible for postage.) The risk assessor will receive the results of the samples from the lab and fill in the paint chip results fields on Form 05. Once the Form has been completed and reviewed for accuracy and consistency, it will be delivered to the program manager for final processing before data entry.

4. Laboratory Analytical Procedure

The central laboratory has shown evidence that it is proficient in paint chip lead analysis under the Environmental Lead Proficiency Analytical Testing Program. All environmental samples, including paint chips, shall be analyzed for total lead. In general, the paint chips will be analyzed as a bulk solid following specific protocols found within EPA document SW-846. The paint chips will be analyzed for lead by flame (FLAA) atomic absorption spectroscopy. Samples will be analyzed to a method detection limit of 16 ppm (parts per million). The samples will be analyzed after they have been prepared with acid digestion in a microwave unit. A standard set of operating procedures (SOPs) will be employed for the analysis of the paint chip samples. These SOPs are contained in the study quality assurance document.

D. Data Recording Procedures (Paint Test Results)

The XRF results will be recorded under the heading XRF Reading. Readings will be reported to the tenths place. If the surface is inaccessible to the XRF, mark the space with an NA for Not Accessible.

The laboratory will provide results of the paint chip samples in parts per million. The risk assessor will record the results on Form 05. Results that are not detectable by the lab should be recorded as "<" followed by the numeric value provided by the lab. If there was not enough paint for analysis (less than 100 mg) and a paint chip was not collected, an N should be recorded in the field for Paint Chip Results.

FORMS 06/07 - DUST SAMPLING

A. Number & Location of Dust Samples

1. Potential Location of Samples:

Before collecting samples, the risk assessor (possibly in conjunction with the interviewer) should locate the following rooms:

a. Principal playroom of child enrolled in the study;
b. Kitchen;
c. Bedroom of the child enrolled in the study;
d. Bedroom of any other child under 6 residing in the dwelling unit;
e. Living room;
f. Bathroom commonly used by child;
g. Most commonly used entryway.

2. Composite Samples

Composite dust wipe sampling is the process of wipe sampling a common component in multiple rooms, inserting the wipes in the same container, and then having all wipes analyzed as one. As the HUD Guidelines suggests, the potential advantage of composite wipe sampling is that when compared to single-surface sampling, the same number of rooms are tested for a lower cost, because the lab analyzes fewer samples. Since composite samples are commonly made up of subsamples from four rooms, the lab only analyzes one sample instead of the four that would be analyzed with single-surface wipe sampling. The potential disadvantage of composite wipe sampling is that information about the dust lead levels in each of the four rooms will not be available. If a child's blood lead level is affected more by the maximum dust lead level in the dwelling instead of the average dust lead level, then composite sampling may gloss over potentially serious hazards.

The potential impact of using composite sampling instead of single-surface sampling will be analyzed in the study. A composite sample and a series of single-surface samples will be collected for four to six component types in each dwelling unit. The impact of the alternate sampling methods on children's blood lead levels will be studied.

There are potentially six component types that will be sampled with composite sampling:

Bare Floors-Center of Room
Carpeted Floors-Center of Room
Bare Floors-Under a Window
Carpeted Floors-Under a Window
Window Trough
Interior Window Sill

Each composite dust wipe sample should be made up of four subsamples from the same component type. For example, an interior window sill composite sample could contain subsamples from window sills in the playroom, kitchen, bedroom of the enrolled child, and the bedroom of a second child less than six years old. In dwelling units where there are only two or three rooms in a dwelling with a particular component type (e.g., a carpeted floor in the center of the room), then a composite sample for that component type should still be collected. However, if at all possible, four subsamples should be collected. In all cases, the risk assessor must be sure to note the number of subsamples collected on both the laboratory submittal sheet and on Form 06 (Composite Dust Sampling). If only one room contains a particular component type, then a composite sample should not be collected. (Since a single-surface sample will already be collected from that location, a second single sample is unnecessary.)

The risk assessor may find that there are more than four rooms in a dwelling with the same component type. For example, there may be eight rooms in a dwelling with a window trough. To select the four rooms that will be sampled, the risk assessor will use the Composite Sampling Location Hierarchy found below to prioritize the rooms. The risk assessor will proceed down the list of rooms on the hierarchy until four room/locations have been identified that contain a specific type of component. The room/location number and the room type will be recorded on Form 06.

Composite Sampling Location Hierarchy

Locations

1. Principal play area
2. Kitchen
3. Bedroom of enrolled child
4. Bedroom of other child less than 6
5. Living Room
6. Bathroom
7. Other Uncarpeted Room(s) (living space only)
8. Other Carpeted Room(s) (living space only)

Example of Composite Sampling Location Selection

The risk assessor arrives at an apartment with the following surface types of each room:

Playroom (in living room)	- Full carpeted floor	Window Present
Enrolled Child's Bedroom	- Full carpeted floor	Window
Second Child's Bedroom	- Full carpeted floor	Window
Kitchen	- Bare floor	Window
Bath	- Bare floor	Window
Master Bedroom	- Full carpeted floor	Window
Hall	- Bare floor	No Window

No other rooms in the apartment

Using the hierarchy, the following composite samples are collected:
(# indicates the hierarchy ranking of the room)

Bare Floor-Center of Room:	Kitchen (#2)
(3 subsamples)	Bath (#6)
	Hall (#7)
Carpeted Floor-Center of Room:	Playroom/Living Room (#1/5)
(4 subsamples)	Child's Bedroom (#3)
	2nd Child's Bedroom (#4)
	Master Bedroom (#8)
Bare Floor-Under Window:	Kitchen (#2)
(2 subsamples)	Bath (#6)
Carpeted Floor-Under Window:	Playroom/Living Room (#1/5)
(4 subsamples)	Child's Bedroom (#3)
	2nd Child's Bedroom (#4)
	Master Bedroom (#8)
Window Sill:	Playroom/Living Room (#1/5)
(4 subsamples)	Kitchen (#2)
(same for Trough)	Child's Bedroom (#3)
	2nd Child's Bedroom (#4)

Discussion: The risk assessor has no choices on floors. For each of the four floor component types, there are four or fewer rooms that are available. Therefore, all rooms with a particular floor covering are selected when sampling floors. The risk assessor does has a choice of windows, however, since there are six rooms that contain windows. Because the first four rooms on the location hierarchy have windows, these rooms are selected for composite sampling of windows. In each case, the risk assessor must record the number of subsamples in each composite sample so that the samples may be analyzed properly.

Composite and single-surface dust wipe samples will often be collected from the same area of a room. The risk assessor must make sure that the wipe areas do not overlap. Windows where both composite and single-surface samples are collected should be divided in half by masking tape. These samples should be collected on opposite sides of the same window. Do not use a second window for the different samples.

3. Single-Surface Samples

a. Sampling Locations

The risk assessor will collect single-surface samples from the following locations:

Most-commonly used entryway to unit

Floor: Collect two floor samples, one from just outside doorway and one just inside doorway. The Main Entry (Hallway/Porch) sample may be from an interior common area hallway or an open porch. If the main entryway opens directly to an outside step/sidewalk, then a second entry sample won't be collected. Record the room/location number on Form 07.

Living Room, Kitchen, Bathroom, Bedroom of Enrolled Child, Bedroom of Other Child

In each of these five rooms, collect the six dust wipe samples as described below. Record the room/location number for each room on Form 07. If there isn't a second bedroom or a second child, do not collect samples from an alternate room.

Floor: Collect four floor samples: One from an entry doorway to the room, one from under a window that is used, one from an area against the wall opposite the window, and one from the center of the room. If no window is present in the room, do not collect an alternate sample. Record the fact that there isn't a window in the column marked Surface Type (0=No window). If the main entryway is in one of the room's listed above, select a second doorway for the entry sample.

Window: Collect one window sill and one window trough sample from the same window. If composite window sill/trough subsamples were collected from this room, collect the single-surface samples from the opposite half of the window. If no window is present in the room or the component is inaccessible, do not collect an alternate sample. Record the fact that there isn't a window or the window is inaccessible in the column marker Surface Type (0=No Window, 1=Inaccessible). Windows that are temporarily inaccessible because they are nailed or screwed shut, should be sampled if they can be opened with a reasonable effort.

Playroom

If one of the tested rooms (living room, kitchen, child's bedroom, 2nd child's bedroom) is determined to be the enrolled child's playroom, then the risk assessor will check off all samples collected from that room in the column marked "Playroom." If the principal playroom as determined by the parent/guardian is not one of the rooms previously sampled, the risk assessor will sample the playroom

and record the results on page 3 of Form 07 next to "Other Room". The playroom column should be checked off.

Multifamily Common Areas

When sampling low-rise buildings (four stories or less), the risk assessor will collect two additional dust samples: one from the floor immediately inside the building entry door and one from the floor of the first-story landing on a common hallway or stairway. If the building has more than four stories, an additional floor sample and a window sill sample will be collected from the fifth floor hallway or stairway.

Exterior Dust Sample

Collect exterior (outside) sample for every dwelling. The exterior sample will be collected from the step/sidewalk just outside of the main entrance to the building. The sample should be collected from an surface that is exposed to the exterior.

b. Identification of Risk Assessment Sampling Locations

According to risk assessment protocols contained in Chapter 5 of the HUD Guidelines, risk assessors are given some professional discretion when determining dust sampling locations. The Guidelines state that "If composite sampling is not used, at least six to eight single-surface dust samples are necessary to evaluate the hazards in each dwelling.…Risk assessors should combine this general guidance with the data from the visual inspection and any information gathered about the residents' use patterns to determine the exact number and location of dust samples to be collected."

For the purposes of evaluating the effectiveness of a professional risk assessment, risk assessors in this study are asked to identify the six to eight sample locations that they would have chosen had this study not been conducted. Risk assessors will check off 6-8 boxes in the column RA Inspection Site where samples would have been collected.

c. Surface Type/Condition

For every sample location that will be tested, the risk assessor will characterize the surface type and surface condition. The sample types are listed at the bottom of Form 07:

- Painted Surface
- Unpainted Wood
- Unpainted Concrete
- Unpainted Metal
- Vinyl/Tile
- Carpet
- Other

Stains, varnishes and shellacs as well as factory applied paint will not be considered paint when determining the surface type.

The risk assessor will characterize the surface condition as:

1. Smooth and Cleanable
2. Mostly Smooth and Cleanable; Minor Deterioration
3. Not Smooth but Generally Cleanable
4. Not Smooth and Not Cleanable

Only the surface that is wiped will be characterized. The assessment is meant to gauge whether the surface is rough or contains cracks or crevices where leaded dust will settle that cannot be removed through routine household cleaning. Carpeting will fall into the final two categories. General guidelines will be provided to risk assessors as part of the training that will required prior to the start of the sample collection. Risk assessors will also be expected to use their professional training and experience to make these determinations.

B. Wipe Sampling Procedures

Risk assessors should conduct composite and single-surface dust wipe sampling using the wipe sampling protocols found in the Appendix to this chapter. Systematic sampling of dust is essential to the basic study design.

C. Data Recording Procedures

Risk assessors should record the measurements of the sample to the nearest 1/8th of an inch. The dust results should be recorded in both total μg/sample and μg/ft^2. Results that are below the limits of detection of the lab will be recorded as ✌<✍ followed by the numeric value provided by the lab.

D. Blank Preparation

The risk assessor will collect one single-surface blank wipe sample for each dwelling unit sampled and submit the sample to the laboratory for analysis. Analysis of the field blank samples determines if the sample media is contaminated. Field blank samples will be obtained after the final component in the dwelling unit has been sampled, but before inspector decontamination.

Field blanks are made up of unused moist towelettes that are removed from their wrappers in the field and immediately inserted into centrifuge tubes. The risk assessor will collect blank wipes by removing a wipe from the package with a gloved hand, shaking open, refolding as it occurs during the actual sampling procedure, and then inserting it into the centrifuge tube without touching any other surface. Each field blank must be labeled with the appropriate identifier for submittal to the lab. The wipe lot number on the package should be recorded.

E. Laboratory Submittal

1. Laboratory Submittal Form Preparation

Samples should be submitted to the central laboratory using the submittal forms that are specified by the lab. The risk assessor who collects the dust samples is responsible for the accurate completion of the laboratory submittal form. The risk assessor should confirm that all samples recorded on Forms 06/07 are in fact present on the laboratory submittal form.

The risk assessor will be responsible for packaging all samples with the laboratory submittal sheets and shipping them to the central laboratory. (The National Center will be responsible for postage.) The risk assessor will receive the results of the samples from the lab and fill in the results fields on Forms 06/07. Once the Forms have been completed and reviewed for accuracy and consistency, they will be delivered to the Local Program Manager for final processing before data entry.

2. Dust-Spiked Sample Submittal

The risk assessor shall insert composite and single-surface dust-spiked samples into the sample stream for every dwelling unit to determine if there is adequate quality control at the laboratory. Dust-spiked samples shall be provided by the Center to the local program mangers, who in turn will provide them to the risk assessors. The risk assessor will submit the spiked samples so that the laboratory cannot distinguish ordinary field samples from spiked samples. The risk assessor will record the original dust-spiked sample number and concentration on Forms 06/07, label the tube with an appropriate field sample number, and enter the field sample number on both Forms 06/07 and the laboratory submittal form. The risk assessor should use different field sample numbers for the spikes so that the spiked sample is not always the last sample for a dwelling.

A dust-spiked sample is defined as a wipe containing a known weight of lead-based paint dust, measured to the nearest 0.1 μg of total dust. A dust-spiked sample is prepared in a laboratory with the amount of lead-based dust present being between 50 - 1000 μg. An appropriate NIST material will be used to spike the wipe.

F. Environmental Laboratory Analytical Procedures and Accreditation

A central laboratory has been selected to conduct environmental sample analysis. The laboratory is recognized by the EPA National Lead Laboratory Accreditation Program (NLLAP). The laboratory has show evidence that it is proficient in dust lead analysis under the Environmental Lead Proficiency Analytical Testing Program.

All environmental samples, including dust, shall be analyzed for total lead. In general, the dust wipes will be analyzed following specific protocols found within EPA document SW-846. The dust wipes will be analyzed for lead by flame (FLAA) atomic absorption spectroscopy. Samples will be analyzed to a method detection limit of 2 μg. The samples will be analyzed after they have been prepared with acid digestion in a microwave unit. A standard set of operating procedures (SOPs) will be employed for the analysis of the dust wipe samples. These SOPs are contained in the study quality assurance document.

G. Quality Assurance/Quality Control

1. Spiked Samples

When the program manager obtains the completed Forms 06/07 from the risk assessor, the program manager will immediately compare the laboratory results of the spiked samples with the true value. Each result from the analysis of the spiked samples must fall within 80% - 120% of the true value. If the laboratory fails to obtain readings within the QA/QC error limits, the Center must be contacted by the project manager immediately and be informed that a spiked sample did not meet QA/QC standards. The Center will review all contemporaneously analyzed spiked samples and determine whether reanalysis of the set of samples is warranted. If any systemic problems are identified during the course of the study, all sites will be notified to cease submittal of wipe samples until the problems are resolved.

2. Blank Samples

The program manager will also be responsible for monitoring the results from the analysis of blank samples. The single-surface blank sample result should be below 5 $\mu g/ft^2$. If the results are at or above this level, the program manager should investigate whether there are any sources of contamination being introduced during the wipe collection process. If no source of contamination is identified and the elevated blank levels persist, the program manager will contact the Center. The Center will investigate the possibility that the wipes were contaminated in manufacturing/distribution.

FORM 08 - SOIL/WATER SAMPLES

A. Soil Sampling

Soil sampling is a standard procedure in the HUD Risk Assessment protocols. The protocols call for two composite samples: one from the child's principal play area and a second from bare areas of the yard or from the perimeter of the building. The HUD Guidelines state that soil sampling may be eliminated from a risk assessment if there are no bare areas of soil around the building.

This study will examine the impact of the soil lead levels on the enrolled child's blood lead levels. Composite samples will be collected from the child's play area and the perimeter of the building. In addition, a third composite sample will be collected from the property line to evaluate the effect of the past use of leaded gasoline. The extent of the ground cover will be characterized for each area sampled. Soil samples *will be collected* from areas of soil covered with grass and other ground cover as well as areas of bare soil, in an attempt to measure the effect of ground cover. Soil will not be sampled when all soil is permanently covered (e.g., paved).

1. Materials

Materials Supplied by the Central Lab

- Centrifuge tubes
- Non-sterilized, non-powdered disposable gloves
- Laboratory Submittal Form

Other Supplies to be Supplied by the Program Manager/Risk Assessor

- Core sampling device (by program manger)
- Disposable wipes (to be used to clean the sampling device)
- Soil/Water Sample Collection Form (Form 08)
- Permanent marker
- Trash bags

2. Soil Sampling Procedures

a. Determine the Sampling Locations

i. Perimeter Sampling Locations: Risk assessors will collect one composite perimeter soil sample. The composite sample will include at least 5 and no more than 10 different aliquots of surface soil from the building perimeter. The aliquots should be collected from all sides of the building where soil is present, regardless of the ground cover. Each spot should be at least 2 feet from each other and between 1 and 3 feet away from the foundation. Where possible, bare soil should be sampled instead of covered soil. Perimeter samples should have a minimum of 2 aliquots per side that can be sampled.

ii. Play Area Sampling Locations: Risk assessors will collect a second composite sample from the child's play area. This sample will consist of at least

5 and no more than 10 aliquots collected along an X-shaped grid in the child's principal play area(s). Each spot should be at least 1 foot distant from each other. The soil where the aliquots are collected should be bare whenever possible. A single composite sample can contain subsamples from one or two play areas.

iii. Property Line Sampling Location: Risk assessors will collect a third composite sample from the property line. This sample will consist of at least 5 and no more than 10 aliquots collected along the area abutting the property line nearest to the street. Each spot should be at least 1 foot distant from each other and between 1 and 5 feet of the property line. Even if there is accessible soil between the property line and the street, this area should not be sampled if it is not part of the property.

If there is no soil to sample, question 01 should be answered 1-No Soil and no further work as far as soil sampling and recordkeeping will be required.

b. Visual Assessment of Soil

Once the general locations for sampling have been identified, the risk assessment should determine exactly where each subsample will be collected and assess the surface cover and presence of paint chips in those areas. Form 08 should be used to record these results. Risk assessors will use the coding on the form to complete the visual assessment.

Subareas of the perimeter and play area composite sample will be assessed separately. Perimeter ground cover should be assessed on four sides of the dwelling. If there are two distinct play area, ground cover should be assessed in each of those areas. The property line sample should be judged as a whole. In the field marked "number of cores," the risk assessor should record the number of aliquots collected in the subarea designated on the form. For example, if 4 out of 10 aliquots came from the front side perimeter sample, 4 should be recorded on the front side line.

c. Soil Collection

Once all prep work is complete, the risk assessor should put on disposable gloves. Sample the top 1/2 inch of soil from each spot. No specific effort should be made to collect visible paint chips. If paint chips are present, they should not be avoided and should be included in the sample. When sampling play areas, the risk assessor should avoid including grass, twigs, stones, and other gross debris in the sample.

The sample tool should be cleaned with a disposable wipe after each composite sample has been collected. Cleaning the tool between subsamples is not necessary.

d. Labeling the Container

The sample number should be written on the tube with a permanent marker. If the sample number is placed on the cap of the tube, the numbering should be off-center to allow the lab to have space to perforate the top during sample preparation. The number should be recorded on the Soil/Water Collection Form (Form 08).

3. Laboratory Submittal

a. Submittal Form Preparation

Risk assessors will submit samples to the central laboratory using the submittal forms that are specified by the lab. The risk assessor who collects the soil samples is responsible for the accurate completion of the laboratory submittal form. The sample numbers from Form 08 must be used on the laboratory submittal form. The risk assessor should confirm that all samples recorded on Form 08 are in fact present on the laboratory submittal form.

The risk assessor will be responsible for packaging all samples with the laboratory submittal sheets and shipping them to the central laboratory. (The National Center will be responsible for postage.) The risk assessor will receive the results of the samples from the lab and fill in the soil results fields on Form 08. Once the Form has been completed and reviewed for accuracy and consistency, it will be delivered to the program manager for final processing before data entry.

b. Spiked Sample Submittal

The risk assessor shall insert spiked soil samples into the sample stream randomly to determine if there is adequate quality control at the laboratory. One spiked sample shall be inserted into the sample stream for every ten dwelling units tested. Spiked soil samples shall be provided by the Center to the local program mangers, who in turn will provide them to the risk assessors. The risk assessor will submit the spiked samples so that the laboratory cannot distinguish ordinary field samples from spiked samples. The risk assessor will record the original spiked soil sample number and concentration on Form 08, label the tube with an appropriate field sample number, and enter the field sample number on both Form 08 and the laboratory submittal form. The risk assessor should use different field sample numbers for the spikes so that the spiked sample is not always the last sample for a dwelling.

4. Laboratory Analytical Procedure

The central laboratory has shown evidence that it is proficient in soil lead analysis under the Environmental Lead Proficiency Analytical Testing Program. All environmental samples, including soil, shall be analyzed for total lead. In general, the

soil will be analyzed as a bulk solid following specific protocols found within EPA document SW-846. The soil will be analyzed for lead by flame (FLAA) atomic absorption spectroscopy. Samples will be analyzed to a method detection limit of 4 ppm (parts per million). The samples will be analyzed after they have been prepared with acid digestion in a microwave unit. A standard set of operating procedures (SOPs) will be employed for the analysis of the soil samples. These SOPs are contained in the study quality assurance document.

5. Quality Assurance/Quality Control

When the program manager obtains the completed Form 08 from the risk assessor, the program manager will immediately compare the laboratory results of the spiked samples with the true value. Each result from the analysis of the spiked samples must fall within 80% - 120% of the true value. If the laboratory fails to obtain readings within the QA/QC error limits, the Center must be contacted by the project manager immediately and be informed that a spiked sample did not meet QA/QC standards. The Center will review all contemporaneously analyzed spiked samples and determine whether reanalysis of the set of samples is warranted. If any systemic problems are identified during the course of the study, all sites will be notified to cease submittal of soil samples until the problems are resolved.

6. Recording Results

The laboratory will provide results in parts per million. The risk assessor will record the results on Form 08. Results that are not detectable by the lab should be recorded as "<" followed by the numeric value provided by the lab.

B. Water Sampling

Water sampling is an optional part of the HUD Risk Assessment Protocols. For this study, water sampling will be conducted in all dwelling units to evaluate water's relative influence as a lead exposure source. The sampling procedures will follow the standard EPA protocol that is recommended in the HUD Guidelines for risk assessors who do collect water samples. The EPA protocol includes two samples: a first draw sample which provides a measure of the lead that likely leached into the water from the pipes in the dwelling and a service line sample which measures the lead in the lines managed by the local water authority.

1. Materials

Materials Supplied by the Central Lab

- One liter containers
- Laboratory Submittal Form

Other Supplies to be Supplied by the Program Manager/Risk Assessor

- Soil/Water Sample Collection Form (Form 08)
- Permanent marker

2. Water Sampling Procedures

a. Determine the Sampling Locations

Samples will be collected from the cold-water kitchen tap or the bathroom sink tap as required in the EPA protocols.

b. Water Collection

Upon entry into the dwelling, the risk assessor will designate the cold-water tap that will be used for sampling. The household will be requested to not use that faucet for the period while the risk assessment is being conducted. At the end of the risk assessment, but before the assessor leaves the dwelling unit, two water samples will be collected from the tap. The family does not have to stop using faucet overnight. The length of the risk assessment study (approximately six hours) will give the water enough time to sit undisturbed prior to the first sample being collected.

The risk assessor will collect the first sample, or first draw tap sample, by placing a one liter water container under the designated faucet. The cold water will be turned on and the container will be filled to capacity. The risk assessor will collect the second sample, or service line sample, after first running the tap until it is cold to the touch. When the water is cold, the second container will be placed under the faucet and filled to capacity. Both containers will be tightly sealed for shipping.

c. Labeling the Containers

The risk assessor will write the sample numbers on the containers with a permanent marker. The number should be recorded on the Soil/Water Collection Form (Form 08).

3. Laboratory Submittal

a. Submittal Form Preparation

Risk assessors will submit samples to the central laboratory using the submittal forms that are specified by the lab. The risk assessor who collects the water samples is responsible for the accurate completion of the laboratory submittal form. The sample numbers from Form 08 must be used on the laboratory submittal form. The risk assessor should confirm that both samples recorded on Form 08 are in fact present on the laboratory submittal form.

The risk assessor will be responsible for packaging all samples with the laboratory submittal sheets and shipping them to the central laboratory. (The National Center will be responsible for postage.) The risk assessor will receive the results of the samples from the lab and fill in the water results fields on Form 08. Once the Form has been completed and reviewed for accuracy and consistency, it will be delivered to the program manager for final processing before data entry.

b. Spiked Sample Submittal

The risk assessor shall insert spiked water samples into the sample stream randomly to determine if there is adequate quality control at the laboratory. One spiked sample shall be inserted into the sample stream for every ten dwelling units tested. Spiked water samples shall be provided by the Center to the local program mangers, who in turn will provide them to the risk assessors. The risk assessor will submit the spiked samples so that the laboratory cannot distinguish ordinary field samples from spiked samples. The risk assessor will record the original spiked water sample number and concentration on Form 08, label the container with an appropriate field sample number, and enter the field sample number on both Form 08 and the laboratory submittal form. The risk assessor should use different field sample numbers for the spikes so that the spiked sample is not always the last sample for a dwelling.

4. Laboratory Analytical Procedure

The laboratory analyzing water samples has shown evidence that it is proficient in lead analysis under the Environmental Lead Proficiency Analytical Testing Program (ELPAT). All environmental samples, including water, shall be analyzed for total lead. The water will be analyzed for lead by graphite furnace (GFAA) atomic absorption spectroscopy. Samples will be analyzed to a method detection limit of 3 ppb (parts per billion). A standard set of operating procedures (SOPs) will be employed for the

analysis of the water samples. These SOPs are contained in the study quality assurance document.

5. Quality Assurance/Quality Control

When the program manager obtains the completed Form 08 from the risk assessor, the program manager will immediately compare the laboratory results of the spiked samples with the true value. Each result from the analysis of the spiked samples must fall within 80% - 120% of the true value. If the laboratory fails to obtain readings within the QA/QC error limits, the Center must be contacted by the project manager immediately and be informed that a spiked sample did not meet QA/QC standards. The Center will review all contemporaneously analyzed spiked samples and determine whether reanalysis of the set of samples is warranted. If any systemic problems are identified during the course of the study, all sites will be notified to cease submittal of water samples until the problems are resolved.

6. Recording Water Sampling Results

The laboratory will provide results in parts per billion. The risk assessor will record the results on Form 08. Results that are not detectable by the lab should be recorded as "<" followed by the numeric value provided by the lab.

Appendix
Dust Wipe Sampling
Protocols

Wipe Sampling Materials

The Central Laboratory will provide the following supplies:

- Disposable Moist Towelettes: Individually-packaged "Fingertowelette"
- Nonsterilized, Nonpowdered Disposable Gloves
  (Disposable gloves are required to prevent cross-sample contamination from hands.)
- Centrifuge Tubes: Nonsterilized polyethylene centrifuge tubes (50 ml size) with sealable caps.
- Floor Templates
  Hard, smooth, reusable templates made of plastic. Templates will be 1 ft^2. Templates must be cleaned with a disposable wipe after each sample.
- Laboratory Submittal Form

Other supplies will be supplied by the Program Manager/Risk Assessor:

- Masking/Painters' Tape
  Masking or painters tape will be used as a window template. Masking tape will also be used to affix the plastic templates to the floor.
- Baby Wipes for cleaning templates
- Measuring tape
- Permanent marker to record sample number of tubes.
- Dust Sampling Form (06/07)
- Trash bags

Composite Wipe Sampling Procedure

Define the Sub-Sample Wipe Areas

Using the "Location Hierarchy" guidance found on page 2-12 of these protocols, select the rooms to be sampled. It is recommended that all templates/tape be laid out first in the rooms that will be sampled. By laying out the sub-sample wipe areas first, the risk assessor will be able to confirm that the areas will be roughly equivalent as required in the HUD Guidelines.

Floor sub-sample wipe areas will be defined with solid one square foot templates; these are secured with tape throughout the residential dwelling unit. Templates must be free of all visual dust and debris, and should be stored in a clean container or bag prior to usage. If not clean, then the templates must be wiped down with a disposable moist towelette before being secured to the sub-sample areas.

Do not walk on or touch the surface to be sampled (i.e., the wipe area.) When putting down a floor template or masking tape, do not touch the wipe area. For window sills/troughs, apply two strips of masking tape across the ends of the sill to define a wipe area at least 0.1 square foot in size (at least 2 inches x 8 inches). It is not necessary to tape the length of the window sill.

When outlining the sub-sample wipe areas with tape, set up all of the areas to be wiped before sampling. The size of these areas must be roughly equivalent (i.e., within plus or minus 15 percent) on each surface, so that one room is not over-sampled. The goal is to determine the average lead levels for each sampled surface type in the residential dwelling unit. If the sub-sample wipe area in one or two rooms is much larger than the wipe areas in the other rooms, then the household average for a given composite dust sample will not be accurate.

Measure the Sub-Sample Wipe Areas

When using solid templates, it should not be necessary to measure the sub-sample wipe areas as the dimensions of the template will already be known and can be recorded directly on the field composite dust sample collection form and laboratory chain-of-custody form.

However, when using tape to define the sub-sample wipe areas, measure each area to the nearest eighth of an inch using a tape measure or ruler. Record a separate measurement for each area that is sub-sampled on the field composite dust sample collection form. The total surface area being wiped must be calculated and reported to the laboratory on the chain-of-custody form. The size of each sub-sample area must be at least 0.10 ft^2 for an adequate level of precision to be obtained.

Preparation and Labeling of the Centrifuge Tubes, and Inspection of Disposable Baby Wipes

Examine the centrifuge tubes to make sure that they are clean. Partially unscrew the cap on the tube so that it can be easily re-opened. The tubes should then be placed in the styrofoam rack nearby so that they are easily accessible during the wipe sampling operation. Label each tube with a unique identifying number and record the number on the field composite dust sample collection form (Form 06) and laboratory chain-of-custody form. If the sample number is placed on the cap of the tube, the numbering should be off-center to allow the lab to have space to perforate the top during sample preparation.

Gloves

Place a disposable glove on one hand or, if needed and more comfortable, on both hands. A new glove or gloves must be used for each composite sample collected. However, changing gloves is not necessary between the collection of the sub-sample wipes so long as the risk assessor does not touch any surface other than the sub-sample wipe areas after putting on the glove (or gloves.) It is also not necessary to wipe the gloved hand before sampling.

Initial Placement of the Moist Towelette

Remove the moist towelette from its wrapper and inspect the wipe to determine if it is moist. If it has dried out, do not use it.

After inspecting the moist towelette, place it at one corner of the surface to be sub-sampled, with the towelette either fully opened or folded in half, and lay it flat.

First Wipe Pass (side-to-side) -- Floors

With the fingers together, grasp the towelette between the thumb and the palm of the hand. Press down firmly, but not excessively, with both the palm and fingers (avoid using the heel of the hand.) Do not touch the surface with the thumb. If the sub-sample wipe area is a square, proceed to wipe from side-to-side with as many "S"-like motions as are necessary to completely cover the entire wipe area. (See explanation below for non-square areas.) Exerting excessive pressure on the towelette will cause it to curl. Exerting too little pressure will result in poor collection of dust. Do not use just the fingertips to hold down the towelette because there will not be complete contact with the surface and some dust may be missed. Attempt to remove all visible dust from the wipe area.

When using tape, do not cross the boundary tape or floor markings, but be sure to wipe the entire sampling area. It is permissible to touch the tape with the towelette but not the surface area beyond the tape.

Second Wipe Pass (top-to-bottom) -- Floors

Fold the towelette in half with the contaminated side facing inward. (The towelette can be folded by laying it on the sub-sample wipe area, contaminated side up, and then folding it over.) Once the towelette is folded, place it in the top corner of the wipe area and press down firmly with the palm and fingers. Repeat wiping the area with "S"-like motions but this time, move in a top-to-bottom direction. Attempt to remove all visible dust. Do not touch the contaminated side of the towelette with the hand or fingers. Also, do not shake the towelette in an attempt to straighten it out since dust may be lost during shaking. (Note: While the ASTM dust sampling method adds a third pass around the perimeter of the area to be wiped, it is not necessary to follow this procedure.)

Wiping Window Sills/Troughs or Other Rectangular Areas

When wiping a window sill/trough (or if the floor sub-sample is a rectangular shape), two side-to-side passes must be made, the second pass having the contaminated side of the towelette folded inward. For a window sill/trough, do not attempt to wipe the irregular edges presented by the contour of the window channel. Avoid touching other portions of the window with the towelette. If paint chips or gross debris are in the window sill, attempt to include as much of it as possible on the towelette. If the area is heavily dust laden, a smaller area should be wiped. It is not necessary to wipe the entire window sill/trough, but do not wipe less than 0.10 ft^2 (at least 2" x 8".)

If some window sills/troughs contain paint chips or other gross debris, remove large debris before wiping but do not remove paint chips. Attempt to include any paint chips that adhere to the towelette. Larger paint chips that will not adhere do not need to be included in the sample.

Packaging the Sub-Sample Towelette in the Centrifuge Tube

After wiping, fold each sub-sample towelette, with the contaminated side facing inward again, and then insert it aseptically (i.e., without touching anything else) into the centrifuge tube. Roll or fold the towelette into the tube to avoid losing dust or other debris. Also, keep the tube within arm's reach to avoid losing debris during the transfer into the tube.

Collecting the Remaining Sub-Samples

After obtaining the first sub-sample wipe, collect the sampling supplies and centrifuge tube rack, and proceed to the location of the next sub-sample area. Select a new moist towelette, remove it from its wrapper, make two wipe passes, and insert the towelette into the same centrifuge tube. This procedure is repeated until all remaining sub-sample wipe areas for a particular composite dust sample (floors or window sills/troughs) have been obtained.

After the last sub-sample for a given composite dust sample has been collected and inserted into the centrifuge tube, seal the tube tightly and remove the gloves. Make any additional notes on the field composite dust sampling collection form or laboratory chain-of-custody form at this time.

To obtain the next composite dust sample, repeat the steps listed above.

Single-Surface Wipe Sampling Procedure

Outline Wipe Area

Floors: Identify the area to be wiped. Do not walk on or touch the surface to be sampled (the wipe area). When putting down template, do not touch the wipe area.

Window sills, troughs, and other rectangular surfaces: Identify the area to be wiped. Do not touch the wipe area. Apply two strips of adhesive tape across the ends of the sill to define a wipe area at least 0.1 square foot in size (at least 2 inches x 8 inches). It is not necessary to tape the length of the window sill.

Preparation of Centrifuge Tubes

Examine the centrifuge tubes make sure that they are clean. Partially unscrew the cap on the centrifuge tube to be sure that it can be opened. Do not use plastic bags to transport or temporarily hold wipe samples.

Gloves

Put a disposable glove on one hand; use a new glove for each sample collected. If you need to use two hands to handle the sample, use two new gloves, one for each hand. It is not necessary for you to wipe the gloved hand before sampling. Use a new glove for each sample collected. Do not touch any surface other than the wipe area after putting on the glove.

Initial Placement of the Moist Towelette

After removing the moist towelette from its wrapper, inspect it to determine if it is moist. If it has dried out, do not use it.

Place the moist towelette at one corner of the surface to be wiped with towelette fully opened and flat on the surface. When using tape, do not cross the boundary tape or floor markings, but be sure to wipe the entire sampling area. It is permissible to touch the tape with the towelette but not the surface beyond the tape.

First Wipe Pass (side-to-side) - Floors

With the fingers together, grasp the towelette between the thumb and the palm. Press down firmly, but not excessively with both the palm and fingers (avoid using the heel of the hand). Do not touch the surface with the thumb. If the wipe area is a square, proceed to wipe side-to-side with as many "S"-like motions as are necessary to completely cover the entire wipe area. (See explanation below for nonsquare areas.) Exerting excessive pressure on the towelette will cause it to curl. Exerting too little pressure will result in poor collection of dust. Do not use only the fingertips to hold down the towelette, because there will not be complete contact with the surface and some dust may be missed. Attempt to remove all visible dust from the wipe area.

Second Wipe Pass (top-to-bottom) - Floors

Fold the towelette in half with the contaminated side facing inward. (You can straighten out the towelette by laying it on the wipe area, contaminated side up, and folding it over.) Once the towelette is folded, place it in the top corner of the wipe area and press down firmly with the palm and fingers. Repeat wiping the area with "S"-like motions; but, on the second pass, move in a top-to-bottom direction. Attempt to remove all visible dust. Do not touch the contaminated side of the towelette with the hand or fingers. Do not shake the towelette in an attempt to straighten it out, since dust may be lost during shaking.

Rectangular Areas (e.g., window sills)

If the surface is a rectangle (such as a window sill), two side-to-side passes must be made, the second pass with the towelette folded so that the contaminated side faces inward. For a window sill or trough, do not attempt to wipe the irregular edges presented by the contour of the window channel. Avoid touching other portions of the window with the towelette. If paint chips or gross debris are in the window trough, attempt to include as much of it as possible on the towelette. If the area is heavily dust laden, a smaller area should be wiped. It is not necessary for you to wipe the entire window sill/trough, but do not wipe less than 0.10 ft^2 (at least 2" x 8").

Paint Chips: Some window sills and troughs contain paint chips or other debris. Remove large debris such as cigarette butts, but do not remove paint chips. Attempt to include any paint chips that adhere to the moist wipe material. Larger paint chips that do not adhere on the towelette do not need to be included in the sample.

Packaging the Towelette

After wiping, fold the towelette with the contaminated side facing inward again, and insert the towelette aseptically (without touching anything else) into the centrifuge tube or other hard-shelled container. Roll or fold the towelette into the container to avoid losing dust or other debris when inserting the towelette into the tube. Also keep the tube within arm's reach, to avoid losing debris during the transfer into the tube.

Labeling the Centrifuge Tube

Seal the tube, and label it with a unique sample number. If the sample number is placed on the cap of the tube, the numbering should be off-center to allow the lab to have space to perforate the top during sample preparation. Record the laboratory submittal sample number on the field sampling form.

Area Measurement

After sampling, measure the surface area wiped to the nearest eighth of an inch using a tape measure or a ruler. Record a separate measurement for each area that is sampled on the field collection form. Be certain to report the total surface area wiped to the laboratory. The size of the area wiped must be at least 0.10 ft^2 for an adequate level of precision to be obtained.

Form Completion

Fill out Form 07 completely. Collect and maintain any field notes regarding any problems with the sampling. Repeat all of the above steps for additional samples in the same house.

Trash Disposal

After completion of all sampling, remove the masking tape and throw it away in a trash bag, and remove and wipe down the solid re-usable templates with a clean moist towelette. Store templates in a sterile or clean bag where they will be ready to use during the next composite wipe sampling activity. Put all gloves and other sampling debris into a trash bag. Remove the trash bag when leaving the residential dwelling unit. Nothing should be left behind, particularly gloves since they can pose a suffocation hazard for young children. All equipment and supplies should be placed in a large sampling travel bag and carried out of the unit.

Personal Protection

During dust sampling, risk assessors must not eat, drink, smoke, or otherwise cause hand-to-mouth contact.

After sampling, wash hands thoroughly with plenty of soap and water before leaving the residential dwelling unit. If the bathroom is used for this purpose, the owner's or resident's permission should be obtained first. If there is no running water in the home, use moist towelettes (or baby wipes) to clean the hands.

Chapter 3: Special Reliability Sampling

Introduction

Two special reliability studies will be conducted as part of the risk assessment study. The studies will look at the comparability of the assessment of the paint film quality when performed by two different risk assessors and the comparability of single-surface dust wipe samples that are taken side-by-side-by-side. The reliability studies will be performed in a subset of the enrolled dwelling units. The studies will be separate from each other although in some dwellings both studies will be conducted. The program manager will be responsible for determining where the special studies will be conducted and scheduling the procedures with the risk assessors.

FORM 05A - RELIABILITY OF PAINT ASSESSMENT

A. General Information

The current risk assessment protocols contain a paint film quality classification system to rate the condition of painted surfaces. Surfaces are classified as intact, fair, poor. Surfaces classified as poor, which are proven to be coated with lead-based paint, are considered to be lead-based paint hazards that must be treated. Currently, there is no scientific evidence to confirm that a surface classified as poor is more hazardous than a surface classified as fair. The additional paint deterioration assessment that will be conducted as part of this study (page 2-7) will begin to address this issue. It has also not been demonstrated that different risk assessors will rate paint on the same painted surfaces in the same categories. Unless there is some reasonable consistency between assessments (also known as high inter-rater reliability), then the classification system cannot adequately achieve the expected results.

To test the inter-rater reliability of the paint film quality classification, a second risk assessor will be present to rate the paint in 30 dwelling units at each site (Baltimore County, Milwaukee, and New York City). The specific dwelling units will be designated by the local program manager, after consulting with the risk assessors schedules. The units do not have to be randomly assigned, but they should be selected from the spectrum of housing types at each site.

Prior to beginning work, the two risk assessors at each site will select a system to rate the same painted components. The system must make sure that each risk assessor rates the same components and that one risk assessor is blind to the other risk assessor's ratings. As long as these two provisions are guaranteed, the paint quality assessments may occur concurrently or consecutively. The risk assessor will notify the local program manager of the system that they will use prior to the start of the project.

The first risk assessor will use Form 05 to record the paint quality. The second risk assessor will use Form 05A. Together, both inspectors will define the painted surface that is being assessed using the identical room/location, wall code and component code. Each inspector will then independently assess the paint film quality using the HUD

classification system and the study paint deterioration criteria.

FORM 07A - RELIABILITY DUST SAMPLE COLLECTION

A. General Information

Imprecise measurement of dust lead loadings can lead to misclassification of lead levels in dwellings. As a results, lead hazards may go undetected and/or may be incorrectly identified. Reliability of sampling may be influenced by spatial variation, temporal variation, laboratory imprecision and error, inherent variability in wipe sampling, and other unknown error. This study will examine the effects when these factors are controlled so to the greatest extent possible they are the same.

In 50 dwelling units at each site, special dust wipe reliability sampling will be conducted. The risk assessor will collect single-surface from three adjacent locations on bare floors, carpeted floors, window sills and window troughs. By collecting the samples from adjacent areas, spatial variability will be controlled as well as possible. Samples will be collected during the same visit to control for temporal variation. All samples will be sent to the same environmental laboratory which will conduct the analyses under strict quality assurance monitoring. Finally, sampling will be conducted by the same risk assessor using the sample collections described in these protocols. The study will determine under these best case controls what variability still exists.

The selection of the 50 dwelling units will be determined by the local program manager. The units do not have to be randomly assigned, but they should be selected from the spectrum of housing types at each site. The selection of dwelling units for the dust sampling reliability sample may directly coincide with the paint deterioration study if it will simplify implementation.

B. Sampling Methodology

1. Locations

The reliability samples will be collected from two central floors and a previously untested window in each dwelling unit. If no floor is carpeted in the dwelling unit, then only one floor will be sampled. The risk assessor will use the Location Hierarchy used for composite sampling (page 2-12) to determine the room/locations. The first rooms on the list with a bare central floor, a carpeted central floor, and a second window (or an untested window) will be selected.

2. Sampling Procedures

Floors: The same procedures will be used to collect the bare floor and carpeted floor reliability samples. The procedure for collecting the bare floor reliability samples is described here; the same procedure should be used if there is a room that contains carpeting.

In the selected room, the single-surface central floor dust sample that was already recorded on the Dust Sample Collection Form (Form 07) will be used as one of the reliability floor samples. Two additional dust wipe samples will be collected from the space adjacent to this sample. The room/location number, the surface type and the

surface condition for the extra samples will be recorded on Form 07A. These reliability samples will be collected in the same manner as the original central floor sample (see the Chapter 2 Appendix). The risk assessor should note that the central floor will also be the location of a composite wipe sample. Special care should be taken so that none of the wipe areas overlap each other. If the two additional reliability samples cannot be collected without moving large pieces of furniture or overlapping with the other wipe areas, the next room/location on the Location Hierarchy should be sampled instead.

Windows: The same procedures will be used to collect the window sill and window trough reliability samples. The procedure for collecting the window trough reliability samples is described here. The same procedure should be used for the sill. Window sill samples should be collected after the trough samples to avoid brushing dust and debris into the trough prior to sampling. The risk assessor should avoid touching the sill while collecting the trough sample.

In the selected room, the previously untested window will be divided into three areas with masking tape. The room/location number, the surface type and the surface condition of the sample locations will be recorded on Form 07A. The three areas of window trough will be tested using the same methodology.

3. Data Recording Procedures

Risk assessors should record the measurements of the sample to the nearest 1/8th of an inch. The dust results should be recorded in both total μg/sample and $\mu g/ft^2$. Results that are below the limits of detection of the lab will be recorded as ✌<✍ followed by the numeric value provided by the lab.

Chapter 4: Questionnaire/Blood Lead Testing

FORM 09 - HOUSEHOLD QUESTIONNAIRE

A. General Information

The Household Questionnaire (Form 09) will be completed with residents in all dwelling units that are enrolled in the study. The primary reason for the household questionnaire is to better understand other non-building related sources of lead. These include activities and hobbies performed by occupants at the home, remodeling and renovation activities in home or in proximity to the home, occupant occupations, use of ceramics and home remedies and water usage. Room-specific information will also be collected on cleaning practices (including a visual observation) and availability of cleaning equipment. Other demographic information to be collected on the family includes household composition and family income. This information will also help to identify and quantify variables that could modify or confound the blood lead results.

The questionnaire is also intended to elicit specific information about the enrolled child and the child's habits that will help us identify factors that may affect the child's blood lead levels. The variables that may affect the child's blood lead level include the length of time spent inside the home, time spent in the homes of others including day care, and time spent out-of-doors; behavioral patterns including mouthing, child activity at an identified window, and achievement of child developmental milestones; and child nutrition including an assessment of milk and fluid intake and use of vitamins.

Prior to completion of the household questionnaire, program staff will obtain signed informed consent for each family to participate in the study. The parent/legal guardian has the right to refuse to participate. If the household refuses, the household and the dwelling unit will be dropped from the study.

The interview must be conducted in person at the home where the family resides, following accepted practices of formal interviewing. All questions must be asked verbatim, in the order in which they are written. Follow-up to explain the question or clarify the interviewee’s response is encouraged. The program staff must interview an adult respondent who is a principal caregiver for the child who is enrolled. If needed, additional follow-up may be done with the family by telephone to clarify responses to the interview.

The Household Questionnaire will be available in English and Spanish. The process for preparing the Spanish translation will include translation of the English version into Spanish, back-translation of the Spanish version into English, and any appropriate changes deemed necessary. For participants who speak neither English nor Spanish, household information will be obtained using experienced interviewers fluent in the participant’s language. The Center will be notified of any such occurrence and a note made on the questionnaire indicating which language was spoken.

All interviewers will be trained in administering the questionnaire.

B. Data Recording

All interviewers will record answers directly on the interview forms. Additional information or comments may be made in the margins so that clarification can be obtained at a later time.

C. Quality Control Activities

Each interview will be reviewed for QC purposes by the site Project Manager following the procedures outlined in the procedures for Office Review of data collection forms, prior to shipment to the Center.

In addition, field Quality Control observations will be performed for each individual who is conducting interviews for the Lead Risk Assessment Project, following the schedule established in the Quality Control Guidelines, to provide a better than 5% field QC check. If warranted, additional field QC observations will be performed to ensure quality and consistency across all three sites.

FORM 10 - BLOOD LEAD RESULTS

A. General Information

Blood lead levels are the most thoroughly studied and best available predictors of adverse health effects of lead exposure in children. Blood lead levels are generally a good measure of recent exposure.

In New York City and Milwaukee, all information will come directly from the laboratory report form provided by the local health department for a child that has been selected for the study. Blood lead levels will not be drawn by program staff.

In Baltimore County, blood lead specimens will be collected in the home by program staff as part of this study. In addition to general consent to participate in the study, the program staff in Baltimore County will obtain informed consent from the parent/legal guardian for the child to have his/her blood tested. Although one child will be enrolled in the study, other children in the household may be tested if the parent/legal guardian requests. The parent/legal guardian will be provided with results of the blood lead testing, which will also be sent to the child's physician on request of the parent/legal guardian.

1. Sample Collection Methodology

In New York City and Milwaukee, children will be selected for the study based upon having the results of a blood lead specimen drawn by venipuncture. Only children whose blood lead levels were analyzed by a pre-approved laboratory may be selected. The test must have been done within three weeks of the interview and environmental assessment of the home.

In Baltimore County, samples will be collected by venipuncture by personnel trained and experienced in pediatric blood collection using proper sterile technique and following universal precautions. Blood samples will be collected in the home at the same time as the administration of the Household Interview. If the phlebotomist is unable to obtain a venous sample, blood may be drawn using capillary procedures using

the finger. Protocols for venous and capillary sample collection are provided (see Appendices following this section).

The DHMH laboratory form will be completed before the specimen is submitted to the laboratory, following standardized procedures and using information obtained from Form 10 and the study participant's parent or legal guardian.

2. Storage and Shipping Instructions for Blood Specimens (Baltimore County)

After a blood specimen has been drawn, the phlebotomist will keep it in the cooler with frozen ice packs until it is delivered to the designated drop-off site. Frozen ice packs should be checked periodically and changed as necessary.

3. Laboratory Methodology and Qualifications

All blood lead level results used in the study will come from clinical laboratories that are in compliance with the Clinical Laboratory Improvement Act of 1988 (CLIA '88), have demonstrated proficiency in blood lead analysis and have been approved by the project's Laboratory QA/QC Manager.

In New York City and Milwaukee, laboratories were selected on the basis of the volume of samples they contributed to the lead screening database. In Baltimore County, analysis was conducted by the State of Maryland's Department of Health and Mental Hygiene's blood lead laboratory, which is a CDC reference laboratory with a proven history of performance on field control samples.

All laboratories included in the study have submitted detailed documentation of their procedures for review by the project's Laboratory QA/QC Manager, who has determined their acceptability for inclusion in the project. Laboratories whose procedures are accepted are assigned a laboratory identification number by the Laboratory QA/QC Manager.

B. Data Recording Procedures

1. Blood Lead Tests

The results of blood lead testing will be reported on Form 10 for each household. For all sites, a copy of the laboratory slip or a print out of the data as retrieved from the local system (i.e., Print Screen) should be maintained as back-up for each Form 10.

The child's first and last names will be placed in the first two columns. Sample Date (date sample was collected) will be placed in column 3. The sample type will be recorded in column 4 (V for venipuncture, F for fingerstick). The three initials of the individual who performed the phlebotomy will be recorded in column 5, entitled "Collect Code". The lab's specimen number will be recorded in column 6. The assigned laboratory number will be recorded in the "Lab ID" (column 7). The last two

columns contain the Analysis Date (column 8), and Blood Lead results (in μg/dl) (column 9).

Form 10 should be initialed and dated by the individual responsible for retrieving information from laboratory records. In Baltimore County, Form 10 should be returned to the program manager along with the Household Interview Form, within one week of the blood draw procedure.

In Baltimore County, Form 10 will be used for field collection of data and the laboratory submittal form will be prepared using the information on Form 10. In the notes section, document the location of the stick(s) and any difficulties or unusual events (i.e., exposures) encountered during the blood draw procedure. If a finger stick was done, explain why. Also document that a thank you gift was given to the child.

In Baltimore County, if more than one child has been tested, record the results of all tested children on one Form 10.

C. Quality Control Activities

Analytical quality control of clinical laboratories performing blood lead analyses will be monitored using bovine blood field control samples, submitted blindly to the laboratories in pediatric vacutainers. Two target values (Pools 1 and 2) have been established for this project: 4.3 μg/dL and 15.3μg/dL. These target values were established by the CDC blood testing laboratory using graphite furnace atomic absorption spectrophotometry and corroborated by anodic stripping voltametry conducted by the Hematology and Environmental Laboratory at the University of Cincinnati's Department of Environmental Health.

In Baltimore County, the Project Manager will submit one blinded low and one blinded high pool pediatric vacutainer every 20th blood sample submission. Results of the blood field control samples are recorded on a blood form and reported weekly to the project's Laboratory QA/QC Manager.

In New York City and Milwaukee, where the projects are not collecting their own blood specimens, field control samples will be sent directly to a designated individual at each of the participating laboratories. This individual will submit the field control samples into the stream of samples being analyzed at the laboratory. Each participating laboratory will receive one low and one high pediatric vacutainer each month. The designated individual will report the results for the two field control samples monthly to the project Laboratory QA/QC Manager.

Acceptable limits for the Baltimore County field control samples are ± 2μg/dL from the target values. In New York City and Milwaukee, the field control samples will be used to judge the over-all performance of the laboratories during the course of the study and to assess the comparability of the reported blood lead level results.

In Baltimore, field quality control observations will be performed on the blood draw following the same schedule as the Household Interview to provide a better than 5%

QC sample. If problems are identified, additional field QC observations will be performed to ensure quality and consistency across phlebotomists.

D. Bloodborne Pathogens Exposure Control Plan

All phlebotomists working directly on this project will strictly adhere to the Bloodborne Pathogens Exposure Control Plan (Appendix C) to ensure their own safety as well as the safety of study participants and their families.

Appendix A
Venipuncture Blood Draw Protocol for Lead Risk Assessment Study

The trained and experienced phlebotomist will obtain a venous sample from the child using proper sterile technique and following universal precautions. If a sample is not obtained after at most two tries, the phlebotomist will obtain a capillary sample from the child's finger.

Materials needed per participant:

storage box
gauze sponge
alcohol wipe
examination gloves
tourniquet
band-aid
2 mL lavender top tube with liquid EDTA anticoagulant
23g l" butterfly assembly with multiple sample luer adapter, sterile
25g l" butterfly assembly with multiple sample luer adapter, for children and difficult sticks
vacutainer holder
puncture-resistant biohazard disposal container
cooler with ice packs
biohazard mailing tube (contains lavender blood collection tube and laboratory form)
plastic zip-lock bags
anti-bacterial soap
paper towels
chuxs
pen
form 10
thank you gift
sticker

Venipuncture Procedure:

Wash hands using the anti-bacterial soap provided or use study participant's restroom.

Locate a suitable table and chair for blood collecting, lay out blood collection supplies, put on gloves.

Have the parent hold the child in a firm pediatric hold.

Locate the puncture site. Hold with 2 fingers on one side of the "alcohol wipe" so that only the other side touches the puncture site. Wipe the area in a circular motion

beginning with a narrow radius and moving outward so as not to cross over the area already cleaned. Repeat with a second alcohol wipe.

Locate the vein and cleanse in manner previously described, then apply the tourniquet. If it is necessary to feel the vein again, do so; but after you feel it, cleanse with alcohol prep again, and dry with a sterile gauze square.

Fix the vein by pressing down on the vein about 1 inch below the proposed point of entry into the skin and pull the skin taut.

Approach the vein in the same direction the vein is running, holding the butterfly needle at a 15 degree angle to the child's arm.

Push the needle, with bevel facing up, firmly and deliberately into the vein. Activate the vacuum collection tube. If the needle is in the vein, blood will flow freely into the tube. If no blood enters the tube, probe for the vein until entry is indicated by blood flowing into the tube.

If no blood is obtained, a second attempt may be made if the parent agrees. If no blood is obtained on the second attempt, obtain a capillary sample from the child's finger.

For blood collection, loosen the tourniquet immediately after blood flow is established and release entirely as the tube fills. Collect 1 lavender top tube (3ml). Immediately after collection of the blood, slowly and completely invert the tube at least 10 times, to insure adequate mixing with the anticoagulant.

When the needle is out of the arm, press gauze firmly on the puncture site. Heavy pressure, as the needle is being withdrawn, should be avoided because it may cause the sharp point of the needle to cut the vein.

Have the child raise their arm (not bend it) and continue to hold the gauze in place for several minutes. This will help prevent hematomas. Place a band-aide on the child's arm.

Place the used needle into the sharps container provided. Do not bend or recap the needle. Place all other contaminated waste (i.e. blood stained gloves, gauze) into the sharps container. Seal the sharps container and place it into the zip-lock bag. Return the sharps container to the blood supply box.

Double bag all other waste material (i.e. uncontaminated wrapping, gloves) in a plastic zip-lock bag. Remove this bag from the study participant's home at the end of the visit. The trash may be disposed at your residence or at the Center.

Write the child's name on the label located on the blood collection tube.

Place the labeled blood collection tube into the plastic zip-lock bag and then place it in the metal tube labeled BIOHAZARD. Complete the Department of Health and Mental Hygiene (DHMH) Laboratory form (see below), place it in the metal tube and seal the

tube with the metal screw top lid. Place the metal tube into the cooler, with frozen ice packs, until the specimen can be delivered to the designated drop off site.

Wash hands with the anti-bacterial soap provided or, if feasible, use the study participant's restroom after completing the blood draw procedure.

Give the child a sticker and a book after the blood draw is completed.

Report to the program manager, by telephone, any adverse reaction experienced by the participant during the venipuncture procedure. Document any adverse reactions in the notes section on Form 10.

NOTE: Minor variations in venipuncture technique based on technician preference are acceptable, provided they do not violate sterile technique or universal precautions and do not increase the chance of specimen contamination. Examples of acceptable variations include: applying the tourniquet before locating a suitable vein and cleansing the site and allowing site to air dry after cleansing with alcohol.

Blood lead levels may be drawn, using the above procedure, on siblings at the parent's request.

Appendix B
Technique for Capillary Blood Lead Sample Collection

It is imperative that all procedures be carried out with meticulous attention to detail, in order to minimize the risk of contaminating the sample with lead. A large majority of false positive capillary sample tests are due to errors in sampling technique.

Materials needed per participant

liquid soap and running water
alcohol pads
gauze pads
lancet (B & D Ultrafine Lancet or Tenderlet)
capillary lead testing kit (contains microcontainer & laboratory form)
band-aid
examination gloves
puncture-resistant sharps container
zip-lock bags
chux
paper towels
cooler with ice packs
form 10
pen
thank you gift
sticker

Capillary Procedure

Fill out laboratory lead form completely as documented in the venipuncture procedure.

Write the child's name on the label.

Wash your hands thoroughly, using the anti-bacterial soap provided or use study participant's restroom.

Wash the child's hands thoroughly with soap and water; rinse and dry with a clean white paper towel.

Locate a suitable table and chair for blood collecting and place chux on the table to create a clean work area.

Place the gauze, bandaid and alcohol wipe on the work area. Place lancet on work area. If using Tenderlet device, unwrap and place it on the work area.

Put on disposable examination gloves.

Hold child's hand, scrub sample area (lateral aspects of thumb preferred) with gauze pad and liquid soap for 10 seconds.

Rinse sample area with alcohol pad, starting at puncture site. Repeat and dry with gauze pad.

Have the parent hold the child in a firm pediatric hold.

Hold child's hand securely, pull cap off lancet, and stick side of child's thumb with lancet.

Wipe off first drop of blood. Discard gauze. Turn hand downward to increase flow of blood.

With child's hand held downward, hold microtainer to puncture site to collect blood. Never drag the microtainer over the skin surface as this will contaminate the specimen (collects skin cells).

Fill microtainer to 500 line. Replace closure (cap) securely. Apply pressure to site with gauze.

Rotate microtainer tube briskly for approximately 15-20 seconds to mix blood with EDTA. Affix label with child's name lengthwise to microtainer; place into plastic bag.

Clean the child's thumb and apply bandaid.

Place the laboratory form and the microtainer into the metal BIOHAZARD tube and seal with the metal screw top lid.

Place the tube into the cooler with ice packs.

Appendix C
Bloodborne Pathogens Exposure Control Plan

A. Exposure Determination:

I. Job Classification and Tasks

Phlebotomists are potentially at risk for occupational exposure to bloodborne pathogens.

The tasks performed during phlebotomy (venipuncture and/or capillary collection) could result in exposure to bloodborne pathogens. These tasks include: blood drawing, labeling and handling specimens, handling sharps, and disposal of contaminated materials.

B. Implementation Schedule

I. Universal Precautions

During the Lead Risk Assessment Study (Study), universal precautions shall be observed by all contractors of the Center in order to prevent contact with blood or other potentially infectious materials. All blood contaminated material will be considered infectious at all times.

II. Engineering Controls

During the course of field work for the Study, contractors of the Center will use the following controls.

1. A puncture-resistant sharps container will be provided to each phlebotomist for the disposal of used needles and broken glass. This container is to be sealed in a zip-lock bag and stored in the blood supply box after each home visit.
2. The phlebotomist will seal the sharps container when the contaminated materials reach the fill line and return it to the program manager at the Center. The program manager will dispose of the sealed sharps container at one of the Baltimore County Department of Health sites during daytime hours.
3. The sharps container and collection equipment will be inspected by the phlebotomist at each use and by the program manager during quality control observational visits. (Quality control visits will be done at least twice for each phlebotomist during the course of the study.) The phlebotomist should discuss any problems or concerns directly with Deborah Holtz, the study coordinator.

III. Work Practice Controls

During the course of the Study, contractors of the Center will use the following practices during work conducted in the homes of clients enrolled in the study.

1. General Requirements

Food and drink will not be kept in the blood supply box or the cooler in which phlebotomy equipment and blood specimens are stored and transported.

2. Disposable Sharps

A red puncture-resistant sharps container will be provided to each phlebotomist. Contaminated needles, lancets and any materials contaminated with blood will be placed in the sharps container immediately after use. Needles will not be bent or recapped. The sharps container will be placed in a zip-lock bag after each use to prevent spillage. The sharps container will be kept in the blood storage box when not in use.

3. Specimen Handling

Labeled blood collection tubes will be placed inside the small zip-lock bag. This will then be placed in the metal tube labeled with the red BIOHAZARD sticker. The metal transport tube will be sealed with the screw top lid. The metal tube will be stored in the cooler, with an ice pack, until it can be transported to the Center or the DHMH Laboratory. If the blood specimen is stored over night or over the weekend, thawed ice packs must be replaced with frozen ice packs every 12 hours.

4. Handwashing

Antibacterial hand washing soap and paper towels will be kept in the blood supply box. The phlebotomist is required to wash their hands with the antiseptic soap after removing the examination gloves. The phlebotomist is required to wash their hands in running water as soon as practical. This may be done in the study participant's home if feasible.

5. Equipment Decontamination

The interior and exterior of the blood supply box and ice cooler will be wiped down weekly by the phlebotomist using a diluted bleach solution provided to the phlebotomist.

6. Personal Protective Equipment

Examination gloves are provided to contractors performing phlebotomy, at no cost, to the contractor. Examination gloves will be worn by the contractor during the blood draw procedure. Gloves will be removed after each blood draw procedure and will be double bagged in a zip-lock bag with other phlebotomy waste.

7. Work Surfaces

The work surface (in the study participant's home) will be covered with a disposable chux. After the blood draw, the chux will be double bagged in a zip-lock bag with other phlebotomy waste.

8. Regulated Waste

All non-contaminated materials used during the blood draw procedure will be double bagged in a zip-lock bag. This waste material will be removed from the study participant's home at the end of the visit and disposed of at the phlebotomist's residence or at the Center.

9. Laundry

During the phlebotomy procedure, the phlebotomist will place a chux over their lap. If the phlebotomist's clothing becomes contaminated with the study participant's blood, the phlebotomist is responsible for cleanup. It is recommended that clothing be washed in hot water as soon as feasible.

10. Hepatitis B Vaccination

Contractors will provide documentation of hepatitis B vaccination to the Center, to be kept on file during the study.

11. Information and Training

All phlebotomists on contract with the Center have participated in training program that included the following:

a. Review of general phlebotomy procedures
b. Review of special procedures for obtaining blood lead levels
c. Review and demonstration of capillary procedures
d. Review of bloodborne pathogen exposure control plan
e. Review of storage, transport and disposal procedures

C. Post Exposure Follow-Up

Each contractor will provide to the Center a written personal plan for follow-up in the event of an exposure. This should include where the contractor will seek medical treatment in the event of an exposure.

If an exposure occurs, the Center recommends that the phlebotomist wash the affected site thoroughly with soap and water. The Center also recommends that the phlebotomist seek medical treatment, at an urgent care center or at an emergency room, as soon as feasible.

Any treatment and counseling will be at the expense of the contractor.

All exposures that occur during the study will be documented in the notes section on Form 10. The documentation must include the circumstances of the incident and the route of exposure. The contractor must also notify the program manager, by telephone, of the exposure.

D. Recordkeeping Requirements

1. Training Records

The Center will maintain training records including:

a. Dates of training sessions
b. Contents or summary of training
c. Name and qualifications of the trainer
d. Name of attendees

Training records will be available to MOSH inspectors and NIOSH at their request. Training records will be available to employees, or an authorized representative of the employee, for examination and copying.

2. Other Records

The Center will maintain other records including:

a. Name and social security number of the contractor
b. Copy of the contractor's hepatitis B vaccination status, including dates of all vaccinations
c. Copy of license
d. CV documenting experience and training in pediatric phlebotomy
e. Documentation indicating contractor has personal health insurance
f. Copy of medical malpractice insurance
g. name and telephone number of who to contact in the event of an emergency

APPENDIX C: TECHNICAL APPENDIX

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Appendix C.1 Comparison of true composite samples and mathematically averaged single surface samples taken in the same locations (report section 6.1.4)

The model used to describe dust lead loading as a function of site, number of sub-samples, and type of sample is

$$\log(y_{ijk}) = \mu + S_i + T_j + M_k + (TM)_{jk} + D_l + e_{ijkl}$$

where

- μ is the intercept
- S_i is the effect of site i (i=1,2,3).
- T_j is the effect of the type of sample (Mean of singles or composite), j=1-2.
- M_k is the effect of the number of sub-samples , k=2,3,4
- $(TM)j_k$ is the interaction between the type of samples and the number of sub-samples
- $D_l \sim$ iid $N(0,\phi^2)$ is the random effect of the lth unit
- $e_{ijkl} \sim$ iid $N(0,\sigma^2_{ijk})$ is the random effect of the sample from the lth unit, with k sub-samples, of sample type j in site i.

Due to computational limitations, initially separate models were run for each combination of site and number of sub-samples. Likelihood ratio tests were performed to test the null hypothesis that variability does not depend on the type of sample. In each case, the null hypothesis was not rejected (each p>0.10), hence type of sample was removed from the variance structure. Then the model described above was run, except $e_{ijkl} \sim$ iid $N(0,\sigma^2_{ik})$. Variance estimates are in Table C.1.1. The rest of the results are described in the body of the report.

Table C.1.1 Error Variance by Site and Number of Sub-Samples for the Average of Single Dust Samples and Composite Dust Samples

Surface Type	Site and Number of Samples	Error Variance (95% CI)
Uncarpeted Floors (Central)	Milwaukee 2-sample	0.047 (0.028,0.094)
	Milwaukee 4-sample	0.309 (0.165,0.770)
	New York 4-sample	0.019 (0.012,0.033)
Uncarpeted Floors (Under Window)	Baltimore 2-sample	0.028 (0.017,0.054)
	Milwaukee 2-sample	0.136 (0.059,0.583)
	Milwaukee 4-sample	0.051 (0.024,0.162)
	New York 2-sample	0.034 (0.016,0.114)
	New York 3-sample	0.021 (0.012,0.044)
	New York 4-sample	0.084 (0.050,0.170)
Window Sills	Baltimore 4-sample	
	Milwaukee 4-sample	
	New York 2-sample	0.0918[1] (0.075,0.115)
	New York 3-sample	
	New York 4-sample	
Window Troughs	Baltimore 4-sample	0.053 (0.039,0.076)
	Milwaukee 4-sample	0.190 (0.126,0.317)
	New York 2-sample	0.075 (0.044,0.155)
	New York 3-sample	0.014 (0.007,0.038)
	New York 4-sample	0.024 (0.013,0.056)

1 = Hypothesis testing determined that the error variance is equal across all sites and number of sub-samples; hence only one estimate is determined.

Appendix C.2 Investigation of the Sources of Dust Lead Loading including Friction/Impact, Blow-in and Track-in (report section 6.2)

Outline:

C.2.1. Variables Included in Models

General Variables

- Site (Baltimore, Milwaukee, New York)
- Surface Type
  - Sills[i] (Painted, Unpainted)
  - Floors[ii] (Carpet, Not carpeted)
- Condition (Smooth & Cleanable, Not Smooth & Cleanable) - Details (Sills[iii], Floors[iv])
- Interaction of Surface Type and Condition
- Building Age (Pre-1900, 1900-1929, 1930-1949, 1950-1959, 1960-1978)

General Variables (Floors Only)

- Floor sample location (room entry, central, perimeter, or under window)
- Log average paint lead[v] loading in room (does not include troughs)
- Average paint lead condition in room (does not include troughs) [1=Intact, 2=Fair, 3=Poor]
- Interaction of log paint lead loading and paint lead condition in room

Exterior Lead Sources

- Log soil lead concentration (average of play, perimeter and curb)
- Soil cover (average of play perimeter and curb) (1=no bare… 5=all bare)
- Interaction of log soil lead concentration and cover
- Point source (yes, no) – not used included in model due to insufficient data
- Log Exterior Dust lead loading
- Log dust lead loading just inside doorway to most commonly used entry
- Log dust lead loading just outside doorway to most commonly used entry

Blow-In Modifiers

- Window Accessibility
  - Sills[vi] (accessible, trough inaccessible)

    - Floors[vii] (sill/trough accessible, sill/trough partially blocked access, sill/trough partially blocked no access, sill/trough completely blocked, trough inaccessible, all inaccessible)
- Height window is from the ground floor (in feet)
- Floor in building[viii] (0,1,2…)
- Air System in window[ix]
    - Sills - not included in analysis if air system in window
    - Floors (yes/no)

Track-In Modifiers (Floors only)

- Number of Floors from Unit Entry
- Floor in building
- Exterior Door: Floor sample is next to an exterior door (1= not next to a door, 2 = next to exterior door, 3= next to an interior door).

Window Lead Sources

- Average Interior Window Paint[x] lead concentration (no trough)
- Average Interior Window Paint condition (no trough)
- Interaction of average Interior Window Paint lead concentration and condition
- Window trough Paint lead[xi] concentration
- Window trough Paint condition
- Interaction of Window trough Paint lead concentration and condition

Additional Window Lead Sources (For sills only)

- Window sill Paint lead concentration
- Window sill Paint condition
- Interaction of Window sill Paint lead concentration and condition

Window Friction Lead Sources

- Paint lead concentration on window

Window friction Modifier

- Window paint condition and Rubbing binding on window[xii] :
    - Intact paint, no rubbing/binding
    - Non-intact paint, no rubbing/binding
    - Intact paint, rubbing/binding
    - Non-intact paint, rubbing/binding

- Type of window (double-hung, casement, or other)

Door Lead Sources (Floor Model only)

- Average Door Paint lead[xiii] concentration
- Average Door Paint condition
- Interaction of average door Paint lead concentration and condition

Door friction Modifier (Floor model only)

- Rubbing binding on door (yes/no)

Note on Paint Lead Loading measurements: New York used an XRF instrument that did not register value above 10 mg/cm^2. The reported results are for models with all individual XRF values above 10 converted to 10. Additionally, all values below 0.1 mg/cm^2 were converted to 0.1 mg/cm^2. Then, the described statistics were calculated. Models were also run only with dwellings with no values reported as ≥ 10 mg/cm^2. Since the results were so similar, they were not reported.

C.2.2. Models

a. General Sill Model (report section 6.2.3)
Log (Dust) = (*General Variables*) + (1 + *Exterior Lead Sources*) * (1 + *Blow-in Modifiers*) + *Window Lead Sources* + (*Window Friction Sources* + 1) * (1 + *Window Friction Modifiers*) + error, where *italicized* phrases refer to the sets of variables under the corresponding heading. The "error"" term accounts for the effects of dwelling, room and error. Dwelling and room variance are allowed to vary by site.

b. Sill Friction Model (report section 6.2.3.3)
The same as the general sill model except a sill is only included if all window paint is intact. Hence the variable for average condition of window paint is removed. The "error"" term accounts for the effects of dwelling, room and error. Dwelling and room variance are allowed to vary by site.

c. General Floor Model (report section 6.2.2)
Log (Dust) = (*General Variables*) + (1 + *Exterior Lead Sources*) * (1 + *Blow-in Modifiers*) * (1 + Floor sample location) + (1 + *Exterior Lead Sources*) * (1 + *Track-in Modifiers*) * (1 + Floor sample location) + (1 + *Window Lead Sources*)* (1 + Floor sample location) + (*Door Friction Sources* + 1) * (1 + *Door Friction Modifiers*)*(1 + Floor sample location) + (*Door Lead Sources* + 1) * (1 + Floor sample location) + error, where *italicized* phrases refer to the sets of variables under the corresponding heading and Floor sample location = central, entry, perimeter or window The "error"" term accounts for the effects of dwelling, room and error. Dwelling and room variance are allowed to vary by site.

Notes:

1. Most (88%) of the windows are double hung. Other than 2 casement windows, all cases of rubbing are on double hung windows. Hence the interaction of type of window and rubbing/binding is not included in the models.
2. The interaction of site by window accessibility by yard soil lead level by yard cover was removed from the sill model due to insufficient data.
3. The interaction of condition of the wiped surface by surface type was removed from the floor model due to insufficient data.

C.2.3. Summary of Sill Model Results (report section 6.2.3)

Data was available for 621 window sills in 184 dwellings. Variables in the final reduced model:

- Cleanability of wiped window sill
- Site
- Interaction of window paint condition and rubbing/binding
- Interaction of average interior window paint lead, window average paint condition and rubbing/binding. (represents window lead hazards)
- Condition of window trough paint

Note: For interactions, all subsets of main effects and interactions are also included

The model output is in Table C.2.1.

C.2.4. Summary of Floor Model Results (report section 6.2.2)

A mixed model was used, accounting for possible correlations between measurements within the same household and room. The model was heteroscedastic, that is, the variability of the building effects and room effects depends on the site. A backward regression procedure was followed.

Data was available for 782 floors in 209 rooms in 173 dwellings. Variables in the final reduced model:

- Interaction of site, window height and exterior dust lead loading (represents blow -in from exterior).
- Interaction of site and soil lead concentration. (represents blow-in/track-in)
- Sample location on floor (window, central, entry or perimeter)
- Interaction of location of floor and condition of window trough paint
- Average window paint lead loading.
- Interaction of average door paint lead loading and floor location
- Outside hall/porch dust lead loading

Note: For interactions, all subsets of main effects and interactions are also included

The model output is in Table C.2.3

C.2.5. SAS Model Output

Table C.2.1 General Sill Model

The Mixed Procedure

Model Information	
Data Set	NEW.SILLM
Dependent Variable	LPB
Covariance Structure	Variance Components
Group Effect	SITE
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
BLDG_ID	182	1001 1002 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1017 1019 1021 1022 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1043 1044 1045 1046 1049 1050 1054 1055 1056 1058 1060 1061 1062 1063 1064 1066 1067 1068 1069 1070 1071 1072 1073 1074 1075 1076 1077 1078 1079 1080 1081 1082 1083 1084 1085 1086 1087 1088 1089 1090 1091 1092 1093 1094 1095 1098 1099 1100 1102 1103 1104 1105 1106 1107 1109 1110 2001 2002 2003 2004 2005 2006 2007 2008 2009 2012 2013 2014 2015 2017 2020 2021 2022 2023 2024 2025 2026 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2070 2071 2072 2073 2074 2075 2076 2077 2078 2080 3001 3011 3013 3014 3032 3033 3036 3038 3040 3050 3052 3053 3055 3056 3058 3060 3063 3069 3072 3075
SITE	3	Baltimore Milwaukee New York
rub	4	1-Intact,NoRub 2-NotIntact,NoRub 3-Intact,Rub 4-NotIntact,Rub

Table C.2.1 General Sill Model

The Mixed Procedure

Dimensions	
Covariance Parameters	4
Columns in X	15
Columns in Z	546
Subjects	1
Max Obs Per Subject	621

Number of Observations	
Number of Observations Read	621
Number of Observations Used	611
Number of Observations Not Used	10

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	970.03237612	
1	3	926.32541257	0.00037230
2	1	926.29097182	0.00000510
3	1	926.29052722	0.00000000

Table C.2.1 General Sill Model

The Mixed Procedure

Convergence criteria met.

Covariance Parameter Estimates		
Cov Parm	**Group**	**Estimate**
BLDG_ID(SITE)	SITE Baltimore	0.008395
BLDG_ID(SITE)	SITE Milwaukee	0.1311
BLDG_ID(SITE)	SITE New York	0.05303
Residual		0.2164

Fit Statistics	
-2 Res Log Likelihood	926.3
AIC (smaller is better)	934.3
AICC (smaller is better)	934.4
BIC (smaller is better)	947.1

Table C.2.1 General Sill Model

The Mixed Procedure

Solution for Fixed Effects							
Effect	**City**	**rub**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept			1.3384	0.1643	179	8.15	<.0001
SITE	Baltimore		-0.00059	0.1038	179	-0.01	0.9955
SITE	Milwaukee		0.5556	0.1311	179	4.24	<.0001
SITE	New York		0	.	.	.	.
NCOND			0.2126	0.04936	419	4.31	<.0001
exterior			0.1185	0.04809	419	2.46	0.0141
rub		1-Intact,NoRub	-0.3690	0.1147	419	-3.22	0.0014
rub		2-NotIntact,NoRub	-0.01954	0.1109	419	-0.18	0.8603
rub		3-Intact,Rub	-0.1317	0.09189	419	-1.43	0.1525
rub		4-NotIntact,Rub	0	.	.	.	.
SXRF_WI*rub		1-Intact,NoRub	0.007708	0.1125	419	0.07	0.9454
SXRF_WI*rub		2-NotIntact,NoRub	0.1901	0.1486	419	1.28	0.2014
SXRF_WI*rub		3-Intact,Rub	0.3826	0.09948	419	3.85	0.0001
SXRF_WI*rub		4-NotIntact,Rub	0.4435	0.07446	419	5.96	<.0001
CSXRF_WW			0.1162	0.03765	419	3.09	0.0022

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
SITE	2	179	14.77	<.0001
NCOND	1	419	18.55	<.0001
exterior	1	419	6.08	0.0141

Table C.2.1 General Sill Model

The Mixed Procedure

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
Rub	3	419	3.68	0.0122
SXRF_WI*rub	4	419	11.69	<.0001
CSXRF_WW	1	419	9.53	0.0022

Least Squares Means						
Effect	**City**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
SITE	Baltimore	1.4886	0.06074	179	24.51	<.0001
SITE	Milwaukee	2.0447	0.07737	179	26.43	<.0001
SITE	New York	1.4892	0.1086	179	13.71	<.0001

Differences of Least Squares Means							
Effect	**City**	**City**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
SITE	Baltimore	Milwaukee	-0.5562	0.1046	179	-5.32	<.0001
SITE	Baltimore	New York	-0.00059	0.1038	179	-0.01	0.9955
SITE	Milwaukee	New York	0.5556	0.1311	179	4.24	<.0001

Table C.2.2 Floor Model

The Mixed Procedure

Model Information	
Data Set	NEW.FLOORM
Dependent Variable	LPB
Covariance Structure	Variance Components
Group Effect	SITE
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information		
Class	**Levels**	**Values**
BLDG_ID	104	1005 1008 1010 1012 1013 1019 1022 1028 1031 1035 1037 1038 1042 1045 1046 1049 1054 1055 1058 1067 1068 1072 1077 1078 1085 1087 1093 1094 1095 1098 1100 1106 1110 2002 2004 2005 2006 2007 2008 2009 2012 2015 2017 2020 2021 2022 2023 2024 2025 2026 2029 2030 2031 2032 2033 2034 2035 2037 2038 2039 2042 2044 2045 2046 2047 2050 2051 2052 2053 2054 2055 2058 2059 2060 2061 2063 2064 2066 2067 2068 2070 2071 2072 2073 2074 2076 2077 2078 3014 3032 3033 3036 3038 3050 3052 3053 3055 3056 3058 3060 3063 3069 3072 3075
SITE	3	Baltimore Milwaukee New York
ROOMID	18	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 20
TY	4	Central Entry Perimeter Window

Table C.2.2 Floor Model

The Mixed Procedure

Dimensions	
Covariance Parameters	7
Columns in X	33
Columns in Z	939
Subjects	1
Max Obs Per Subject	1306

Number of Observations	
Number of Observations Read	1306
Number of Observations Used	782
Number of Observations Not Used	524

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	721.56853572	
1	3	394.92730628	0.00397561
2	2	392.97018001	0.00050113
3	1	392.69593919	0.00001946
4	1	392.68589554	0.00000008
5	1	392.68585560	0.00000000

Table C.2.2 Floor Model

The Mixed Procedure

Convergence criteria met.

Covariance Parameter Estimates		
Cov Parm	**Group**	**Estimate**
BLDG_ID(SITE)	SITE Baltimore	0.02153
BLDG_ID(SITE)	SITE Milwaukee	0.04363
BLDG_ID(SITE)	SITE New York	0.01621
ROOMID(BLDG_ID)	SITE Baltimore	0.01150
ROOMID(BLDG_ID)	SITE Milwaukee	0.06632
ROOMID(BLDG_ID)	SITE New York	0.01407
Residual		0.05516

Fit Statistics	
-2 Res Log Likelihood	392.7
AIC (smaller is better)	406.7
AICC (smaller is better)	406.8
BIC (smaller is better)	425.2

Table C.2.2 Floor Model

The Mixed Procedure

Solution for Fixed Effects							
Effect	**City**	**Sample Type**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept			-1.4737	0.5809	95	-2.54	0.0128
SITE	Baltimore		2.2028	0.6434	95	3.42	0.0009
SITE	Milwaukee		1.5972	0.6779	95	2.36	0.0205
SITE	New York		0	.	.	.	.
TY		Central	0.01632	0.06210	562	0.26	0.7928
TY		Entry	0.1198	0.06210	562	1.93	0.0542
TY		Perimeter	0.08578	0.06210	562	1.38	0.1677
TY		Window	0	.	.	.	.
LYARD*SITE	Baltimore		-0.3106	0.1610	562	-1.93	0.0543
LYARD*SITE	Milwaukee		0.1371	0.1216	562	1.13	0.2599
LYARD*SITE	New York		0.4926	0.1896	562	2.60	0.0096
cs_ww*TY		Central	0.002988	0.03672	562	0.08	0.9352
cs_ww*TY		Entry	0.02617	0.03672	562	0.71	0.4763
cs_ww*TY		Perimeter	0.03271	0.03672	562	0.89	0.3734
cs_ww*TY		Window	0.1016	0.03589	562	2.83	0.0048
SXRF_D*TY		Central	0.01755	0.03923	562	0.45	0.6549
SXRF_D*TY		Entry	0.05665	0.03923	562	1.44	0.1493
SXRF_D*TY		Perimeter	0.1078	0.03923	562	2.75	0.0062
SXRF_D*TY		Window	0.07727	0.03869	562	2.00	0.0463

Table C.2.2 Floor Model

The Mixed Procedure

Solution for Fixed Effects							
Effect	**City**	**Sample Type**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
outside			0.1203	0.04694	562	2.56	0.0106
ALT			0.05961	0.03328	562	1.79	0.0737
exterior			0.3507	0.2373	562	1.48	0.1399
ALT*exterior			-0.04640	0.02173	562	-2.14	0.0331
ALT*SITE	Baltimore		-0.05621	0.03472	562	-1.62	0.1060
ALT*SITE	Milwaukee		-0.09287	0.04043	562	-2.30	0.0220
ALT*SITE	New York		0	.	.	.	.
exterior*SITE	Baltimore		0.01766	0.2854	562	0.06	0.9507
exterior*SITE	Milwaukee		-0.2271	0.2634	562	-0.86	0.3889
exterior*SITE	New York		0	.	.	.	.
ALT*exterior*SITE	Baltimore		0.03277	0.02451	562	1.34	0.1818
ALT*exterior*SITE	Milwaukee		0.06037	0.02480	562	2.43	0.0152
ALT*exterior*SITE	New York		0	.	.	.	.
SXRF_WI			0.1189	0.05704	562	2.08	0.0377

Table C.2.2 Floor Model

The Mixed Procedure

Type 3 Tests of Fixed Effects				
Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
SITE	2	95	5.92	0.0038
TY	3	562	1.66	0.1751
LYARD*SITE	3	562	3.91	0.0089
cs_ww*TY	4	562	3.52	0.0075
SXRF_D*TY	4	562	2.95	0.0198
outside	1	562	6.57	0.0106
ALT	1	562	0.49	0.4861
exterior	1	562	6.88	0.0089
ALT*exterior	1	562	2.70	0.1007
ALT*SITE	2	562	2.67	0.0700
exterior*SITE	2	562	0.92	0.3972
ALT*exterior*SITE	2	562	3.30	0.0375
SXRF_WI	1	562	4.34	0.0377

Table C.2.2 Floor Model

The Mixed Procedure

Least Squares Means							
Effect	**City**	**Sample Type**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
TY		Central	0.5397	0.05608	562	9.62	<.0001
TY		Entry	0.6645	0.05608	562	11.85	<.0001
TY		Perimeter	0.6178	0.05608	562	11.02	<.0001
TY		Window	0.6638	0.05586	562	11.88	<.0001
SITE	Baltimore		0.5795	0.1268	95	4.57	<.0001
SITE	Milwaukee		0.7716	0.07192	95	10.73	<.0001
SITE	New York		0.5132	0.08422	95	6.09	<.0001

Differences of Least Squares Means									
Effect	**City**	**Sample Type**	**City**	**Sample Type**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
TY		Central		Entry	-0.1248	0.02404	562	-5.19	<.0001
TY		Central		Perimeter	-0.07811	0.02404	562	-3.25	0.0012
TY		Central		Window	-0.1241	0.02384	562	-5.21	<.0001
TY		Entry		Perimeter	0.04668	0.02404	562	1.94	0.0526
TY		Entry		Window	0.000669	0.02384	562	0.03	0.9776
TY		Perimeter		Window	-0.04601	0.02384	562	-1.93	0.0541
SITE	Baltimore		Milwaukee		-0.1921	0.1475	95	-1.30	0.1961

Table C.2.2 Floor Model

The Mixed Procedure

Differences of Least Squares Means									
Effect	**City**	**Sample Type**	**City**	**Sample Type**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
SITE	Baltimore		New York		0.06630	0.1489	95	0.45	0.6572
SITE	Milwaukee		New York		0.2584	0.1215	95	2.13	0.0360

Appendix C.3 Exploration of the Components of Variation in Dust Sampling (report section 6.4)

Part I: Reliability Ratios

Side-by-Side Model:

Model: $\log(y_{ijk}) = site_i + building_j\ (site_i) + e_{ijk}$, i=1-3, j=1-N_i, k=1-3. (2)
Where:

$\log(y_{ijk})$ is the sample from side-by-side sample k in building j in site i
$site_i$ is the fixed effect of site i
$building_j\ (site_i)$ ~iid $N(0,\sigma^2_{Bi})$, σ^2_{Bi} is the variability between buildings/rooms in site i
e_{ijk} ~ iid $N(0,\sigma^2_{Ei})$, σ^2_{Ei} is the variability between side-by-side samples in site i

This model was run separately for window sills, window troughs, central bare floors and central carpeted floors.

Table C.3.1 presents the variability estimates and 95% confidence intervals.

Measurement Error and Reliability Estimates

In this study, the side-by-side models are used to find measurement errors and reliability estimates. The classical model of measurement error in a population is $X_i = T_i + E_i$ where X_i is the observed measure for a given subject that differs from the true value T_i due to the measurement error E_i , which is assumed to have a normal distribution with mean 0 and variance σ^2_E. The model also assumes that the errors are independent of each other and of the true value.

The measure of the measurement error used to describe the validity/reliability of the measurement X for the true measure T is the Reliability Ratio or the Intraclass Correlation Coefficient defined as: $R = \rho^2_{TX} = 1 - \frac{\sigma^2_E}{\sigma^2_X} = \frac{\sigma^2_T}{\sigma^2_X} = \frac{\sigma^2_T}{\sigma^2_T + \sigma^2_E}$, where σ^2_T is the variance of the true exposure values in the population and σ^2_X is the variance of the observed exposure values. Then, for the side-by-side models described above, the reliability ratio for city i is:

$$R_i = 1 - \frac{\sigma^2_{Ei}}{\sigma^2_{Bi} + \sigma^2_{Ei}} = \frac{\sigma^2_{Bi}}{\sigma^2_{Bi} + \sigma^2_{Ei}}. \quad (3)$$

Fleiss (1986) gave a method for the analysis of reliability studies and indicated the method for finding the confidence intervals for the reliability ratio. For our models, building j in city i has k=3 dust lead measurement (i.e. there are k=3 repeated measurements of dust lead for building j in city i) and N_i being the number of buildings in city i. Then, the lower 100 (1-α)% confidence interval for R_i in city i is:

$$R_i \geq \frac{\frac{BMS_i}{WMS_i} - F_{N_i-1, N_i(k-1), \alpha}}{\frac{BMS_i}{WMS_i} + (k-1)F_{N_i-1, N_i(k-1), \alpha}}; \quad (4)$$

where BMS_i = Between-building mean square in city i = $\hat{\sigma}^2_{Ei} + k\hat{\sigma}^2_{Bi}$ and WMS_i = Within-building mean square in city i = $\hat{\sigma}^2_{Ei}$.

Part II: Estimates of Variability Attributable to Building, Room and Error

Non-Side-by-Side Model

Model: $\log(y_{ijk}) = site_i + building_j\ (site_i) + room_{jk}\ (site_i)$, i=1-3, j=1-$N_i$, k=1-$k_{ij}$. (1)
Where:

$\log(y_{ijk})$ is the sample from room k in building j in site i
$site_i$ is the fixed effect of site i
$building_j\ (site_i) \sim N(0,\sigma^2_{Bi})$, σ^2_{Bi} is the variability between buildings in site i
$room_{jk}\ (site_i) \sim N(0,\sigma^2_{Ei})$, σ^2_{Ei} is the between room/error variability in site i

Separate models were run for window sills, window troughs and for four different locations (entry, perimeter, window and central) of floor for the three cities. For each of the four locations of floor, two separate models were run for bare and carpeted surface.

Table C.3.2 presents the variability estimates and 95% confidence intervals generated by this model.

Ideally I could have estimates of the between-building, between-room, and side-by-side variances. Although this is not directly possible with the sampling scheme employed in this study, the percentages of variability due to these three sources can be determined by following these steps:
1. E=% error attributable to side-by-side error =
100%* Side-by-side variability /(Side-by-side variability + Between Dwelling/Room variability) – *All estimates from side-by-side model*
2. B=% error attributable to building =
100%*Between-building variability/(Between-building variability + Between room/error variability) – *All estimates from non side-by-side model*
3. Then by subtraction,
R = % error attributable to room = 100%-E-B

Validity to combine the model results:
It would be valid to combine the results if the total variability of dwellings used in side-by-side sampling is equal to the total variability of dwellings not used in side-by-side sampling. This was tested with simple F-tests for each surface type. For each site and

surface type except troughs when all sites are combined, the variances are not significantly different. Hence, it is valid to combine results for these surface types. However, this is not the case for troughs combined across sites (p=0.0193).

Part III: Simulation of the Effects of Variability

Assume that dust lead observation for building j, Y_j is Log Normal, with mean δ_j and variance τ^2_j. Then, Log(Y_j) is Normal, with mean μ_j and variance σ^2_j where

(i) $\delta_j = \exp(\mu_j + \sigma^2_j/2)$, and (1)

(ii) $\tau^2_j = \delta_j^2 \exp(\sigma^2_j - 1)$

Assume that S is the dust lead standard for a particular surface. Then consider the hypothesis:

H_0: $\delta_j < S$ (i.e., house j passes the dust test)

H_A: $\delta_j \geq S$ (i.e., house j fails the dust test).

Also suppose that the results in a home are based on a statistic, Q. Then the test will consist of rejecting H_0 if $Q_j \geq S$. Hence,

P(Type I Error) = P ($Q_j \geq S$ / $\delta_j < S$)

P(Type II Error) = P ($Q_j < S$ / $\delta_j \geq S$).

No simple form exists for the sampling distribution of the arithmetic mean. So, we use simulations to calculate the error probabilities. For calculating the Type I Error, the following steps were considered:

(i) Set S (the standard for the surface). Select the true level $\delta_j = S_0$ (where $S_0<S$). Then, from equation (1), $\mu_0 = \log(S_0) - \sigma^2_j/2$.

(ii) From the non side-by-side results, the estimate of room/error variance of log(Y_j) is $\hat{\sigma}^2$ for all j.

(iii) Generate k X_{ij} from a log normal distribution with mean and variance specified in (i) and (ii), respectively. Calculate the mean of these k observations.

(iv) Repeat step (iii) 10000 times.

(v) P(Type I Error) = $[\sum_{i=1}^{1000} I(\bar{X}_i \geq S)]/10000$.

For calculating the Type II Error, the following steps were considered:

(vi) Select the true level $\delta_j = S_A$ (where $S_A>S$). Then, from equation (1), $\mu_A = \log(S_A) - \sigma^2_j/2$.

(vii) Generate k Z_{ij} from a log normal distribution with mean and variance specified in (vi) and (ii), respectively. Calculate the mean of these k observations.

(viii) Repeat step (vii) 10000 times.

(ix) P(Type II Error) = $[\sum_{i=1}^{1000} I(\overline{Z_i} < S)]/10000$.

Table C.3.3 Presents error estimates for the 1,2,3,4, and 5 samples with a "true" unobservable level at 50%, 100%, 150%, 200% of the standard, for each sample type. Standards considered are $40\mu g/ft^2$ and $250\mu g/ft^2$ for floors and sills, respectively. Estimates are presented for each site.

Table C.3.1: Estimates of components of variance (95% Confidence Intervals) for Side-by-Side samples

Type of Sample	City	Dwelling/Room	Side-by-side
Sill	Baltimore	0.747(0.521,1.161)	0.096(0.074,0.127)
	Milwaukee	1.465(1.003,2.341)	0.386(0.300,0.515)
	New York	2.126(1.388,3.663)	0.485(0.364,0.678)
Trough	Baltimore	2.465(1.710,3.860)	0.421(0.328,0.560)
	Milwaukee	3.894(2.703,6.095)	0.541(0.420,0.722)
	New York	3.509(2.320,5.923)	0.291(0.218,0.410)
Bare Central Floor	Baltimore	0.273(0.184,0.448)	0.123(0.096,0.164)
	Milwaukee	0.889(0.627,1.359)	0.116(0.091,0.152)
	New York	0.561(0.367,0.961)	0.177(0.134,0.244)
Carp Central Floor	Baltimore	0.154(0.093,0.301)	0.206(0.160,0.276)
	Milwaukee	0.460(0.309,0.755)	0.107(0.082,0.145)
	New York	0.259(0.151,0.541)	0.092(0.065,0.140)

Table C.3.2: Estimates of components of variance (95% Confidence Intervals) for Dust Samples (not Side-by-Side)

Sample Type	Surface Type	City	Dwelling	Room/Error
Entry Floor	Bare	Baltimore	0.095(0.053,0.219)	0.220(0.172,0.293)
		Milwaukee	0.586(0.399,0.944)	0.210(0.153,0.304)
		New York	0.348(0.174,1.010)	0.236(0.136,0.508)
Entry Floor	Carpet	Baltimore	0.184(0.127,0.291)	0.197(0.162,0.245)
		Milwaukee	0.578(0.399,0.912)	0.448(0.359,0.574)
		New York	0.375(0.259,0.590)	0.238(0.194,0.300)
Entry Floor	Total	Baltimore	0.150(0.107,0.224)	0.207(0.180,0.241)
		Milwaukee	0.548(0.392,0.819)	0.402(0.343,0.479)
		New York	0.358(0.251,0.549)	0.253(0.212,0.308)
Perimeter Floor	Bare	Baltimore	0.144(0.096,0.241)	0.131(0.102,0.175)
		Milwaukee	0.436(0.294,0.713)	0.196(0.144,0.283)
		New York	0.465(0.292,0.853)	0.036(0.019,0.090)
Perimeter Floor	Carpet	Baltimore	0.188(0.125,0.315)	0.292(0.239,0.366)
		Milwaukee	0.606(0.410,0.987)	0.568(0.451,0.737)
		New York	0.327(0.212,0.569)	0.329(0.260,0.429)
Perimeter Floor	Total	Baltimore	0.179(0.128,0.266)	0.225(0.195,0.262)
		Milwaukee	0.638(0.455,0.959)	0.467(0.395,0.559)
		New York	0.323(0.217,0.532)	0.328(0.268,0.411)

Table C.3.2: Estimates of components of variance (95% Confidence Intervals) for Dust Samples (not Side-by-Side) (Continued)

Sample Type	Surface Type	City	Dwelling	Room/Error
Central Floor	Bare	Baltimore	0.125(0.083,0.206)	0.146(0.118,0.186)
		Milwaukee	0.414(0.272,0.707)	0.268(0.198,0.384)
		New York	0.209(0.097,0.728)	0.286(0.180,0.521)
Central Floor	Carpet	Baltimore	0.201(0.138,0.317)	0.183(0.146,0.238)
		Milwaukee	0.611(0.425,0.953)	0.474(0.380,0.608)
		New York	0.435(0.298,0.695)	0.313(0.254,0.396)
Central Floor	Total	Baltimore	0.149(0.108,0.220)	0.179(0.156,0.208)
		Milwaukee	0.595(0.427,0.888)	0.420(0.358,0.500)
		New York	0.434(0.305,0.668)	0.302(0.252,0.368)
Window Floor	Bare	Baltimore	0.105(0.061,0.225)	0.226(0.176,0.300)
		Milwaukee	0.405(0.241,0.820)	0.490(0.360,0.708)
		New York	1.664(1.005,3.276)	0.236(0.126,0.592)

Table C.3.2: Estimates of components of variance (95% Confidence Intervals) for Dust Samples (not Side-by-Side) (Continued)

Sample Type	Surface Type	City	Dwelling	Room/Error
Window Floor	Carpet	Baltimore	0.096(0.047,0.297)	0.469(0.384,0.588)
		Milwaukee	0.804(0.531,1.359)	0.858(0.678,1.119)
		New York	0.302(0.180,0.605)	0.518(0.409,0.676)
Window Floor	Total	Baltimore	0.123(0.080,0.210)	0.354(0.307,0.413)
		Milwaukee	0.682(0.471,1.077)	0.807(0.683,0.970)
		New York	0.348(0.219,0.639)	0.621(0.508,0.778)
Trough		Baltimore	1.947(1.405,2.878)	1.993(1.708,2.354)
		Milwaukee	3.073(2.173,4.679)	1.993(1.652,2.454)
		New York	1.060(0.642,2.075)	1.967(1.558,2.562)
Sill		Baltimore	0.218(0.134,0.419)	0.831(0.717,0.975)
		Milwaukee	0.839(0.514,1.612)	2.267(1.905,2.743)
		New York	0.922(0.575,1.714)	1.340(1.068,1.733)

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Central Floor	40	Baltimore	20	1	0.0299	.
				2	0.0088	.
				3	0.0026	.
				4	0.0006	.
				5	0.0002	.
Central Floor	40	Baltimore	40	1	0.4140	0.5860
				2	0.4376	0.5671
				3	0.4402	0.5538
				4	0.4507	0.5434
				5	0.4532	0.5445
Central Floor	40	Baltimore	60	1	.	0.2263
				2	.	0.1215
				3	.	0.0698
				4	.	0.0416
				5	.	0.0264
Central Floor	40	Baltimore	80	1	.	0.0746
				2	.	0.0190
				3	.	0.0062
				4	.	0.0012
				5	.	0.0004
Central Floor	40	Milwaukee	20	1	0.0835	.
				2	0.0442	.
				3	0.0278	.
				4	0.0175	.
				5	0.0106	.
Central Floor	40	Milwaukee	40	1	0.3656	0.6344
				2	0.3984	0.6016
				3	0.4215	0.5785
				4	0.4280	0.5720
				5	0.4435	0.5565
Central Floor	40	Milwaukee	60	1	.	0.3757
				2	.	0.2699
				3	.	0.2050
				4	.	0.1550

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Central Floor	40	Milwaukee	60	5	.	0.1302
Central Floor	40	Milwaukee	80	1	.	0.2288
				2	.	0.1124
				3	.	0.0569
				4	.	0.0338
				5	.	0.0179
Central Floor	40	NYC	20	1	0.0583	.
				2	0.0288	.
				3	0.0124	.
				4	0.0053	.
				5	0.0031	.
Central Floor	40	NYC	40	1	0.3879	0.6062
				2	0.4222	0.5844
				3	0.4343	0.5625
				4	0.4316	0.5590
				5	0.4372	0.5536
Central Floor	40	NYC	60	1	.	0.3299
				2	.	0.2076
				3	.	0.1490
				4	.	0.1031
				5	.	0.0776
Central Floor	40	NYC	80	1	.	0.1648
				2	.	0.0597
				3	.	0.0292
				4	.	0.0130
				5	.	0.0050
Bare Central Floor	40	Baltimore	20	1	0.0347	.
				2	0.0072	.
				3	0.0022	.
				4	0.0010	.
				5	0.0000	.
Bare Central Floor	40	Baltimore	40	1	0.4053	0.5844
				2	0.4359	0.5550

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Bare Central Floor	40	Baltimore	40	3	0.4468	0.5534
				4	0.4487	0.5519
				5	0.4488	0.5407
Bare Central Floor	40	Baltimore	60	1	.	0.2279
				2	.	0.1227
				3	.	0.0727
				4	.	0.0424
				5	.	0.0243
Bare Central Floor	40	Baltimore	80	1	.	0.0836
				2	.	0.0192
				3	.	0.0048
				4	.	0.0015
				5	.	0.0005
Bare Central Floor	40	Milwaukee	20	1	0.0892	.
				2	0.0557	.
				3	0.0332	.
				4	0.0199	.
				5	0.0144	.
Bare Central Floor	40	Milwaukee	40	1	0.3659	0.6324
				2	0.4055	0.6089
				3	0.4097	0.5909
				4	0.4148	0.5857
				5	0.4295	0.5744
Bare Central Floor	40	Milwaukee	60	1	.	0.4157
				2	.	0.2961
				3	.	0.2302
				4	.	0.1772
				5	.	0.1461
Bare Central Floor	40	Milwaukee	80	1	.	0.2553
				2	.	0.1364
				3	.	0.0727
				4	.	0.0428
				5	.	0.0262

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Bare Central Floor	40	NYC	20	1	0.0660	.
				2	0.0293	.
				3	0.0153	.
				4	0.0072	.
				5	0.0040	.
Bare Central Floor	40	NYC	40	1	0.3907	0.6055
				2	0.4103	0.5802
				3	0.4328	0.5712
				4	0.4431	0.5614
				5	0.4524	0.5519
Bare Central Floor	40	NYC	60	1	.	0.3321
				2	.	0.2160
				3	.	0.1574
				4	.	0.1057
				5	.	0.0759
Bare Central Floor	40	NYC	80	1	.	0.1615
				2	.	0.0737
				3	.	0.0311
				4	.	0.0126
				5	.	0.0055
Carp Central Floor	40	Baltimore	20	1	0.0232	.
				2	0.0033	.
				3	0.0008	.
				4	0.0001	.
				5	0.0001	.
Carp Central Floor	40	Baltimore	40	1	0.4134	0.5698
				2	0.4478	0.5541
				3	0.4471	0.5409
				4	0.4537	0.5401
				5	0.4654	0.5336
Carp Central Floor	40	Baltimore	60	1	.	0.1897
				2	.	0.0907
				3	.	0.0462
				4	.	0.0264

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Carp Central Floor	40	Baltimore	60	5	.	0.0124
Carp Central Floor	40	Baltimore	80	1	.	0.0497
				2	.	0.0091
				3	.	0.0017
				4	.	0.0001
				5	.	0.0000
Carp Central Floor	40	Milwaukee	20	1	0.0531	.
				2	0.0211	.
				3	0.0067	.
				4	0.0046	.
				5	0.0024	.
Carp Central Floor	40	Milwaukee	40	1	0.4033	0.6038
				2	0.4272	0.5847
				3	0.4367	0.5636
				4	0.4424	0.5492
				5	0.4538	0.5423
Carp Central Floor	40	Milwaukee	60	1	.	0.3031
				2	.	0.1836
				3	.	0.1262
				4	.	0.0857
				5	.	0.0596
Carp Central Floor	40	Milwaukee	80	1	.	0.1406
				2	.	0.0496
				3	.	0.0193
				4	.	0.0061
				5	.	0.0040
Carp Central Floor	40	NYC	20	1	0.0582	.
				2	0.0237	.
				3	0.0111	.
				4	0.0055	.
				5	0.0020	.
Carp Central Floor	40	NYC	40	1	0.3994	0.6115
				2	0.4200	0.5904

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Carp Central Floor	40	NYC	40	3	0.4327	0.5652
				4	0.4352	0.5585
				5	0.4510	0.5508
Carp Central Floor	40	NYC	60	1	.	0.3129
				2	.	0.2018
				3	.	0.1348
				4	.	0.0978
				5	.	0.0637
Carp Central Floor	40	NYC	80	1	.	0.1504
				2	.	0.0550
				3	.	0.0196
				4	.	0.0088
				5	.	0.0034
Window Sill	250	Baltimore	125	1	0.1170	.
				2	0.0848	.
				3	0.0684	.
				4	0.0555	.
				5	0.0463	.
Window Sill	250	Baltimore	250	1	0.3266	0.6711
				2	0.3537	0.6396
				3	0.3799	0.6220
				4	0.3921	0.6134
				5	0.3987	0.6075
Window Sill	250	Baltimore	375	1	.	0.5121
				2	.	0.3936
				3	.	0.3319
				4	.	0.2918
				5	.	0.2552
Window Sill	250	Baltimore	500	1	.	0.3869
				2	.	0.2467
				3	.	0.1799
				4	.	0.1315
				5	.	0.0957

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Window Sill	250	Milwaukee	125	1	0.1086	.
				2	0.1140	.
				3	0.1097	.
				4	0.1034	.
				5	0.0978	.
Window Sill	250	Milwaukee	250	1	0.2291	0.7778
				2	0.2597	0.7400
				3	0.2801	0.7176
				4	0.3054	0.7029
				5	0.3098	0.6814
Window Sill	250	Milwaukee	375	1	.	0.6842
				2	.	0.6077
				3	.	0.5642
				4	.	0.5348
				5	.	0.5028
Window Sill	250	Milwaukee	500	1	.	0.6176
				2	.	0.5180
				3	.	0.4462
				4	.	0.4032
				5	.	0.3587
Window Sill	250	NYC	125	1	0.1201	.
				2	0.1087	.
				3	0.0935	.
				4	0.0934	.
				5	0.0743	.
Window Sill	250	NYC	250	1	0.2750	0.7147
				2	0.3163	0.6899
				3	0.3437	0.6705
				4	0.3550	0.6482
				5	0.3618	0.6349
Window Sill	250	NYC	375	1	.	0.5962
				2	.	0.5029
				3	.	0.4467
				4	.	0.4128

Table C.3.3: Probabilities of Error for Specified True Dust Lead Loading Averages by Site and Number of Samples (Continued)

Sample Type	Standard	Site	True Lead Loading	#samples	Pr(TYPE I)	Pr(TYPE II)
Window Sill	250	NYC	375	5	.	0.3767
Window Sill	250	NYC	500	1	.	0.4991
				2	.	0.3762
				3	.	0.2951
				4	.	0.2454
				5	.	0.2035

References:

Fleiss, J. L. (1986) *The design and analysis of clinical experiments*, pp. 1-32. John Wiley and Sons, New York.

Notes from Appendix C.2

[i] If a sill was reported to have a surface type of 0(no window), 1(not accessible), 7 (carpet) or 8(other), then the sill wasn't included in the model. Valid categories were categorized as painted (2) or unpainted (3,4,5).

[ii] If a floor is reported as other (8), the floor wasn't included in model (unknown whether carpeted or not). If a floor was reported as carpeted (7) and either smooth and cleanable or mostly smooth & cleanable, the floor was not included in the model (protocol violation).

[iii] Sill surface condition collapsed into: smooth & cleanable (1), somewhat smooth and cleanable (2-4)

[iv] Floor condition was collapsed into: smooth & cleanable or somewhat smooth and cleanable according to the following rules: Carpeted floors were categorized as somewhat smooth and cleanable. Uncarpeted floor surface condition collapsed into: smooth & cleanable (1), somewhat smooth and cleanable (2-4)

[v] Individual values above 10 mg/cm^2 are truncated to 10 mg/cm^2. Values below 0.1 mg/cm^2 are set equal to 0.1 mg/cm^2.

[vi] The accessibility code is collapsed for sills as follows: (a) 'Sill/trough accessible', 'Sill/trough partially blocked access', ''Sill/trough partially blocked no access', or 'Sill/trough completely blocked', (b); Trough inaccessible' or 'All inaccessible'.

[vii] The accessibility code is collapsed for floors as follows: (a) 'Sill/trough accessible' or 'Sill/trough partially blocked access', (b) ''Sill/trough partially blocked no access', or 'Sill/trough completely blocked', (c); Trough inaccessible' or 'All inaccessible'.

[viii] Basements not included in model. The ground floor is coded as zero.

[ix] If window accessible is coded as "sill/trough accessible" yet there is an air system in the window, the data is excluded.

[x] If window is unpainted, then: (1) no window rubbing/binding; (2) set window paint to zero; (3) set window condition to good (4) Set window jamb paint to zero; (5) Set window jamb condition to good (6) Set window trough paint to zero; (7) Set window trough condition to good.

[xi] If the window is coded as 'Trough inaccessible' or 'All inaccessible' and there is no air system in the window, then the trough paint lead concentration is set to 0 mg/cm^2 and the condition is set to "good".

[xii] If window accessible is coded as "trough inaccessible" or "all inaccessible" then there is no rubbing on the window.

[xiii] If door is unpainted, then the following is done: (1) no door rubbing/binding; (2) set door jamb paint to zero; (3) set door paint to zero; (4) set door condition to good

APPENDIX D: EXTENDED REPORT TABLES

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GENERAL NOTES ON PERFORMANCE CHARACTERISTIC PRESENTATION:

1. For performance characteristics, XX = Not able to calculate.
2. If not able to calculate a p-value, table contains "."
3. When multiple sample types are considered simultaneously (a) data is only included in the table if all sample types were available in a dwelling; and (b) if the standard for one surface type is not considered in the particular scenario, it is coded as ".".

Table D1: Performance Characteristics for Risk Assessment Environmental Testing Protocols Studied (Report Table 5.4 & 5.8)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
1. HUD Guidelines (Average dust)	Baltimore	97	56	0.443	XX	44(34,54)	XX	98(88,100)
	Milwaukee	63	97	0.492	100(89,100)	6(1,21)	51(38,64)	100(16,100)
	New York	69	68	0.452	64(46,79)	27(13,46)	49(34,64)	41(21,64)
	Milw & NY	132	82	0.822	81(69,89)	17(9,28)	50(40,60)	46(26,67)
	All	229	71	0.080	79(68,88)	33(26,41)	33(26,41)	79(67,88)
2. HUD Guidelines (Maximum dust)	Baltimore	97	57	0.433	XX	43(33,53)	XX	98(87,100)
	Milwaukee	63	97	0.492	100(89,100)	6(1,21)	51(38,64)	100(16,100)
	New York	69	70	0.612	67(49,81)	27(13,46)	50(35,65)	43(22,66)
	Milw & NY	132	83	1.000	82(71,90)	17(9,28)	50(41,60)	48(27,69)
	All	229	72	0.054	81(70,89)	32(25,40)	34(26,41)	80(68,89)
3. HUD Interim (Maximum dust)	Baltimore	97	53	0.474	XX	47(37,57)	XX	98(88,100)
	Milwaukee	63	94	0.113	100(89,100)	13(4,29)	53(39,66)	100(40,100)
	New York	69	67	0.444	61(43,77)	27(13,46)	48(33,63)	39(20,61)
	Milw & NY	132	80	1.000	79(67,88)	20(11,32)	50(41,60)	48(29,68)
	All	229	68	0.044	78(66,87)	36(29,44)	34(27,42)	79(68,88)
4. EPA Current (Average dust)	Baltimore	97	48	1.000	XX	51(41,61)	XX	98(89,100)
	Milwaukee	63	94	0.113	100(89,100)	13(4,29)	53(39,66)	100(40,100)
	New York	69	68	0.452	64(46,79)	27(13,46)	49(34,64)	41(21,64)
	Milw & NY	132	80	1.000	81(69,89)	20(11,32)	51(41,61)	50(30,70)
	All	229	67	0.009	79(68,88)	39(31,46)	35(28,43)	82(71,90)

Table D2: Performance Characteristics for Screening Environmental Testing Protocols Studied (Report Table 5.4)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
1. HUD Original	Baltimore	58	50	1.000	XX	49(36,63)	XX	97(82,100)
	Milwaukee	15	80	1.000	75(19,99)	18(2,52)	25(5,57)	67(9,99)
	New York	38	71	1.000	72(47,90)	30(12,54)	48(29,68)	55(23,83)
	Milw & NY	53	74	1.000	73(50,89)	26(12,45)	41(26,58)	57(29,82)
	All	111	61	0.472	70(47,87)	41(31,52)	24(14,35)	84(69,93)
2. EPA Current	Baltimore	58	31	1.000	XX	68(55,80)	XX	98(87,100)
	Milwaukee	15	73	1.000	75(19,99)	27(6,61)	27(6,61)	75(19,99)
	New York	38	47	0.757	44(22,69)	50(27,73)	44(22,69)	50(27,73)
	Milw & NY	53	55	0.588	50(28,72)	42(25,61)	38(21,58)	54(33,74)
	All	111	42	0.638	48(27,69)	59(48,69)	23(12,38)	81(70,90)
3. HUD Current	Baltimore	58	36	1.000	XX	63(49,76)	XX	97(86,100)
	Milwaukee	15	87	1.000	100(40,100)	18(2,52)	31(9,61)	100(16,100)
	New York	38	61	0.096	44(22,69)	25(9,49)	35(16,57)	33(12,62)
	Milw & NY	53	68	0.134	55(32,76)	23(10,41)	33(19,51)	41(18,67)
	All	111	51	1.000	52(31,73)	49(38,60)	21(11,34)	80(66,89)

Table D3: Performance Characteristics for Risk Assessment Environmental Testing Protocols Studied with Study Selected Dust Testing Sites (Table 5.8)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
1. HUD Guidelines (Average dust)	Baltimore	97	56	0.443	XX	44(34,54)	XX	98(88,100)
	Milwaukee	64	97	0.493	100(89,100)	6(1,20)	50(37,63)	100(16,100)
	NYC	69	72	0.293	67(49,81)	21(9,39)	48(34,63)	37(16,62)
	Milw/NYC	133	84	0.635	82(71,90)	14(6,24)	49(40,59)	43(22,66)
	All	230	72	0.075	81(70,89)	31(24,39)	33(26,41)	80(68,89)
2. HUD Guidelines (Maximum dust)	Baltimore	97	59	0.412	XX	41(31,51)	XX	98(87,100)
	Milwaukee	64	97	0.493	100(89,100)	6(1,20)	50(37,63)	100(16,100)
	NYC	69	74	0.422	69(52,84)	21(9,39)	49(35,63)	39(17,64)
	Milw/NYC	133	85	0.809	84(73,92)	14(6,24)	50(40,59)	45(23,68)
	All	230	74	0.070	82(71,91)	30(23,37)	33(26,41)	80(68,89)
3. HUD Interim (Maximum dust)	Baltimore	97	51	0.495	XX	49(39,59)	XX	98(89,100)
	Milwaukee	64	94	0.114	100(89,100)	12(3,28)	52(38,65)	100(40,100)
	NYC	69	72	0.293	67(49,81)	21(9,39)	48(34,63)	37(16,62)
	Milw/NYC	133	83	1.000	82(71,90)	17(9,28)	50(40,60)	48(27,69)
	All	230	69	0.013	81(70,89)	36(28,44)	35(27,43)	82(71,90)

Table D4: Performance Characteristics for Current and Modified Protocols (Report Table 7.7)

Protocol	Site	Units	# fail	% P-Value	Sensitivity	Specificty	PPV	NPV
1. Current	Baltimore	97	82	1.000	100(3,100)	18(11,27)	1(0,7)	100(80,100)
	Milwaukee	64	100	.	100(89,100)	XX	48(36,61)	XX
	NYC	69	99	0.478	100(90,100)	3(0,16)	53(40,65)	100(3,100)
	Milw/NYC	133	99	0.496	100(95,100)	2(0,8)	51(42,60)	100(3,100)
	All	230	92	0.002	100(95,100)	11(7,17)	32(26,39)	100(81,100)
2. Current Except Det=Poor	Baltimore	97	49	1.000	XX	50(40,60)	XX	98(89,100)
	Milwaukee	64	94	0.114	100(89,100)	12(3,28)	52(38,65)	100(40,100)
	NYC	69	72	0.600	69(52,84)	24(11,42)	50(36,64)	42(20,67)
	Milw/NYC	133	83	0.822	84(73,92)	18(10,30)	51(41,61)	52(31,73)
	All	230	69	0.005	82(71,91)	37(30,45)	35(28,43)	83(73,91)
3. Current Except No Paint	Baltimore	97	3	1.000	XX	97(91,99)	XX	99(94,100)
	Milwaukee	64	80	0.062	90(74,98)	30(16,49)	55(40,69)	77(46,95)
	NYC	69	26	0.422	31(16,48)	79(61,91)	61(36,83)	51(37,65)
	Milw/NYC	133	52	0.166	58(46,70)	55(42,67)	57(44,68)	56(43,69)
	All	230	31	0.000	57(45,69)	80(73,86)	54(42,66)	82(75,87)
4. Current Except No Paint or Sill	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
	Milwaukee	64	70	0.104	81(63,93)	39(23,58)	56(40,70)	68(43,87)
	NYC	69	14	0.087	22(10,39)	94(80,99)	80(44,97)	53(39,66)
	Milw/NYC	133	41	0.079	49(37,62)	67(54,78)	60(46,73)	56(45,68)
	All	230	25	0.000	49(36,61)	85(79,90)	58(44,71)	80(73,85)
5. Current Except No Paint or Sill & per=2000PPM	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
	Milwaukee	64	58	0.013	74(55,88)	58(39,75)	62(45,78)	70(50,86)
	NYC	69	10	0.431	14(5,29)	94(80,99)	71(29,96)	50(37,63)
	Milw/NYC	133	33	0.042	42(30,54)	76(64,85)	64(48,78)	56(45,67)
	All	230	20	0.000	41(29,54)	89(83,93)	61(45,75)	78(72,84)

Table D5: Optimal Risk Assessment Protocols for Milwaukee (Report Table 7.3)

rank	Protocol Number	Floor Mean	Sill Mean	Well Mean	Perimeter Soil	# Interior F/P LBP	# Exterior F/P LBP	Play Soil	Water
1	15941	10	-	-	2000	-	-	400	-
2	15937	10	-	-	2000	-	-	-	-
3	15365	10	-	-	-	-	-	400	-
4	15361	10	-	-	-	-	-	-	-
5	31493	15	-	-	5000	-	-	400	-
6	30725	15	-	-	-	-	-	400	-
7	583	-	-	-	2000	-	-	400	10
8	581	-	-	-	2000	-	-	400	-
9	579	-	-	-	2000	-	-	-	10
10	577	-	-	-	2000	-	-	-	-
11	46851	25	-	-	5000	-	-	-	10
12	46849	25	-	-	5000	-	-	-	-
13	46083	25	-	-	-	-	-	-	10
14	46081	25	-	-	-	-	-	-	-
15	62209	40	-	-	5000	-	-	-	-

Table D6: Performance Characteristics for Optimal Risk Assessment Protocols for Milwaukee (Report Table 7.4)

Rank	Protocol Number	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
1	15941	64	81	0.000	100	36	60	100
2	15937	64	78	0.001	97	39	60	93
3	15365	64	73	0.000	94	45	62	88
4	15361	64	70	0.001	90	48	62	84
5	31493	64	64	0.002	84	55	63	78
6	30725	64	59	0.006	77	58	63	73
7	583	64	56	0.006	74	61	64	71
8	581	64	53	0.007	71	64	65	70
9	579	64	50	0.012	68	67	66	69
10	577	64	47	0.012	65	70	67	68
11	46851	64	44	0.011	61	73	68	67
12	46849	64	41	0.010	58	76	69	66
13	46083	64	34	0.035	48	79	68	62
14	46081	64	31	0.030	45	82	70	61
15	62209	64	27	0.048	39	85	71	60

Table D7: Performance Characteristics for Milwaukee's Optimal Risk Assessment Protocols for All Sites (Report Tables 7.4 & 7.5)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
01 #15941	Baltimore	97	6	1.000	XX	94(87,98)	XX	99(94,100)
	Milwaukee	64	81	0.000	100(89,100)	36(20,55)	60(45,73)	100(74,100)
	NYC	69	19	1.000	19(8,36)	82(65,93)	54(25,81)	48(35,62)
	Milw/NYC	133	49	0.084	57(44,69)	59(46,71)	58(46,71)	57(45,69)
	All	230	31	0.000	56(43,68)	80(73,86)	54(41,65)	81(74,87)
02 #15937	Baltimore	97	5	1.000	XX	95(88,98)	XX	99(94,100)
	Milwaukee	64	78	0.001	97(83,100)	39(23,58)	60(45,74)	93(66,100)
	NYC	69	14	1.000	14(5,29)	85(68,95)	50(19,81)	47(34,61)
	Milw/NYC	133	45	0.118	52(40,65)	62(49,74)	58(45,71)	56(44,68)
	All	230	28	0.000	51(39,64)	81(75,87)	54(41,66)	80(73,86)
03 #15365	Baltimore	97	5	1.000	XX	95(88,98)	XX	99(94,100)
	Milwaukee	64	73	0.000	94(79,99)	45(28,64)	62(46,75)	88(64,99)
	NYC	69	16	1.000	17(6,33)	85(68,95)	55(23,83)	48(35,62)
	Milw/NYC	133	44	0.055	52(40,65)	65(52,76)	60(47,73)	57(45,69)
	All	230	27	0.000	51(39,64)	83(76,88)	56(42,68)	80(73,86)
04 #15361	Baltimore	97	4	1.000	XX	96(90,99)	XX	99(94,100)
	Milwaukee	64	70	0.001	90(74,98)	48(31,66)	62(47,76)	84(60,97)
	NYC	69	12	1.000	11(3,26)	88(72,97)	50(16,84)	48(35,61)
	Milw/NYC	133	40	0.077	48(35,60)	68(56,79)	60(46,74)	56(45,67)
	All	230	25	0.000	47(35,60)	85(78,90)	56(42,69)	79(72,85)
05 #31489	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
	Milwaukee	64	59	0.006	77(59,90)	58(39,75)	63(46,78)	73(52,88)
	NYC	69	9	1.000	8(2,22)	91(76,98)	50(12,88)	48(35,61)
	Milw/NYC	133	33	0.097	40(28,53)	74(62,84)	61(45,76)	55(44,66)
	All	230	20	0.000	40(28,52)	88(82,93)	59(43,73)	78(71,84)

Table D7: Performance Characteristics for Milwaukee's Optimal Risk Assessment Protocols for All Sites (Report Table 7.4 & 7.5) (Continued)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
06a #30725	Baltimore	97	3	1.000	XX	97(91,99)	XX	99(94,100)
	Milwaukee	64	59	0.006	77(59,90)	58(39,75)	63(46,78)	73(52,88)
	NYC	69	13	1.000	14(5,29)	88(72,97)	56(21,86)	48(35,62)
	Milw/NYC	133	35	0.070	43(31,56)	73(60,83)	62(46,75)	56(45,67)
	All	230	22	0.000	43(31,55)	87(81,92)	58(43,72)	78(72,84)
06b #31493	Baltimore	97	3	1.000	XX	97(91,99)	XX	99(94,100)
	Milwaukee	64	64	0.002	84(66,95)	55(36,72)	63(47,78)	78(56,93)
	NYC	69	13	1.000	14(5,29)	88(72,97)	56(21,86)	48(35,62)
	Milw/NYC	133	38	0.049	46(34,59)	71(59,82)	62(47,75)	57(45,67)
	All	230	23	0.000	46(33,58)	86(80,91)	58(44,72)	79(72,85)
06c #77383	Baltimore	97	6	0.062	100(3,100)	95(88,98)	17(0,64)	100(96,100)
	Milwaukee	64	59	0.006	77(59,90)	58(39,75)	63(46,78)	73(52,88)
	NYC	69	16	1.000	17(6,33)	85(68,95)	55(23,83)	48(35,62)
	Milw/NYC	133	37	0.072	45(33,57)	71(59,82)	61(46,75)	56(45,67)
	All	230	24	0.000	46(33,58)	85(79,90)	56(42,70)	79(72,85)
07a #00583	Baltimore	97	6	0.062	100(3,100)	95(88,98)	17(0,64)	100(96,100)
	Milwaukee	64	56	0.006	74(55,88)	61(42,77)	64(46,79)	71(51,87)
	NYC	69	16	1.000	17(6,33)	85(68,95)	55(23,83)	48(35,62)
	Milw/NYC	133	35	0.070	43(31,56)	73(60,83)	62(46,75)	56(45,67)
	All	230	23	0.000	44(32,57)	86(79,91)	57(42,70)	79(72,84)
07b #77381	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
	Milwaukee	64	56	0.006	74(55,88)	61(42,77)	64(46,79)	71(51,87)
	NYC	69	7	1.000	8(2,22)	94(80,99)	60(15,95)	48(36,61)
	Milw/NYC	133	31	0.060	39(27,51)	77(65,87)	63(47,78)	55(45,66)
	All	230	19	0.000	38(27,51)	90(84,94)	60(44,75)	78(71,83)

Table D7: Performance Characteristics for Milwaukee's Optimal Risk Assessment Protocols for All Sites (Report Table 7.4 & 7.5) (Continued)

Protocol	Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
08a #00581	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
	Milwaukee	64	53	0.007	71(52,86)	64(45,80)	65(46,80)	70(51,85)
	NYC	69	7	1.000	8(2,22)	94(80,99)	60(15,95)	48(36,61)
	Milw/NYC	133	29	0.056	37(26,50)	79(67,88)	64(47,79)	55(45,66)
	All	230	18	0.000	37(25,49)	90(84,94)	61(45,76)	77(71,83)
08b #77379	Baltimore	97	5	0.052	100(3,100)	96(90,99)	20(1,72)	100(96,100)
	Milwaukee	64	53	0.007	71(52,86)	64(45,80)	65(46,80)	70(51,85)
	NYC	69	13	1.000	14(5,29)	88(72,97)	56(21,86)	48(35,62)
	Milw/NYC	133	32	0.064	40(28,53)	76(64,85)	63(47,77)	56(45,66)
	All	230	21	0.000	41(29,54)	88(82,92)	58(43,72)	78(71,84)
09a #00579	Baltimore	97	5	0.052	100(3,100)	96(90,99)	20(1,72)	100(96,100)
	Milwaukee	64	50	0.012	68(49,83)	67(48,82)	66(47,81)	69(50,84)
	NYC	69	13	1.000	14(5,29)	88(72,97)	56(21,86)	48(35,62)
	Milw/NYC	133	31	0.060	39(27,51)	77(65,87)	63(47,78)	55(45,66)
	All	230	20	0.000	40(28,52)	88(82,93)	59(43,73)	78(71,84)
09b #77377	Baltimore	97	1	1.000	XX	99(94,100)	XX	99(94,100)
	Milwaukee	64	50	0.012	68(49,83)	67(48,82)	66(47,81)	69(50,84)
	NYC	69	3	1.000	3(0,15)	97(84,100)	50(1,99)	48(35,60)
	Milw/NYC	133	26	0.073	33(22,45)	82(70,90)	65(46,80)	55(44,65)
	All	230	15	0.000	32(22,45)	92(87,96)	63(45,79)	76(70,82)
10 #00577	Baltimore	97	1	1.000	XX	99(94,100)	XX	99(94,100)
	Milwaukee	64	47	0.012	65(45,81)	70(51,84)	67(47,83)	68(49,83)
	NYC	69	3	1.000	3(0,15)	97(84,100)	50(1,99)	48(35,60)
	Milw/NYC	133	24	0.067	31(21,44)	83(72,91)	66(47,81)	54(44,64)
	All	230	14	0.000	31(20,43)	93(87,96)	64(45,80)	76(70,82)

Table D7: Performance Characteristics for Milwaukee's Optimal Risk Assessment Protocols for All Sites (Report Table 7.4 & 7.5) (Continued)

Protocol		Site	# Units	% fail	P-Value	Sensitivity	Specificty	PPV	NPV
11	#46851	Baltimore	97	4	0.041	100(3,100)	97(91,99)	25(1,81)	100(96,100)
		Milwaukee	64	44	0.011	61(42,78)	73(54,87)	68(48,84)	67(49,81)
		NYC	69	13	0.481	17(6,33)	91(76,98)	67(30,93)	50(37,63)
		Milw/NYC	133	28	0.020	37(26,50)	82(70,90)	68(50,82)	56(46,66)
		All	230	18	0.000	38(27,51)	91(85,95)	63(47,78)	78(71,83)
12	#46849	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	41	0.010	58(39,75)	76(58,89)	69(48,86)	66(49,80)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw/NYC	133	21	0.018	30(19,42)	88(78,95)	71(51,87)	55(45,65)
		All	230	12	0.000	29(19,42)	95(91,98)	71(51,87)	76(70,82)
13	#46083	Baltimore	97	4	0.041	100(3,100)	97(91,99)	25(1,81)	100(96,100)
		Milwaukee	64	34	0.035	48(30,67)	79(61,91)	68(45,86)	62(46,76)
		NYC	69	13	0.481	17(6,33)	91(76,98)	67(30,93)	50(37,63)
		Milw/NYC	133	23	0.039	31(21,44)	85(74,92)	68(49,83)	55(45,65)
		All	230	15	0.000	32(22,45)	92(87,96)	63(45,79)	76(70,82)
14	#46081	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	31	0.030	45(27,64)	82(65,93)	70(46,88)	61(45,76)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw/NYC	133	17	0.034	24(14,36)	91(81,97)	73(50,89)	54(44,64)
		All	230	10	0.000	24(14,35)	96(92,99)	73(50,89)	75(69,81)
15	#62209	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	27	0.048	39(22,58)	85(68,95)	71(44,90)	60(44,74)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw/NYC	133	14	0.045	21(12,33)	92(83,97)	74(49,91)	54(44,63)
		All	230	8	0.000	21(12,32)	97(93,99)	74(49,91)	74(68,80)

Table D8: Performance Characteristics for Individual Dust Sample Types Based on The Maximum (Report Table 6.1.1)

Sample Type	Standard	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
All Floors	25	Baltimore	97	5	0.052	100(3,100)	96(90,99)	20(1,72)	100(96,100)
		Milwaukee	64	55	0.014	71(52,86)	61(42,77)	63(45,79)	69(49,85)
		NYC	69	9	0.675	11(3,26)	94(80,99)	67(22,96)	49(36,62)
		Milw & NYC	133	31	0.060	39(27,51)	77(65,87)	63(47,78)	55(45,66)
		All	230	20	0.000	40(28,52)	88(82,93)	59(43,73)	78(71,84)
All Floors	40	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	39	0.072	52(33,70)	73(54,87)	64(43,82)	62(45,77)
		NYC	69	6	0.615	8(2,22)	97(84,100)	75(19,99)	49(37,62)
		Milw & NYC	133	22	0.092	28(18,41)	85(74,92)	66(46,82)	54(44,64)
		All	230	13	0.000	28(18,40)	93(87,96)	61(42,78)	75(69,81)
All Floors	100	Milwaukee	64	14	1.000	13(4,30)	85(68,95)	44(14,79)	51(37,65)
		NYC	69	1	1.000	3(0,15)	100(89,100)	100(3,100)	49(36,61)
		Milw & NYC	133	8	1.000	7(2,17)	92(83,97)	50(19,81)	50(40,59)
		All	230	4	0.166	7(2,16)	97(93,99)	50(19,81)	71(65,77)
Bare Floors	25	Baltimore	96	4	0.042	100(3,100)	97(91,99)	25(1,81)	100(96,100)
		Milwaukee	64	39	0.200	48(30,67)	70(51,84)	60(39,79)	59(42,74)
		NYC	69	7	1.000	8(2,22)	94(80,99)	60(15,95)	48(36,61)
		Milw & NYC	133	23	0.300	27(17,39)	82(70,90)	60(41,77)	52(42,62)
		All	229	15	0.001	28(18,40)	91(85,95)	56(38,73)	75(68,81)
Bare Floors	40	Baltimore	96	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	27	0.159	35(19,55)	82(65,93)	65(38,86)	57(42,72)
		NYC	69	4	1.000	6(1,19)	97(84,100)	67(9,99)	48(36,61)
		Milw & NYC	133	15	0.225	19(11,31)	89(79,96)	65(41,85)	52(43,62)
		All	229	10	0.003	19(11,30)	94(90,97)	59(36,79)	73(67,79)
Bare Floors	100	Milwaukee	64	8	0.667	10(2,26)	94(80,99)	60(15,95)	53(39,66)
		NYC	69	1	1.000	3(0,15)	100(89,100)	100(3,100)	49(36,61)
		Milw & NYC	133	5	0.680	6(2,15)	97(89,100)	67(22,96)	50(41,59)
		All	229	3	0.065	6(2,14)	99(96,100)	67(22,96)	71(65,77)

Table D8: Performance Characteristics for Individual Dust Sample Types Based on The Maximum (Report Table 6.1.1) (Continued)

Sample Type	Standard	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
Carpeted Floors	25	Baltimore	90	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	54	26	0.035	40(21,61)	86(68,96)	71(42,92)	63(46,77)
		NYC	32	3	1.000	6(0,29)	100(78,100)	100(3,100)	48(30,67)
		Milw & NYC	86	17	0.048	26(14,42)	91(78,97)	73(45,92)	56(44,68)
		All	176	9	0.000	26(14,41)	96(91,99)	69(41,89)	80(73,86)
Carpeted Floors	40	Milwaukee	54	22	0.188	32(15,54)	86(68,96)	67(35,90)	60(43,74)
		NYC	32	3	1.000	6(0,29)	100(78,100)	100(3,100)	48(30,67)
		Milw & NYC	86	15	0.139	21(10,37)	91(78,97)	69(39,91)	55(43,66)
		All	176	7	0.000	21(10,36)	97(92,99)	69(39,91)	79(72,85)
Carpeted Floors	100	Milwaukee	54	11	0.675	8(1,26)	86(68,96)	33(4,78)	52(37,67)
		Milw & NYC	86	7	0.677	5(1,16)	91(78,97)	33(4,78)	50(39,61)
		All	176	3	0.635	5(1,16)	97(92,99)	33(4,78)	76(69,82)

Table D8: Performance Characteristics for Individual Dust Sample Types Based on The Maximum (Report Table 6.1.1) (Continued)

Sample Type	Standard	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
Window Sill	125	Baltimore	97	6	1.000	XX	94(87,98)	XX	99(94,100)
		Milwaukee	64	77	0.242	84(66,95)	30(16,49)	53(38,67)	67(38,88)
		NYC	69	19	0.761	17(6,33)	79(61,91)	46(19,75)	46(33,60)
		Milw & NYC	133	47	0.863	48(35,60)	55(42,67)	52(39,65)	51(39,63)
		All	230	30	0.000	47(35,60)	78(71,84)	47(35,60)	78(71,84)
Window Sill	250	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	59	0.803	61(42,78)	42(25,61)	50(33,67)	54(33,73)
		NYC	69	16	0.330	11(3,26)	79(61,91)	36(11,69)	45(32,58)
		Milw & NYC	133	37	0.592	34(23,47)	61(48,72)	47(33,62)	48(37,59)
		All	230	22	0.009	34(23,46)	83(76,88)	45(31,60)	75(68,81)
Window Sill	500	Milwaukee	64	47	0.465	42(25,61)	48(31,66)	43(25,63)	47(30,65)
		NYC	69	4	0.603	3(0,15)	94(80,99)	33(1,91)	47(35,60)
		Milw & NYC	133	25	0.321	21(12,33)	71(59,82)	42(25,61)	47(37,57)
		All	230	14	0.099	21(12,32)	88(82,93)	42(25,61)	73(66,79)
Window Trough	400	Baltimore	97	41	1.000	XX	58(48,68)	XX	98(91,100)
		Milwaukee	64	86	0.729	84(66,95)	12(3,28)	47(34,61)	44(14,79)
		NYC	69	39	0.629	36(21,54)	58(39,75)	48(29,68)	45(30,61)
		Milw & NYC	133	62	0.477	58(46,70)	35(24,48)	48(36,59)	45(31,60)
		All	230	53	0.469	57(45,69)	49(41,57)	32(24,41)	73(64,81)
Window Trough	800	Baltimore	97	32	1.000	XX	68(57,77)	XX	98(92,100)
		Milwaukee	64	81	1.000	81(63,93)	18(7,35)	48(34,62)	50(21,79)
		NYC	69	22	0.384	17(6,33)	73(54,87)	40(16,68)	44(31,59)
		Milw & NYC	133	50	0.388	46(34,59)	45(33,58)	46(34,59)	45(33,58)
		All	230	43	0.562	46(33,58)	59(51,66)	32(23,42)	72(63,79)

Table D9: Performance Characteristics for Individual Dust Sample Types Based on The Average (Report Table 6.1.2)

Sample Type	Standard	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
All Floors	25	Milwaukee	64	31	0.030	45(27,64)	82(65,93)	70(46,88)	61(45,76)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	17	0.034	24(14,36)	91(81,97)	73(50,89)	54(44,64)
		All	230	10	0.000	24(14,35)	96(92,99)	73(50,89)	75(69,81)
All Floors	40	Milwaukee	64	16	0.178	23(10,41)	91(76,98)	70(35,93)	56(41,69)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	9	0.128	13(6,24)	95(87,99)	75(43,95)	52(43,61)
		All	230	5	0.001	13(6,24)	98(95,100)	75(43,95)	73(67,79)
All Floors	100	Milwaukee	64	5	0.607	6(1,21)	97(84,100)	67(9,99)	52(39,65)
		Milw & NYC	133	2	1.000	3(0,10)	98(92,100)	67(9,99)	50(41,59)
		All	230	1	0.209	3(0,10)	99(97,100)	67(9,99)	71(65,77)
Bare Floors	25	Baltimore	96	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	30	0.173	39(22,58)	79(61,91)	63(38,84)	58(42,72)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	16	0.153	21(12,33)	89(79,96)	67(43,85)	53(43,62)
		All	229	10	0.001	21(12,32)	94(90,97)	61(39,80)	74(67,80)
Bare Floors	40	Baltimore	96	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	64	19	0.208	26(12,45)	88(72,97)	67(35,90)	56(41,70)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	11	0.156	15(7,26)	94(85,98)	71(42,92)	52(43,61)
		All	229	7	0.002	15(7,25)	97(93,99)	67(38,88)	73(66,79)
Bare Floors	100	Milwaukee	64	5	0.607	6(1,21)	97(84,100)	67(9,99)	52(39,65)
		Milw & NYC	133	2	1.000	3(0,10)	98(92,100)	67(9,99)	50(41,59)
		All	229	1	0.211	3(0,10)	99(97,100)	67(9,99)	71(64,77)
Carpeted Floors	25	Milwaukee	54	22	0.188	32(15,54)	86(68,96)	67(35,90)	60(43,74)
		Milw & NYC	86	14	0.223	19(9,34)	91(78,97)	67(35,90)	54(42,66)
		All	176	7	0.002	19(8,33)	97(92,99)	67(35,90)	79(72,85)
Carpeted Floors	40	Milwaukee	54	17	0.718	20(7,41)	86(68,96)	56(21,86)	56(40,70)
		Milw & NYC	86	10	0.736	12(4,26)	91(78,97)	56(21,86)	52(40,63)
		All	176	5	0.040	12(4,25)	97(92,99)	56(21,86)	77(70,83)
Carpeted Floors	100	Milwaukee	54	4	0.493	XX	93(77,99)	XX	52(38,66)
		Milw & NYC	86	2	0.494	XX	95(85,99)	XX	50(39,61)
		All	176	1	1.000	XX	98(95,100)	XX	75(68,82)

Table D9: Performance Characteristics for Individual Dust Sample Types Based on The Average (Report Table 6.1.2) (Continued)

Sample Type	Standard	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
Window Sill	125	Baltimore	97	3	1.000	XX	97(91,99)	XX	99(94,100)
		Milwaukee	64	72	0.784	74(55,88)	30(16,49)	50(35,65)	56(31,78)
		NYC	69	17	0.531	14(5,29)	79(61,91)	42(15,72)	46(32,59)
		Milw & NYC	133	44	0.728	42(30,54)	55(42,67)	48(35,62)	48(36,60)
		All	230	27	0.002	41(29,54)	80(73,86)	46(33,59)	76(69,83)
Window Sill	250	Baltimore	97	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	64	50	1.000	48(30,67)	48(31,66)	47(29,65)	50(32,68)
		NYC	69	13	0.728	11(3,26)	85(68,95)	44(14,79)	47(34,60)
		Milw & NYC	133	31	0.577	28(18,41)	67(54,78)	46(31,63)	48(37,58)
		All	230	18	0.024	28(18,40)	86(79,91)	45(30,61)	74(67,80)
Window Sill	500	Milwaukee	64	31	0.791	29(14,48)	67(48,82)	45(23,68)	50(35,65)
		NYC	69	4	0.603	3(0,15)	94(80,99)	33(1,91)	47(35,60)
		Milw & NYC	133	17	0.500	15(7,26)	80(69,89)	43(23,66)	48(39,58)
		All	230	10	0.149	15(7,25)	92(87,96)	43(23,66)	72(65,78)
Window Trough	400	Baltimore	97	37	1.000	XX	63(52,72)	XX	98(91,100)
		Milwaukee	64	84	1.000	84(66,95)	15(5,32)	48(34,62)	50(19,81)
		NYC	69	33	0.621	31(16,48)	64(45,80)	48(27,69)	46(31,61)
		Milw & NYC	133	58	0.599	55(43,67)	39(28,52)	48(37,60)	46(33,60)
		All	230	49	0.315	54(42,67)	53(45,61)	33(24,42)	74(65,81)
Window Trough	800	Baltimore	97	24	1.000	XX	76(66,84)	XX	99(93,100)
		Milwaukee	64	80	1.000	81(63,93)	21(9,39)	49(35,63)	54(25,81)
		NYC	69	17	0.531	14(5,29)	79(61,91)	42(15,72)	46(32,59)
		Milw & NYC	133	47	0.604	45(33,57)	50(37,63)	48(35,61)	47(35,59)
		All	230	37	0.182	44(32,57)	65(58,73)	35(25,46)	74(66,81)

Table D10: Performance Characteristics for Floor, Sill & Trough Dust Sample Types Based on The Maximum (Report Table 6.1.3)

Standards	Floor Type	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
(F=100,S=500,T=800)	All Floors	Baltimore	97	32	1.000	XX	68(57,77)	XX	98(92,100)
		Milwaukee	64	88	0.468	84(66,95)	9(2,24)	46(33,60)	38(9,76)
		NYC	69	28	0.419	22(10,39)	67(48,82)	42(20,67)	44(30,59)
		Milw & NYC	133	56	0.222	51(38,63)	38(26,51)	45(34,57)	43(30,57)
		All	230	46	0.471	50(38,62)	56(48,63)	32(23,42)	73(64,80)
(F=100,S=500,T=800)	Bare Floors	Baltimore	96	32	1.000	XX	67(57,77)	XX	98(92,100)
		Milwaukee	64	88	0.468	84(66,95)	9(2,24)	46(33,60)	38(9,76)
		NYC	69	28	0.419	22(10,39)	67(48,82)	42(20,67)	44(30,59)
		Milw & NYC	133	56	0.222	51(38,63)	38(26,51)	45(34,57)	43(30,57)
		All	229	46	0.473	50(38,62)	55(47,63)	32(23,42)	72(64,80)
(F=100,S=500,T=800)	Carpeted Floors	Baltimore	90	31	1.000	XX	69(58,78)	XX	98(91,100)
		Milwaukee	54	85	1.000	84(64,95)	14(4,32)	46(31,61)	50(16,84)
		NYC	32	28	1.000	29(10,56)	73(45,92)	56(21,86)	48(27,69)
		Milw & NYC	86	64	0.823	62(46,76)	34(20,50)	47(34,61)	48(30,67)
		All	176	47	0.054	60(44,75)	57(48,66)	31(22,42)	82(72,89)
(F=40,S=250)	All Floors	Baltimore	97	4	1.000	XX	96(90,99)	XX	99(94,100)
		Milwaukee	64	72	0.169	81(63,93)	36(20,55)	54(39,69)	67(41,87)
		NYC	69	19	0.761	17(6,33)	79(61,91)	46(19,75)	46(33,60)
		Milw & NYC	133	44	0.728	46(34,59)	58(45,70)	53(39,66)	51(39,63)
		All	230	27	0.000	46(33,58)	80(73,86)	49(36,62)	78(71,84)
(F=40,S=250)	Bare Floors	Baltimore	96	4	1.000	XX	96(90,99)	XX	99(94,100)
		Milwaukee	64	69	0.425	74(55,88)	36(20,55)	52(37,68)	60(36,81)
		NYC	69	19	0.761	17(6,33)	79(61,91)	46(19,75)	46(33,60)
		Milw & NYC	133	43	1.000	43(31,56)	58(45,70)	51(37,64)	50(38,62)
		All	229	27	0.001	43(31,55)	80(73,86)	48(35,61)	77(70,83)
(F=40,S=250)	Carpeted Floors	Baltimore	90	2	1.000	XX	98(92,100)	XX	99(94,100)
		Milwaukee	54	65	0.155	76(55,91)	45(26,64)	54(37,71)	68(43,87)
		NYC	32	16	0.161	6(0,29)	73(45,92)	20(1,72)	41(22,61)
		Milw & NYC	86	47	1.000	48(32,64)	55(39,70)	50(34,66)	52(37,67)
		All	176	24	0.000	47(31,62)	83(76,89)	48(32,64)	83(75,89)

Table D10: Performance Characteristics for Floor, Sill & Trough Dust Sample Types Based on The Maximum (Report Table 6.1.3) (Continued)

Standards	Floor Type	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
(F=25,S=125)	All Floors	Baltimore	97	11	0.113	100(3,100)	90(82,95)	9(0,41)	100(96,100)
		Milwaukee	64	83	0.045	94(79,99)	27(13,46)	55(40,68)	82(48,98)
		NYC	69	25	1.000	25(12,42)	76(58,89)	53(28,77)	48(34,62)
		Milw & NYC	133	53	0.387	57(44,69)	52(39,64)	54(42,66)	54(41,67)
		All	230	35	0.000	57(45,69)	74(67,81)	48(37,60)	81(73,87)
(F=25,S=125)	Bare Floors	Baltimore	96	10	0.104	100(3,100)	91(83,96)	10(0,45)	100(96,100)
		Milwaukee	64	81	0.109	90(74,98)	27(13,46)	54(39,68)	75(43,95)
		NYC	69	25	1.000	25(12,42)	76(58,89)	53(28,77)	48(34,62)
		Milw & NYC	133	52	0.489	55(43,67)	52(39,64)	54(41,66)	53(40,66)
		All	229	34	0.000	56(43,68)	75(67,81)	48(37,60)	80(73,86)
(F=25,S=125)	Carpeted Floors	Baltimore	90	8	1.000	XX	92(84,97)	XX	99(93,100)
		Milwaukee	54	76	0.065	88(69,97)	34(18,54)	54(37,69)	77(46,95)
		NYC	32	22	0.678	18(4,43)	73(45,92)	43(10,82)	44(24,65)
		Milw & NYC	86	56	0.523	60(43,74)	48(32,63)	52(37,67)	55(38,71)
		All	176	31	0.000	58(42,73)	77(69,84)	45(32,59)	85(78,91)

Table D11: Performance Characteristics for Floor, Sill & Trough Dust Sample Types Based on The Average (Report Table 6.1.3)

Standards	Floor Type	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
(F=100,S=500,T=800)	All Floors	Baltimore	97	24	1.000	XX	76(66,84)	XX	99(93,100)
		Milwaukee	64	83	1.000	84(66,95)	18(7,35)	49(35,63)	55(23,83)
		NYC	69	22	0.384	17(6,33)	73(54,87)	40(16,68)	44(31,59)
		Milw & NYC	133	51	0.489	48(35,60)	45(33,58)	47(35,60)	46(34,59)
		All	230	40	0.142	47(35,60)	64(56,71)	35(25,46)	74(66,81)
(F=100,S=500,T=800)	Bare Floors	Baltimore	96	24	1.000	XX	76(66,84)	XX	99(93,100)
		Milwaukee	64	83	1.000	84(66,95)	18(7,35)	49(35,63)	55(23,83)
		NYC	69	22	0.384	17(6,33)	73(54,87)	40(16,68)	44(31,59)
		Milw & NYC	133	51	0.489	48(35,60)	45(33,58)	47(35,60)	46(34,59)
		All	229	40	0.183	47(35,60)	63(55,71)	35(25,46)	74(66,81)
(F=100,S=500,T=800)	Carpeted Floors	Baltimore	90	22	1.000	XX	78(67,86)	XX	99(92,100)
		Milwaukee	54	81	0.736	84(64,95)	21(8,40)	48(32,63)	60(26,88)
		NYC	32	25	1.000	24(7,50)	73(45,92)	50(16,84)	46(26,67)
		Milw & NYC	86	60	1.000	60(43,74)	39(24,55)	48(34,62)	50(32,68)
		All	176	41	0.012	58(42,73)	65(56,73)	35(24,47)	83(74,89)
(F=40,S=250)	All Floors	Baltimore	97	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	64	52	1.000	52(33,70)	48(31,66)	48(31,66)	52(33,70)
		NYC	69	16	1.000	17(6,33)	85(68,95)	55(23,83)	48(35,62)
		Milw & NYC	133	33	1.000	33(22,45)	67(54,78)	50(35,65)	49(39,60)
		All	230	20	0.003	32(22,45)	86(79,91)	49(34,64)	75(68,81)
(F=40,S=250)	Bare Floors	Baltimore	96	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	56	0.806	58(39,75)	45(28,64)	50(33,67)	54(34,72)
		NYC	69	16	1.000	17(6,33)	85(68,95)	55(23,83)	48(35,62)
		Milw & NYC	133	35	1.000	36(24,48)	65(52,76)	51(36,66)	50(39,61)
		All	229	21	0.001	35(24,48)	84(78,90)	49(34,64)	76(69,82)
(F=40,S=250)	Carpeted Floors	Baltimore	90	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	54	52	1.000	52(31,72)	48(29,67)	46(28,66)	54(33,73)
		NYC	32	13	0.319	6(0,29)	80(52,96)	25(1,81)	43(24,63)
		Milw & NYC	86	37	0.509	33(20,50)	59(43,74)	44(26,62)	48(34,62)
		All	176	19	0.012	33(19,49)	86(79,91)	42(25,61)	80(72,86)

Table D11: Performance Characteristics for Floor, Sill & Trough Dust Sample Types Based on The Average (Report Table 6.1.3) (Continued)

Standards	Floor Type	site	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
(F=25,S=125)	All Floors	Baltimore	97	3	1.000	XX	97(91,99)	XX	99(94,100)
		Milwaukee	64	81	0.109	90(74,98)	27(13,46)	54(39,68)	75(43,95)
		NYC	69	20	1.000	19(8,36)	79(61,91)	50(23,77)	47(34,61)
		Milw & NYC	133	50	0.604	52(40,65)	53(40,65)	53(40,65)	52(40,65)
		All	230	30	0.000	51(39,64)	79(72,85)	51(38,63)	80(72,85)
(F=25,S=125)	Bare Floors	Baltimore	96	5	1.000	XX	95(88,98)	XX	99(94,100)
		Milwaukee	64	78	0.369	84(66,95)	27(13,46)	52(37,66)	64(35,87)
		NYC	69	20	1.000	19(8,36)	79(61,91)	50(23,77)	47(34,61)
		Milw & NYC	133	48	0.863	49(37,62)	53(40,65)	52(39,64)	51(38,63)
		All	229	30	0.000	49(36,61)	78(70,84)	48(36,60)	78(71,84)
(F=25,S=125)	Carpeted Floors	Baltimore	90	3	1.000	XX	97(90,99)	XX	99(94,100)
		Milwaukee	54	74	0.212	84(64,95)	34(18,54)	53(36,68)	71(42,92)
		NYC	32	19	0.383	12(1,36)	73(45,92)	33(4,78)	42(23,63)
		Milw & NYC	86	53	0.832	55(39,70)	48(32,63)	50(35,65)	53(36,68)
		All	176	28	0.000	53(38,69)	80(73,87)	47(33,62)	84(77,90)

Table D12: Protocols of for Optimal Floor, Sill and Trough Protocols (Report Table 6.1.5)

Rank	Protocol Number	Floor Mean	Floor Mean(No Entry)	Sill Mean	Well Mean
1	11	-	5	-	-
2	692	10	-	250	-
3	662	10	-	-	-
4a	12	-	10	-	-
4b	728	15	-	-	-
5	794	20	-	-	-
6	860	25	-	-	-
7	14	-	20	-	-
8	15	-	25	-	-

Table D13: Performance Characteristics for Optimal Floor, Sill and Trough Protocols (Report Table 6.1.5)

Rank	Protocol Number	SITE	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
1	11	Baltimore	97	12	1.000	XX	88(79,93)	XX	99(94,100)
		Milwaukee	64	83	0.006	97(83,100)	30(16,49)	57(42,70)	91(59,100)
		NYC	69	29	0.797	31(16,48)	73(54,87)	55(32,77)	49(34,64)
		Milw & NYC	133	55	0.165	61(49,73)	52(39,64)	56(44,68)	57(43,69)
		All	230	37	0.000	60(48,72)	73(65,80)	48(37,59)	81(74,87)
2	692	Baltimore	97	5	1.000	XX	95(88,98)	XX	99(94,100)
		Milwaukee	64	80	0.012	94(79,99)	33(18,52)	57(42,71)	85(55,98)
		NYC	69	22	0.772	19(8,36)	76(58,89)	47(21,73)	46(33,60)
		Milw & NYC	133	50	0.388	54(41,66)	55(42,67)	55(42,67)	54(41,66)
		All	230	31	0.000	53(40,65)	78(71,84)	51(39,63)	80(73,86)
3	662	Baltimore	97	4	1.000	XX	96(90,99)	XX	99(94,100)
		Milwaukee	64	70	0.001	90(74,98)	48(31,66)	62(47,76)	84(60,97)
		NYC	69	12	1.000	11(3,26)	88(72,97)	50(16,84)	48(35,61)
		Milw & NYC	133	40	0.077	48(35,60)	68(56,79)	60(46,74)	56(45,67)
		All	230	25	0.000	47(35,60)	85(78,90)	56(42,69)	79(72,85)
4a	12	Baltimore	97	1	1.000	XX	99(94,100)	XX	99(94,100)
		Milwaukee	64	55	0.014	71(52,86)	61(42,77)	63(45,79)	69(49,85)
		NYC	69	12	0.712	14(5,29)	91(76,98)	63(24,91)	49(36,62)
		Milw & NYC	133	32	0.064	40(28,53)	76(64,85)	63(47,77)	56(45,66)
		All	230	19	0.000	40(28,52)	90(84,94)	61(45,76)	78(71,84)

Table D13: Performance Characteristics for Optimal Floor, Sill and Trough Protocols (Report Table 6.1.5) (Continued)

Rank	Protocol Number	SITE	# Units	% fail	P-Value (Fisher Exact)	Sensitivity	Specificity	PPV	NPV
4b	728	Baltimore	97	2	1.000	XX	98(93,100)	XX	99(94,100)
		Milwaukee	64	55	0.014	71(52,86)	61(42,77)	63(45,79)	69(49,85)
		NYC	69	9	1.000	8(2,22)	91(76,98)	50(12,88)	48(35,61)
		Milw & NYC	133	31	0.133	37(26,50)	76(64,85)	61(45,76)	54(44,65)
		All	230	19	0.000	37(25,49)	89(83,93)	58(42,73)	77(70,83)
5	794	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	44	0.043	58(39,75)	70(51,84)	64(44,81)	64(46,79)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	23	0.061	30(19,42)	85(74,92)	67(47,83)	54(44,64)
		All	230	13	0.000	29(19,42)	94(89,97)	67(47,83)	76(69,82)
6	860	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	31	0.030	45(27,64)	82(65,93)	70(46,88)	61(45,76)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	17	0.034	24(14,36)	91(81,97)	73(50,89)	54(44,64)
		All	230	10	0.000	24(14,35)	96(92,99)	73(50,89)	75(69,81)
7	14	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	20	0.030	32(17,51)	91(76,98)	77(46,95)	59(44,72)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	11	0.026	18(10,29)	95(87,99)	80(52,96)	53(44,63)
		All	230	7	0.000	18(9,29)	98(95,100)	80(52,96)	74(68,80)
8	15	Baltimore	97	0	.	XX	100(96,100)	XX	99(94,100)
		Milwaukee	64	16	0.005	29(14,48)	97(84,100)	90(55,100)	59(45,72)
		NYC	69	3	0.494	6(1,19)	100(89,100)	100(16,100)	49(37,62)
		Milw & NYC	133	9	0.004	16(8,27)	98(92,100)	92(62,100)	54(44,63)
		All	230	5	0.000	16(8,27)	99(97,100)	92(62,100)	74(67,80)

Table D14: Average Dust Lead from the set of {Unit entry, LR, K, BA and BR1} where LR, K, BA and BR1 samples are taken from the same location in a room (Report Table 6.5.4)

SITE_ID	Location	Protocol #	#Rooms	Entry	LR	K	BA	BR1	# Samples-Not EBL	GM (95% CI)-Not EBL	# Samples-EBL	GM (95% CI)-EBL	GM EBL/GM NotEBL	P-value	note
Milwaukee	Central	1	1					Y	38	6(5,8)	34	16(11,24)	2.7	<.0001	**
		5	2			Y		Y	38	8(7,10)	35	18(12,25)	2.3	0.0010	**
		9	2		Y			Y	38	7(5,9)	35	16(11,24)	2.3	0.0010	**
		13	3		Y	Y		Y	38	8(6,11)	35	18(12,25)	2.3	0.0010	**
		25	3	Y	Y			Y	38	12(8,16)	35	27(19,38)	2.3	0.0010	**
		29	4	Y	Y	Y		Y	38	12(9,16)	35	25(19,35)	2.1	0.0010	**
		8	1		Y				38	6(5,9)	34	14(10,21)	2.3	0.0020	**
		12	2		Y	Y			38	8(6,11)	35	16(12,22)	2.0	0.0020	**
		17	2	Y				Y	38	13(10,19)	35	30(21,42)	2.3	0.0020	**
		21	3	Y		Y		Y	38	13(9,18)	35	27(20,37)	2.1	0.0020	**
		24	2	Y	Y				38	13(9,19)	35	29(21,40)	2.2	0.0020	**
		28	3	Y	Y	Y			38	13(9,18)	35	26(20,35)	2.0	0.0020	**
		4	1			Y			38	9(7,12)	35	16(13,21)	1.8	0.0030	**
		16	1	Y					38	18(12,27)	35	38(28,52)	2.1	0.0040	**
		20	2	Y		Y			38	15(11,21)	35	29(23,38)	1.9	0.0040	**
		27	4	Y	Y		Y	Y	38	12(8,17)	35	24(17,33)	2.0	0.0040	**
		31	5	Y	Y	Y	Y	Y	38	12(9,16)	35	23(17,31)	1.9	0.0040	**
		7	3			Y	Y	Y	38	9(7,12)	35	16(12,23)	1.8	0.0050	**
		3	2				Y	Y	38	8(6,10)	35	15(11,21)	1.9	0.0060	**
		15	4		Y	Y	Y	Y	38	9(6,12)	35	17(12,23)	1.9	0.0060	**
		19	3	Y			Y	Y	38	13(9,18)	35	25(18,35)	1.9	0.0060	**
		23	4	Y		Y	Y	Y	38	13(9,18)	35	24(18,33)	1.8	0.0060	**
		11	3		Y		Y	Y	38	8(6,11)	35	16(11,22)	2.0	0.0070	**
		26	3	Y	Y		Y		38	13(9,18)	35	24(18,32)	1.8	0.0080	**
		30	4	Y	Y	Y	Y		38	13(9,18)	35	23(18,30)	1.8	0.0080	**
		22	3	Y		Y	Y		38	14(10,20)	35	25(19,32)	1.8	0.0110	**
		18	2	Y			Y		38	15(10,22)	35	27(21,35)	1.8	0.0120	**
		14	3		Y	Y	Y		38	9(6,12)	35	15(12,20)	1.7	0.0150	**
		6	2			Y	Y		38	9(7,12)	35	15(12,19)	1.7	0.0170	**
		10	2		Y		Y		38	8(5,11)	35	14(10,18)	1.8	0.0210	**
		2	1				Y		37	8(5,11)	35	12(10,15)	1.5	0.0490	**

Table D14: Average Dust Lead from the set of {Unit entry, LR, K, BA and BR1} where LR, K, BA and BR1 samples are taken from the same location in a room (Report Table 6.5.4) (continued)

SITE_ID	Location	Protocol #	#Rooms	Entry	LR	K	BA	BR1	# Samples-Not EBL	GM (95% CI)-Not EBL	# Samples-EBL	GM (95% CI)-EBL	GM EBL/GM NotEBL	P-value	note
Milwaukee	Perimeter	70	1		Y				37	6(5,8)	33	14(10,19)	2.3	0.0010	**
		72	2		Y		Y		37	7(5,10)	34	16(11,24)	2.3	0.0020	**
		84	3	Y		Y	Y		38	13(9,18)	35	27(20,37)	2.1	0.0020	**
		88	3	Y	Y		Y		38	12(9,17)	35	26(19,37)	2.2	0.0020	**
		92	4	Y	Y	Y	Y		38	12(8,16)	35	24(18,33)	2.0	0.0020	**
		76	3		Y	Y	Y		37	8(6,11)	35	16(11,23)	2.0	0.0030	**
		80	2	Y			Y		38	14(10,20)	35	31(22,43)	2.2	0.0030	**
		86	2	Y	Y				38	13(9,19)	35	27(20,37)	2.1	0.0030	**
		90	3	Y	Y	Y			38	12(9,17)	35	24(18,32)	2.0	0.0030	**
		78	1	Y					38	18(12,27)	35	38(28,52)	2.1	0.0040	**
		82	2	Y		Y			38	15(10,21)	35	28(22,37)	1.9	0.0040	**
		68	2			Y	Y		37	9(6,11)	35	17(12,24)	1.9	0.0060	**
		74	2		Y	Y			37	8(6,10)	35	14(10,19)	1.8	0.0060	**
		73	3		Y		Y	Y	38	9(6,12)	34	18(12,27)	2.0	0.0070	**
		93	5	Y	Y	Y	Y	Y	38	12(9,17)	35	24(17,33)	2.0	0.0090	**
		71	2		Y			Y	38	8(6,11)	34	16(11,24)	2.0	0.0100	**
		66	1			Y			37	8(6,11)	34	14(11,19)	1.8	0.0110	**
		89	4	Y	Y		Y	Y	38	13(9,18)	35	25(17,36)	1.9	0.0110	**
		65	2				Y	Y	38	9(6,13)	33	19(13,29)	2.1	0.0120	**
		85	4	Y		Y	Y	Y	38	14(10,19)	35	25(18,35)	1.8	0.0130	**
		91	4	Y	Y	Y		Y	38	13(9,18)	35	24(17,32)	1.8	0.0130	**
		77	4		Y	Y	Y	Y	38	9(7,12)	35	17(11,25)	1.9	0.0140	**
		87	3	Y	Y			Y	38	14(10,20)	35	26(18,36)	1.9	0.0150	**
		81	3	Y			Y	Y	38	15(10,21)	35	27(19,39)	1.8	0.0180	**
		64	1				Y		32	10(8,14)	30	20(13,31)	2.0	0.0200	**
		83	3	Y		Y		Y	38	15(11,21)	35	26(19,36)	1.7	0.0210	**
		75	3		Y	Y		Y	38	9(7,12)	35	15(11,22)	1.7	0.0240	**
		79	2	Y				Y	38	17(12,24)	35	30(21,42)	1.8	0.0260	**
		69	3			Y	Y	Y	38	10(7,13)	35	17(12,25)	1.7	0.0270	**
		63	1					Y	38	9(6,13)	33	16(11,25)	1.8	0.0440	**
		67	2			Y		Y	38	10(7,13)	35	15(11,23)	1.5	0.0660	*

Table D14: Average Dust Lead from the set of {Unit entry, LR, K, BA and BR1} where LR, K, BA and BR1 samples are taken from the same location in a room (Report Table 6.5.4) (continued)

SITE_ID	Location	Protocol #	#Rooms	Entry	LR	K	BA	BR1	# Samples-Not EBL	GM (95% CI)-Not EBL	# Samples-EBL	GM (95% CI)-EBL	GM EBL/GM NotEBL	P-value	note
Milwaukee	Room Entry	128	1			Y			38	9(7,12)	35	20(15,26)	2.2	<.0001	**
		129	2			Y		Y	38	10(8,13)	35	20(15,27)	2.0	<.0001	**
		132	1		Y				38	9(7,11)	34	20(15,26)	2.2	<.0001	**
		133	2		Y			Y	38	10(8,12)	35	20(16,26)	2.0	<.0001	**
		136	2		Y	Y			38	9(7,12)	35	21(17,27)	2.3	<.0001	**
		137	3		Y	Y		Y	38	10(8,13)	35	22(17,28)	2.2	<.0001	**
		144	2	Y		Y			38	15(11,21)	35	33(26,43)	2.2	<.0001	**
		152	3	Y	Y	Y			38	14(10,18)	35	30(24,38)	2.1	<.0001	**
		153	4	Y	Y	Y		Y	38	14(10,18)	35	28(23,36)	2.0	<.0001	**
		125	1					Y	38	9(7,12)	34	19(14,26)	2.1	0.0010	**
		138	3		Y	Y	Y		38	11(8,14)	35	22(17,29)	2.0	0.0010	**
		139	4		Y	Y	Y	Y	38	11(9,14)	35	22(17,29)	2.0	0.0010	**
		145	3	Y		Y		Y	38	14(11,20)	35	30(23,38)	2.1	0.0010	**
		148	2	Y	Y				38	15(11,21)	35	31(24,40)	2.1	0.0010	**
		149	3	Y	Y			Y	38	14(10,19)	35	28(22,36)	2.0	0.0010	**
		154	4	Y	Y	Y	Y		38	14(11,19)	35	29(22,37)	2.1	0.0010	**
		155	5	Y	Y	Y	Y	Y	38	14(11,19)	35	28(22,36)	2.0	0.0010	**
		146	3	Y		Y	Y		38	15(11,21)	35	30(23,40)	2.0	0.0020	**
		135	3		Y		Y	Y	38	11(9,15)	35	21(16,28)	1.9	0.0030	**
		147	4	Y		Y	Y	Y	38	15(11,20)	35	28(22,37)	1.9	0.0030	**
		151	4	Y	Y		Y	Y	38	15(11,20)	35	28(21,36)	1.9	0.0030	**
		140	1	Y					38	18(12,27)	35	38(28,52)	2.1	0.0040	**
		150	3	Y	Y		Y		38	15(11,21)	35	29(22,38)	1.9	0.0040	**
		131	3			Y	Y	Y	38	12(9,15)	35	21(15,28)	1.8	0.0050	**
		134	2		Y		Y		38	11(8,14)	35	20(15,27)	1.8	0.0050	**
		141	2	Y				Y	38	16(11,22)	35	31(23,41)	1.9	0.0050	**
		130	2			Y	Y		38	11(8,15)	35	20(15,27)	1.8	0.0070	**
		143	3	Y			Y	Y	38	16(12,22)	35	29(21,38)	1.8	0.0120	**
		142	2	Y			Y		38	17(12,24)	35	31(23,43)	1.8	0.0130	**
		127	2				Y	Y	38	12(9,16)	35	19(14,26)	1.6	0.0320	**
		126	1				Y		37	11(8,16)	35	17(12,24)	1.5	0.1050	

Table D14: Average Dust Lead from the set of {Unit entry, LR, K, BA and BR1} where LR, K, BA and BR1 samples are taken from the same location in a room (Report Table 6.5.4) (continued)

SITE_ID	Location	Protocol #	#Rooms	Entry	LR	K	BA	BR1	# Samples-Not EBL	GM (95% CI)-Not EBL	# Samples-EBL	GM (95% CI)-EBL	GM EBL/GM NotEBL	P-value	note
Milwaukee	Window	190	1			Y			37	12(8,16)	34	29(21,40)	2.4	<.0001	**
		191	2			Y		Y	38	12(9,16)	35	27(19,37)	2.3	0.0010	**
		206	2	Y		Y			38	16(11,24)	35	37(29,49)	2.3	0.0010	**
		208	3	Y		Y	Y		38	14(10,21)	35	32(24,45)	2.3	0.0020	**
		207	3	Y		Y		Y	38	16(11,23)	35	33(25,44)	2.1	0.0030	**
		214	3	Y	Y	Y			38	16(11,23)	35	34(25,45)	2.1	0.0030	**
		202	1	Y					38	18(12,27)	35	38(28,52)	2.1	0.0040	**
		216	4	Y	Y	Y	Y		38	14(10,21)	35	31(22,43)	2.2	0.0050	**
		199	3		Y	Y		Y	38	13(9,19)	35	27(19,37)	2.1	0.0060	**
		209	4	Y		Y	Y	Y	38	15(10,22)	35	31(22,43)	2.1	0.0060	**
		215	4	Y	Y	Y		Y	38	16(11,24)	35	32(24,43)	2.0	0.0070	**
		192	2			Y	Y		37	11(7,16)	35	23(16,34)	2.1	0.0080	**
		193	3			Y	Y	Y	38	12(8,17)	35	25(17,36)	2.1	0.0080	**
		198	2		Y	Y			37	13(9,19)	35	26(19,36)	2.0	0.0080	**
		187	1					Y	38	9(6,13)	33	19(13,28)	2.1	0.0090	**
		204	2	Y			Y		38	14(9,21)	35	29(20,42)	2.1	0.0090	**
		210	2	Y	Y				38	16(10,24)	35	32(23,44)	2.0	0.0100	**
		217	5	Y	Y	Y	Y	Y	38	15(10,23)	35	30(22,42)	2.0	0.0110	**
		194	1		Y				37	10(6,15)	33	21(14,30)	2.1	0.0120	**
		195	2		Y			Y	38	11(8,17)	34	23(16,33)	2.1	0.0150	**
		212	3	Y	Y		Y		38	14(9,21)	35	28(19,41)	2.0	0.0150	**
		201	4		Y	Y	Y	Y	38	13(9,19)	35	25(18,36)	1.9	0.0160	**
		200	3		Y	Y	Y		37	12(8,18)	35	24(17,35)	2.0	0.0170	**
		203	2	Y				Y	38	17(11,25)	35	30(22,42)	1.8	0.0230	**
		189	2				Y	Y	38	10(6,16)	33	20(13,31)	2.0	0.0280	**
		205	3	Y			Y	Y	38	15(10,22)	35	27(19,40)	1.8	0.0290	**
		196	2		Y		Y		37	10(6,15)	34	19(13,29)	1.9	0.0320	**
		197	3		Y		Y	Y	38	12(7,18)	34	22(15,33)	1.8	0.0320	**
		211	3	Y	Y			Y	38	16(11,24)	35	29(21,41)	1.8	0.0320	**
		213	4	Y	Y		Y	Y	38	15(10,23)	35	27(19,40)	1.8	0.0390	**
		188	1				Y		31	10(6,17)	29	17(11,28)	1.7	0.1350	

APPENDIX E: QUALITY CONTROL DATA

E.1. Water Lead

36 spike samples, with true lead concentrations between 4.9 and 49 PPB were analyzed. The average recovery rate was 106%. Ninety-four percent (34) of the samples had between 80% and 120% recovery. Plot E.1 presents the percent recovery over the course of the study.

E.2. Soil Lead

28 spike samples, with true lead concentrations between 640 and 6090 PPM were analyzed. The average recovery rate was 111%. Ninety-six percent (27) of the samples had between 80% and 120% recovery. Plot E.2 presents the percent recovery over the course of the study.

E.3. Single Dust Wipe

255 spike samples, with true lead quantities between 19.3 and 575.3µg were analyzed. The average recovery rate was 98%. 99.6% of the samples had between 80% and 120% recovery. Plot E.3 presents the percent recovery over the range of true lead quantities.

252 blank samples were analyzed. Eighty-eight percent (222) were reported as "< 2µg" and an additional 9% (23) were reported as "<5µg". The remaining 3% (7) were between 5µg and 16µg.

E.4. Composite of Four Dust Wipes

254 spike samples, with true lead quantities between 71.9 and 837.5µg were analyzed. The average recovery rate was 93%. 99.6% of the samples had between 80% and 120% recovery. Plot E.4 presents the percent recovery over the range of true lead quantities.

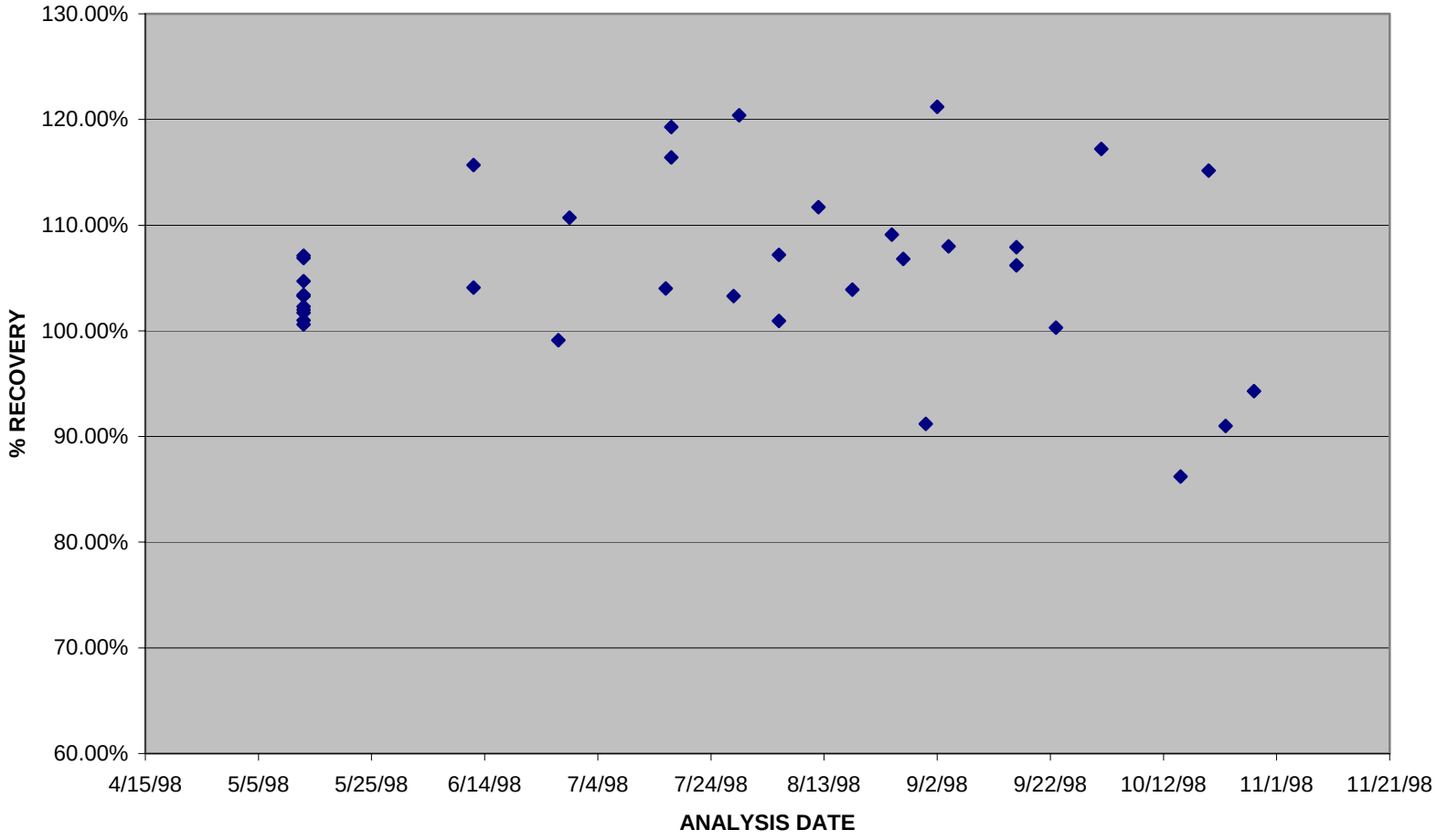
E.5. Blood Lead

Baltimore: 12 spike samples, with true blood lead concentrations between 4.3 and 15.3µg/dL were analyzed. All twelve sample results were within 3µg/dL of the true lead concentration.

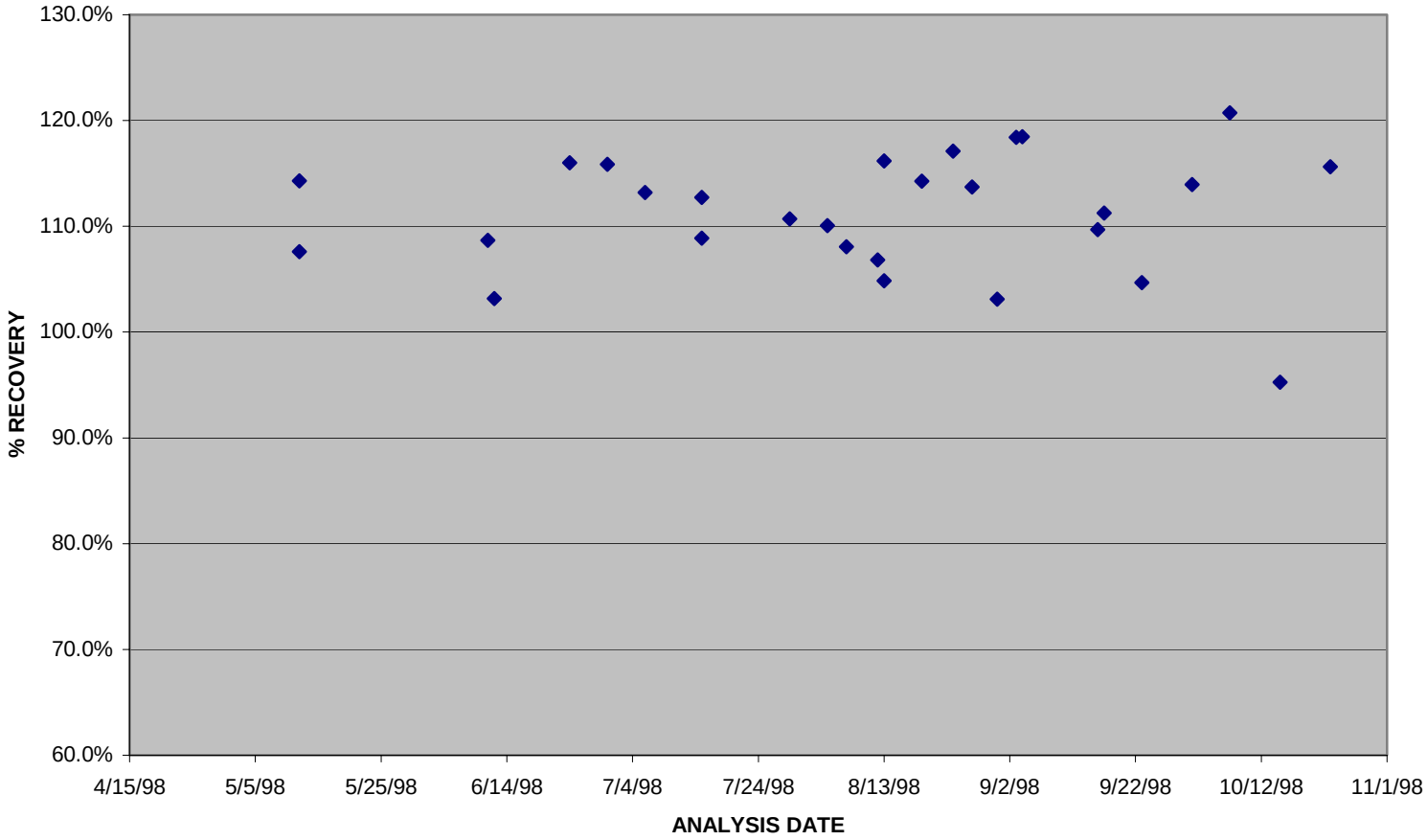
Milwaukee: 14 spike samples, with true blood lead concentrations between 4.3 and 15.3µg/dL were analyzed. Ninety-three percent (13) of the sample results were within 3µg/dL of the true lead concentration.

New York City: 40 spike samples, with true blood lead concentrations between 4.3 and 15.3µg/dL were analyzed. Seventy-five percent (30) of the sample results were within 3µg/dL of the true lead concentration and an additional 15% (6) were within 3.3µg/dL of the true lead concentration

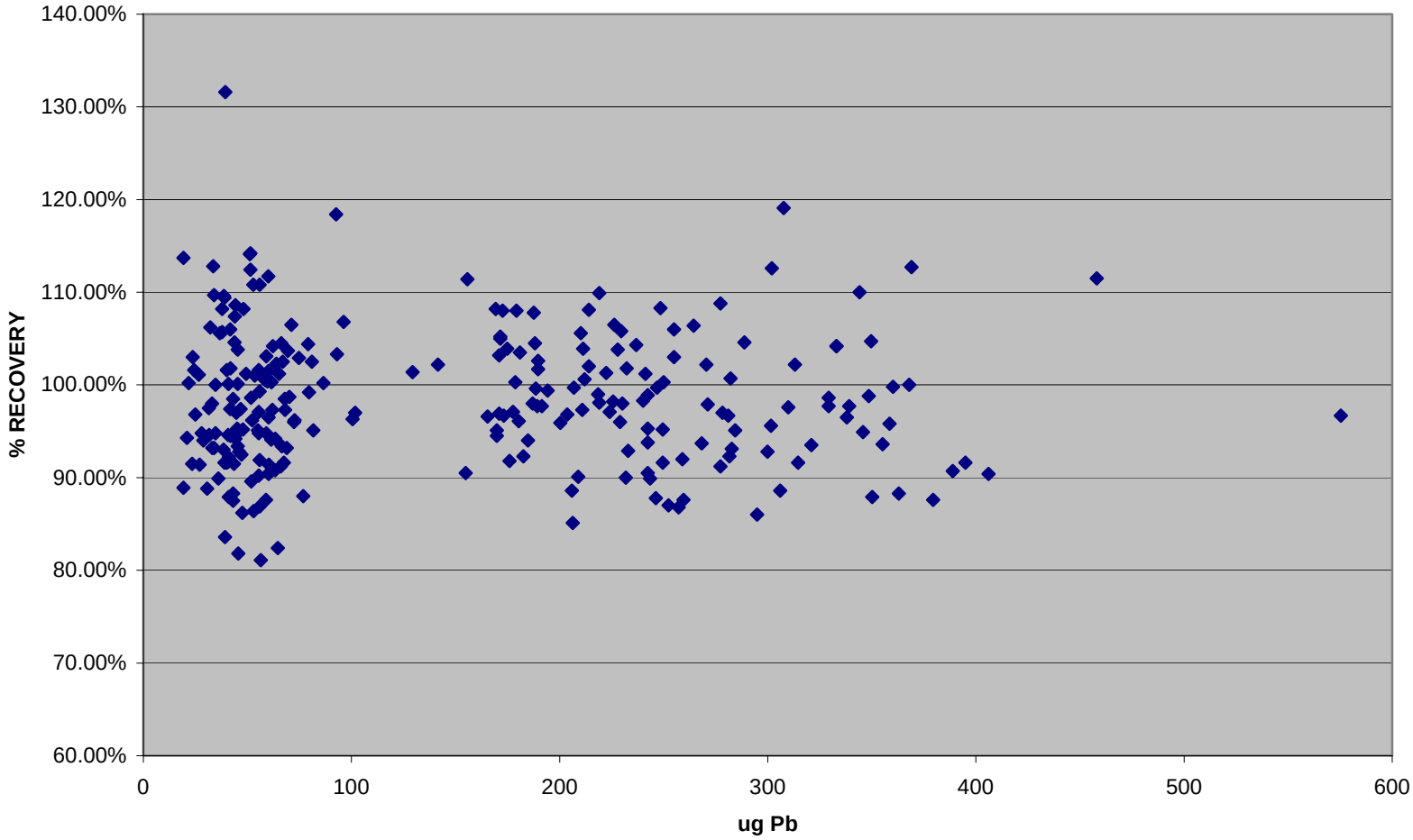
Plot E.1 Water Lead Concentration Spike Sample
Percent Recovery Over Time



Plot E.2 Soil Lead Concentration Spike Sample
Percent Recovery Over Time



Plot E.3 Single Surface Dust Wipe Spike Sample
Percent Recovery by True Quantity of Lead



Plot E.4 Composite of Four Dust Wipes Spike Sample
Percent Recovery by True Quantity of Lead.